Series 1959, No. 2

Issued November 1961

SOIL SURVEY

Issaquena County Mississippi

OUR SOIL ★ OUR STRENGTH

Growth Through Agricultural Progress

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

HOW TO USE THE SOIL SURVEY REPORT

THIS REPORT on Issaquena County, Mississippi, will serve several groups of readers. It will help farmers in planning the kind of management that will protect their soils and provide good yields; assist engineers in selecting sites for roads, ponds, buildings, and other structures; aid foresters in managing woodlands; serve as a reference for students and teachers; and add to the knowledge of soil scientists.

In making this survey, soil scientists dug holes and examined surface soils and subsoils; measured slopes with a hand level; noticed differences in growth of crops, weeds, and brush; and, in fact, recorded all the things about the soils that they believed might affect their suitability for farming, grazing, engineering, and related uses.

The scientists plotted the boundaries of the soils on aerial photographs. Then, cartographers prepared from the photographs the detailed soil map in the back of this report. Fields, woods, roads, and many other landmarks can be seen on the map.

Locating the soils

Use the index to the map sheets to locate areas on the large detailed map. The index is a small map of the county, on which numbered rectangles have been drawn to show what area is covered by each sheet of the detailed map. On the detailed map, the boundaries of the soils are outlined and there is a symbol for each kind of soil. All areas marked with the same symbol have the same kind of soil. Suppose, for example, an area located on the map has the symbol **Cb**. The legend for the detailed map shows that **Cb** represents Commerce silt loam, 0 to 2 percent slopes. This soil and all the others mapped in the county are described in the section "Descriptions of Soils."

Finding information

Different sections of this report will be of special interest to different groups of readers.

Farmers can learn about their soils in the section "Descriptions of Soils," and how to manage the soils and what yields to expect in the section "Use and Management of Soils."

Foresters and others interested in woodlands can refer to the subsection "General Management," which discusses the management of woodlands.

Engineers will find the engineering characteristics of the soils summarized in the subsection "Engineering Properties of Soils."

Soil scientists will find information about how the soils were formed and how they are classified in the section "Genesis, Morphology, and Classification of Soils."

Students, teachers, and other users will find information about soils and their management in various parts of the report, depending on their particular interest.

The last part of the report gives general information about the county and about the kind of agriculture. It will be of particular interest to persons not familiar with the county.

* * *

This soil survey is part of the technical assistance furnished by the Soil Conservation Service to the Issaquena County Soil Conservation District. Fieldwork for this survey was completed in 1959. Unless otherwise indicated, all statements refer to conditions at the time the survey was in progress.

U.S. GOVERNMENT PRINTING OFFICE: 1961

For sale by the Superintendent of Documents, U.S. Government Printing Office, Washington 25, D.C.

Contents

Series 1959, No. 2

Issued November 1961

SOIL SURVEY OF ISSAQUENA COUNTY, MISSISSIPPI

SURVEY BY A. H. WYNN, JR., W. M. MORRIS, JR., F. T. SCOTT, AND L. B. WALTON, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

REPORT BY A. H. WYNN, JR., D. E. ALCORN, AND R. L. PARKER, SOIL CONSERVATION SERVICE, UNITED STATES DEPARTMENT OF AGRICULTURE

UNITED STATES DEPARTMENT OF AGRICULTURE IN COOPERATION WITH THE MISSISSIPPI AGRICULTURAL EXPERIMENT STATION

ISSAQUENA COUNTY is entirely within the flood plain of the Mississippi River. It is bounded on the south by Warren County, on the east by Sharkey and Yazoo Counties, on the north by Washington County, and on the west by the Mississippi River (fig. 1). It is irregular in shape and has a maximum length of about 41 miles and a maximum width of about 26 miles. The approximate land area is about 265,600 acres.

Because of its location, the county has been susceptible to flooding by the Mississippi River. This hazard has been lessened since the levees were built, and the county has become more productive agriculturally. Nevertheless, certain sections still have a backwater problem.

The total rainfall is greater than that needed for most crops, and drainage is needed in winter and in spring. In summer, water for plant use often is limited. Cotton and soybeans are the principal crops grown in the county. The production of livestock is increasing.

The soils in the county developed from alluvium deposited by the Mississippi River. They are well supplied with plant nutrients. There are large supplies of water below the surface. Bedrock is at a great depth, which is a handicap in some engineering projects because artificial bases must be used for large structures.

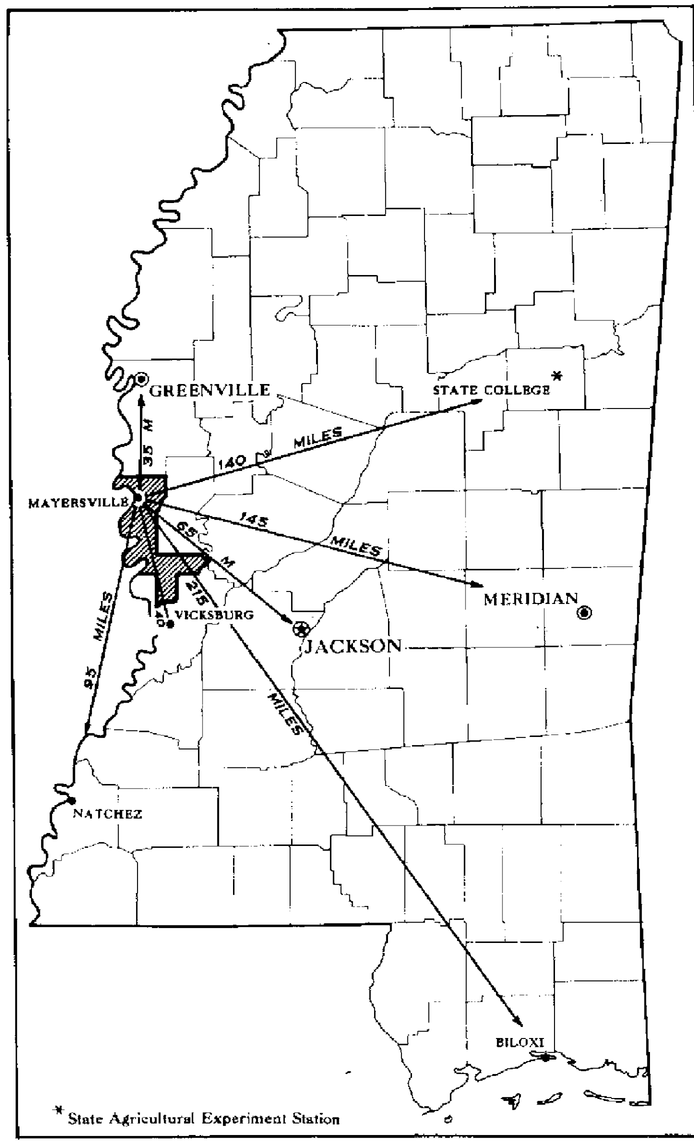

Figure 1.—**Location of Issaquena County in Mississippi.**

General Soil Map

In mapping a county or other large tract, it is fairly easy to see definite changes as one travels from place to place. There are many obvious changes, among them changes in shape, gradient, and length of slopes, in the course, depth, and speed of streams, in kinds of native plants, and even in the kinds of agriculture. Along with these obvious changes in the environment, there are less easily noticed changes in the patterns of soils.

By drawing lines around the different patterns of soils on a small map, one may obtain a map of the general soil areas, also called soil associations. Such a map is useful to those who want a general idea of the soils, who want to compare different parts of a county, or who want to locate large areas suitable for some particular kind of agriculture or other broad land use.

The five soil associations in Issaquena County are shown on the colored soil map at the back of this report.

Each association is named for the major soil series in it, but each may include soils of other series. Also, the major soil series in one association may occur in others. Each of the five soil associations is described in this section.

1. Commerce-Robinsonville-Crevasse Association

This association occupies broad, nearly level areas on recent natural levees. It is mostly along the eastern side of the Mississippi River levee, but a considerable acreage is along Deer Creek. The soils formed from medium-textured to coarse-textured recent alluvium. The coarser textured and better drained soils commonly are at the higher elevations adjacent to streams. As the distance from the stream increases, the soils become finer textured and more poorly drained.

The Commerce soils generally are at the lowest elevations on recent natural levees. They are somewhat poorly drained to moderately well drained and have a dark grayish-brown to brown surface soil and a grayish-brown stratified subsoil.

The Robinsonville soils generally are at the higher elevations adjacent to streams. They are moderately well drained to well drained and have a dark-brown surface soil and a brown and yellowish-brown, stratified subsoil.

The Crevasse soils are on ridge-depressional topography near old levee breaks. They formed from coarse-textured sediments and are excessively drained.

This association makes up about 10 percent of Issaquena County. The Commerce soils comprise 60 percent of the association; the Robinsonville soils, 15 percent; and the Crevasse soils, 10 percent. Inclusions of Sharkey, Dowling, Tunica, and Bowdre soils make up the balance. About half of the association is in capability class I. The rest is predominantly in class II, but considerable acreages are in classes III and IV.

The soils in this association are among the best for agriculture of any in the county. Most of the acreage has been cleared and is used for crops. The farms are mostly of the general type. They range from small owner operated units to large plantations. The principal crops are cotton, soybeans, small grain, and corn.

2. Commerce-Tunica-Bowdre Association

This association generally occupies nearly level areas on natural levees where slack-water clay was deposited over coarser textured material. The surface soil is silty clay loam to clay, and the subsoil is coarser textured. Slopes are steeper along streams and depressions. The slack-water clay is thinnest at the higher elevations near old stream runs. It becomes thicker as the distance from the stream increases and as the elevation becomes lower. Narrow depressions are scattered throughout the association and form a part of the natural drainage system.

The Commerce soils are at the higher elevations adjacent to streams. They are somewhat poorly drained to moderately well drained. The surface soil is dark-brown and brown silty clay loam and is underlain by medium-textured, stratified material.

The Tunica soils are at the lower elevations. They are somewhat poorly drained. The surface soil and subsoil are dark grayish-brown clay and are underlain by coarser textured material at depths of 20 to 30 inches.

The Bowdre soils are in areas between the Commerce soils and the Tunica soils. They are moderately well drained. The surface soil is dark-gray or very dark grayish-brown clay and coarser textured material is present at depths of 10 to 20 inches.

This association occupies about 20 percent of the county. The Commerce soils comprise approximately 35 percent of the association; the Tunica soils, 30 percent; and the Bowdre soils, 20 percent. Inclusions of Sharkey and Dowling clays make up the rest. Most of the association is in capability class II. A small acreage is in class I. The rest is in classes III and IV.

About 75 percent of the acreage has been cleared and is used for crops and pasture. The farms are relatively large. They range in kind from general farms to highly specialized livestock farms. The principal crops are cotton, soybeans, and small grain. A large acreage is in pasture. The soils are somewhat difficult to manage because good tilth is hard to maintain.

3. Beulah-Dundee-Forestdale Association

This association occupies nearly level to gently sloping areas along old streams. The soils developed from moderately coarse textured to moderately fine textured alluvium that has some degree of profile development. They are coarser textured at the higher elevations adjacent to streams, but, as the distance from the stream increases, the elevation becomes lower and the soils are finer textured. Narrow, shallow depressions are scattered throughout the association and form part of the natural drainage pattern.

The Beulah soils are at the higher elevations near streams. They are somewhat excessively drained and have a dark-brown and brown surface soil and a pale-brown to light yellowish-brown subsoil.

The Dundee soils are at slightly lower elevations than the Beulah soils. They are somewhat poorly drained to moderately well drained and have a grayish-brown surface soil and a very dark grayish-brown silty clay loam subsoil.

The Forestdale soils are at the lower elevations on old natural levees. They are poorly drained to somewhat poorly drained. The surface soil is dark grayish-brown silty clay loam, and the subsoil is gray silty clay.

This association occupies less than 5 percent of the county. The Beulah soils comprise about 37 percent of the association; the Dundee soils, 33 percent; and the Forestdale soils, 15 percent. Inclusions of Dowling, Sharkey, and Tunica soils make up the rest. More than 60 percent of the association is in capability class II. The rest is mostly in capability classes I and III.

Most of the acreage has been cleared and is used for crops. The farms range in size from small family-operated units to comparatively large plantations. The soils are easily tilled and conserved and are suited to a variety of crops. The principal crops are cotton, soybeans, small grain, and corn.

4. Sharkey-Dowling-Tunica Association

This association is in wide, level and nearly level, slack-water areas. Some sloping soils are along narrow depressions scattered throughout the association. The soils formed from clay sediments deposited by still or slowly moving water.

The Sharkey soils are on broad, low flats. They are poorly drained and have a very dark gray clay surface soil and a very dark gray clay subsoil.

The Dowling soils are in depressions. They are poorly drained and have a very dark gray clay surface soil and a mottled, gleyed clay subsoil.

The Tunica soils are at the higher elevations along streams. They are somewhat poorly drained. The surface soil is thick, dark-colored clay and is underlain by coarser textured material.

This association occupies about 55 percent of Issaquena County. The Sharkey soils comprise about 65 percent of the association; the Dowling soils, 15 percent; and Tunica soils, 10 percent. Inclusions of Bowdre and Forestdale soils make up the rest. Most of the acreage is in capability class III. The rest is in classes II and IV.

About 75 percent of the acreage is still in forest. The rest has been cleared and is used principally for crops and pasture. The farms range in size from small family-operated units to large plantations. The soils are very difficult to manage. Good surface drainage is hard to obtain. Part of the acreage is subject to overflow or backwater. The principal crops are soybeans, cotton, and small grain. A considerable acreage is in pasture.

5. Alluvial Land Association

This association consists of soils between the Mississippi River and its levee. These soils are subject to annual overflow, and some remain under water for long periods. The overflow normally occurs in spring or early in summer.

This association makes up about 10 percent of Issaquena County. More than 90 percent of it is in extensive forest, where it was impractical to delineate the soils separately. Cleared areas were classified, and the principal soils are those of the Robinsonville, Commerce, Crevasse, Dowling, Sharkey, Tunica, and Bowdre series. These soils range in texture from sand to clay and in drainage from poor to excessive. The topography is nearly level but includes some steeper areas along streambanks and depressions.

Cleared areas are used for cotton, soybeans, and corn. There is a great risk in growing small grains, except on the higher areas, because of the overflow hazard. A considerable acreage is in pasture.

Use and Management of Soils

This section has five main parts. The first explains the system of classification used to show the relative suitability of the soils for various uses; the second is a discussion of management of the soils of Issaquena County by capability units; the third describes the general management of the soils for cropland, pasture, woodland, and wildlife; the fourth gives estimates of yields of the principal crops under two levels of management; and the fifth contains information that can be used by engineers.

Capability Groups of Soils

The capability classification is a grouping of soils that shows, in a general way, how suitable they are for most kinds of farming. It is a practical grouping based on limitations of the soils, the risk of damage when they are used, and the way they respond to treatment.

In this system all the kinds of soil are grouped at three levels—the capability class, subclass, and unit. The eight capability classes in the broadest grouping are designated by Roman numerals I through VIII. In class I are the soils that have few limitations, the widest range of use, and the least risk of damage when they are used. The soils in the other classes have progressively greater natural limitations. In class VIII are soils and land forms so rough, shallow, or otherwise limited that they do not produce worthwhile yields of crops, grazing, or wood products.

The subclasses indicate major kinds of limitations within the classes. Within most of the classes there can be up to four subclasses. The subclass is indicated by adding a small letter, *e*, *w*, *s*, or *c*, to the class numeral, for example, IIe. The letter *e* shows that the main limitation is risk of erosion unless close-growing plant cover is maintained; *w* means that water in or on the soil will interfere with plant growth or cultivation (in some soils the wetness can be partly corrected by artificial drainage); *s* shows that the soil is limited mainly because it is shallow, droughty, or stony; and *c*, used in only some parts of the country, indicates that the chief limitation is climate that is too cold or too dry.

In class I there are no subclasses, because the soils of this class have few or no limitations. Class V can contain, at the most, only subclasses *w*, *s*, and *c*, because the soils in it have little or no erosion hazard but have other limitations that limit their use largely to pasture, range, woodland, or wildlife.

Within the subclasses are the capability units, groups of soils enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping of soils for many statements about their management. Capability units are generally identified by numbers assigned locally, for example, IIe-1 or IIIe-2.

Soils are classified in capability classes, subclasses, and units in accordance with the degree and kind of their permanent limitations; but without consideration of major and generally expensive land-forming that would change the slope, depth, or other characteristics of the soil; and without consideration of possible but unlikely major reclamation projects.

The eight classes in the capability system, and the subclasses and units in this county, are described in the list that follows.[1]

[1] After the report for Issaquena County was prepared for publication, the soils shown in capability units IIs-2, IIs-4, IIs-5, IIs-6, IIIs-2, and IIIs-4 were reassigned to capability units IIw-2, IIw-4, IIw-5, IIw-6, IIIw-2, and IIIw-4 respectively.

Class I.—Soils that have few limitations that restrict their use.

Unit I–1.—Somewhat poorly drained to moderately well drained soils on natural levees; 0 to 2 percent slopes.

Unit I–2.—Well-drained soils on recent natural levees; 0 to 2 percent slopes.

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

Subclass IIe.—Soils susceptible to moderate erosion if not protected.

Unit IIe–1.—Somewhat poorly drained to moderately well drained soils on recent natural levees; 2 to 5 percent slopes.

Unit IIe–2.—Well-drained soils on recent natural levees; 2 to 5 percent slopes.

Unit IIe–4.—Somewhat poorly drained to moderately well drained silty clay loams; 2 to 5 percent slopes.

Subclass IIs.—Soils moderately limited by low water-holding capacity or other soil features.

Unit IIs–1.—Somewhat droughty soils; 0 to 3 percent slopes.

Unit IIs–2.—Somewhat poorly drained and moderately well drained clays; 0 to 2 percent slopes.

Unit IIs–4.—Poorly drained to somewhat poorly drained silty clay loams; 0 to 2 percent slopes.

Unit IIs–5.—Poorly drained soils underlain by clay; 0 to 2 percent slopes.

Unit IIs–6.—Somewhat poorly drained to moderately well drained silty clay loams; 0 to 2 percent slopes.

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

Subclass IIIw.—Soils limited by very slow permeability and by susceptibility to flooding.

Unit IIIw–11.—Poorly drained clays that have slow surface drainage; 0 to ½ percent slopes.

Unit IIIw–13.—Poorly drained, mixed-textured soils in depressions.

Subclass IIIs.—Soils limited by poor tilth.

Unit IIIs–2.—Somewhat poorly drained and moderately well drained clays; 2 to 5 percent slopes.

Unit IIIs–4.—Poorly drained clays; 0 to 5 percent slopes.

Class IV.—Soils that have very severe limitations that restrict the choice of plants, require very careful management, or both.

Subclass IVw.—Soils susceptible to flooding and ponding.

Unit IVw–1.—Poorly drained clays in depressions.

Subclass IVs.—Soils severely limited by droughtiness and low water-holding capacity.

Unit IVs–1.—Droughty soils; 0 to 3 percent slopes.

Class V.—Soils that have little or no erosion hazard, but have other limitations that are impractical to remove without major reclamation, that limit their use largely to pasture, range, woodland, or wildlife food and cover.

There are no class V soils in Issaquena County.

Class VI.—Soils that have severe limitations that make them generally unsuited for cultivation and limit their use largely to pasture or range, woodland, or wildlife food and cover.

There are no class VI soils in Issaquena County.

Class VII.—Soils that have very severe limitations that make them unsuited for cultivation without major reclamation and that restrict their use largely to grazing, woodland, or wildlife.

There are no class VII soils in Issaquena County.

Class VIII.—Soils and land forms that have limitations that preclude their use, without major reclamation, for commercial production of plants; and restrict their use to recreation, wildlife, water supply, or esthetic purposes.

There are no class VIII soils in Issaquena County.

Capability Units

Each of the 16 capability units in Issaquena County is discussed in the following pages. All of the soils in one unit need about the same kind of management, respond to management in about the same way, and have essentially the same limitations. The crop rotations mentioned are given as examples; they are not the only rotations suited to the soils of the unit.

Capability unit I–1

This capability unit consists of nearly level soils that are somewhat poorly drained to moderately well drained. The surface soil is silt loam or very fine sandy loam and is from 4 to 8 inches thick. The subsoil is stratified and ranges in texture from silt loam to silty clay loam. In some places the subsoil is directly above thick beds of slack-water clay. The following soils are in this unit:

Commerce silt loam, 0 to 2 percent slopes.
Commerce silt loam, moderately shallow, 0 to 2 percent slopes.
Commerce very fine sandy loam, 0 to 2 percent slopes.
Dundee silt loam, 0 to 2 percent slopes.

These soils occupy slightly less than 5 percent of the county. They are easy to work, and surface runoff is no problem. The available water holding capacity is moderate to high. Permeability is moderate to moderately slow except where there is a plowsole. The content of organic matter is low. Natural fertility is moderate to high. The reaction normally is slightly acid to mildly alkaline.

These soils are among the best in the county for crops and pasture. They are well suited to cotton, corn, soybeans, and small grain and to vetch and wild winter peas grown as winter cover crops. Bermudagrass, dallisgrass, johnsongrass, whiteclover, vetch, and wild winter peas are good pasture plants. Sudangrass and other summer grasses do well. Annual lespedeza, alfalfa, red clover, and tall fescue are only fairly well suited.

Trees that grow well are cottonwood, pecan, sweetgum, water oak, American elm, boxelder, and sugarberry.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed.

These soils can be worked throughout a wide range of moisture content. If left bare they tend to crust and pack after rains, and a good stand of crops may be difficult to obtain. The best time to plow is early in spring. In places a plowsole, or hard compact layer, is just beneath the surface layer. It can be shattered by deep tillage or by subsoiling in fall when the soil is dry. Rows should be arranged so that excess water will run off without causing erosion. W-type ditches are needed as outlets.

The content of organic matter can be increased by turning under crop residues, by using a suitable sod crop in the cropping system, and by growing winter legumes after clean-tilled crops. Nonlegume crops respond to applications of nitrogen fertilizer. In some places lime is needed for best yields of alfalfa and some other legumes.

Capability unit I–2

The only soil in this capability unit is Robinsonville very fine sandy loam, 0 to 2 percent slopes. This soil is nearly level and well drained. The surface soil is predominantly very fine sandy loam and is approximately 6 inches thick. The subsoil is stratified very fine sandy loam and silt loam that becomes coarser with depth.

This soil occupies less than 1 percent of the county. It normally has a favorable supply of available moisture but is slightly droughty in dry periods. Surface runoff is no problem. Permeability is moderate to moderately rapid except where there is a plowsole. The content of organic matter is low. Natural fertility is high. The reaction is slightly acid to moderately alkaline.

This soil is well suited to cotton, early truck crops, and small grain. Good yields of bermudagrass, johnsongrass, and crimson clover can be expected. This soil is fairly well suited to early corn, vetch, wild winter peas, and whiteclover but is poorly suited to fescue, alfalfa, dallisgrass, and annual lespedeza. Growing late-maturing corn, soybeans, sorghum, millet, and sudangrass is risky because of the limited moisture supply.

Trees that grow well are cottonwood, sycamore, sweetgum, water oak, American elm, and boxelder.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed.

This soil can be worked throughout a wide range of moisture content. If left bare it tends to crust and pack after heavy rains. A plowsole may form just beneath the surface and will restrict the development of roots and the internal movement of water. It should be shattered by deep tillage in fall when the soil is dry. Rows should be arranged so that excess water will run off without causing erosion, and W-type ditches are needed for outlets.

Adding organic matter will improve the structure and will increase the available water holding capacity, the rate of infiltration, and the bacterial activity. It also will reduce crusting. The content of organic matter can be increased by turning under crop residues, by including a suitable sod crop in the cropping system, and by growing legumes after clean-tilled crops. In most places nitrogen is the fertilizer most needed.

Capability unit IIe–1

The only soil in this capability unit is Commerce very fine sandy loam, 2 to 5 percent slopes. This gently sloping, somewhat poorly drained to moderately well drained soil is on recent natural levees. The surface soil is silt loam or very fine sandy loam that is from 4 to 8 inches deep. The subsoil is stratified silt loam, very fine sandy loam, and silty clay loam. This soil occurs in long, narrow areas along the sides of bayous or depressions.

This soil occupies about 0.2 percent of the county. It is easy to till, but surface runoff needs to be controlled. Permeability is moderate to moderately slow, and the available water holding capacity is moderate to high. The content of organic matter is low, but natural fertility is moderate to high. The reaction normally is slightly acid to mildly alkaline.

This soil is well suited to cotton, corn, soybeans, small grain, millet, and sudangrass. Vetch and wild winter peas do well as winter cover crops. Suitable pasture crops are bermudagrass, johnsongrass, dallisgrass, whiteclover, and winter legumes. Fescue, alfalfa, red clover, and annual lespedeza are only fairly well suited.

Trees that grow well are cottonwood, pecan, sweetgum, water oak, American elm, boxelder and sugarberry.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control runoff, clean-tilled crops should be grown only about half the time and a close-growing crop or a soil-improving crop should be grown in the other years.

This soil can be worked throughout a wide range of moisture content. If left bare it tends to crust and pack after hard rains, and a good stand of crops may be difficult to obtain. If clean-tilled crops are grown continuously, some areas will become moderately eroded. Rows should be arranged on the contour to prevent further erosion and to conserve moisture. Grassed waterways are not usually needed as row outlets.

The content of organic matter can be increased by turning under crop residues, by using a suitable sod crop in the cropping system, and by growing winter legumes after clean-tilled crops. Nonlegume crops respond to nitrogen fertilizer. In places lime may be needed for best yields of alfalfa and other legumes.

Capability unit IIe–2

The only soil in this capability unit is Robinsonville very fine sandy loam, 2 to 5 percent slopes. This gently sloping, well-drained soil is on recent natural levees. The surface soil is very fine sandy loam. The stratified subsoil is very fine sandy loam and silt loam that normally becomes coarser with depth. This soil occurs in long, narrow areas along bayous or depressions.

This soil occupies only about 0.1 percent of the county. It is easy to work, but surface runoff needs to be controlled. Permeability is moderate to moderately rapid except where there is a plowsole. This soil generally has a favorable supply of moisture but is slightly droughty in dry periods. The content of organic matter is low. Natural fertility is high. The reaction is slightly acid to moderately alkaline.

This soil is well suited to cotton, small grain, and early truck crops. It is fairly well suited to early corn, vetch, and wild winter peas. Late corn and soybeans are not suitable because of the drought hazard. Bermudagrass, johnsongrass, and crimson clover yield well. Whiteclover, vetch, and wild winter peas are fairly well suited. Fescue, dallisgrass, annual lespedeza, and annual summer grasses generally are not suited.

Trees that grow well are cottonwood, sycamore, sweetgum, water oak, American elm, and box elder.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control runoff, clean-tilled crops should be grown only about half the time and a close-growing crop or a soil-improving crop should be grown in the other years.

This soil can be worked throughout a wide range of moisture content. If left bare it tends to crust and pack after heavy rains. If a plowsole restricts root development and the internal movement of water, it should be shattered by deep tillage when the soil is dry.

If clean-tilled crops are grown continuously, some areas will become moderately eroded. Rows should be so arranged as to prevent further erosion and to conserve moisture. W-type ditches and, in some areas, grassed waterways are needed as outlets.

The content of organic matter should be built up and maintained to improve soil structure and to increase the available water holding capacity, permeability, and bacterial activity. Organic matter can be added by turning under crop residues, by including a suitable sod crop in the cropping rotation, and by growing winter legumes after clean-tilled crops. Nitrogen is needed for most nonlegume crops. In some places lime is needed for the best yields of alfalfa and other legumes.

Capability unit IIe-4

The only soil in this capability unit is Commerce silty clay loam, 2 to 5 percent slopes. This soil is gently sloping and is somewhat poorly drained to moderately well drained. The surface soil is silty clay loam and is 4 to 6 inches thick. The subsoil is stratified silt loam and very fine sandy loam.

This soil occupies about 1 percent of the county. Some areas are already moderately eroded. Surface runoff should be controlled to prevent further erosion. Permeability is moderately slow. The available water holding capacity is moderate to high. The content of organic matter is low, and natural fertility is high. The reaction is slightly acid to mildly alkaline.

This soil is well suited to most crops commonly grown in the area. Corn is fairly well suited. Most of the perennial and summer grasses common to the area, as well as the perennial and annual legumes, grow well.

The trees that grow well are cottonwood, pecan, sweetgum, water oak, American elm, boxelder and sugarberry.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control runoff, clean-tilled crops should be grown only about half the time and a close-growing crop or a soil-improving crop should be grown in the other years.

This soil tends to clod and should not be worked when wet. Rows should be arranged so that excess water will run off without causing erosion. W-type ditches and, in some areas, vegetated waterways are needed for row outlets.

Additional organic matter will improve the workability of the soil and will increase the available water holding capacity and the bacterial activity. The content of organic matter can be increased by turning under crop residues, by including a suitable sod crop in the cropping system, and by growing winter legumes after clean-tilled crops. Nitrogen is the fertilizer generally needed for most nonlegume crops. In some places lime is needed for the best yields of alfalfa and other legumes.

Capability unit IIs-1

The only soil in this capability unit is Beulah very fine sandy loam, 0 to 3 percent slopes. This nearly level, somewhat droughty soil is on old natural levees. The surface soil is a very fine sandy loam and silt loam and is about 6 inches thick in most places. The subsoil is a very fine sandy loam that grades with depth to loamy fine sand.

This soil occupies about 0.3 percent of the county. It is easy to till. Surface runoff is no problem. Internal drainage is somewhat excessive. Permeability is moderately rapid. The available water holding capacity is low, and the content of organic matter is low. The reaction is strongly acid.

This soil is well suited to early truck crops and small grain, which grow in spring when moisture normally is abundant. It is fairly well suited to cotton and early corn but not to soybeans, late corn, and millet. The most suitable sod crops are bermudagrass, johnsongrass, and crimson clover. Dallisgrass, fescue, sudangrass, annual lespedeza, white clover, and red clover are not suitable.

Trees that grow well are blackgum, sweetgum, sycamore, and various species of oak.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control runoff, clean-tilled crops should be grown only about half the time and a close-growing crop or a soil-improving crop should be grown in the other years.

This soil can be worked throughout a wide range of moisture content. If left bare it tends to crust and pack, and a good stand of crops may be difficult to obtain. The best time to prepare this soil for planting is early in spring. Rows should be arranged carefully to conserve moisture and to permit excess water to run off without causing erosion. V-type and W-type ditches are needed for outlets in some areas.

Additional organic matter will increase the available water holding capacity. The content of organic matter can be increased by turning under crop residues, by including a suitable sod crop in the cropping system, and by growing winter legumes after clean-tilled crops. Nonlegume crops respond to applications of nitrogen fertilizer.

Capability unit IIs-2

This capability unit consists of nearly level, somewhat poorly drained and moderately well drained clayey soils. The surface soil and subsoil are clay. The underlying material, at depths of 10 to 32 inches, is coarser textured. The following soils are in this capability unit:

Bowdre clay, 0 to 2 percent slopes.
Tunica clay, 0 to 2 percent slopes.

These soils occupy almost 9 percent of the county. They are somewhat difficult to manage. When dry, they harden and crack. When wet, they are very plastic. Water moves into and through them slowly, except when they are cracked. Then it moves rapidly until the cracks seal up. Surface runoff is no problem. The soils are well supplied with water for plant use. The content of organic matter is low, but natural fertility is high. The reaction is acid to mildly alkaline.

These soils are best suited to pasture and hay crops. They are well suited to cotton, soybeans, sorghum, small grain, vetch, and wild winter peas. They are fairly well suited to corn, annual lespedeza, millet, and sudangrass. Suitable sod crops are tall fescue, johnsongrass, dallisgrass, alfalfa, white clover, red clover, and winter legumes.

Trees that grow well are sweetgum, American elm, cottonwood, and various species of oak.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control runoff, clean-tilled crops should be grown only about half the time and a close-growing crop or a soil-improving crop should be grown in the other years.

Good tilth is hard to maintain. Properly arranged rows and V-type and W-type ditches are needed to prevent ponding and to permit excess water to run off without causing erosion. Deep plowing in fall or early in winter is desirable to prevent excessive clodding at planting time. High seedbeds will help to drain and aerate these soils.

The content of organic matter can be increased by turning under crop residues and by using a suitable sod crop in the cropping system. Nitrogen is the only fertilizer needed for most crops.

Capability unit IIs-4

This capability unit consists of nearly level, somewhat poorly drained to poorly drained soils that are on old natural levees. The surface soil is silty clay loam and is about 4 inches thick. The subsoil is gleyed, mottled clay and is underlain by coarser textured material. The following soils are in this capability unit:

Forestdale silty clay loam, 0 to 2 percent slopes.
Sharkey silty clay loam, 0 to 2 percent slopes.

These soils occupy less than 4 percent of the county. They are favorably supplied with available moisture. Permeability is slow. In some of the more nearly level areas, surface runoff is slow. These soils crack when dry and are slightly plastic when wet. Good tilth is difficult to maintain. The content of organic matter is low, and natural fertility is low. The reaction is medium acid.

These soils are well suited to soybeans, annual lespedeza, rice, small grain, vetch, wild winter peas, and sorghum. They are fairly well suited to cotton, sudangrass, and millet. In most years growing corn is risky, but in some years yields are moderately high. Suitable pasture crops are bermudagrass, johnsongrass, and winter legumes. Fescue, dallisgrass, red clover, white clover, and summer annuals are fairly well suited.

Trees that grow well are bitter pecan, green ash, rock elm, red maple, and various species of oak.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control runoff, clean-tilled crops should be grown only about half the time and a close-growing crop or a soil-improving crop should be grown in the other years.

These soils are inclined to form clods when cultivated and are somewhat cold natured. Proper arrangement of rows and V-type and W-type ditches are needed so that excess water will run off without causing erosion. Seedbeds should be high to help drain and aerate the soils.

Additional organic matter will improve infiltration and workability, increase bacterial activity, and reduce crusting. The content of organic matter can be increased by turning under crop residues, by using a suitable sod crop in the cropping system, and by growing winter legumes after clean-tilled crops. In most places nitrogen is the only fertilizer needed.

Capability unit IIs-5

This capability unit consists of poorly drained, shallow soils. These soils are underlain by slack-water clay at depths of 5 to 20 inches. Their slope is less than 2 percent. The following soils are in this capability unit:

Sharkey silt loam, overwash, 0 to 2 percent slopes.
Sharkey fine sandy loam, overwash, 0 to 2 percent slopes.

These soils occupy about 1 percent of the county. Surface runoff is no problem. Permeability is moderately rapid to moderately slow in the surface soil and very slow in the underlying layers. The available water holding capacity is high to very high. The content of organic matter is low, but the natural fertility is high. The reaction is slightly acid to mildly alkaline.

These soils are well suited to cotton, soybeans, sorghum, fescue, dallisgrass, johnsongrass, bermudagrass, wild winter peas, and whiteclover. They are fairly well suited to corn, sudangrass, millet, annual lespedeza, red clover, vetch, and alfalfa.

Trees that grow well are sweetgum, water oak, hackberry, elm, and ash.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control runoff, clean-tilled crops should be grown only about half the time and a close-growing crop or a soil-improving crop should be grown in the other years.

These soils are easy to till but, if left bare, will crust, puddle, and pack after rains. Their somewhat cold nature may delay planting. Rows should be carefully laid out so that excess water will empty into V-type and W-type ditches.

577739—61——2

Additional organic matter will improve soil structure, reduce crusting and puddling, and increase infiltration, available water holding capacity, and bacterial activity. The content of organic matter can be increased by turning under crop residues, by using a suitable sod crop in the cropping system, and by growing winter legumes after clean-tilled crops.

Capability unit IIs-6

This capability unit consists of nearly level, somewhat poorly drained to moderately well drained soils. The surface soil is silty clay loam and is 4 to 8 inches thick. The subsoil is dominantly silt loam. The following soils are in this capability unit:

Commerce silty clay loam, 0 to 2 percent slopes.
Commerce silty clay loam, moderately shallow, 0 to 2 percent slopes.
Dundee silty clay loam, 0 to 2 percent slopes.
Tunica silty clay loam, 0 to 2 percent slopes.

These soils make up about 8 percent of the county. Surface runoff is only a minor problem, but permeability is moderately slow to slow. The available water holding capacity is moderate to high. The content of organic matter is low, but natural fertility is high. The reaction is medium acid to mildly alkaline.

These soils are well suited to soybeans, small grain, cotton, and sorghum. They are fairly well suited to corn, sudangrass, millet, and annual lespedeza. Pasture crops to which they are well suited are fescue, bermudagrass, johnsongrass, dallisgrass, whiteclover, and wild winter peas. They are only fairly well suited to red clover, vetch, and alfalfa.

Trees that grow well are cottonwood, pecan, sweetgum, various species of oak, American elm, boxelder, and sugarberry.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control runoff, clean-tilled crops should be grown only about half the time and a close-growing crop or a soil-improving crop should be grown in the other years.

These soils are somewhat difficult to till because they tend to break into clods. They should not be worked when wet. Rows should be arranged so that water will run off, and W-type ditches should be used to remove excess water without causing erosion.

The content of organic matter can be increased by turning under crop residues, by using a suitable sod crop in the cropping system, and by growing winter legumes after clean-tilled crops. Most nonlegume crops will respond to nitrogen.

Capability unit IIIw-11

This capability unit consists of level, poorly drained, slack-water soils. The surface soil is predominantly clay. The subsoil restricts the movement of air and water. The following soils are in this capability unit:

Sharkey clay, 0 to ½ percent slopes.
Sharkey and Dowling clays.

These soils occupy more than 35 percent of the county. Most of the acreage is in forest. These soils are very difficult to manage. When dry, they are extremely hard and crack extensively. When wet, they are very plastic and the cracks seal over. Surface runoff is slow, and water from higher areas tends to collect and pond. Permeability is very slow. The available water holding capacity is generally very high. After a prolonged wet season, the water table may be near the surface. If the soils are cultivated, the content of organic matter normally is low. Natural fertility is high. The reaction is strongly acid to slightly acid.

Use of these soils is limited by excess moisture, poor tilth, and the hazard of local floods. The soils are best suited to rice and soybeans. Unless drained, they are not suited to cotton and small grain. Growing corn is hazardous.

Bermudagrass, dallisgrass, johnsongrass, fescue, and whiteclover are well suited. Sudangrass, millet, red clover, and annual lespedeza are fairly well suited.

Trees that grow well are green ash, American elm, hackberry, Nuttall oak, overcup oak, and bitter pecan.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control water, these soils should be in perennial vegetation most of the time.

These soils can be worked only within a very narrow range of moisture content. Good stands are difficult to obtain because the soils tend to crust. Seedbeds should be prepared early so they can settle before planting. Rows should be arranged to permit maximum drainage. V-type and W-type ditches should be placed in the low spots. In places, dragline ditches are needed for outlets.

The content of organic matter can be increased by using a suitable sod crop in the cropping system. Nitrogen is the fertilizer most needed.

Capability unit IIIw-13

The Dowling soils are the only soils in this capability unit. They are poorly drained, mixed-textured soils that occur in long, narrow depressions. Additional sediments are deposited periodically from the adjacent higher areas. The surface soil ranges in texture from silty clay to very fine sandy loam. The subsoil is clay, and in places there are thin lenses of coarser textured material.

These soils make up less than 1 percent of the county. Surface runoff is very slow to ponded. Permeability is very slow, and in wet seasons the water table is at the surface. The available water holding capacity is high. The content of organic matter is higher than that in the surrounding soils. Inherent fertility is high. The reaction is strongly acid to neutral.

These soils are limited in use by local flooding, poor drainage, and poor tilth. They are suited to rice and sorghum. In areas that are not adequately drained, it is hazardous to grow soybeans, cotton, corn, small grain, and most other crops. Suitable pasture crops are fescue, bermudagrass, dallisgrass, sudangrass, whiteclover, and millet. Johnsongrass and red clover do not grow well.

Trees that grow well on these soils are cypress, tupelogum, willow, overcup oak, and Nuttall oak.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control water, these soils should be in perennial vegetation most of the time.

Dragline, V-type, and W-type ditches are needed to drain these low areas. If crops are grown, rows should be so arranged as to provide maximum surface drainage.

Nitrogen is the only fertilizer needed.

Capability unit IIIs-2

This capability unit consists of gently sloping, somewhat poorly drained and moderately well drained soils. These soils have a clay surface soil and a clay subsoil. They are underlain by coarser textured material at depths of 10 to 32 inches. The following soils are in this capability unit:

Bowdre clay, 2 to 5 percent slopes.
Tunica clay, 2 to 5 percent slopes.

These soils occupy about 0.5 percent of the county. They are somewhat difficult to manage. When dry, they harden and crack. When wet, they are very plastic. Surface runoff needs to be controlled. Water moves into and through the soils slowly, except when they are cracked. Then it moves rapidly until the cracks seal up. The content of organic matter is low, and natural fertility is high. The reaction is strongly acid to mildly alkaline.

These soils are well suited to cotton, soybeans, small grain, vetch, and wild winter peas. They are fairly well suited to annual lespedeza, millet, and sudangrass. Growing corn and sorghum is risky. Pasture crops that are suitable are fescue, dallisgrass, bermudagrass, johnsongrass, alfalfa, whiteclover, and red clover.

Trees that grow well are sweetgum, American elm, cottonwood, and various species of oak.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control water, these soils should be in perennial vegetation most of the time.

Good tilth is difficult to maintain. Seedbeds should be prepared early so they can settle before planting. High seedbeds will help to dry and aerate the soils. Rows should be arranged so that water will run off without causing erosion. Vegetated waterways are needed in places.

The content of organic matter can be increased by turning under crop residues and by using a suitable sod crop in the cropping system. In most places nitrogen is the only fertilizer needed.

Capability unit IIIs-4

This capability unit consists of nearly level and gently sloping, slack-water soils that are poorly drained. The surface soil is clay or silty clay that is about 4 inches thick. The deep subsoil is clay that restricts the movement of air and water. The following soils are in this capability unit:

Mhoon silty clay, 0 to 2 percent slopes.
Sharkey clay, ½ to 2 percent slopes.
Sharkey clay, 2 to 5 percent slopes.

These soils occupy less than 10 percent of the county. They are difficult to manage. When dry, they harden and crack. When wet, they become very plastic and the cracks seal over. Excess water runs off the lower areas somewhat slowly. Permeability is very slow. The available water holding capacity is generally very high. After a prolonged wet period, the water table is near the surface. When the soils are first cleared the content of organic matter is high, but it decreases rapidly after the soils are tilled. Natural fertility is high. The reaction is strongly acid to mildly alkaline.

These soils are suited to soybeans, rice, small grain, vetch, and wild winter peas. They are fairly well suited to cotton, sudangrass, millet, and annual lespedeza. Corn is a very uncertain crop. Suitable pasture crops are bermudagrass, dallisgrass, fescue, johnsongrass, white clover, and red clover (fig. 2).

Figure 2.—Pasture of fescue and whiteclover on Sharkey clay.

Trees that grow best are American elm, willow oak, sugarberry, Nuttall oak, bitter pecan, green oak, persimmon, red maple, and mulberry.

A conservation cropping system consists of a clean-tilled crop every year if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control water, these soils should be in perennial vegetation most of the time.

These soils can be worked only within a narrow range of moisture content. Seedbeds should be prepared early and should be allowed to settle before planting. Rows should be so arranged as to provide maximum drainage without causing erosion. V-type and W-type ditches are needed, and in places dragline ditches are needed for outlets.

The content of organic matter can be increased by turning under crop residues and by using a suitable sod crop in the cropping system. In most places nitrogen is the only fertilizer needed.

Capability unit IVw-1

The only soil in this capability unit is Dowling clay. This poorly drained soil occurs in long, level depressions throughout the slack-water areas. Additional sediments washed from the higher areas are deposited periodically.

Both the surface soil and the subsoil are very plastic clay.

This soil occupies about 11 percent of the county. Runoff from higher areas tends to collect and pond on it. Permeability is very slow, and in wet seasons the water table is at the surface. The available water holding capacity is high. This soil contains more organic matter than the surrounding soils, and its natural fertility is high. The reaction is strongly acid to neutral.

This soil is best suited to hay and pasture, but it is well suited to rice. Soybeans, millet, sorghum, and sudangrass are fairly well suited. Growing row crops is risky.

Trees that grow well are cypress, tupelo-gum, willow, Nuttall oak, and overcup oak.

A conservation cropping system consists of clean-tilled crops and close-growing (or soil-improving) crops, each about half of the time, if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, and supporting practices are carried out as needed. Without supporting practices to control water, these soils should be in perennial vegetation most of the time.

This soil is difficult to manage. When dry, it shrinks and cracks. Tilth is poor. Excess surface water often delays the planting and cultivating of row crops.

Surface drainage should be provided by properly arranged rows and by dragline and W-type ditches.

Because of poor drainage and poor aeration, fertilizer is not efficiently utilized.

Capability unit IVs-1

Crevasse sandy loams and loamy sands, 0 to 3 percent slopes, are the only soils in this capability unit. These soils are nearly level and are excessively drained. The surface soil is very fine sandy loam to loamy fine sand and is about 4 inches thick. The subsoil is stratified loamy sand and sandy loam. In some places it is underlain by slack-water clay at depths of 30 to 40 inches.

These soils occupy about 0.7 percent of the county. They are droughty. Permeability is rapid to moderately rapid. Consequently, surface runoff is no problem. The available water holding capacity is low. The content of organic matter normally is low, but where bermudagrass has been growing for a number of years, it is comparatively high. Natural fertility is low. The reaction is neutral to moderately alkaline.

A conservation cropping system consists dominantly of close-growing crops that are soil conserving or soil improving. A clean-tilled crop can be grown occasionally if crop residues are utilized, fertilizers are applied according to soil tests and to current recommendations, supporting practices to control water are carried out, and the soil is protected from backwater. Without supporting practices, these soils should be in perennial vegetation nearly all of the time. The best suited crops are those that grow in winter and in spring when moisture normally is abundant. Early truck crops are well suited. Early corn, small grain, and wild winter peas are fairly well suited. Bermudagrass is the best pasture crop. Crimson clover is fairly well suited.

Trees that grow well are black willow, cottonwood, sycamore, American elm, and boxelder.

These soils are easily worked but are very droughty. Rows should be so arranged as to conserve moisture. These soils should not be left without a cover.

Additional organic matter will increase the available water holding capacity. Organic matter can best be supplied by turning under crop residues and by growing a suitable sod crop. Nitrogen is needed. Soil tests should be made to determine needs for other fertilizers.

General Management

Management of cropland.—Some principles of good management apply to all the tillable soils in Issaquena County. These include the use of a suitable crop rotation, the return of crop residues to the soil, the arrangement of rows so as to improve drainage without causing erosion, the use of grassed drainageways, and the application of adequate amounts of fertilizers and lime.

A suitable crop rotation is one that helps to control erosion, increases the content of organic matter, and improves the general physical condition of the soil. A cover crop in the rotation will help to protect the soil and will add organic matter to the soil. If practical, winter cover crops should be allowed to mature before being turned under. A legume in the rotation will add nitrogen to the soil. Suitable rotations are suggested in the discussion of each capability unit.

Residues from crops should be left on the soil to provide a protective cover. When turned under they improve workability and water-holding capacity and increase the content of organic matter. Residues can be shredded and then spread evenly. Fields should not be burned over.

The control of excess water by the arrangement of rows and the use of various types of drains is discussed in the subsection, Conservation Engineering. Other practices that help control water include vegetating the waterways on the steeper slopes and planting perennial hay and pasture crops on the steeper banks along streams and bayous.

Nitrogen is the principal fertilizer needed for most locally grown crops. At present, phosphate and potash have little effect on crops other than legumes. In time, as larger applications of nitrogen are used, the response to phosphate and potash may increase.

Fertilizer recommendations based on recent experiments are published periodically by the Mississippi Agricultural Experiment Station. These recommendations are general, they are not for specific soil types, nor are the rates suggested the ones needed to obtain exceptionally high yields. The amount of lime needed must be determined by soil tests. Soil testing is a free service offered by the Mississippi Extension Service. Information concerning this service can be obtained from the county agent.

Management of pasture.—The commercial production of livestock, principally beef cattle, has increased considerably in recent years. As a result, the acreage in pasture has greatly increased.

Most of the acreage now in pasture is suited to row crops and will be used for pasture and row crops in rotation. Only a small part on the steeper slopes along streambanks and depressions is unsuitable for cultivation.

Most long-range grazing programs are based on the use of perennial grasses and legumes. The most practical combination is one that includes either a summer or a winter perennial grass grown with a suitable legume. The legume supplies nitrogen to the grass and increases the content of protein in the forage.

Summer perennial grasses that are suitable are bermudagrass, dallisgrass, and johnsongrass. Coastal bermudagrass is somewhat new to the area. It is a hybrid that does not seed and is propagated by stolons. Once established, it is dependable and produces large quantities of high-quality forage. It is more nearly erect than common bermudagrass, which is also well suited. Dallisgrass and johnsongrass furnish excellent grazing. Lespedeza is a suitable legume to grow with dallisgrass. Red clover and wild winter peas are suitable with johnsongrass.

Fescue is the only winter perennial grass that is suitable. Wild winter peas, white clover, and red clover are suitable legumes.

Small grain, millet, and other annual crops can be grown to supplement the perennial pastures and to provide forage for feeder cattle.

Management of woodland.—Forests occupy 160,700 acres in Issaquena County—60.5 percent of the land area. Almost one-fifth of this acreage is between the Mississippi River and its levee; this area includes some of the most productive hardwood sites in the Nation.

A large part of the woodland is privately owned. The tracts range in size from a few to several thousand acres. Several large corporations own considerable acreages, and there are large tracts on the larger plantations.

The forests of the county are typically delta forests. They contain a variety of commercially valuable trees, principally oak, gum, cypress, ash, sycamore, cottonwood, willow, elm, pecan, and honeylocust. The species vary with the location. There are two major sites—first bottoms and terraces. Within each are four secondary sites—ridges, flats, sloughs, and swamps. On first bottoms there is a fifth secondary site—the new land, or front, along present or recent drainage channels.[2]

The sweetgum-water oak type of forest occurs on first bottoms but not in deep sloughs, in swamps, on fronts, or on the poorest flat sites. Other species commonly included in this type of forest are green ash, soft elm, hackberry, overcup oak, and pecan.

On the terraces, which are older formations than the first bottoms, the white oak-red oak type of forest occurs. Commonly included in this type of forest are hickory, white ash, blackgum, and winged elm. The terraces in Issaquena County are not extensive, and the white oak-red oak forest is not common.

The cottonwood-willow forest is a fast-growing type. Cottonwood generally grows in sandy loam on high banks along streams or cutoff lakes or in old fields. Willow grows on low banks along rivers or in shallow sloughs or swamps near rivers. In places the two species are associated. Areas from which the cottonwood and willow are removed are commonly taken over by sweetgum, sycamore, hackberry, green ash, soft elm, maple, boxelder, persimmon, and cypress.

The tupelo-cypress forest occurs mainly in the deep swamps and on the fertile but heavy buckshot soils of the low, wet flats and deep sloughs. In some sections of the county, pure stands of one species or the other prevail.

[2] Forestry Service, USDA. Occasional Paper 116.

The overcup oak-bitter pecan forest occupies poorly drained clay flats on both the first bottoms and the terraces of the larger streams. These are rather poor species, but they generally are associated with more desirable species, principally Nuttall oak and green ash.

Inventory figures show that the forests of Issaquena County contain some 84 million cubic feet of standing timber. In 1956, 6 million cubic feet of forest products were removed. About 26 million board feet of sawtimber made up the largest part of this harvest.

Much of the woodland in the county, especially that owned by smaller landowners, is in poor condition because of fires and poor cutting practices. Most of the virgin forests are gone. The present forests have been cut over several times without regard for proper harvesting practices.

The trend in Issaquena County is to convert woodland to farmland. The land to be cleared should be carefully chosen because some areas will produce more income if used to grow trees than if used for row crops or pasture.

Simple practices would make the woodlands of the county more productive. They are (1) removing cull trees if they interfere with thrifty timber; (2) reducing losses from fire and other destructive agents; and (3) improving cutting practices so that more land is left in condition to produce continuous high yields of timber.

Management of wildlife.—The lakes, swamps, and bayous and the vast woodland areas in Issaquena County provide excellent habitats for wildlife. In certain seasons many people come to the county to hunt and fish. The lakes and streams are well stocked with fish. Raccoons are plentiful and are hunted for their fur. Squirrels are fairly plentiful. In the migration season doves concentrate in large flocks. Ducks and geese are fairly plentiful late in fall and in winter. Quail are not too numerous. Deer are numerous, but only the bucks are hunted. State and Federal game laws are enforced by both the State and Federal Fish and Game Commissions.

Management of wildlife consists mainly of providing food if natural sources fail. At times small clearings in the forest are seeded to provide grazing for deer. Supplemental feed for waterfowl is provided by flooding grainfields and oak flats late in fall and early in winter.

Management of waters for game fish consists mostly of controlling the population of rough fish. Little work of this kind has been done in the county, but many rough fish are taken each year by commercial fishermen.

Estimated Yields

In table 1 are given the estimated average acre yields of the principal crops grown on each of the soils in Issaquena County under two levels of management. In columns A are average yields based on management now prevalent in the county. In columns B are yields based on management that includes the choice of suitable crop varieties, proper use of fertilizers, control of insects, proper tillage, and adequate drainage.

The estimates are based mainly on information obtained from experimental data and from farmers and other agricultural workers who were in a position to observe soils and crop yields in this county and in neighboring counties.

TABLE 1.—*Estimated average acre yields of principal crops under two levels of management*

[Yields in columns A are those to be expected over a period of years under common management practices; those in columns B, under improved management practices. Absence of yield indicates crop is not commonly grown under management specified]

Soil	Capability unit	Cotton		Corn		Soybeans		Oats		Rice [1]	
		A	B	A	B	A	B	A	B	A	B
		Lb.	*Lb.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*	*Bu.*
Alluvial land	------	------	------	------	------	------	------	------	------	------	------
Beulah very fine sandy loam, 0 to 3 percent slopes.	IIs–1	375	500	35	55	------	------	30	60	------	------
Bowdre clay, 0 to 2 percent slopes	IIs–2	425	550	30	45	15	25	30	50	------	------
Bowdre clay, 2 to 5 percent slopes	IIIs–2	425	550	25	40	15	25	30	50	------	------
Commerce silt loam, 0 to 2 percent slopes	I–1	700	825	45	90	30	45	40	65	------	------
Commerce silt loam, moderately shallow, 0 to 2 percent slopes.	I–1	700	825	45	90	30	45	40	65	------	------
Commerce very fine sandy loam, 0 to 2 percent slopes.	I–1	700	825	45	90	30	45	40	65	------	------
Commerce very fine sandy loam, 2 to 5 percent slopes.	IIe–1	650	750	35	80	15	40	40	65	------	------
Commerce silty clay loam, 0 to 2 percent slopes.	IIs–6	650	775	35	60	30	40	35	55	------	------
Commerce silty clay loam, 2 to 5 percent slopes.	IIe–4	550	600	30	55	20	30	35	55	------	------
Commerce silty clay loam, moderately shallow, 0 to 2 percent slopes.	IIs–6	625	750	35	60	30	40	35	55	------	------
Crevasse sandy loams and loamy sands, 0 to 3 percent slopes.	IVs–1	------	------	------	------	------	------	------	------	------	------
Dowling clay	IVw–1	------	------	------	------	15	30	------	------	------	75
Dowling soils	IIIw–13	200	300	15	35	15	30	------	------	------	75
Dundee silt loam, 0 to 2 percent slopes	I–1	625	750	45	90	20	35	40	60	------	------
Dundee silty clay loam, 0 to 2 percent slopes	IIs–6	525	650	30	55	20	35	35	55	------	70
Forestdale silty clay loam, 0 to 2 percent slopes.	IIs–4	350	475	------	------	20	35	30	50	50	85
Mhoon silty clay, 0 to 2 percent slopes	IIIs–4	325	420	25	45	25	45	25	45	50	75
Robinsonville very fine sandy loam, 0 to 2 percent slopes.	I–2	700	825	45	90	------	------	45	65	------	------
Robinsonville very fine sandy loam, 2 to 5 percent slopes.	IIe–2	625	750	40	70	------	------	45	65	------	------
Sharkey clay, ½ to 2 percent slopes	IIIs–4	300	475	25	45	20	40	25	45	------	85
Sharkey clay, 0 to ½ percent slopes	IIIw–11	175	250	------	------	10	30	25	45	------	85
Sharkey clay, 2 to 5 percent slopes	IIIs–4	300	475	20	40	25	45	25	45	------	------
Sharkey silty clay loam, 0 to 2 percent slopes.	IIs–4	325	425	------	------	25	40	25	45	------	85
Sharkey fine sandy loam, overwash, 0 to 2 percent slopes.	IIs–5	675	800	40	85	30	45	40	65	------	------
Sharkey silt loam, overwash, 0 to 2 percent slopes.	IIs–5	675	800	40	85	30	45	40	65	------	------
Sharkey and Dowling clays	IIIw–11	------	------	------	------	------	------	------	------	------	------
Tunica clay, 0 to 2 percent slopes	IIs–2	450	600	25	50	25	40	30	55	------	70
Tunica clay, 2 to 5 percent slopes	IIIs–2	450	600	20	45	30	40	30	55	------	------
Tunica silty clay loam, 0 to 2 percent slopes	IIs–6	475	650	25	50	15	25	30	55	------	------

[1] Rice is not grown in the county at the present time but is well suited to several soils.

Tables 2, 3, 4, and 5 show the estimated average cow-months of grazing per acre for the specified soils with the pasture combinations listed and at the specified rates of nitrogen fertilization.

Properly managed legumes in the plant community supply considerable amounts of nitrogen to the soil. The estimated amounts supplied are shown in a footnote in each table.

The estimate of average cow-months of grazing is an index to the amount of forage that is supplied under different plant communities. For example, an estimate of 2.5 cow-months per acre indicates that in 1 month enough forage is supplied to graze 2 cows for a full month and 1 cow for half a month.

The information in these tables was furnished by the Delta Branch Experiment Station in cooperation with the Soil Conservation Service.

TABLE 2.—*Estimated average cow-months of grazing per acre on Beulah and Crevasse soils* [1]

Plant community [2]	Rates of nitrogen fertilization	Cow-months grazing per acre												Total cow-months	Clippings	Hay
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.			
	Lb. per acre														*Tons*	*Tons*
1. Coastal bermudagrass and wild winter peas.	120	0	0.5	1.6	1.6	1.8	2.4	2.4	1.8	1.4	1.0	0.7	0.3	15.5	2.0	6.0
	60	0	.5	1.2	1.5	1.6	2.0	1.6	1.2	1.0	.7	.3	0	11.6	1.5	5.0
	30	0	.5	1.2	1.5	1.6	1.6	1.2	1.0	.8	.5	.3	0	10.2	1.0	4.0
	Native [3]	0	.5	1.2	1.5	1.6	1.4	1.0	.8	.6	.5	.3	0	9.4	1.0	3.0
2. Common bermudagrass and wild winter peas.	120	0	0	1.0	1.2	1.4	1.8	1.8	1.2	1.0	.8	.5	0	10.7	1.0	4.0
	60	0	0	.8	1.2	1.2	1.6	1.2	1.0	.8	.5	0	0	8.3	0	3.0
	30	0	0	.8	1.2	1.2	1.4	1.0	.8	.6	.3	0	0	7.3	0	2.5
	Native [3]	0	0	.8	1.2	1.2	1.2	.8	.6	.4	.3	0	0	6.5	0	2.0
3. Johnsongrass and crimson clover.	120	0	0	1.0	1.5	2.0	2.2	2.0	1.2	.8	.6	0	0	11.3	1.5	6.0
	60	0	0	1.0	1.2	2.0	2.0	1.0	.8	.6	.4	0	0	11.0	1.0	5.0
	30	0	0	1.0	1.2	1.5	1.5	.8	.6	.4	.3	0	0	7.3	0	4.0
	Native [3]	0	0	1.0	1.0	1.2	1.2	.6	.4	.2	.2	0	0	5.8	0	3.0
4. Dallisgrass and lespedeza.	120	0	0	0	1.0	1.5	1.8	1.8	1.2	.8	.4	0	0	8.5	1.5	(4)
	60	0	0	0	1.0	1.4	1.4	.8	.6	.5	.2	0	0	5.9	1.0	(4)
	30	0	0	0	1.0	1.2	1.2	.6	.4	.4	.2	0	0	5.0	.7	(4)
	Native [3]	0	0	0	1.0	1.0	1.0	.4	.3	.3	.2	0	0	4.2	.3	(4)

[1] Droughty soils produce somewhat earlier forage than heavier textured soils but dry up more rapidly late in summer. Tall fescue is not suited to these soils, and if planted it can be expected to die out in 2 or 3 years.

[2] Properly managed legumes in plant community 1 will supply the equivalent of 100 pounds of nitrogen; in community 2, 80 pounds; in 3, 75 pounds; and in 4, 30 pounds.

[3] "Native" means that no fertilizer has been applied in the past 5 years.

[4] These plants generally are not used for hay.

TABLE 3.—*Estimated average cow-months of grazing per acre on Commerce, Dundee, and Robinsonville soils*

Plant community [1]	Rates of nitrogen fertilization [2]	Cow-months grazing per acre												Total cow-months	Clippings	Hay
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.			
	Lb. per acre														*Tons*	*Tons*
1. Coastal bermudagrass and wild winter peas.	120	0	0.5	1.2	1.6	1.8	2.4	2.4	2.0	1.8	1.4	0.7	0.3	16.1	2.0	8.0
	60	0	.5	1.2	1.5	1.8	2.0	2.0	1.6	1.4	1.2	.6	.3	14.1	0	6.0
	30	0	.5	1.2	1.5	1.6	1.8	1.6	1.4	1.2	1.0	.5	.3	12.6	0	4.0
	Native [3]	0	.5	1.0	1.2	1.4	1.6	1.4	1.2	.8	.8	.5	.3	10.7	0	3.0
2. Tall fescue and whiteclover.	120	.3	.6	1.0	2.0	2.0	1.0	.6	0	.6	1.0	1.5	1.0	11.6	1.0	(4)
	60	.3	.6	1.0	2.0	2.0	1.0	.6	0	.4	.8	1.2	1.0	10.9	.5	(4)
	30	.3	.6	1.0	2.0	2.0	1.0	.6	0	0	.4	.8	.4	9.1	0	(4)
	Native [3]	.3	.6	1.0	2.0	2.0	.8	.4	0	0	------	.8	.4	8.3	0	(4)
3. Common bermudagrass and wild winter peas.	120	0	0	.8	1.2	1.4	1.8	1.8	1.6	1.2	1.0	.5	0	11.3	1.0	6.0
	60	0	0	.8	1.0	1.4	1.6	1.6	1.0	1.0	.8	.3	0	9.5	0	4.0
	30	0	0	.8	1.0	1.2	1.2	1.2	1.0	.8	.6	.3	0	8.1	0	3.0
	Native [3]	0	0	.8	1.0	1.0	1.2	1.0	.6	.4	.4	.2	0	6.6	0	2.0
4. Johnsongrass and red clover.	120	0	0	.7	1.5	2.0	2.2	2.2	2.0	1.6	1.0	0	0	13.2	1.5	7.0
	60	0	0	.7	1.2	2.0	2.0	1.2	1.0	.8	.6	0	0	9.5	1.0	5.5
	30	0	0	.7	1.2	1.5	1.5	1.0	.8	.6	.2	0	0	7.5	0	4.5
	Native [3]	0	0	.7	1.0	1.2	1.2	.8	.6	.4	.2	0	0	6.1	0	4.0
5. Dallisgrass and lespedeza.	120	0	0	0	1.0	1.5	1.8	1.8	1.5	1.2	1.0	0	0	9.8	1.5	(4)
	60	0	0	0	1.0	1.4	1.4	1.2	.8	.6	.3	0	0	6.7	1.0	(4)
	30	0	0	0	1.0	1.2	1.2	1.0	.6	.4	.3	0	0	5.7	.7	(4)
	Native [3]	0	0	0	.8	1.0	1.0	.8	.4	.3	.3	0	0	4.6	.3	(4)

[1] Properly managed legumes in plant community 1 will supply the equivalent of 100 pounds of nitrogen; in community 2, 100 pounds; in 3, 90 pounds; in 4, 100 pounds; and in 5, 50 pounds.

[2] To prevent damage to the clover, the nitrogen fertilization of tall fescue-whiteclover pastures generally should be in fall after the fall growth is removed.

[3] "Native" means that no fertilizer has been applied in the past 5 years.

[4] These plants generally are not used for hay.

TABLE 4.—*Estimated average cow-months of grazing per acre on Bowdre, Dowling, Mhoon, Sharkey, and Tunica soils*

Plant community [1]	Rates of nitrogen fertilization	Cow-months grazing per acre												Total cow-months	Clippings	Hay
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.			
	Lb. per acre														*Tons*	*Tons*
1. Tall fescue and whiteclover.	120	0	0.6	1.0	2.0	2.0	1.2	0.8	0.3	0.6	1.0	1.5	1.0	12.0	1.0	(2)
	60	0	.6	1.0	2.0	2.0	1.2	.8	.3	.4	.8	1.2	.8	11.1	0	(2)
	30	0	.6	1.0	1.8	1.8	1.2	.8	.3	0	.8	1.0	.6	9.9	0	(2)
	Native [3]	0	.6	1.0	1.6	1.6	1.0	.6	.3	0	.4	.8	.4	8.3	0	(2)
2. Coastal bermudagrass and wild winter peas.	120	0	0	1.2	1.6	1.6	2.4	2.4	2.0	1.8	1.4	.7	.3	15.4	2.0	7.0
	60	0	0	1.0	1.2	1.4	2.0	2.0	1.6	1.4	1.2	.6	.3	12.7	1.5	5.0
	30	0	0	1.0	1.2	1.4	1.8	1.6	1.4	1.0	.8	.5	.3	11.0	1.0	4.0
	Native [3]	0	0	.8	1.0	1.2	1.6	1.4	1.2	.8	.6	.4	.3	9.3	1.0	3.0
3. Common bermudagrass and wild winter peas.	120	0	0	.8	1.2	1.4	1.8	1.8	1.5	1.0	.8	.3	0	10.6	1.5	6.0
	60	0	0	.8	1.0	1.0	1.6	1.4	1.0	.8	.6	.3	0	8.5	1.0	4.0
	30	0	0	.8	1.0	1.0	1.4	1.2	.8	.6	.4	.3	0	7.5	.7	3.0
	Native [3]	0	0	.8	1.0	1.0	1.0	1.0	.6	.4	.3	.3	0	6.4	.5	2.0
4. Dallisgrass and lespedeza.	120	0	0	0	.8	1.5	1.8	1.8	1.5	1.2	.1	0	0	8.7	1.5	(2)
	60	0	0	0	.8	1.4	1.4	1.2	.8	.6	.3	0	0	6.5	1.0	(2)
	30	0	0	0	.8	1.2	1.2	1.0	.6	.4	.3	0	0	5.5	.7	(2)
	Native [3]	0	0	0	.6	1.0	1.0	.8	.4	.3	.3	0	0	4.4	.5	(2)
5. Johnsongrass and red clover.	120	0	0	0	1.2	2.0	2.0	2.2	2.0	1.6	1.0	0	0	12.0	1.5	7.0
	60	0	0	0	1.0	2.0	2.0	1.6	1.2	1.0	.8	0	0	9.6	1.0	5.5
	30	0	0	0	1.0	1.5	1.5	1.2	1.0	.8	.6	0	0	7.6	0	4.5
	Native [3]	0	0	0	1.0	1.2	1.2	1.0	.8	.6	.4	0	0	6.2	0	3.5

[1] Properly managed legumes in plant community 1 will supply the equivalent of 90 pounds of nitrogen; in community 2, 90 pounds; in 3, 80 pounds; in 4, 40 pounds; and in 5, 90 pounds.

[2] These plants generally are not used for hay.

[3] "Native" means that no fertilizer has been applied in the past 5 years.

TABLE 5.—*Estimated average cow-months of grazing per acre on Forestdale soil* [1]

Plant community [2]	Rates of nitrogen fertilization	Cow-months grazing per acre												Total cow-months	Clippings	Hay
		Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.			
	Lb. per acre														*Tons*	*Tons*
1. Coastal bermudagrass and wild winter peas.	120	0	0	0	1.0	1.5	2.0	2.4	2.2	2.0	1.4	0.8	0.4	13.7	1.0	6.0
	60	0	0	0	1.0	1.5	1.6	2.0	2.0	1.5	1.0	.4	0	11.0	1.0	4.5
	30	0	0	0	1.0	1.5	1.4	1.8	1.8	1.2	.6	.3	0	9.6	1.0	3.5
	Native [3]	0	0	0	1.0	1.5	1.2	1.2	1.2	1.0	.4	0	0	7.5	.5	2.5
2. Tall fescue and whiteclover.	120	0	0	.8	1.5	1.8	1.2	1.0	.5	.6	1.0	1.5	.8	10.7	0	(4)
	60	0	0	.8	1.5	1.8	1.2	1.0	.5	.4	.8	1.2	.6	9.8	0	(4)
	30	0	0	.8	1.5	1.8	1.2	1.0	.3	0	.8	1.0	.4	8.8	0	(4)
	Native [3]	0	0	.8	1.3	1.6	1.0	.8	.3	0	.4	.6	.3	7.1	0	(4)
3. Dallisgrass and lespedeza.	120	0	0	0	.3	1.2	1.8	1.8	1.5	1.2	1.0	0	0	8.8	1.0	(4)
	60	0	0	0	.3	1.0	1.4	1.2	.8	.6	.3	0	0	5.6	.6	(4)
	30	0	0	0	.3	1.0	1.2	1.0	.6	.4	.3	0	0	4.8	.4	(4)
	Native [3]	0	0	0	.3	.8	1.0	.8	.4	.3	.3	0	0	3.9	.3	(4)
4. Common bermudagrass and wild winter peas.	120	0	0	0	.8	1.3	1.5	1.0	1.8	1.6	1.0	.4	0	9.4	1.0	5.0
	60	0	0	0	.8	1.3	1.3	1.3	1.2	1.0	.8	0	0	7.7	0	3.5
	30	0	0	0	.8	1.3	1.2	1.2	1.0	.8	.6	0	0	6.9	0	2.5
	Native [3]	0	0	0	.8	1.3	1.0	1.0	.8	.6	.4	0	0	5.9	0	2.0
5. Johnsongrass and red clover.	120	0	0	0	1.0	1.6	2.0	2.0	2.0	1.6	1.0	0	0	11.2	1.5	6.0
	60	0	0	0	1.0	1.4	2.0	1.6	1.2	1.0	.8	0	0	9.0	1.0	4.5
	30	0	0	0	1.0	1.2	1.5	1.2	1.0	.8	.6	0	0	7.3	0	4.0
	Native [3]	0	0	0	1.0	1.0	1.2	1.0	.8	.6	.4	0	0	6.0	0	3.0

[1] This soil must be well drained to maintain a stand of legumes.

[2] Properly managed legumes in plant community 1 will supply the equivalent of 50 pounds of nitrogen; in 2, 50 pounds; in 3, 30 pounds; in 4, 50 pounds; and in 5, 60 pounds.

[3] "Native" means that no fertilizer has been applied in the past 5 years.

[4] These plants generally are not used for hay.

Engineering Properties of Soils

Soil engineering deals with soil as structural material and as foundation material upon which structures rest. To engineers, soil is a natural material that occurs in infinite variety over the earth and that may have widely different engineering properties within the space covered by a single project. Generally, soil must be used in the locality and in the condition in which it occurs.

Important steps in soil engineering are to differentiate between the various kinds of soil and to map their location, to determine their engineering properties, to correlate their properties with the requirements of the job, and to select the best material for each job.

Engineers of the United States Bureau of Public Roads and the Soil Conservation Service collaborated with soil scientists of the Soil Conservation Service in preparing this subsection.

This section and others in the report contain information that can be used by engineers to—

1. Make soil and land use studies that will aid in selecting and developing industrial, business, residential, and recreational sites.
2. Assist in designing drainage and irrigation structures and in planning dams and other structures for water and soil conservation.
3. Make preliminary evaluations of soil and ground conditions that will aid in selecting highway, pipeline, and airport locations and in planning detailed soil surveys for the intended locations.
4. Locate sand and gravel for use in structures.
5. Correlate performance of engineering structures with types of soil and thus develop information that will be useful in designing and maintaining structures.
6. Determine the suitability of soil units for cross-country movements of vehicles and construction equipment.
7. Supplement information obtained from other published maps and reports and aerial photographs for the purpose of making soil maps and reports that can be used readily by engineers.

The soil map and the descriptive soil report are somewhat generalized, however, and should be used only in planning more detailed field surveys that will, in turn, be used to determine the in-place condition of the soil at the site of the proposed engineering construction.

Some terms used by soil scientists may not be familiar to engineers, and some words—for example, soil, clay, silt, sand, and parent material—have special meanings in soil science. Most of these terms are defined in the Glossary at the back of this report. Other parts of this report also may be useful to engineers, particularly the section "Descriptions of Soils."

At many construction sites, major soil variations occur within the depth of proposed excavations and several different soils may occur within short distances. If the maps, descriptions, and other data in this report are used to plan detailed soil investigations at construction sites, a minimum number of soil samples will be needed for laboratory testing. After testing the soils and observing their behavior, in place, under various conditions, engineers should be able to anticipate to some extent the properties of the various types of soil wherever they are mapped.

In table 6 the soils of the county are described briefly and their estimated physical properties are given.

The soil characteristics most likely to affect the common engineering practices are shown in table 7. These characteristics are evaluated on the basis of the estimates given in table 6, the test data shown in table 8, and actual field experience and performance.

Soil test data

To help evaluate the soils for engineering purposes, samples of the principal soil types in three extensive soil series were tested in accordance with standard procedures. The results of those tests are given in table 8.

Each soil type was sampled to a depth of about 6 feet in three localities. The test data show some variations in the characteristics of these soils but probably do not show the entire range of variations in the lower horizons. The data, therefore, may not be adequate for estimating the characteristics of soil material in deep cuts on rolling topography.

The engineering soil classifications in table 8 are based on data obtained by mechanical analyses and by tests made to determine liquid limits and plastic limits. Mechanical analyses were made by combined sieve and hydrometer methods.

The liquid-limit and plastic-limit tests measure the effect of water on the consistence of the soil material. As the moisture content of clayey soil increases from a very dry state, the material changes from a solid to a semisolid, or plastic, state. As the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material passes from a solid state to a plastic state. The liquid limit is the moisture content at which the material passes from a plastic state to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is in a plastic condition.

If a soil material is compacted at successively higher moisture contents, assuming that the compactive effort remains constant, the density of the compacted material will increase until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest dry density obtained in the compaction test is termed "maximum dry density". Moisture-density data are important in earthwork, for, as a rule, optimum stability is obtained if the soil is compacted to about the maximum dry density when it is at approximately the optimum moisture content.

Engineering classification systems

Most highway engineers classify soil materials in accordance with the system approved by the American Association of State Highway Officials (*1*).[3] In this system soil materials are classified in seven principal groups. The groups range from A-1, consisting of gravelly soils of high bearing capacity, to A-7, consisting of clay soils having low strength when wet. Within

[3] Italic numbers in parentheses refer to Literature Cited, page 39.

TABLE 6.—*Brief descriptions of the soils*

[The physical properties are based on field observations

Map symbol	Soil	Brief description of soils	Depth to seasonally high water table [1]	Depth from surface [2]	Engineering classification: USDA textural class
			Feet	*Inches*	
Ba	Beulah very fine sandy loam, 0 to 3 percent slopes.	Somewhat excessively drained very fine sandy loam underlain by loamy fine sand.	4 to 6+	0 to 6	Very fine sandy loam.
				6 to 20	Very fine sandy loam.
				20 to 50	Loamy fine sand.
Bk Bm	Bowdre clay, 0 to 2 percent slopes. Bowdre clay, 2 to 5 percent slopes.	Moderately well drained clay underlain by coarser textured sediments at depths of 10 to 20 inches.	½ to 6	0 to 15	Clay
				15 to 20	Silty clay loam
				20 to 35	Silt loam
				35 to 58	Very fine sandy loam.
Cb Cn Cr Ch Ck	Commerce silt loam, 0 to 2 percent slopes. Commerce very fine sandy loam, 0 to 2 percent slopes. Commerce very fine sandy loam, 2 to 5 percent slopes. Commerce silty clay loam, 0 to 2 percent slopes. Commerce silty clay loam, 2 to 5 percent slopes.	Somewhat poorly drained to moderately well drained, stratified very fine sandy loam to silty clay loam.	2	0 to 6	Silt loam
				6 to 44	Silt loam
				44 to 50	Silty clay loam
Cm Cd	Commerce silty clay loam, moderately shallow, 0 to 2 percent slopes. Commerce silt loam, moderately shallow, 0 to 2 percent slopes.	Somewhat poorly drained to moderately well drained stratified silt loam to silty clay loam underlain by clay at depths of 20 to 36 inches.	1 to 2	0 to 6	Silty clay loam
				6 to 28	Silt loam
				28 to 36+	Clay
Cv	Crevasse sandy loams and loamy sands, 0 to 3 percent slopes.	Excessively drained, stratified sandy loam to loamy sand.	2 to 4+	0 to 4	Loamy sand
				4 to 40	Loamy sand
Da Db	Dowling clay. Dowling soils.	Poorly drained clayey soils in depressions.	0	0 to 4	Clay
				4 to 40	Clay
Df Dk	Dundee silt loam, 0 to 2 percent slopes. Dundee silty clay loam, 0 to 2 percent slopes.	Somewhat poorly drained to moderately well drained silt loam and silty clay loam.	2 to 4	0 to 6	Silt loam
				6 to 18	Silty clay loam
				18 to 36	Silt loam
Fd	Forestdale silty clay loam, 0 to 2 percent slopes.	Poorly drained to somewhat poorly drained silty clay loam underlain by silty clay and clay.	½ to 1	0 to 4	Silty clay loam
				4 to 8	Silty clay
				8 to 26	Clay
				26 to 30	Silty clay
				30 to 36	Silty clay loam
Mh	Mhoon silty clay, 0 to 2 percent slopes.	Poorly drained silty clay underlain by stratified silty clay to silt loam.	0 to ½	0 to 11	Silty clay
				11 to 30	Silt loam
				30 to 34	Silty clay loam
				34 to 40	Clay
Ro Rs	Robinsonville very fine sandy loam, 0 to 2 percent slopes. Robinsonville very fine sandy loam, 2 to 5 percent slopes.	Well-drained very fine sandy loam.	3	0 to 6	Very fine sandy loam.
				6 to 42	Very fine sandy loam.
Sb Sa Sc Sk	Sharkey clay, ½ to 2 percent slopes. Sharkey clay, 0 to ½ percent slopes. Sharkey clay, 2 to 5 percent slopes. Sharkey silty clay loam, 0 to 2 percent slopes.	Poorly drained clayey soils.	0 to ½	0 to 4	Clay
				4 to 28	Clay
				29 to 46	Silty clay

and their estimated physical properties

and experience and apply only to Issaquena County]

Engineering classification—Continued		Percentage passing sieve—		Permeability [3]	Structure	Available moisture holding capacity [4]	Reaction [5]	Dispersion [6]	Shrink-swell potential [7]
Unified	AASHO	No. 200	No. 10						
				Inches per hour		*Inches per foot*	*pH*		
SM or SC	A-4	40	100	2.5 to 5.0	Fine granular	1.08	5.1 to 5.5	High	Low.
SM or SC	A-2	30	100	2.5 to 5.0	Subangular blocky.	1.44	5.1 to 5.5	High	Low.
SM	A-1-b or A-2.	12	100	5.0 to 10.0	Structureless	.84	5.1 to 5.5	High	Low.
MH-CH	A-7	95	100	0.05 to 0.2	Massive	4.0	4.5 to 5.0	Low	Very high.
CL	A-6	60 to 95	100	0.2 to 0.8	Structureless	2.9	4.5 to 5.0	Moderate	Moderate.
ML-CL	A-4	60 to 95	100	0.8 to 2.5	Structureless	2.0	4.5 to 5.0	High	Low.
SM or ML	A-2 or A-4	25 to 65	100	0.8 to 2.5	Structureless	1.44	4.5 to 5.0	High	Low.
ML-CL	A-4	95	100	0.8 to 2.5	Fine granular	2.0	6.1 to 6.5	High	Low.
ML	A-4	70 to 95	100	0.8 to 2.5	Structureless	2.0	6.6 to 7.8	High	Low.
CL or CH	A-4 to A-7	95	100	0.2 to 0.8	Structureless	2.9	7.4 to 7.8	Moderate	Moderate.
CL	A-7	95	100	0.2 to 0.8	Fine granular	2.9	6.1 to 6.5	Moderate	Moderate.
ML-CL	A-4	95	100	0.8 to 2.5	Structureless	2.0	6.6 to 7.8	High	Low.
CL	A-6 or A-7	95	100	<.05	Massive	4.0	6.6 to 7.8	Low	Very high.
SP	A-2	5	100	5.0 to 10.0	Structureless	.7	6.6 to 7.3	High	Low.
SP	A-2	5	100	5.0 to 10.0	Structureless	.7	6.6 to 7.3	High	Low.
CH	A-7	95	100	<.05	Granular	4.0	6.1 to 6.5	Low	Very high.
CH	A-7	95	100	<.05	Massive	4.0	6.1 to 6.5	Low	Very high.
ML-CL	A-4	90	100	0.8 to 2.5	Fine granular	2.0	5.6 to 6.0	High	Low.
CL	A-6	95	100	0.2 to 0.8	Subangular blocky.	3.0	6.1 to 6.5	Moderate	Moderate.
ML-CL	A-4	95	100	0.8 to 2.5	Structureless	2.0	6.1 to 6.5	High	Low.
CL	A-6	90	100	0.2 to 0.8	Granular	2.8	5.6 to 6.0	Moderate	Moderate.
CH	A-6	90	100	.05 to 0.2	Subangular blocky.	3.5	5.6 to 6.0	Low	High.
CH	A-7	95	100	<.05	Subangular blocky.	3.5	5.6 to 6.0	Low	Very high.
CH	A-6	90	100	.05 to 0.2	Massive	3.5	5.6 to 6.0	Low	High.
CL	A-6	90	100	0.2 to 0.8	Massive	2.8	5.6 to 6.0	Moderate	Moderate.
CH	A-7	95	100	<.05	Massive	4.0	6.6 to 7.3	Low	High.
ML-CL	A-6	70 to 90	100	0.8 to 2.5	Structureless	2.0	7.9 to 8.4	High	Low.
CL	A-6	95	100	0.2 to 0.8	Structureless	2.9	7.9 to 8.4	Moderate	Moderate.
CH	A-7	95	100	<.05	Massive	4.0	7.4 to 7.8	Low	Very high.
ML	A-4	60	100	2.5 to 5.0	Fine granular	1.44	6.6 to 7.3	High	Low.
ML	A-4	60	100	2.5 to 5.0	Structureless	1.44	7.4 to 8.4	High	Low.
CH	A-7	95	100	<.05	Granular	4.0	4.5 to 5.0	Low	Very high.
CH	A-7	95	100	<.05	Massive	4.0	4.4 to 5.0	Low	Very high.
CH	A-7	95	100	<.05	Massive	4.0	5.6 to 6.0	Low	High.

TABLE 6.—*Brief description of the soils and*

Map symbol	Soil	Brief description of soils	Depth to seasonally high water table [1]	Depth from surface [2]	Engineering classification: USDA textural class
			Feet	*Inches*	
Sf	Sharkey fine sandy loam, overwash, 0 to 2 percent slopes.	Poorly drained clayey soils that have been overwashed by fine sandy loam and silt loam to depths of 5 to 20 inches.	½ to 1	0 to 5	Fine sandy loam
Se	Sharkey silt loam, overwash, 0 to 2 percent slopes.			5 to 14	Very fine sandy loam.
				14 to 36+	Clay
Sr	Sharkey and Dowling clays.	Unclassified slack-water clay and soils in depressions in wooded areas.	½ to 1	0 to 40	Clay
Ta	Tunica clay, 0 to 2 percent slopes.	Somewhat poorly drained clayey soils underlain by coarser textured material at depths of 20 to 32 inches.	0 to ½	0 to 6	Clay
Tb	Tunica clay, 2 to 5 percent slopes.			6 to 28	Clay
Tc	Tunica silty clay loam, 0 to 2 percent slopes.			28 to 36	Silty clay loam
				36 to 45+	Silt loam

[1] In winter the water table can be expected to rise almost to the surface.

[2] Depths are those shown in the typical soil profile of each soil series described in the section "Descriptions of Soils."

[3] Permeability is based on soil structure without compaction. The method used to estimate permeability was developed by Alfred M. O'Neal (See "A Key for Evaluating Soil Permeability by Means of Certain Field Clues" in SSSA Proceedings, v. 16, No. 3).

each group, the relative engineering value of the soil material may be indicated by a group index number. Group indexes range from 0 for the best materials to 20 for the poorest. The group index number is shown in parentheses, following the soil group symbol (see table 8). The AASHO classification of each sample tested is shown in next to the last column in table 8.

Some engineers prefer to use the Unified Soil Classification System (*9*). In this system soil materials are identified as coarse grained (8 classes), fine grained (6 classes), or highly organic. The classification of each sample tested, according to the Unified system, is given in the last column in table 8.

Conservation engineering

This subsection explains the methods now used in the county for draining, irrigating, and leveling soils. In planning drainage, irrigation, or leveling of a soil, it will be helpful to study the engineering properties of that soil, as they are shown in tables 6 and 7.

DRAINAGE.—A good drainage system is essential if the farmlands of Issaquena County are to be used efficiently. Much has been done to improve drainage, but additional improvements are needed.

Outlets.—Adequate outlets are essential to good drainage. The numerous streams and bayous in the county should provide ample outlets, but over the years natural levees have built up until streams are at higher elevations than surrounding areas, and many of the deeper streams are choked with brush and vegetation. To provide drainage outlets, dragline ditches should be run from the slack-water areas to the streams and bayous, and the streams and bayous should be cleared of brush and vegetation. In many places this has been done by workers employed by the drainage districts, by the Corps of Army Engineers, and by the Soil Conservation Service.

Secondary drainage ditches.—These ditches generally are cut with a dragline and are trapezoidal in shape. They have a minimum depth of 2½ feet and have ½ : 1 side slopes. One ditch of this type commonly provides drainage for several farms.

V-type and W-type ditches.—These ditches serve as field drains and carry water from the rows to the secondary drainage ditches. As the name implies, the V-type ditch is shaped like the letter V. It has 3 : 1 minimum side slopes and, consequently, if fairly deep, is relatively wide at the top. It is generally designed to remove from 2 to 3 inches of water over a period of 24 hours. A ditch of this type is easy to maintain, and it can be crossed by farm machinery or used as a place to turn farm machinery. Water, however, will not drain easily into a V-type ditch unless the soil is leveled or special inlets are made.

A W-type ditch is built by moving the spoil from two small parallel ditches toward the center of the area between the ditches. This raises the height of the area and produces a ridge between the ditches. Water from the rows can drain easily into each of the two ditches (fig. 3). The raised center can be cultivated or can be used as a road or turnrow.

Row arrangement.—The arrangement of rows is important in providing drainage on farms. The grade of the rows should be just enough so that excess water will run off slowly and will not cause erosion. For most soils in the county, the best grade is 0.3 of a foot of fall per 100 feet of row length. Care is needed to keep the rows short enough so that the volume of water to be handled is not too large. Rows at this grade are run approximately at right angles to the predominant slope. Rows on the contour, *their estimated physical properties*—Continued

Engineering classification—Continued		Percentage passing sieve—		Permeability [3]	Structure	Available moisture holding capacity [4]	Reaction [5]	Dispersion [6]	Shrink-swell potential [7]
Unified	AASHO	No. 200	No. 10						
				Inches per hour		*Inches per foot*	*pH*		
SM or ML	A-2 or A-4	10 to 75	100	0.8 to 2.5	Fine granular	1.44	6.6 to 7.3	High	Low.
SM or ML	A-2 or A-4	30 to 85	100	0.8 to 2.5	Structureless	1.44	6.6 to 7.3	High	Low.
CH	A-7	95	100	<.05	Massive	4.0	7.4 to 7.8	Low	Very high.
CH	A-7	95	100						
MH-CH	A-7	95	100	.05 to 0.2	Granular		6.6 to 7.3	Low	Very high.
MH-CH	A-7	95	100	.05 to 0.2	Massive		6.6 to 7.3	Low	Very high.
ML-CL or CL	A-4 or A-6	60 to 95	100	0.2 to 0.8	Structureless		7.4 to 7.8	Moderate	Moderate.
ML or ML-CL	A-4	60 to 95	100	0.8 to 2.5	Structureless		7.4 to 7.8	High	Low.

[4] Available water is an approximation of the capillary water in the soil when the flow downward by gravity has practically stopped.

[5] Reaction, if extreme either way, can have an important bearing on structures or on soil stabilization treatment.

[6] Dispersion is an estimate of the tendency of a soil to "slake" down into individual particles and thereby lose stability.

[7] The shrink-swell potential is the tendency of soil to change in volume when subjected to changes in moisture.

***Figure 3.*—A W-type ditch in a field planted to vetch. Because of the absence of spoil, water can easily drain into the ditch.**

or nearly so, tend to be located in uniform soil throughout their length. It is desirable to have rows drain into W-type ditches so that drainage and moisture supply tend to be equalized throughout the field and the stand and the growth of crops are uniform.

IRRIGATION.—The average annual precipitation as recorded in Issaquena County is 54.6 inches, but even in normal years supplemental irrigation is likely to be needed for part of the growing season because rainfall is not evenly distributed. Much of the rain falls in winter. From June through September there is not enough moisture for optimum growth of plants.

Fortunately, soils act as a reservoir. They store excess water in periods of abundant rainfall and release moisture in dry periods. Some soils hold a greater amount of moisture than others. For example, a clayey soil will hold more moisture than a sandy soil.

Even though the soils store water, there is not always enough for plants during the growing season. The average monthly deficit in June and July is influenced by the storage capacity of the soils. In August and September, regardless of the storage capacity of the soils, there normally is a moisture deficiency.

Three methods of irrigation are used in Issaquena County: the sprinkler, the graded furrow, and the contour border methods. Each method has advantages and limitations.

The sprinkler method.—The sprinkler method consists of spraying water into the air so that it falls like rain, in a uniform pattern and at such a rate that it can be absorbed by the soil. This method has the advantage of being suited to all kinds of soils and slopes. Fairly uniform amounts of water can be applied. More labor generally is needed to operate a sprinkler system than to operate a well-planned furrow or border system.

The graded furrow method.—This method consists of releasing water into the furrows between the rows from a high point in the field. The water moves slowly down the furrows and seeps into the soil as it advances. This method is suitable for medium textured to moderately fine textured soils. It also works well on fine-textured soils that crack when dry, but only after the cracks are fairly well developed.

The graded furrow method generally requires less labor than the sprinkler method but is less efficient. It has the disadvantage of being suitable only for well-graded soils that have a uniform surface. Preparation for this type of irrigation ranges from a minor smoothing job to complete leveling.

The contour border method.—This method consists of applying water to small areas faster than it can be ab-

TABLE 7.—*Estimated suitability*

Soil series and map symbols	Adaptability to winter grading [1]	Suitability for—		Suitability as a source of—		Suitability for use in dikes and levees
		Road subgrade	Road fill	Topsoil	Sand	
Beulah (Ba)	Good; occurs at high elevations and has a low water table.	Good	Good	Good	Good but limited.	Good
Bowdre (Bk, Bm)	Poor to fair	Poor	Poor	Poor	Poor	Fair if well constructed.
Commerce (Cb, Cd, Cn, Cr, Ch, Ck, Cm).	Fair	Poor to fair	Fair	Poor to fair	Poor	Good if well constructed and vegetated.
Crevasse (Cv)	Good; occurs on high ridges.	Good	Good	Poor	Good but limited.	Good if well constructed and vegetated.
Dowling (Da, Db)	Poor because of site and clay content.	Poor	Poor	Poor	Poor	Poor because of shrinking and swelling.
Dundee (Df, Dk)	Fair	Poor to fair	Fair	Poor to fair	Poor	Good if well constructed and vegetated.
Forestdale (Fd)	Poor because of high water table.	Poor	Poor	Poor	Poor	Fair if well constructed.
Mhoon (Mh)	Poor because of high water table.	Poor	Poor	Poor	Poor	Fair if well constructed.
Robinsonville (Ro, Rs)	Good	Fair	Fair	Good	Good but limited.	Good if vegetated
Sharkey (Sb, Sa, Sc, Sk, Sf, Se, Sr)	Poor because of site and clay content.	Poor	Poor	Poor	Poor	Poor because of shrinking and swelling.
Tunica (Ta, Tb, Tc)	Poor because of clay content.	Poor	Poor	Poor	Poor	Good if surface is mixed with subsoil.

[1] The adaptability of these soils to grading in wet weather is the same as that for grading in winter.

sorbed. The water spreads over the area and is retained by the contour levees until it infiltrates to the desired depth. The water that has not been absorbed is then released and drains off into a lower area. This method requires little labor and can be used on slopes to better advantage than the furrow method. It also requires less preparation and is efficient in the use of water. The range of crops that can be grown is narrower than under either of the other two methods. Pasture grasses, hay, and rice are commonly grown. Cotton, corn, and some other row crops also do well. If row crops are grown, the levee strips should be disked early to destroy the weeds.

LEVELING.—Land is leveled to provide better surface drainage, to increase the efficiency of irrigation, and to prepare for the use of mechanized equipment. Three degrees of leveling are in general use—smoothing, rough grading, and leveling.

Smoothing.—This consists of removing minor surface irregularities without altering the general topographic pattern. Many of the irregularities are so slight that they are not apparent to the eye. Landplanes, levelers, or floats are used for smoothing.

Rough grading.—This consists of removing greater irregularities—knolls, mounds, or ridges—and filling in the pockets and low areas. The cuts are deeper than in smoothing, commonly amounting to more than 2 feet. Large earth-moving equipment is required. Rough grading generally is followed by smoothing.

Leveling to an established grade.—This consists of grading the surface to a predetermined plane or series of planes. The planes may be level, but they generally are made to slope in the same direction that the rows will run or at right angles to the rows. A topographic map and a grading plan are needed. About the same kind of equipment is used as for smoothing and rough grading. Fields that are to be irrigated are leveled enough to permit the efficient use of water.

Highway construction

Some of the problems of designing, constructing, and maintaining highways are caused by the characteristics of the soils or by drainage. The bedrock in this county presents no great problem because it is at great depths, but because of its depth, it cannot be used as footings for foundations.

of soils for engineering uses

Suitability for irrigation	Need for drainage	Suitability as sites for farm ponds	
		Reservoirs	Embankments
Good intake rate; low water-holding capacity. Suitable for leveling.	Not needed; excessively drained.	Poor; high seepage rate	Good.
Low intake rate when wet; takes water rapidly when cracked. Good water-holding capacity. Suitable for leveling when dry; medium cuts allowable; underlain by coarser textured material.	Surface drainage needed; slow permeability and infiltration.	Good; impervious when wet; thin layer of clay material.	Fair if well constructed.
Good intake rate and water-holding capacity. Suitable for leveling; deep cuts allowable on moderately shallow soils.	Some surface drainage needed.	Fair where extensive clay layers occur.	Good if well constructed and vegetated.
Not suitable	Not needed; excessively drained.	Poor; high seepage rate	Poor; low density; low content of silt and clay with high content of sand.
Low intake rate when wet; takes water rapidly when cracked. Good water-holding capacity. On-site examination needed if leveling is planned; generally receives fill.	Surface drainage needed; very slow permeability when wet.	Good; impervious when wet; will support deep water.	Poor but can be used with proper specifications.
Fair intake rate; good water-holding capacity. Leveling permissible; moderate cuts allowable.	Some surface drainage needed.	Fair where extensive clay layers occur.	Good if well constructed and vegetated.
Slow intake rate; good water-holding capacity. Some uniform areas are suitable for leveling; only limited cuts allowable.	Surface drainage needed; poor internal drainage.	Fair where silty clay layers occur.	Fair if well constructed.
Slow intake rate; good water-holding capacity. Suitable for leveling when dry; deep cuts allowable.	Surface drainage needed; poor internal drainage.	Good; impervious when wet; will support deep water.	Fair if well constructed.
Good intake rate; fair water-holding capacity. Suitable for leveling; deep cuts allowable.	Some surface drainage needed.	Poor; may not hold water	Good.
Good intake rate when cracked, very slow intake rate when wet; good water-holding capacity. Suitable for leveling when dry; deep cuts allowable.	Surface drainage needed; slow infiltration when wet.	Good; impervious when wet; will support deep water.	Poor.
Good intake rate when cracked, very slow intake rate when wet; good water-holding capacity. Suitable for leveling when dry; moderate cuts allowable.	Surface drainage needed	Good	Fair if surface soil is mixed with subsoil.

The data in table 6 are useful in evaluating the suitability of the various soils for use in highway construction. The Dowling and Sharkey soils and the upper layers of the Mhoon and Tunica soils shrink when dry and swell when wet. These soils are not suitable for subgrades, because the contraction and expansion would cause the pavement to warp and crack. Cracking and warping can be minimized by using as a foundation course beneath the pavement a thick layer of soil material that shrinks and swells very little. The foundation course should extend through the shoulder of the road.

Table 7 shows the general suitability of the various soils as sources of topping material. Sandy loams and loamy sands are the best topping material for the shoulders of roads and will support a limited amount of traffic.

Table 6 shows that many soils either have a high water table or have ponded water on the surface for long periods each year. Roads on these soils should be constructed on fill sections and should be provided with adequate underdrains and surface drains. In lowlands and other areas that are flooded, roads are best constructed on a continuous embankment that is several feet above the level of frequent floods. Swampy soils provide a poor foundation for roads; hence, swampy soil materials should be removed from roadway sections and replaced by more stable material.

The natural levees are generally the best sites for roads because they have good surface drainage. Some of the soils on natural levees are composed of sandy materials that are well suited to use for the foundations of pavements. Any of the medium-textured soils are suitable for roads through farms or fields. Good surface drainage is required for roadbeds and shoulders.

Descriptions of Soils

This section gives detailed information about the soils in Issaquena County. In it the soil series and the various soils, or mapping units, are described in detail. The texture, structure, consistence, and other significant characteristics of each soil are given.

An important part of each series description is the soil profile, a record of what the soil scientist observed when he dug into the ground. It is to be assumed that all soils of one series have essentially the same kind of profile.

TABLE 8.—*Engineering test data for soil*

[Tests performed by the Bureau of Public Roads in accordance with standard

Soil type and location of samples	Parent material	Bureau of Public Roads report number	Depth	Horizon
			Inches	
Bowdre clay:				
1 mile northwest of Tallula (modal profile)	Slack-water clay underlain by fine-textured alluvium.	S34126	4 to 11	A_2
		S34127	11 to 14	AD
		S34128	14 to 33	D_1
		S34129	33 to 72+	D_2
1.5 miles north of Fitler (underlain by clay)	Slack-water clay underlain by fine-textured alluvium.	S34130	6 to 15	A_2
		S34131	20 to 35	D_1
		S34132	35 to 58	D_2
2 miles northwest of Grace (sandy D horizon)	Slack-water clay underlain by fine-textured alluvium.	S34133	4 to 11	A_2
		S34134	11 to 20	D_1
		S34135	27 to 72+	D_3
Commerce silt loam:				
8 miles northwest of Mayersville (modal profile).	Recent alluvium	S34136	6 to 17	AC
		S34137	17 to 44	C_1
		S34138	44 to 54	C_2
200 yards east of Tallula (sandy loam C horizon).	Recent alluvium	S34139	4 to 22	AC
		S34140	22 to 48	C_1
		S34141	48 to 72	C_2
Commerce silty clay loam:				
0.25 mile east of Tallula (high in silty clay loam).	Recent alluvium	S34142	4 to 9	A
		S34143	20 to 52	C_1
		S34144	52 to 72+	C_2
Sharkey clay:				
2 miles northeast of Tallula (modal profile)	Slack-water sediments	S34145	4 to 23	A_{21}
		S34146	28 to 46	C
		S34147	46 to 72+	D
2 miles northeast of Fitler (fine texture)	Slack-water sediments	S34148	3 to 43	A_2
		S34149	45 to 72	C
2.5 miles southeast of Grace (stratified)	Slack-water sediments	S34150	6 to 40	A_2
		S34151	44 to 55	D_2
		S34152	55 to 72	D_3

[1] Mechanical analyses according to the American Association of State Highway Officials Designation: T. 88. Results of the procedure frequently differ somewhat from results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method and the various grain-size fractions are calculated on the basis of all the material, including that more than 2 millimeters in diameter. In the SCS procedure, the fine material is analyzed by the pipette method and the material more than 2 millimeters in diameter is excluded from calculations of the grain-size fractions. The mechanical analyses used in this table are not suitable for use in naming textural classes for soils.

The differences, if any, are explained in the description of the soil or are indicated by the soil name. For example, Sharkey clay and Sharkey silty clay loam are both members of the Sharkey series. One has a clay surface soil, and the other has a silty clay loam surface soil. Another important feature included in the name of the soil is the slope range on which it was mapped.

Following the name of each soil is a symbol in parentheses. This symbol identifies the soil on the detailed map. Also given is the capability unit in which the soil was placed and certain broad interpretations as to the use and suitabilities of the soil. The capability units are described in the section "Use and Management of Soils."

In describing the soil profile, the soil scientist assigns a symbol to the various layers, or horizons. Symbols beginning with A refer to the surface soil, those beginning with B refer to the subsoil, and those beginning with C to the substratum, or parent material.

The boundaries between horizons are described as abrupt if less than 1 inch thick; clear if from 1 to 2½ inches thick; gradual if from 2½ to 5 inches thick; and diffuse if more than 5 inches thick. The shape of the boundary is described as smooth, wavy, irregular, or broken.

The color of a soil can be described in words or can be indicated by the Munsell color notations, which are used by soil scientists to evaluate soil colors precisely. Unless otherwise noted, Munsell notations given in this report are for moist colors.

Technical terms used in the soil descriptions are defined in the Glossary.

The approximate acreage and proportionate extent of the soils mapped in Issaquena County are shown in table 9.

samples taken from nine soil profiles

procedures of the American Association of State Highway Officials (AASHO) (*1*)]

Mechanical analysis [1]							Liquid limit	Plasticity index	Classification	
Percentage passing sieve—			Percentage smaller than—						AASHO [2]	Unified [3]
No. 40 (0.42 mm.)	No. 60 (0.25 mm.)	No. 200 (0.074 mm.)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
----------	100	95	90	71	57	44	52	23	A-7-6(16)	MH-CH
----------	100	95	81	47	28	24	33	12	A-6 (9)	CL
----------	100	87	62	31	19	15	29	6	A-4 (8)	ML-CL
----------	100	31	18	8	6	4	(4)	(4)	A-2-4(0)	SM
----------	100	95	89	75	65	54	64	34	A-7-5 (20)	MH-CH
----------	100	95	83	47	26	22	33	12	A-6 (9)	CL
----------	100	87	58	25	15	12	27	5	A-4 (8)	ML-CL
100	99	95	93	82	76	68	81	49	A-7-5 (20)	CH
100	90	63	56	43	34	30	38	21	A-6 (10)	CL
100	85	6	5	2	2	2	(4)	(4)	A-3 (0)	SP-SM
----------	----------	100	94	56	20	16	31	7	A-4(8)	ML-CL
----------	100	97	80	33	8	6	26	3	A-4(8)	ML
----------	100	99	98	84	55	39	57	32	A-7-6(19)	CH
----------	100	95	83	45	20	16	31	9	A-4(8)	ML-CL
----------	100	73	51	24	10	8	24	3	A-4(8)	ML
----------	100	95	86	48	17	13	30	6	A-4(8)	ML-CL
----------	100	99	94	70	44	33	46	22	A-7-6(14)	CL
----------	100	93	76	36	15	12	28	6	A-4(8)	ML-CL
----------	100	99	96	69	30	23	37	14	A-6(10)	ML-CL
----------	100	99	97	90	83	74	94	53	A-7-5(20)	MH-CH
----------	100	99	96	84	62	51	65	38	A-7-6(20)	CH
----------	100	95	76	40	23	20	34	12	A-6(9)	ML-CL
----------	----------	100	98	90	75	62	82	46	A-7-5(20)	MH-CH
----------	----------	100	98	86	60	49	67	37	A-7-5(20)	CH
----------	----------	100	99	90	68	54	72	38	A-7-5(20)	MH-CH
----------	----------	100	99	93	70	55	74	44	A-7-5(20)	CH
----------	----------	100	98	92	81	70	98	60	A-7-5(20)	CH

[2] Based on the Classification of Soils and Soil-Aggregate Mixtures for Highway Construction Purposes, AASHO Designation: M, 145–49.

[3] Based on the Unified Soil Classification System, Tech. Memo. No. 3–357, v. 1, Waterways Experiment Station, Corps of Engineers March 1953.

[4] Nonplastic.

Alluvial Land

Alluvial land (Af).—Many different soils are included in this mapping unit. The principal soils are members of the Crevasse, Robinsonville, Commerce, Bowdre, Tunica, Sharkey, and Dowling series. Most of the acreage is nearly level, but some areas along streambanks and in depressions have steeper slopes.

These soils occur in large, wooded areas between the Mississippi River and its levee. They are frequently flooded in spring and early in summer. They range in texture from sand to clay and in drainage from poor to excessive. Normally, they are neutral to moderately alkaline.

Use and suitability.—If cleared and protected from flooding, these soils would be very productive. Alluvial land is not in a capability unit.

Beulah Series

The soils in this series are nearly level to gently sloping and are somewhat excessively drained. They developed from moderately coarse textured alluvium on old natural levees. These soils normally have a dark-brown surface soil and a light yellowish-brown subsoil. The texture of both layers is very fine sandy loam. Horizon differentiation is weak and consists largely of differences in color between the surface soil and the subsoil. The reaction is acid throughout. The natural forest consists of blackgum, sweetgum, sycamore, and various species of oak.

There is only one Beulah soil mapped in Issaquena County. This soil occupies less than 1 percent of the county, but the individual areas are fairly large and are mainly in the northern part of the county. Associated soils are those of the Dundee and Dowling series. The

TABLE 9.—*Approximate acreage and proportionate extent of the soils mapped*

Soil	Acres	Percent	Soil	Acres	Percent
Alluvial land	26, 530	10. 0	Dundee silty clay loam, 0 to 2 percent slopes	360	0. 1
Beulah very fine sandy loam, 0 to 3 percent slopes	870	. 3	Forestdale silty clay loam, 0 to 2 percent slopes	380	. 1
Borrow Pits	5, 100	1. 9	Levee berms	2, 720	1. 0
Bowdre clay, 0 to 2 percent slopes	6, 840	2. 6	Mhoon silty clay, 0 to 2 percent slopes	440	. 2
Bowdre clay, 2 to 5 percent slopes	580	. 2	Robinsonville very fine sandy loam, 0 to 2 percent slopes	1, 555	. 6
Commerce silt loam, 0 to 2 percent slopes	6, 670	2. 5	Robinsonville very fine sandy loam, 2 to 5 percent slopes	385	. 1
Commerce silt loam, moderately shallow, 0 to 2 percent slopes	1, 120	. 4	Sharkey clay, ½ to 2 percent slopes	23, 375	8. 8
Commerce very fine sandy loam, 0 to 2 percent slopes	3, 260	1. 2	Sharkey clay, 0 to ½ percent slopes	740	. 3
Commerce very fine sandy loam, 2 to 5 percent slopes	645	. 2	Sharkey clay, 2 to 5 percent slopes	910	. 3
Commerce silty clay loam, 0 to 2 percent slopes	16, 200	6. 1	Sharkey silty clay loam, 0 to 2 percent slopes	9, 025	3. 4
Commerce silty clay loam, 2 to 5 percent slopes	2, 290	. 9	Sharkey fine sandy loam, overwash, 0 to 2 percent slopes	865	. 3
Commerce silty clay loam, moderately shallow, 0 to 2 percent slopes	2, 230	. 8	Sharkey silt loam, overwash, 0 to 2 percent slopes	2, 380	. 9
Crevasse sandy loams and loamy sands, 0 to 3 percent slopes	1, 900	. 7	Sharkey and Dowling clays	93, 177	35. 1
Dowling clay	29, 685	11. 2	Tunica clay, 0 to 2 percent slopes	15, 920	6. 0
Dowling soils	1, 485	. 6	Tunica clay, 2 to 5 percent slopes	785	. 3
Dundee silt loam, 0 to 2 percent slopes	390	. 1	Tunica silty clay loam, 0 to 2 percent slopes	2, 660	1. 0
			Total	265, 600	100. 0

Beulah soil is better drained than the Dundee and has less profile development. It is on higher areas than the Dowling soils and developed from coarser textured alluvium.

The Beulah soil is used mostly for crops, but its use is somewhat limited because of droughtiness.

Beulah very fine sandy loam, 0 to 3 percent slopes (Ba).—This soil is on wide ridges near abandoned streambeds.

Profile (NW¼NE¼SW¼ sec. 11, T. 13 N., R. 8 W.):

A_p 0 to 6 inches, dark-brown to brown (10YR 4/3) very fine sandy loam; weak, fine, granular structure; loose when dry, very friable when moist; numerous fine roots; strongly acid; abrupt smooth boundary.

B 6 to 20 inches, light yellowish-brown (10YR 6/4) very fine sandy loam; weak, medium, subangular blocky structure; loose when dry; very friable when moist; many roots; few old root channels filled with darker material; strongly acid; gradual smooth boundary.

C 20 to 50 inches +, very pale brown (10YR 7/4) loamy fine sand; structureless; loose; few fine roots; strongly acid.

The A_p horizon ranges in color from dark grayish brown (10YR 4/2) to brown (10YR 5/3). In places this horizon is silt loam or loam. The B horizon ranges in color from pale brown (10YR 6/3) to brownish yellow (10YR 6/6). A few small areas are underlain by clay at a depth of about 32 inches. Included are small areas that have steeper slopes.

Except where there is a plowsole, or compacted layer, the movement of water into and through this soil is moderately rapid. Surface runoff is slow, and the available moisture holding capacity and the content of organic matter are low. This soil can be worked throughout a wide range of moisture content.

Use and suitability.—Most of this soil is used for crops. Cotton yields are good except in periods of drought. Small grain for early grazing is well suited. Early truck crops do well. To improve tilth and increase the available moisture holding capacity, the content of organic matter should be built up and maintained. The soil needs nitrogen. Where a plowsole occurs it should be broken by deep tillage when the soil is dry. Rows should be arranged so that excess water will run off without causing erosion.

Capability unit IIs-1.

Borrow Pits

Borrow Pits (Bp).—These pits constitute about 2 percent of the acreage of the county. They are on the river side of the levee along the Mississippi River and run the length of the levee. Material for building the levee was taken from these pits.

Some of the pits hold water all year and are excellent for fishing. Others dry up and are grazed by livestock. Willow trees that have grown on many of the pits may be used eventually for pulpwood.

Borrow Pits is not in a capability unit.

Bowdre Series

The Bowdre series consists of moderately well drained, clayey soils that are underlain by coarser textured material. These soils are at the higher elevations in slackwater areas and are nearly level to gently sloping.

The surface soil is very dark gray or very dark grayish-brown clay or silty clay. The upper layers are underlain by silty clay loam at depths of 10 to 20 inches. The silty clay loam normally grades into coarser textured material. These soils crack extensively when wet and seal up when dry. The reaction ranges from very strongly acid to mildly alkaline. The original forest cover consisted of sweetgum, American elm, bitter pecan, cottonwood, honeylocust, and various species of oak and included a dense undergrowth of brush and vines.

The Bowdre soils make up about 3 percent of the county. They are scattered throughout the county but are mostly in the western part. They are associated with the Sharkey, Tunica, and Commerce soils. The Bowdre soils are underlain by coarser textured material than the Sharkey soils. They have a shallower surface soil than the Tunica soils and are better drained. They developed from finer textured sediments than the Commerce soils.

The Bowdre soils are used mostly for crops or pasture.

Bowdre clay, 0 to 2 percent slopes (Bk).—This soil commonly is on wide slopes at the base of natural levees. It forms a transitional area between the soils on the natural levees and the soils in slack-water areas. It also occurs on low, undulating ridges in slack-water areas. A small acreage not protected by the levee is subject to overflow.

Profile (SW¼SE¼ sec. 23, T. 11 N., R. 9 W.):

A_p 0 to 6 inches, very dark gray (10YR 3/1) clay; moderate, fine and medium, granular structure; extremely hard when dry, very plastic when moist; numerous ferromanganese concretions; numerous fibrous roots; very strongly acid; abrupt smooth boundary.

AC 6 to 15 inches, very dark grayish-brown (10YR 3/2) clay; few, fine, distinct mottles of dark reddish brown (5YR 3/4); massive with suggestion of medium, subangular blocky peds; extremely hard when dry, very plastic when moist; numerous fibrous roots; numerous fine ferromanganese concretions; very strongly acid; clear smooth boundary.

C 15 to 20 inches, grayish-brown (10YR 5/2) silty clay loam; common, medium, distinct mottles of dark brown (7.5YR 3/2 and 4/4); essentially structureless but tends toward weak, medium, subangular blocky peds; slightly hard when dry, friable when moist; few fine roots; few fine ferromanganese concretions; very strongly acid; clear smooth boundary.

D_1 20 to 35 inches, brown (10YR 5/3) silt loam; many, medium, faint mottles of dark yellowish brown (10YR 4/4); structureless; soft when dry, very friable when moist; few small roots; few fine ferromanganese concretions; very strongly acid; gradual smooth boundary.

D_2 35 to 58 inches, brown (10YR 5/3) very fine sandy loam; common, medium, faint mottles of dark yellowish brown (10YR 4/4); structureless; loose when dry, very friable when moist; few fine ferromanganese concretions; very strongly acid.

The A horizon ranges from 10 to 20 inches in thickness. In places it is directly above a D horizon that ranges in texture from very fine sandy loam to loamy fine sand and in reaction from very strongly acid to mildly alkaline. Included are some areas that have a silty clay surface soil.

Water moves slowly into and through this soil. If the soil is dry and cracked, however, water moves very rapidly through it until the cracks fill up. The natural fertility is high, but the content of organic matter is low. The fine-textured surface soil makes good tilth hard to maintain.

Use and suitability.—This soil is used for crops and pasture. Suitable crops are soybeans, small grain, and cotton. This soil is difficult to work but if well managed is very productive. The addition of organic matter in the form of sod crops, cover crops, or crop residues will greatly improve its workability. Drainage generally is needed. Nitrogen is the most needed fertilizer.

Capability unit IIs-2.

Bowdre clay, 2 to 5 percent slopes (Bm).—This soil has a profile like that of Bowdre clay, 0 to 2 percent slopes, and is on narrow slopes along streambanks and depressions. It also occurs on ridge-depressional relief. A small acreage not protected by the levee is subject to overflow. Included are a few areas that are moderately eroded.

Use and suitability.—This soil can be used and managed in the same way as Bowdre clay, 0 to 2 percent slopes, but rows should be arranged so that excess water will run off without causing erosion. Vegetated waterways are needed in some places.

Capability unit IIIs-2.

Commerce Series

The Commerce series consists of somewhat poorly drained to moderately well drained soils that formed from medium-textured sediments deposited by the Mississippi River. These soils generally are nearly level to gently sloping.

The surface soil normally is dark grayish-brown very fine sandy loam to silty clay loam. It is underlain by a stratified subsoil that ranges in texture from fine sandy loam to silty clay loam. These soils are too young to show much profile development. The original forest cover consisted of cottonwood, sycamore, pecan, sweetgum, green ash, American elm, and other trees and a dense undergrowth of vines and canes.

These soils make up about 12 percent of the county. They occur along natural waterways throughout the county. Associated soils are those of the Robinsonville, Tunica, Bowdre, and Sharkey series. The Commerce soils are not so well drained as the Robinsonville soils and are mottled near the surface. They developed from coarser textured sediments than the Tunica, Bowdre, and Sharkey soils.

The Commerce soils are used mostly for crops and pasture. Because of the gentle slopes and other favorable characteristics, they are very good agricultural soils.

Commerce silt loam, 0 to 2 percent slopes (Cb).—This soil is along the natural levees of streams and bayous. It generally occurs in relatively large areas. A small acreage not protected by the levee is subject to overflow.

Profile (sec. 11, T. 13 N., R. 9 W., between gravel road and levee, ¼ mile west of the intersection):

A_p 0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; soft when dry, very friable when moist; numerous fine roots; slightly acid; abrupt smooth boundary.

AC 6 to 17 inches, dark grayish-brown (10YR 4/2) silt loam; few, fine, faint mottles of dark yellowish brown (10YR 4/4); structureless; slightly hard when dry, very friable when moist; compact; numerous fine roots; neutral; clear smooth boundary.

C_1 17 to 44 inches, grayish-brown (10YR 5/2) silt loam; few, fine, distinct mottles of yellowish brown (10YR 5/6); structureless; soft when dry, very friable when moist; few fine roots; mildly alkaline; gradual smooth boundary.

C_2 44 to 50 inches, very dark gray (10YR 3/1) silty clay loam; few, medium, distinct mottles of dark yellowish brown (10YR 3/4) and yellowish brown (10YR 5/8); structureless; slightly hard when dry, firm when moist; mildly alkaline.

The color of the A_p horizon ranges from dark grayish brown (10YR 4/2) to brown (10YR 5/3). In places the C horizon is very fine sandy loam, and in some places it contains layers of either finer or coarser textured material. The individual horizons vary considerably in thickness. In places one horizon or another may be lacking. The whole profile has a stratified appearance. The reaction ranges from slightly acid to mildly alkaline.

Water moves into and through this soil at a moderate rate. The available water holding capacity is moderate to moderately high. Runoff is medium to rapid. Natural fertility is high, but the content of organic matter is low. In many places a plowsole, or compacted layer, is immediately below the surface.

Use and suitability.—This is one of the most desirable soils in the county for agriculture. Most of the acreage is used for crops, such as cotton, corn, soybeans, and small grain. Under good management, yields are high. This soil is easily managed but tends to crust when bare. The content of organic matter can be increased by growing cover crops and sod crops and by turning under crop residues. Nitrogen is the most needed fertilizer. V-type and W-type ditches are needed in some places. Where a plowsole occurs, it should be broken by deep tillage when the soil is dry.

Capability unit I-1.

Commerce silt loam, moderately shallow, 0 to 2 percent slopes (Cd).—This soil is similar to Commerce silt loam, 0 to 2 percent slopes, except that it is underlain by slack-water clay at depths of 20 to 36 inches (fig. 4).

***Figure 4.*—Profile of Commerce silt loam. Notice the stratified appearance. The dark-colored material in the lower part of the profile is slack-water clay.**

It is on the lower parts of recent natural levees. A small acreage not protected by the levee is subject to overflow. Included are some areas that have a surface soil of very fine sandy loam.

Use and suitability.—This soil is used and managed in about the same way as Commerce silt loam, 0 to 2 percent slopes. Surface drainage is more of a problem because this soil is on lower areas.

Capability unit I-1.

Commerce very fine sandy loam, 0 to 2 percent slopes (Cn).—This soil is similar to Commerce silt loam, 0 to 2 percent slopes, except that it has a coarser textured surface soil and a higher content of sand throughout the profile. Water moves into and through this soil at a slightly higher rate. A small acreage not protected by the levee is subject to overflow.

Use and suitability.—This soil is used and managed in the same way as Commerce silt loam, 0 to 2 percent slopes. It is easily worked and is less inclined to crust than the silt loams.

Capability unit I-1.

Commerce very fine sandy loam, 2 to 5 percent slopes (Cr).—This soil is on gentle slopes along streambanks and depressions. Its profile is similar to that of Commerce silt loam, 0 to 2 percent slopes, except that the surface soil is coarser textured and generally the content of sand throughout the profile is higher. Water moves into and through this soil at a slightly higher rate. A small acreage not protected by the levee is subject to overflow. Included are some areas that have a silt loam surface soil.

Use and suitability.—This soil is used and managed in about the same way as Commerce silt loam, 0 to 2 percent slopes. Because of the slope, rows should be arranged so that excess water will run off without causing erosion.

Capability unit IIe-1.

Commerce silty clay loam, 0 to 2 percent slopes (Ch).—This soil is on the lower parts of recent natural levees. The profile is similar to that of Commerce silt loam, 0 to 2 percent slopes, except that the surface soil is dark-brown or dark grayish-brown silty clay loam that is from 4 to 8 inches deep, and the subsoil is stratified silt loam or very fine sandy loam. Water moves into and through this soil more slowly. A small acreage not protected by the levee is subject to overflow. Included are small areas of Bowdre silty clay loam, which was not mapped separately in this county.

This soil cracks when dry, but not to the same extent as the slack-water clays. The silty clay loam surface soil makes good tilth difficult to maintain.

Use and suitability.—Most of this soil is used for cotton, soybeans, small grain, and corn. A considerable acreage is in pasture. The rest is in forest. Under good management, yields of most crops are moderately high. The workability can be greatly improved by adding organic matter in the form of cover crops, sod crops, and crop residues. Nitrogen is the fertilizer most needed. V-type and W-type ditches are needed in most places.

Capability unit IIs-6.

Commerce silty clay loam, 2 to 5 percent slopes (Ck).—This soil is on ridge-depressional relief and along the banks of streams and depressions. It is similar to Commerce silty clay loam, 0 to 2 percent slopes, except that the surface soil is thinner. A small acreage not protected by the levee is subject to overflow. Included are a few small areas of Commerce silty clay loam, moderately shallow, 0 to 2 percent slopes.

Use and suitability.—This soil is used and managed in about the same way as Commerce silty clay loam, 0 to 2 percent slopes. If row crops are grown, the rows should be arranged so that excess water will run off without causing erosion. Vegetated outlets are needed in some places. Additional organic matter will greatly improve workability. Nitrogen is the fertilizer most needed.

Capability unit IIe-4.

Commerce silty clay loam, moderately shallow, 0 to 2 percent slopes (Cm).—This soil is similar to Commerce silty clay loam, 0 to 2 percent slopes, except that it is underlain by slack-water clay at depths of 20 to 36 inches and occurs on slightly lower parts of recent natural levees. A small acreage not protected by the levee is subject to overflow.

Use and suitability.—This soil is used and managed in about the same way as Commerce silty clay loam, 0 to 2 percent slopes, but it generally requires more intensive surface drainage. Nitrogen is usually needed.

Capability unit IIs–6.

Crevasse Series

The Crevasse series consists of nearly level to gently sloping, excessively drained soils that formed from coarse-textured alluvium. These soils occur near old levee breaks along the Mississippi River. They were laid down by very fast moving water. The surface soil ranges in texture from very fine sandy loam to loamy fine sand. The stratified subsoil is sandy loam and loamy sand. In many places there are lenses of coarser textured sand in the profile. The reaction normally is neutral to moderately alkaline, but in places it is strongly acid. The forest cover consists of black willow, cottonwood, and sycamore.

These soils occur in the northern and western parts near the Mississippi River. The total acreage is small, but the individual areas are relatively large. Associated soils are those of the Robinsonville, Commerce, and Sharkey series. The Crevasse soils differ from the Robinsonville and Commerce soils in being excessively drained. They differ from the Sharkey soils in being coarser textured.

The Crevasse soils are used mostly for pasture. They are not suited to most crops, because of droughtiness.

Crevasse sandy loams and loamy sands, 0 to 3 percent slopes (Cv).—These soils are on low ridges near old levee breaks. A small acreage not protected by the levee is subject to overflow.

Profile (NE¼ sec. 30, T. 13 N., R. 8 W.; 100 yards south of plantation headquarters):

- A 0 to 4 inches, black (10YR 2/1) loamy sand; structureless; loose; numerous grains of clear quartz crystals; dense mat of bermudagrass roots; neutral; clear smooth boundary.
- C_1 4 to 18 inches, pale-brown (10YR 6/3) loamy sand; structureless; loose when dry, loose when moist; numerous grains of clear quartz crystals; numerous grass roots; neutral; gradual smooth boundary.
- C_2 18 to 40 inches, very pale brown (10YR 7/4) loamy sand; structureless; loose; numerous grains of clear quartz crystals; few small roots; neutral.

The color of the A horizon varies with the content of organic matter. In cultivated areas the color normally is dark brown (10YR 3/3) to grayish brown (10YR 5/2). The texture of the A horizon ranges from very fine sandy loam to loamy sand. The C horizon consists of stratified loamy sand and sandy loam. A few areas are underlain by clay at depths of 20 to 36 inches. Included are a few small areas that are somewhat excessively drained.

Water moves into and through these soils rapidly. The available water holding capacity and natural fertility are low. The content of organic matter normally is low if the soils are cultivated. If the soils are left in sod for a long time, the content of organic matter builds up.

Use and suitability.—These soils are best suited to permanent pasture. Droughtiness limits their use for crops. Small grain for early grazing does well. Where the soils are underlain by clay at depths of 20 to 36 inches, early maturing crops do fairly well.

Capability unit IVs–1.

Dowling Series

The Dowling series consists of poorly drained soils in depressions. These soils formed from a mixture of slack-water clay and local alluvium. The surface soil generally is very dark gray clay, and the subsoil is highly gleyed clay. The reaction is very strongly acid to neutral. Surface drainage is slow, and runoff from higher areas collects in these areas. The soils contract and crack when dry and expand and seal up when wet. The forest cover consists of cypress, tupelo-gum, willow, Nuttall oak, and overcup oak.

These soils make up about 12 percent of the county. The individual areas are small and are scattered throughout the county. These soils form a part of the natural drainage pattern and are associated with most of the other soils in the county.

A large acreage is still in forest. The rest is used for crops or pasture, although these are not good agricultural soils.

Dowling clay (Do).—This soil is in long, narrow, depressed areas and is associated with the Sharkey, Tunica, Bowdre, and Forestdale soils.

Profile (NE¼NE¼ sec. 7, T. 12 N., R. 8 W.):

- A_{1p} 0 to 4 inches, very dark gray (10YR 3/1) and very dark grayish-brown (10YR 3/2) clay; moderate, fine and medium, granular structure; extremely hard when dry, very plastic when moist; many fine roots; slightly acid; abrupt smooth boundary.
- A_{12} 4 to 16 inches, very dark gray (2.5Y 3/0) clay; many, medium, distinct mottles of strong brown (7.5YR 5/8); massive; extremely hard when dry, very plastic when moist; few fine ferromanganese concretions; slightly acid; clear smooth boundary.
- C 16 to 40 inches +, dark-gray (7.5YR 4/0) and gray (7.5YR 5/0) clay; many, fine and medium, distinct mottles of dark brown (7.5YR 4/4) and strong brown (7.5YR 5/8); massive; extremely hard when dry, very plastic when moist; few fine ferromanganese concretions; slightly acid.

In places the surface layer is silty clay. In a few places thin strata of coarser textured material are in the profile.

Water moves into and through this soil very slowly. The available water holding capacity and natural fertility are high, but slow surface drainage and poor physical properties make this soil difficult to manage.

Use and suitability.—More than 60 percent of the acreage is still in forest. The rest is used for crops and pasture. The principal crops are cotton and soybeans, but growing crops is hazardous if the soil is not adequately drained. Flooding makes permanent pasture hard to maintain. Most areas can be drained by V-type and W-type ditches. Dragline ditches are needed for outlets in many places. Nitrogen is the only fertilizer needed.

Capability unit IVw–1.

Dowling soils (Db).—These soils are in narrow depressions and are associated with the Commerce, Robinsonville, and Dundee soils. They are similar to Dowling clay, but the texture of their surface soil ranges from clay to loamy fine sand. They occur in such intricate patterns that it is difficult to separate them into types. In many places thin layers of coarse-textured material are in the lower part of the profile. Included are a few small areas of Souva soils, none of which are mapped in Issaquena County.

Use and suitability.—These soils are used mostly for crops or pasture. The principal crops are cotton and soybeans. Yields are slightly higher than on Dowling clay. In undrained areas growing of crops is hazardous. The drainage requirements are similar to those of Dowling clay. If drained these soils generally are used in the same way as surrounding soils. Nitrogen is the fertilizer most needed.

Capability unit IIIw–13.

Dundee Series

The Dundee series consists of somewhat poorly drained to moderately well drained soils that occur on nearly level slopes along old natural levees. These soils developed from medium textured and moderately fine textured alluvium. They normally have a dark grayish-brown surface soil and a very dark grayish-brown subsoil. Their profile development is stronger than that of the better drained soils of the old natural levees. The original forest cover consisted of hickory, winged elm, blackgum, white ash, sweetgum, various species of oak, and a dense undergrowth of brush and vines.

These soils make up less than 1 percent of the county and occur in the northern part along old streambeds. Associated soils are those of the Beulah and Sharkey series. The Beulah soils are somewhat excessively drained and are less developed than the Dundee. The Sharkey soils are finer textured.

The Dundee soils are used mostly for crops. Because of their gentle slopes and other favorable characteristics, they are very good agricultural soils.

Dundee silt loam, 0 to 2 percent slopes (Df).—This soil is on old natural levees.

Profile (NW¼NW¼ sec. 6, T. 13 N., R. 8 W.):

A_p 0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam; weak, fine, granular structure; soft when dry, very friable when moist; medium acid; abrupt smooth boundary.

B 6 to 18 inches, very dark grayish-brown (10YR 3/2) silty clay loam; common, fine, distinct mottles of dark brown (7.5YR 4/4); weak, medium, subangular blocky structure; slightly hard when dry, friable when moist; slightly acid; smooth boundary.

C 18 to 36 inches, dark grayish-brown (10YR 4/2) silt loam; common, fine, distinct mottles of yellowish brown (10YR 5/4); structureless; soft when dry, very friable when moist; slightly acid.

The A horizon ranges in thickness from 4 to 8 inches, and in some places its texture is very fine sandy loam. The B horizon ranges in thickness from 10 to 20 inches, and in places its texture is silty clay. The C horizon ranges in texture from very fine sandy loam to silty clay loam and in some areas is underlain by clay at a depth of about 30 inches. Also included are small areas that are steeper and are moderately eroded.

Water moves into and through this soil at moderate to moderately slow rates. Runoff is medium. The available water holding capacity is high. Natural fertility is moderate. The content of organic matter is low. Tilth is good.

Use and suitability.—Cotton is the principal crop, but most crops locally grown are well suited. Under good management, yields are high. This soil is easy to work throughout a wide range of moisture content. Adding organic matter will improve tilth and increase the available moisture holding capacity. Where needed, surface drainage can be provided by the arrangement of rows and by the use of V-type and W-type ditches as outlets. Nitrogen is the fertilizer most needed.

Capability unit I–1.

Dundee silty clay loam, 0 to 2 percent slopes (Dk).—This soil generally is on the lower parts of old natural levees. It is similar to Dundee silt loam, 0 to 2 percent slopes, except that it is finer textured. This soil is fairly easy to work but tends to crack when dry. Water moves into and through it slowly. Included are a few areas that have steeper slopes.

Use and suitability.—Cotton, soybeans, and small grain are well suited. Under good management, yields are moderately high. Surface drainage generally is needed and can be provided by the arrangement of rows and by the use of V-type and W-type ditches. Organic matter is needed to improve the workability and general condition of the soil. Sod crops, cover crops, and crop residues are excellent sources of this material. Nitrogen is the fertilizer most needed.

Capability unit IIs–6.

Forestdale Series

The Forestdale series consists of poorly drained to somewhat poorly drained soils that are on the lower parts of old natural levees. These soils are nearly level to gently sloping. They developed from medium textured and moderately fine textured alluvium. The surface soil normally is dark-gray to light grayish-brown silty clay loam. The substratum is light brownish gray. The reaction is acid. The original forest cover consisted of bitter pecan, green ash, rock elm, red maple, various species of oak, and a dense undergrowth of brush and vines.

Only one Forestdale soil is mapped in Issaquena County. It is in the eastern part of the county along the Yazoo and Little Sunflower Rivers. Associated soils are those of the Dundee and Sharkey series. The Forestdale soil is more poorly drained than the Dundee soils. It is lighter colored than the Sharkey soils and is better drained.

The Forestdale soil is used mostly for crops. Management is a problem, however, because this soil is cold natured.

Forestdale silty clay loam, 0 to 2 percent slopes (Fd).—This soil is on ridge-depressional relief along streams and bayous.

Profile (SW¼NE¼ sec. 18, T. 9 N., R. 8 W.):

A_p 0 to 4 inches, dark-gray (10YR 4/1) and dark grayish-brown (10YR 4/2) silty clay loam; moderate, fine and medium, granular structure; slightly hard when dry, friable when moist; numerous roots; medium acid; abrupt smooth boundary.

B_1 4 to 8 inches, grayish-brown (10YR 5/2) silty clay; common, medium, distinct mottles of dark yellowish brown (10YR 4/4) and yellowish brown (10YR 5/8); moderate, medium, subangular blocky structure; hard when dry, very plastic when moist; few roots; medium acid; clear smooth boundary.

B_{2g} 8 to 26 inches, gray (10YR 5/1 and 6/1) clay; common, medium, distinct mottles of strong brown (7.5YR 5/8); moderate, medium, subangular blocky structure; hard when dry, very plastic when moist; few roots; medium acid; clear smooth boundary.

B_{3g} 26 to 30 inches, gray (10YR 6/1) silty clay; common, medium, distinct mottles of strong brown (7.5YR 5/8); massive to weak, fine, subangular blocky structure; hard when dry, very plastic when moist; few fine iron concretions; medium acid; clear smooth boundary.

C_g 30 to 36 inches, light brownish-gray (10YR 6/2) silty clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/8) and reddish yellow (7.5YR 6/8); massive; slightly hard when dry, friable when moist; medium acid; few fine iron concretions.

The A horizon ranges in thickness from 3 to 5 inches, and in some places its texture is silt loam. The B horizon ranges in thickness from 18 to 26 inches and in color from grayish brown (10YR 5/2) to light gray (10YR 7/1). Included are small areas that have steeper slopes and are moderately eroded.

Water moves into and through this soil slowly. Runoff is also slow. Natural fertility and the content of organic matter are low. Tilth is poor.

Use and suitability.—This soil is used for crops, principally cotton, soybeans, and small grain. Under good management, yields are moderately high. Corn generally is a poor risk, but when weather conditions are favorable, it does well. Pasture is well suited. Because the soil is difficult to work, cultivation is often delayed after rains. Drainage is needed, but if suitable outlets are available V-type and W-type ditches usually are adequate. Organic matter is needed to improve the workability and general condition of this soil. Nitrogen is the fertilizer most needed.

Capability unit IIs-4.

Levee Berms

Levee berms (Le).—The levee of the Mississippi River makes up about 1 percent of Issaquena County. It extends the length of the county. This levee, including the berms, is about 30 feet in height, 10 feet or more in width at the top, and about 100 feet in width at the base. In places it is considerably wider.

The levee provides excellent grazing for a large number of livestock. Grazing rights are leased from the Mississippi River Levee Board, generally by farmers whose property adjoins the levee.

Levee berms is not in a capability unit.

Mhoon Series

The Mhoon series consists of level and nearly level, poorly drained and somewhat poorly drained stratified soils at the base of natural levees. The surface soil is dark grayish-brown silty clay. The subsoil is gleyed, stratified silt loam, silty clay loam, or clay. The reaction is slightly acid to moderately alkaline. These soils expand and crack when dry and seal up when wet. The forest cover consists of black willow, pecan, cottonwood, sweetgum, various species of water-tolerant oak, and a dense undergrowth of brush and briers.

Only one Mhoon soil is mapped in Issaquena County. It is somewhat limited in extent and occurs mostly in the western part. Associated soils are those of the Sharkey and Commerce series. The Mhoon soil is coarser textured than the Sharkey soils and is stratified. It is finer textured than the Commerce soils and more poorly drained.

About half the acreage of the Mhoon soil is used for crops or pasture. The rest is in forest. This soil is difficult to manage because drainage and tilth are poor.

Mhoon silty clay, 0 to 2 percent slopes (Mh).—This soil is on lower parts of recent natural levees. It is transitional to the slack-water clay soils.

Profile (SE¼SE¼ sec. 5, T. 12 N., R. 7 W.):

A_{1p} 0 to 4 inches, dark grayish-brown (10YR 4/2) silty clay; moderate, fine and medium, granular structure; very hard when dry, plastic when moist; numerous fine roots; neutral; abrupt smooth boundary.

A_{12} 4 to 11 inches, very dark grayish-brown (10YR 3/2) silty clay; common, medium, faint mottles of dark yellowish brown (10YR 3/4); massive; very hard when dry, plastic when moist; numerous fine roots; mildly alkaline; clear smooth boundary.

C_{1g} 11 to 30 inches, gray (10YR 6/1) silt loam; few, medium, faint mottles of pale brown (10YR 6/3) and common, fine, distinct mottles of strong brown (7.5YR 5/6); structureless; soft when dry, slightly sticky when moist; few fine ferromanganese concretions; few fine roots; moderately alkaline; clear smooth boundary.

C_{2g} 30 to 34 inches, light brownish-gray (10YR 6/2) silty clay loam; common, medium, distinct mottles of strong brown (7.5YR 5/6) and pink (7.5YR 7/4); structureless; slightly hard when dry, sticky when moist; few ferromanganese concretions; moderately alkaline; clear smooth boundary.

C_{3g} 34 to 40 inches, dark-gray (10YR 4/1) clay; common, medium, prominent mottles of yellowish red (5YR 5/6); massive; extremely hard when dry, very plastic when moist; mildly alkaline.

The A horizon ranges in color from very dark grayish brown to dark grayish brown, and in some places the texture is clay. In the C horizon the individual layers vary in thickness; their relative positions in the profile may differ, and in some areas one layer or another is lacking.

Water moves very slowly into this soil. Runoff also is slow. Natural fertility is high, but, except when the soil is first cleared, the content of organic matter is low. This soil is very difficult to work. Nitrogen is the fertilizer most needed.

Use and suitability.—The principal crops are soybeans and cotton. Pasture does well. Drainage is needed for row crops. It generally can be provided by V-type and W-type ditches that have adequate outlets. Additional organic matter will greatly improve the workability of this soil.

Capability unit IIIs-4.

Robinsonville Series

The Robinsonville series consists of moderately well drained and well drained soils that formed from medium-textured sediments deposited by the Mississippi River. These soils are on natural levees of streams and are nearly level to gently sloping. The surface soil normally is dark-brown very fine sandy loam. It is underlain by well-drained, stratified material that ranges in texture from loamy fine sand to silty clay loam. The reaction is slightly acid to moderately alkaline. The original forest cover consisted of cottonwood, sycamore, pecan, sweetgum, water oak, American elm, and boxelder and a dense undergrowth of vines and canes.

These soils make up less than 1 percent of the county. They are generally in the western part and are associated with Commerce and Crevasse soils. They are better drained than the Commerce soils and are mottled at greater depths. They are finer textured than the Crevasse soils.

The Robinsonville soils are used mostly for row crops. Because of their excellent tilth and gentle slopes, they are very good agricultural soils.

Robinsonville very fine sandy loam, 0 to 2 percent slopes (Rc).—This soil is on the higher parts of recent natural levees. It occurs in comparatively large areas and is important to local agriculture. A small acreage not protected by the levee is subject to overflow.

Profile (SE¼ sec. 2, T. 10 N., R. 8 W.; 100 yards north of Fitler, east of State Highway No. 1):

A_p 0 to 6 inches, dark-brown (10YR 4/3) very fine sandy loam; weak, fine, granular structure; loose when dry, very friable when moist; numerous grass roots; neutral; abrupt smooth boundary.

AC 6 to 17 inches, brown (10YR 5/3) very fine sandy loam; stratified; loose when dry, very friable when moist; numerous grass roots; few old tree-root channels; mildly alkaline; clear smooth boundary.

C_1 17 to 27 inches, yellowish-brown (10YR 5/4) very fine sandy loam; stratified; loose when dry, very friable when moist; many fine grass roots; moderately alkaline; abrupt smooth boundary.

C_2 27 to 42 inches, pale-brown (10YR 6/3) very fine sandy loam; stratified; loose when dry, very friable when moist; few fine grass roots; old tree-root channels; moderately alkaline; abrupt smooth boundary.

C_3 42 to 45 inches, dark-brown (10YR 4/3) silt loam; few, fine, faint mottles of dark yellowish brown (10YR 4/4); stratified; soft when dry, very friable when moist; moderately alkaline; abrupt smooth boundary.

C_4 45 to 55 inches, brown (10YR 5/3) and light brownish-gray (10YR 6/2) very fine sandy loam; stratified; loose when dry, very friable when moist; few fine ferromanganese concretions; few old root channels; moderately alkaline.

In places the texture of the A horizon is silt loam. In some areas loamy sand occurs in the lower part of the profile. A plowsole, or compacted layer, occurs in many places beneath the A_p horizon. Some areas are slightly acid in reaction.

Except where there is a plowsole, water moves into and through this soil at moderate to moderately rapid rates. Runoff is medium. The soil is well supplied with plant nutrients, but the content of organic matter is low. Tilth is very good.

Use and suitability.—This is one of the best agricultural soils in the county. It is well suited to cotton, corn, soybeans, small grain, and most other crops locally grown. It is very well suited to early grazing. Under good management, yields of most crops are high. This soil can be worked throughout a wide range of moisture conditions. Adding organic matter will improve tilth and increase the available water holding capacity. Sod crops, cover crops, and crop residues are excellent sources of this material. Where a plowsole occurs it should be broken by deep tillage when the soil is dry. Adequate drainage can be provided by the arrangement of rows and by the use of V-type and W-type ditches.

Capability unit I–2.

Robinsonville very fine sandy loam, 2 to 5 percent slopes (Rs).—This soil occurs in long, narrow strips along streams. Its profile is similar to that of Robinsonville very fine sandy loam, 0 to 2 percent slopes. A small acreage not protected by the levee is subject to overflow. Included are small areas that have steeper slopes. Also included are areas that have a surface soil of silt loam.

Use and suitability.—This soil is used and managed in about the same way as Robinsonville very fine sandy loam, 0 to 2 percent slopes. Rows should be arranged so that excess water will run off without causing erosion. Vegetated waterways are needed in places. The content of organic matter should be increased.

Capability unit IIe–2.

Sharkey Series

The Sharkey series consists of dark-colored, poorly drained clayey soils that developed in slack-water areas from fine-textured alluvium, locally called buckshot. These soils generally are level or nearly level, but some small areas along bayous or depressions are gently sloping. The surface soil commonly is very dark gray clay underlain by dark gray or very dark gray clay mottled with brown and yellow. These soils contract and crack extensively when dry and expand and seal up when wet. The original forest cover consisted of green ash, American elm, hackberry, red maple, bitter pecan, sweetgum, various kinds of water-tolerant oak, and a dense undergrowth of brush and vines.

These soils make up about 14 percent of the county and are widely scattered. Associated soils are those of the Tunica, Bowdre, Mhoon, and Dowling series. The Sharkey soils are more poorly drained than the Tunica soils and are underlain by finer textured material. They are more poorly drained than the Bowdre soils, which are underlain by silty clay loam at depths of 10 to 20 inches. They are not stratified like the Mhoon soils. The depressions in areas of Sharkey soils are occupied by the Dowling clay.

About half of the acreage of the Sharkey soils is used for crops or pasture. These soils are difficult to manage, however, because drainage and tilth are poor.

Sharkey clay, ½ to 2 percent slopes (Sb).—This soil is on wide, nearly level slopes. A small acreage is subject to overflow.

Profile (SE¼ sec. 32, T. 11 N., R. 8 W., 200 yards east of road):

A_{11p} 0 to 4 inches, very dark gray (10YR 3/1) clay; few, fine, faint mottles of shades of brown; weak, fine and medium, granular structure; extremely hard when dry, very plastic when moist; numerous fine roots; very strongly acid; abrupt smooth boundary.

A_{12} 4 to 23 inches, dark-gray (10YR 4/1) clay; common, medium, distinct mottles of dark reddish brown (5YR 3/4); massive with suggestion of medium, subangular blocky peds; extremely hard when dry, very plastic when moist; numerous roots; extremely acid; clear smooth boundary.

A_{13} 23 to 28 inches, very dark gray (10YR 3/1) clay; few, fine, distinct mottles of dark reddish brown (5YR 3/4); massive with suggestion of medium, subangular blocky peds; extremely hard when dry, very plastic when moist; few fine roots; very strongly acid; clear smooth boundary.

C_g 28 to 46 inches, gray (10YR 5/1) silty clay; common, medium, distinct mottles of dark brown (7.5YR 4/4); massive; extremely hard when dry, very plastic when moist; medium acid; gradual boundary.

The A horizon ranges in color from black (10YR 2/1) to gray (10YR 5/1), and in places the texture is silty clay. The C_g horizon ranges in color from dark gray (10YR 4/1) to gray (10YR 6/1). In some places stratified material ranging in texture from clay to silt loam is at depths of more than 40 inches.

Water moves into and through this soil very slowly, except when the soil is cracked; then it moves very rapidly until the cracks seal up. When this soil is first cleared, the content of organic matter is fairly high, but the content decreases rapidly under cultivation. The available moisture holding capacity is very high. Nitrogen is the fertilizer most needed. Runoff is slow.

Use and suitability.—About half of the acreage is in forest. The rest is used for crops and pasture. The crops best suited are soybeans, small grain, and pasture. Cotton is fairly well suited. Rice is also suited. Corn is an uncertain crop. This soil is very difficult to manage because it remains wet for long periods after rains and is extremely hard when dry. Surface drainage in the form of V-type or W-type ditches that have adequate outlets is essential. Tilth and the general condition of the soil can be improved by growing sod crops and cover crops and by turning under crop residues.

Capability unit IIIs-4.

Sharkey clay, 0 to ½ percent slopes (Sa).—This soil is on broad, flat slopes at lower elevations than other Sharkey clays. It has a darker colored surface soil than Sharkey clay, ½ to 2 percent slopes, and is more highly gleyed throughout the profile. Runoff is slow. If this soil is not adequately drained, runoff from higher areas collects and remains ponded for long periods.

Use and suitability.—About 60 percent of the acreage is in forest. The rest is used for crops and pasture. This soil is suited to about the same crops as Sharkey clay, ½ to 2 percent slopes, but because of poor drainage, growing of cotton is hazardous. Pasture is well suited. Drainage must be provided before most crops can be grown. Dragline ditches generally are needed.

Capability unit IIIw-11.

Sharkey clay, 2 to 5 percent slopes (Sc).—This soil occurs as long, narrow bands along streambanks or depressions. In some places, it is on ridge-depressional relief along the bends of old stream runs. It is similar to Sharkey clay, ½ to 2 percent slopes, but the surface soil is lighter colored. Included is a very small acreage that has steeper slopes. Some small areas are moderately eroded. Rills have formed in places. Runoff is rapid.

Use and suitability.—Most of the acreage is used for crops or pasture. This soil is suited to cotton and soybeans but is better suited to pasture or close-growing crops, such as hay or small grain. If row crops are grown, rows should be arranged so that excess water will run off without causing erosion. Organic matter in the form of sod crops, cover crops, or crop residues will greatly improve the tilth and general condition of the soil.

Capability unit IIIs-4.

577739—61——3

Sharkey silty clay loam, 0 to 2 percent slopes (Sk).—This soil is in areas where silty clay loam was deposited over Sharkey clay. The overwash material ranges in thickness from 4 to 12 inches and is underlain by dark-colored clay. This soil is similar to Sharkey clay, ½ to 2 percent slopes, but is easier to till and is less inclined to crack. It takes water at a faster rate. A small acreage not protected by the levee is subject to overflow. Small areas that have steeper slopes are included. Also included are small areas of Mhoon silty clay loam, which is not mapped separately in Issaquena County.

Use and suitability.—Most of this acreage is used for pasture and crops. This soil is used and managed in about the same way as Sharkey clay, ½ to 2 percent slopes, except that growing of cotton and corn is less hazardous. Surface drainage is essential.

Capability unit IIs-4.

Sharkey fine sandy loam, overwash, 0 to 2 percent slopes (Sf).—This soil is at the base of natural levees where medium textured and moderately coarse textured alluvium has washed or sloughed over slack-water clay. It is also near the Mississippi River where fast-moving water has deposited sandy loam and loamy sand over slack-water clay. It is similar to Sharkey silt loam, overwash, 0 to 2 percent slopes, but its surface layer is stratified very fine sandy loam or fine sandy loam, 8 to 20 inches deep. Included are small areas that have steeper slopes. Also included are a few small areas that have an overwash of loamy sand.

Profile (NW¼SE¼ sec. 19, T. 13 N., R. 8 W., across road from farm headquarters):

A_p 0 to 5 inches, dark grayish-brown (10YR 4/2) fine sandy loam; weak, fine, granular structure; loose when dry, very friable when moist; numerous fine roots; neutral; abrupt smooth boundary.

A_2 5 to 14 inches, dark-brown to brown (10YR 4/3) very fine sandy loam; structureless; loose when dry, very friable when moist; numerous fine roots; neutral; clear smooth boundary.

A_{1b} 14 to 36 inches +, very dark grayish-brown (10YR 3/2) clay; common, distinct mottles of brown (7.5YR 5/4); massive; extremely hard when dry, very plastic when moist; few fine roots; mildly alkaline.

Use and suitability.—This soil is used and managed in about the same way as Sharkey silt loam, overwash, 0 to 2 percent slopes. The sandier areas are best suited to pasture.

Capability unit IIs-5.

Sharkey silt loam, overwash, 0 to 2 percent slopes (Se).—This soil is at the base of natural levees where medium-textured material has washed or sloughed over Sharkey clay. It also occurs near the Mississippi River where fast-moving water has deposited a layer of silt loam over slack-water clay. The profile of this soil is like that of Sharkey fine sandy loam, overwash, 0 to 2 percent slopes, except that the surface layer is stratified silt loam that is from 5 to 20 inches deep. This layer is underlain by dark-colored clay. The average depth of the overwash material is about 12 inches. In many places thin layers of finer textured material are in the silt loam overwash. A small acreage not protected by the levee is subject to overflow.

Water moves into and through this soil at a moderately slow rate. Runoff is medium. Natural fertility is high, but the content of organic matter is low. Tilth is good and is easy to maintain.

Use and suitability.—Most of this soil has been cleared and is used for crops and pasture. Cotton, corn, and soybeans are well suited. Under good management, yields are high. Surface drainage generally is needed. Nitrogen is the fertilizer most needed.

Capability unit IIs-5.

Sharkey and Dowling clays (Sr).—This undifferentiated unit is in extensive wooded areas where it is difficult to delineate the soils separately. The topography is level and nearly level but is steeper along streams and bayous. Drainage is poor. The reaction is acid.

These soils make up about 35 percent of the county. They are mostly in the southern and central parts between the Mississippi River and Deer Creek. One large tract is between Deer Creek and the Yazoo River.

The principal soils are the Sharkey and Dowling, but Tunica, Bowdre, and Forestdale soils are included. The Sharkey soils are on broad, level and nearly level areas. The Dowling soils are in depressions. A small acreage is subject to overflow or backwater (fig. 5). (See Dowling series for profile of Dowling clay.)

Figure 5.—**Backwater area in southern part of county. Notice the high-water marks on trunks of trees.**

Profile of Sharkey clay (NE¼SW¼ sec. 5, T. 12 N., R. 7 W., along pipe line):

A_{11} 0 to 5 inches, very dark grayish-brown (10YR 3/2) dry clay; few, small, prominent mottles of reddish brown (5YR 4/4); moderate, fine and medium, granular structure; extremely hard when dry, very plastic when moist; medium acid; abrupt boundary.

A_{12} 5 to 26 inches, very dark gray (10YR 3/1) clay; common, small, prominent mottles of reddish brown (5YR 4/4) and dark brown (7.5YR 4/4); massive with suggestion of medium, subangular blocky peds; extremely firm when dry, very plastic when moist; medium acid; gradual smooth boundary.

C_g 26 to 50 inches, dark-gray (10YR 4/1) clay; many, medium mottles of shades of yellow and brown; massive; extremely hard when dry, very plastic when moist; medium acid to mildly alkaline.

Use and suitability.—Most of the acreage is in forest. Capability unit IIIw-11.

Tunica Series

The Tunica series consists of somewhat poorly drained clayey soils that are underlain by coarser textured material. These soils are at the higher elevations in slackwater areas and are nearly level to gently sloping. The surface layer generally is very dark grayish-brown clay and is underlain by dark grayish-brown to dark-gray clay. This material is underlain at depths of 20 to 32 inches by well-drained silty clay loam that in many places grades into silt loam (fig. 6). These soils crack extensively when dry and seal up when wet. The reaction normally is slightly acid to neutral, but near the Mississippi River it is mildly alkaline. The original forest consisted of sweetgum, American elm, bitter pecan, green ash, various species of oak, and a dense undergrowth of brush and vines.

These soils make up about 7 percent of the county. They are distributed throughout the county but are mostly in the western part. Associated soils are those of the Sharkey, Bowdre, and Commerce series. The Tunica soils

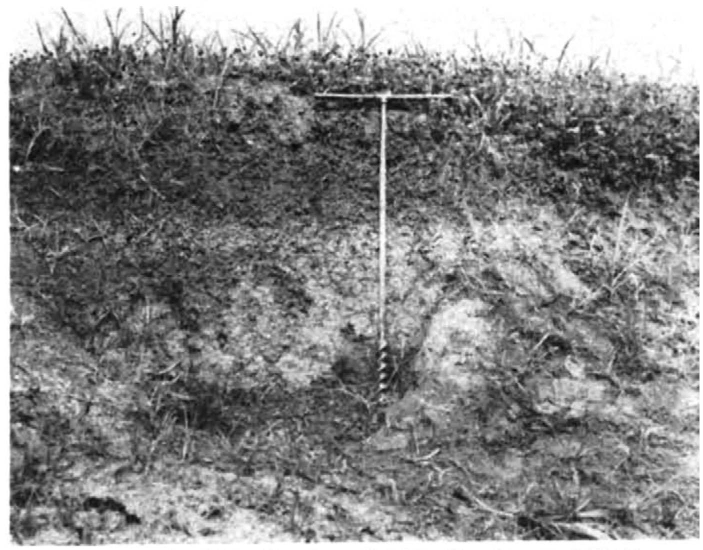

Figure 6.—**Profile of Tunica clay. Light-colored material in lower part is silty clay loam that grades into silt loam.**

are underlain by coarser textured material than the Sharkey soils. They have a thicker layer of clay than the Bowdre soils and are more poorly drained. They developed from finer material than the Commerce soils.

The Tunica soils are used mostly for crops and pasture. They are better suited to crops than the Sharkey soils because they are not so poorly drained.

Tunica clay, 0 to 2 percent slopes (Ta).—This soil is at the higher elevations in slack-water areas. A small acreage not protected by the levee is subject to overflow.

Profile (NW¼NW¼ sec. 32, T. 12 N., R. 8 W.):

A_{1p} 0 to 6 inches, very dark grayish-brown (10YR 3/2) clay; weak, fine and medium, granular structure; extremely hard when dry, very plastic when wet; numerous fine roots; neutral; abrupt smooth boundary.

A_{12} 6 to 18 inches, very dark grayish-brown (10YR 3/2) and dark grayish-brown (10YR 4/2) clay; few, fine, distinct mottles of yellowish brown (10YR 5/4); massive with suggestion of medium, subangular blocky peds; extremely hard when dry, very plastic when moist; numerous fine roots; neutral; gradual smooth boundary.

AC 18 to 28 inches, dark-gray (10YR 4/1) clay; common, fine, distinct mottles of yellowish brown (10YR 5/4); massive; extremely hard when dry, very plastic when moist; a few fine roots; neutral; clear smooth boundary.

C 28 to 36 inches, dark-brown (10YR 3/3) and dark grayish-brown (10YR 4/2) silty clay loam; common, fine, distinct mottles of yellowish brown (10YR 5/8) and yellow (10YR 7/8); structureless; slightly hard when dry, friable when moist; few fine ferromanganese concretions; mildly alkaline; gradual smooth boundary.

D 36 to 45 inches +, pale-brown (10YR 6/3) to light yellowish-brown (10YR 6/4) silt loam; common, medium, distinct mottles of strong brown (7.5YR 5/8); structureless; soft when dry, very friable when moist; few fine ferromanganese concretions; mildly alkaline.

The A horizon ranges in thickness from 20 to 32 inches, and in places the texture is silty clay. The texture of the C horizon ranges from silty clay loam to loamy sand. In many places thin layers of yellowish-red (5YR 4/6) clay are in the C horizon.

Water moves into and through this soil slowly except when the soil is dry and cracked; then it moves rapidly until the cracks seal up. Natural fertility is high, but the content of organic matter is low. The fine-textured surface soil makes tillage very difficult.

Use and suitability.—Most of this soil has been cleared and is used for crops and pasture. The principal crops are cotton, soybeans, and small grain. Pasture is well suited. Under good management, the soil is very productive, but it can be worked only within a narrow range of moisture conditions. Adding organic matter in the form of sod crops, cover crops, or crop residues will help to improve its workability. Some surface drainage normally is needed. Nitrogen is the fertilizer most needed.

Capability unit IIs-2.

Tunica clay, 2 to 5 percent slopes (Tb).—This soil is along streambanks and depressions. Its profile is similar to that of Tunica clay, 0 to 2 percent slopes. A small acreage not protected by the levee is subject to overflow. Included are small areas that have steeper slopes and are moderately eroded.

Use and suitability.—This soil is used and managed in about the same way as Tunica clay, 0 to 2 percent slopes. A considerable acreage is in pasture. If row crops are grown, rows should be arranged so that excess water will run off without causing erosion. Adding organic matter will greatly improve workability.

Capability unit IIIs-2.

Tunica silty clay loam, 0 to 2 percent slopes (Tc).—This soil is at the base of natural levees where moderately fine textured material has washed or sloughed over Tunica clay. It is similar to Tunica clay, 0 to 2 percent slopes, but has a surface layer of silty clay loam that is from 4 to 8 inches deep. Included are a few small areas of Bowdre silty clay loam, which is not mapped separately in this county. Also included are small areas that have a slope of more than 2 percent.

Use and suitability.—This soil is used mostly for crops or pasture. It is used and managed in about the same way as Tunica clay, 0 to 2 percent slopes, but yields of most crops are slightly higher. Drainage generally is needed. Rows should be arranged so that excess water will run off without causing erosion.

Capability unit IIs-6.

Genesis, Morphology, and Classification of Soils[4]

This section has three main parts. The first explains the five soil-forming factors and the role of each in determining the distribution of the soils in Issaquena County; the second discusses the morphology and composition of the soils in the county; and the third classifies the soils by higher categories.

Factors of Soil Formation

Soil is the result of climatic and biological forces, which are modified by topographic conditions and, thus modified, act upon a parent material over a period of time. The nature of the soil at any point depends upon the combination of these five major soil-forming factors at that point. All five of these factors come into play in the formation of every soil. The degree to which each dominates varies from place to place. In general, the most evident differences between soils of two distant areas are likely to be due to differences in climate and in types of native vegetation, while differences in adjacent soils in the same locality are most likely to be due to differences in the parent material or in their topographic position.

Climate

The climate of Issaquena County is of the humid, warm-temperate type that is characteristic of the Southeastern United States. The summers are warm, with occasional hot periods and maximum temperatures above 100° F. The winters are mild, with short periods of freezing weather. Weather bureau records of the Greenville Station, in Washington County, Mississippi, are summarized in table 10; they are representative of the climatic conditions in Issaquena County.

Over the county, climate has been a uniform factor in soil development but has made only a slight impression on the soils. Regions with a humid, warm-temperate climate such as that in this county normally have strongly weathered, leached, acid soils of low fertility. But the flood plain of the Mississippi River is geologically young, and time has not yet permitted strong weathering of the sediments in place. These sediments have come mainly from sections of the country where weathering is not intense. Thus, the soils normally associated with humid, warm-temperate climate do not occur in Issaquena County, although they are present in the nearby hill sections.

[4] This section was taken in part from a similar one prepared for the soil survey report on Tunica County, Miss., by ROY W. SIMONSON, director of soil classification and correlation, Soil Conservation Service, USDA.

TABLE 10.—*Temperature and precipitation at Greenville Station, Washington County, Miss.*

[Elevation, 132 feet]

Month	Temperature [1]			Precipitation [2]			
	Average	Absolute maximum	Absolute minimum	Average	Driest year (1952)	Wettest year (1923)	Average snowfall
	° F.	° F.	° F.	Inches	Inches	Inches	Inches
December	45. 6	85	6	6. 57	4. 40	11. 73	0. 4
January	45. 5	90	−1	4. 78	3. 75	5. 50	1. 1
February	48. 6	91	−5	4. 48	4. 17	6. 83	. 5
Winter	46. 6	91	−5	15. 83	12. 32	24. 06	2. 0
March	56. 3	91	15	5. 53	3. 50	5. 88	. 2
April	64. 6	95	29	5. 03	5. 67	6. 37	0
May	72. 1	99	38	5. 02	1. 98	7. 85	0
Spring	64. 3	99	15	15. 58	11. 15	20. 10	. 2
June	79. 7	105	47	3. 31	(3)	4. 65	0
July	82. 1	110	53	3. 35	2. 42	5. 33	0
August	81. 8	107	54	3. 86	1. 50	8. 10	0
Summer	81. 2	110	47	10. 52	3. 92	18. 08	0
September	76. 8	107	37	3. 17	1. 33	3. 98	0
October	65. 4	96	25	2. 69	. 03	4. 79	0
November	54. 7	87	16	4. 13	2. 60	5. 65	. 1
Fall	65. 6	107	16	9. 99	3. 96	14. 42	. 1
Year	64. 4	110	−5	51. 92	31. 35	76. 66	2. 3

[1] Average temperature based on a 69-year record, through 1955; highest and lowest temperatures based on a 59-year record, through 1952.

[2] Average precipitation based on a 68-year record, through 1955; wettest and driest years based on a 68-year record, in the period 1887–1955; snowfall based on a 57-year record, through 1952.

[3] Trace.

Living organisms

Prior to settlement of the county, the native vegetation was most important in the complex of living organisms that affect soil development. The activities of animals were seemingly of minor importance. The first settlers found a cover of dense forests broken here and there by canebrakes. Heavy stands of cypress filled the swampy areas, whereas hardwood stands occupied most of the better drained soils and many of the wet ones. The differences in native vegetation seem to have been associated mainly with variations in drainage. Only the major differences in the original vegetation are reflected to any extent in the soils, probably because of the general youth of the land surface.

With the development of agriculture in Issaquena County, man has become important to the future direction and rate of development of the soils. The clearing of the forests, the cultivation of the soils, the introduction of new species of plants, the building of levees for flood protection, and the artificial improvement of natural drainage will be reflected in the direction and rates of soil genesis in the future. Few results of these changes can as yet be seen. Some probably will not be evident for many centuries. The complex of living organisms reflecting soil genesis in Issaquena County has been drastically changed, however, as a result of man's activity.

Parent material

Alluvial sediments laid down by the Mississippi River are the chief parent materials of soils in the county. The total thickness of the alluvium in Issaquena County ranges from 87 to 173 feet with an average thickness of 139 feet.

The alluvium in Issaquena County has a mixed lithology, originating as it does in the wide reaches of the upper Mississippi River Basin. Sedimentary rocks are most extensive in this upper basin, which extends from Montana to Pennsylvania, but other kinds of rocks are also exposed and serve as sediment sources in many places. Immense areas in the upper basin are mantled by recent glacial drift and loess. The alluvium along the lower stretches of the Mississippi, including Issaquena County, has come from the multitude of soils, rocks, and unconsolidated sediments of some 20 States. As a result the alluvium consists of a mixture of minerals. Furthermore, many of the minerals are comparatively fresh and but slightly weathered.

Within Issaquena County, there are wide ranges in the texture of the alluvium because of differences in deposition. All of it has been laid down by river water, either quiet or in flood. As the river overflows its channel and the water spreads out over the flood plain, the coarser sediments are dropped first. Sands are commonly deposited in bands parallel to and near the channel. Low ridges thus formed are known as natural levees. As the floodwaters continue to spread, they move more slowly, and finer sediments, such as silts, are deposited next, usually in mixture with some sands and clays. When the flood has passed and water is left standing in the lowest parts of the flood plain, the finest sediments, or clays, may settle out. These so-called slack-water clays do not settle until the water becomes still.

The simple pattern of coarse sediments near the channel, fine sediments in slack-water areas some distance away, and medium-textured sediments between the two, is not common at the present time along the Mississippi. Over the centuries the river channel has migrated back and forth across much of the flood plain, sometimes cutting out natural levees laid down earlier, sometimes depositing sand on top of slack-water clays. The normal pattern of sediment distribution from a single channel has been partly or wholly truncated in many places and has had subsequent beds of alluvium superimposed. All possible combinations of sediments resulting from the superposition of the simple patterns, one upon another, now exist on the flood plains, but in many places there are fragments of former channels, with their adjacent sandy natural levees, very gently sloping medium-textured sediments, and slack-water clays.

Differences in texture of the alluvium are accompanied by some differences in chemical and mineralogical composition. Sandier sediments are usually higher in quartz than are those of intermediate or fine textures. Conversely, they are lower in feldspars and ferromagnesian minerals. Sandier sediments are characteristically more siliceous and lower in bases. They are also lower in carbonates for the most part, but not always. Some of the more recently deposited sandier levees are distinctly calcareous, whereas many of the slack-water sediments are free of carbonates and are slightly acid.

Topography

Issaquena County is a small part of an immense flood plain that is nearly level. The topography ranges from the level areas of slack-water clays to gently sloping ridges that once bordered the river channel. Local differences in elevation are commonly measurable in feet. Seldom are there differences of as much as 15 feet within 1 square mile. In some of the lowest and flattest parts of the flood plain, the maximum differences in elevation are less than 5 feet in as many square miles. Slopes are generally less than 2 percent in gradient. Greater slopes occur on a few streambanks and on the present natural levees of the Mississippi River; these may range up to 15 percent. The total area of strong slopes in the county is negligible.

The highest area in the county is in the northwestern part; it is approximately 110 feet above sea level. The lowest area is in the southern part and is approximately 80 feet above sea level. Because of the higher elevations near the Mississippi River, natural drainage is to Steele Bayou and to the Yazoo River.

The flatness of the county contributes to the slow drainage of many of the soils. Water moves into the main channels with difficulty, especially from the areas of slack-water clays. Movement of water through such soils is also slow, which tends to accentuate drainage problems. A much larger part of the county would probably have been wet and swampy if, in the past, the Mississippi River channel had not meandered across the flood plain.

Time

Geologically, the soils of the county are young. Even now some areas receive fresh sediments at frequent intervals. It seems probable that the sediments now forming the land surface in Issaquena County arrived during and after the advances of the Wisconsin glaciers, the latest of which was moving into the North Central States 11,000 years ago (*2*). The soils being formed on glacial drift of the Mankato stage (last of the Wisconsin glaciers) in those States show little horizonation other than the downward leaching of carbonates and the accumulation of organic matter in the surface layer. The present surface of the Mankato drift has probably been exposed for 8,000 years. Assuming that the development of horizon differentiation in the alluvium of Issaquena County would be as rapid as that in Mankato drift, the soils could be somewhat older than those of south-central Minnesota. Even so, the comparison indicates that the time span for the development of horizons in the soils of Issaquena County has been very short.

Morphology and Composition

Soil morphology in Issaquena County is expressed generally in faint horizons. Some of the soils do have one distinct or prominent horizon, but those are in the minority. None of the soils have prominent horizons within the solum. Marked differences in texture between the solum, or C horizon, and an underlying D horizon occur in some profiles, for example, the Tunica and Bowdre soils formed from thin beds of clay over sand. Generally speaking, horizon differentiation is in its early stages or has scarcely started, and the horizons themselves are indistinct.

The differentiation of horizons in the soils of the county is the result of one or more of the following processes: Accumulation of organic matter, leaching of carbonates and salts more soluble than calcium carbonate, translocation of silicate clay minerals, and reduction and transfer of iron. In most soil profiles in the county, two or more of these processes have operated in the development of horizons. For example, the first two are reflected in the feeble horizons of Crevasse sandy loams and loamy sands, but the first and last are chiefly responsible for the morphology of Sharkey clay. All four processes have operated to some extent in the differentiation of horizons in Dundee soils.

Some organic matter has accumulated in the uppermost layers of most soils in Issaquena County to form an A_1 horizon. Much of that organic matter is in the form of humus. The quantities are very small in some soils but fairly large in others. Soils such as Beulah very fine sandy loam have faint and thin A_1 horizons low in organic matter at best. Some areas of soil lack any A_1 horizon. Other soils, such as Sharkey clay, have evident, thick A_1 horizons fairly high in organic matter. Taking the soils of the county as a whole, the accumulation of organic matter has been important among the processes of horizon differentiation.

Leaching of carbonates and salts has occurred in all soils of the county, although it has been of limited importance in horizon differentiation. The effects have been indirect, in that the leaching permitted the subsequent translocation of silicate clay minerals in some soils. Carbonates and salts have been carried completely out of the profile of many of the well-drained soils. Even in the wettest soils, some leaching is indicated by the absence of carbonates and by the acid reactions. Leaching of the very wet soils is slow because water movement through the profile is itself slow. Leaching has also made little progress in removal of carbonates from soils forming on the most recent sediments near the channel of the Mississippi River.

Translocation of silicate clay minerals has contributed to the development of horizons in relatively few soils in the county. It has affected mainly the soils of the Dundee series. Darker coatings on ped faces and clay films in former root channels in the B horizon of these soils indicate some downward movement of silicate clay minerals from the A horizons. The actual amount of clay movement has been small, but it has contributed to horizon differentiation. In the Dundee soils, translocation of clay has been about as important as the accumulation of organic matter has been in horizon differentiation. Leaching of carbonates and salts from the upper profile seems to be a necessary prelude to the movement of the silicate clays.

The reduction and transfer of iron, a process called gleying, has occurred in all of the poorly drained and somewhat poorly drained soils. It has also occurred to some extent in the deeper horizons of moderately well drained soils, such as Dundee silt loam. With the large areas of naturally wet soils in Issaquena County, the reduction and transfer of iron has been of importance in horizon differentiation.

The gray colors of the deeper horizons in the wet soils indicate the reduction of iron oxides. This reduction is commonly accompanied by some transfer of iron, which may be local or general in character. After it has been reduced, iron may be removed completely from some horizons and may even go out of the soil profile. More commonly in Issaquena County, it has moved a short distance and stopped either in the horizon of its origin or in a nearby horizon. Iron has been segregated within deeper horizons of many of the soils to form yellowish-red, strong-brown, or yellowish-brown mottles. Iron has also been segregated into concretions in deeper profiles of some soils.

The differentiation of the A horizon from the deeper horizons in poorly drained soils of Issaquena County is caused in part by the reduction and transfer of iron. Horizon differences also result in part from a greater accumulation of organic matter in the surface layer. The effects of gleying are evident but not prominent in the profiles of the soils in Issaquena County generally. This seems to reflect the youth of the land surface and of the soils. The time during which the sediments have been subject to horizon differentiation has not been long enough to permit the development of prominent horizons in the soil profiles.

Classification of Soils by Higher Categories

Soils are placed in narrow classes for the organization and application of knowledge about their behavior within farms and counties. They are placed in broad classes for study and comparisons of continents and other large areas. In the comprehensive system of soil classification followed in the United States, the soils are placed in six categories (*8*). Beginning with the most inclusive, the six categories are the order, suborder, great soil group, family, series, and type.

There are three orders in which all the soils of the country are grouped, and thousands of types. The suborder and family categories have never been fully developed and thus have been little used. Attention has been given largely to the classification of soils into soil types and series within counties or comparable areas and to the subsequent grouping of series into great soil groups and orders. Soil types are further broken down into phases, so as to provide finer distinctions significant to soil use and management.

Classes in the highest category of the classification scheme are the zonal, intrazonal, and azonal orders (*8*). The zonal order comprises soils with evident, genetically related horizons that reflect the predominant influences of climate and living organisms in their formation. The intrazonal order includes soils with evident, genetically related horizons that reflect the predominant influence of a local factor of topography or parent materials over the effects of climate and living organisms. The azonal order includes soils that lack distinct, genetically related horizons, commonly because of youth, resistant parent material, or steep topography. Table 11 groups the soils of Issaquena County by higher categories. A description of each soil series listed will be found in the section "Descriptions of Soils."

The Dundee series is tentatively classified in the Gray-Brown Podzolic group, although there is evidence for placing it in the Brunizem (Prairie) group as well. Gray-Brown Podzolic soils have a thin, dark A_1 horizon over a light brownish-gray and often platy A_2 horizon, which is underlain by a brown to yellowish-brown, finer textured B horizon that grades into a lighter colored and usually coarser textured C horizon.

TABLE 11.—*Classification of soils of Issaquena County by higher categories*

Great soil group	Series	Type
ZONAL SOILS		
Gray-Brown Podzolic.	Dundee	Dundee silt loam; Dundee silty clay loam.
INTRAZONAL SOILS		
Low-Humic Gley	Dowling Forestdale	Dowling clay; Dowling soils. Forestdale silty clay loam.
Grumusol	Sharkey	Sharkey clay; Sharkey silty clay loam; Sharkey silt loam, overwash; Sharkey fine sandy loam, overwash.
AZONAL SOILS		
Alluvial	Beulah Bowdre Commerce Mhoon Robinsonville. Tunica	Beulah very fine sandy loam. Bowdre clay. Commerce silt loam; Commerce very fine sandy loam; Commerce silty clay loam. Mhoon silty clay. Robinsonville very fine sandy loam. Tunica clay; Tunica silty clay loam.
Regosol	Crevasse	Crevasse sandy loams and loamy sands.

Brunizem (Prairie) soils have a thick, dark grayish-brown to very dark brown A_1 horizon that grades into a brownish B horizon, which may be mottled; the B horizon grades, in turn, into a lighter colored and normally coarser textured C horizon. Both the Gray-Brown Podzolic soils and the Brunizem soils normally occur under humid, cool-temperate climates; the former under deciduous forest, and the latter under tall prairie grasses (*4*).

The Dundee soils lack a distinct A_2 horizon, but all areas of the soils have been disturbed through cultivation. Consequently, it seems highly probable that the plow layer now includes former thin A_1 and A_2 horizons. The soils clearly lack a thick, dark A_1 horizon and do not appear to have had one in the past.

The present character of the B horizon would permit placing of the Dundee soils in either of the two great soil groups. The apparent absence of a thick A_1 horizon, and the probability that the A_1 and A_2 horizons have been mixed by plowing, form a basis for placing the soils in the Gray-Brown Podzolic group. It should be recognized, however, that the soils are intergrades to the Brunizem soils, being almost as much like them as like the central members of the Gray-Brown Podzolic group.

Soils of the intrazonal order are by far the most extensive in Issaquena County. These include the Dowling, Forestdale, and Sharkey series. All are either poorly drained or somewhat poorly drained. None seems to have distinct horizons, although all show the effects of gleying and accumulation of organic matter. These soils either are members of or are closely related to hydromorphic groups. The absence of a thick A_1 horizon high in organic matter is used as a basis for excluding these series from the Humic Gley group (*7*). The series seem more appropriately classified as Low-Humic Gley soils, with the exception of the Sharkey soils (*7*), which exhibit properties of churning through shrinking, swelling, and cracking and are therefore tentatively classified as Grumusols (*5*).

Recognition of the Low-Humic Gley group was proposed initially for somewhat poorly drained to poorly drained soils lacking a prominent A_1 horizon but having strongly gleyed B and C horizons with little textural differentiation. The recognition of two great soil groups for the Low-Humic Gley and Humic Gley (Wiesenboden) soils was based on thickness of the A horizon and on its content of organic matter.

Humic Gley soils are high in organic matter, whereas Low-Humic Gley soils are moderate to low. The Dowling and Forestdale soils are not high in organic matter, and they do show effects of gleying. They show less evidence of cracking and churning than the Sharkey soils. On the basis of present knowledge, classification of the two series as Low-Humic Gley soils seems appropriate. Further studies may indicate that the Dowling soils are intergrades to Grumsols because they are closely related to the Sharkey series.

Azonal soils are less extensive in Issaquena County than intrazonal soils, despite the fact that the whole area consists of geologically recent alluvium. Azonal soils are, however, much more extensive in the county than zonal soils. At the same time, all soils classified in the zonal and intrazonal orders are marginal to the azonal order because of their low degree of horizonation. Only the series that lack genetically related horizons or are in the initial stages of horizon differentiation are placed in the azonal order. Although the total area of these series is less than that of intrazonal soils, their number is greater. The azonal order includes the Beulah, Bowdre, Commerce, Mhoon, Robinsonville, and Tunica series, which are all classed as Alluvial soils, and the Crevasse series, which is classed as a Regosol.

The Alluvial soils lack distinct horizons because the sediments in which they are developing are so young. Given more time under natural conditions, most of these soils would eventually have had profiles similar to those of the Dundee series. Whether that will now occur in soils under cultivation remains to be seen. The regime in which the soils now exist differs greatly from that of their original natural environment. Some of the processes important in horizon differentiation probably will be accentuated and others subdued. Some may progress more rapidly and others more slowly. The net effect of the change in environment on future development of the soils cannot be forecast as yet with any certainty and may not be apparent for some centuries.

Regosols may be defined as an azonal group of soils consisting of deep unconsolidated rock (soft mineral deposits) in which few or no clearly expressed soil characteristics have developed (*7*). The Crevasse series fits this definition, inasmuch as there is little difference in color and texture in the vertical section.

Additional Facts About Issaquena County

This section discusses the organization and population of the county, the cultural facilities, the means of transportation and communication, and some of the natural resources. It gives the history of agriculture in the county and the present status of agriculture.

Organization and Population

Issaquena County, originally part of Washington County, was organized in 1844 from territory acquired in 1820 from the Choctaw Indians. Its name is derived from two Indian words, "Issa," meaning deer, and "Okhina," meaning river or water road (*6*). In 1876, Issaquena, Washington, and Warren Counties contributed land to form adjacent Sharkey County.

The early settlers were mostly of English and Scotch-Irish descent and were from the more settled parts of the country. Mayersville, the county seat, was named for an extensive landowner in the area, David Mayers.

The Mississippi River has been important in the development of the county. Most early settlements were on the high lands along the river, and the settlers depended on river travel for contact with the outside world. The county has depended mainly on agriculture for its economy, and until recently the river was used to transport much of the local produce.

The last levee break within the county was in 1913, but the Mississippi River used to overflow its banks periodically and flood vast areas. After the flood of 1927, which inundated a large part of Issaquena County, the Federal Government, under the Flood Control Act, took over the levee system.

In the 1950 census the entire county is classified as rural and the total population is 4,966. Since 1940 the overall population has decreased. This decrease has been caused mainly by the mechanization of farms and the subsequent migration of farm workers to urban areas.

There are no incorporated towns in Issaquena County. Important trading centers are Mayersville, Grace, Fitler, Shipland, and Valley Park.

The county is governed by a board of supervisors. Five men, one elected from each beat for a 4-year term, serve on this board.

Cultural Facilities

The cultural facilities in Issaquena County are limited because there are no large towns and the county is completely agricultural.

There are a number of Protestant churches in the county and one modern elementary school. However, school buses furnish transportation to elementary schools and high schools in adjacent Sharkey and Washington Counties. These schools are partly financed by Issaquena County.

The residents of Issaquena County use many of the facilities at Rolling Fork in Sharkey County. Both counties sponsor the hospital and the library at Rolling Fork. Recreational facilities include a swimming pool and a ball park.

Transportation and Communication

U.S. Highway No. 61 passes through the southern part of the county and extends northward to Memphis and Chicago and southward to Vicksburg and New Orleans. State Highway No. 1 runs the length of the county. It intersects U.S. Highway No. 82 north of Issaquena County at Greenville, Mississippi. State Highway No. 14 runs eastward from Mayersville and intersects U.S. Highway No. 61 at Rolling Fork in Sharkey County. Most of the local roads are gravel and are usable the year around.

The Illinois Central Railroad crosses the southern part of the county, roughly parallel to U.S. Highway No. 61.

Telephone and electric services are available throughout the county.

Natural Resources

Soil, water, and forest are the three main resources of Issaquena County, but inasmuch as soil and forest resources are discussed in other sections of this report, only water resources are discussed here.

Issaquena County is well supplied with streams, bayous, and lakes, but many of them are dry part of the year. The principal streams are Steele Bayou, Mound, Indian Bayou, Newsom Bayou, Deer Creek, and the Little Sunflower and Yazoo Rivers. The larger lakes are in the southwestern part of the county and are cutoffs of the Mississippi River. The Mississippi River forms the western boundary of the county.

Wells supply water for household use and for livestock. The wells are of two types—shallow wells that extend only into the alluvium; and deep, or artesian, wells that extend through the alluvium into the underlying Coastal Plain formation.

The alluvium in Issaquena County ranges in thickness from 87 feet to 173 feet, with an average thickness of 139 feet (*3*). The upper part, composed of loam and clay, averages 25 feet in thickness (*3*). The lower part, composed of basal clay and gravel, averages 114 feet in thickness. This lower layer provides water not only for domestic use but also for irrigation. This water is high in minerals and requires treatment to make it suitable for industrial use.

Kosciusko sand is the main source of artesian water in Issaquena County. Artesian wells range in depth from 780 to 1,400 feet and in diameter from 2 to 4 inches. They produce from 10 to 160 gallons of water per minute. Some wells that once were free flowing now must be pumped because continual use has reduced pressure.

History and Present Status of Agriculture

The people of Issaquena County depend mainly on agriculture as a means of livelihood. The early economy of the county was based on the plantation system, and cotton was the main cash crop. In 1934, the first government restrictions were placed on cotton acreage. Since then the importance of cotton has declined, and the cropping system has become more diversified. The growing of small grain and soybeans and the production of livestock have increased in importance.

The census figures for 1954 give the total land area of Issaquena County as 265,600 acres. About 42 percent of this acreage is in farms, and the rest is mainly in large wooded tracts. The total cleared area in the county in 1954 was about 60,000 acres. Conservative estimates indicate that there is now about 85,000 acres of cleared land in the county.

Between 1950 and 1954, the number of farms in the county decreased from 801 to 605, but the size of farms increased. The greatest reduction in number is in farms of less than 100 acres, and the greatest increase in size is in farms of 100 to 499 acres. The average size in 1954 was 183.3 acres. In 1950 the average size was 137.2 acres.

Table 12 shows a comparison of the number of farms in various groups for the years 1950 and 1954.

TABLE 12.—*Comparison of number of farms in various size groups for stated years*

Size in acres	1950	1954
	No. of farms	*No. of farms*
0 to 49	545	381
50 to 99	155	110
100 to 219	41	55
220 to 499	18	22
500 to 999	19	14
1000 or more	23	23

Most farms in Issaquena County are general farms that produce cotton, soybeans, small grain, and corn. On some general farms fairly large numbers of livestock are raised. Several farms are operated mainly for the production of livestock. The acreages of the principal crops and pasture grown in the county in stated years are given in table 13.

TABLE 13.—*Acreages of principal crops and pasture for stated years*

Crop	1949	1954
Cotton harvested	22, 372	13, 646
Soybeans harvested for beans	2, 550	9, 640
Corn for all purposes	6, 103	3, 065
Oats threshed or combined	4, 055	5, 669
Hay (excluding soybeans, cowpeas, peanuts, and sorghum hay)	4, 021	3, 813
Pasture:		
Cropland used only for pasture	6, 804	18, 830
Other pasture (not cropland and not woodland)	6, 798	10, 559

Much of the acreage now in pasture is suited to row crops and will be used for pasture and row crops in rotation. For convenience, many permanent pastures are near farm homesites. Some are on steep banks along streams and bayous, and others are on the levee along the Mississippi River.

The production of livestock in Issaquena County has been increasing in importance for a number of years.

The greatest increase is in the number of beef cattle. Most beef cattle are of very good grade. Dairy cattle range from those of very poor quality, kept principally for home use, to high-producing animals in commercial herds. The number of horses and mules has decreased since the mechanization of farms. Table 14 lists the kind and number of the principal livestock in the county for specified years.

TABLE 14.—*Kind and number of livestock*

Kind	1940	1950	1954
Cattle and calves	[1] 4, 606	5, 377	31, 860
Milk cows	729	679	914
Horses and colts	[1] 530	[2] 457	[2] 322
Mules and colts	[1] 1, 259	600	280
Hogs and pigs	[3] 5, 777	5, 527	3, 079

[1] Over 3 months old.
[2] Includes ponies.
[3] Over 4 months old.

In 1954 there were 605 farms in the county. Of the farm operators, 237 were full owners, 63 were part owners, 5 were managers, and 300 were tenants.

Most of the farms are family-sized units, on which the family does most of the work with the help of occasional outside day labor. The larger farms are operated either by tenants or by day laborers, under the supervision of the owner or manager. Two types of tenant systems are used. In one the tenant pays a fixed rent for use of the land. In the other the tenant works the land and pays the landlord a fixed part of the crop as rent. Under this arrangement, each agrees to supply certain items, such as fertilizer, equipment, or capital, and to share the crop according to the contribution of each. In recent years the trend has been to operate the farms with day labor.

The amount of equipment and the facilities available on the farms in the county vary widely. The larger farms are highly mechanized, and most of the other farms are mechanized to a considerable extent. Only a few farms still depend completely on horses or mules for power. Table 15 shows the number of farms that in 1950 and in 1954 had the equipment and facilities specified.

TABLE 15.—*Equipment and facilities for stated years*

Equipment or facility	1950	1954
	No. of farms	*No. of farms*
Telephones	20	71
Electricity	475	446
Running water	(1)	191
Tractors	567	525
Motortrucks	275	287
Automobiles	227	310

[1] Not reported.

Nitrogen is the fertilizer most needed for most locally grown crops. Phosphate, potash, and lime are used where high production is desired or where specialized crops are grown. Table 16 gives the amount of fertilizer used in 1954 on specified acreage for the crops named.

TABLE 16.—*Fertilizer used for various crops in 1954*

Crop	Tons of fertilizer	Acres
Cotton	1, 253	13, 262
Corn	221	2, 109
Hay and cropland pasture	226	3, 026
Other pasture	26	395
Other crops	396	4, 301

Literature Cited

(1) AMERICAN ASSOCIATION OF STATE HIGHWAY OFFICIALS.
1955. STANDARD SPECIFICATIONS FOR HIGHWAY MATERIALS AND METHODS OF SAMPLING AND TESTING. Ed. 7, 2 pts., illus. Washington, D.C.

(2) ARNOLD, J. R., and LIBBY, W. F.
1951. RADIOCARBON DATES. Science 113: No. 2927, pp. 111–120.

(3) BROWN, G. F.
1947. GEOLOGY AND ARTESIAN WATER OF THE ALLUVIAL PLAIN IN NORTHWESTERN MISSISSIPPI. Miss. State Geol. Survey Bul. 65. Univ. Miss. 424 pp., illus.

(4) MARBUT, C. F.
1935. SOILS OF THE UNITED STATES. *In* U.S. Dept. Agr. Atlas of Amer. Agr., pt. 3, Advance sheets, No. 8, 98 pp., illus.

(5) OAKES, H., and THORP, J.
1950. DARK CLAY SOILS OF WARM REGIONS, VARIOUSLY CALLED RENDZINA, BLACK COTTON SOIL, REGUR, AND TIRS. Soil Sci. Soc. Amer. Proc. 15: 348–354.

(6) ROWLAND, D.
1925. HISTORY OF MISSISSIPPI. 2 v. Chicago and Jackson.

(7) THORP, J., and SMITH, GUY D.
1949. HIGHER CATEGORIES OF SOIL CLASSIFICATION: ORDER, SUBORDER, AND GREAT SOIL GROUPS. Soil Sci. 67: 117–126.

(8) UNITED STATES DEPARTMENT OF AGRICULTURE.
1938. SOILS AND MEN. U.S. Dept. Agr. Ybk. 1938, 1232 pp., illus.

(9) WATERWAYS EXPERIMENT STATION, CORPS OF ENGINEERS.
1953. THE UNIFIED SOIL CLASSIFICATION SYSTEM. Tech. Memo. 3–357, 3 v.

Glossary

Aggregate (of soil). Many fine soil particles held in a single mass or cluster, such as a clod, crumb, block, or prism.

Alluvium. Soil material deposited on land by streams.

Available moisture holding capacity. The capacity (or ability) of soil to hold water available for plant use. Often expressed in inches per foot depth of soil.

Clay. (1) Mineral particles less than 0.002 millimeter in diameter. (2) As a textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Consistence, soil. The properties of soil material that determine its resistance to crushing and its ability to be molded or changed in shape. The following terms are frequently used to describe consistence:

Brittle. When dry, breaks with a clean fracture or shatters to cleanly broken hard fragments if struck a sharp blow.

Compact. Dense and firm, but not cemented.

Firm. When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.

Friable. When moist, crushes easily under gentle to moderate pressure between thumb and forefinger and coheres when pressed together.

Impervious. Very resistant to penetration by water and, normally, to penetration by air and plant roots.

Plastic. When wet, soil material forms a wire or spindle when rolled in hands; moderate pressure required to change shape of the soil mass; easily molded and puttylike; not friable.

Sticky. After pressure, adheres to both thumb and forefinger and tends to stretch somewhat rather than pull free from either finger; adhesive rather than cohesive when wet but normally very cohesive when dry; decided tendency to stick to other materials and objects when wet.

Stiff. Resists deformation or rupture; firm, tenacious, and tending to imperviousness. Term normally is applied to consistence of soil when in place and moderately wet.

Tight. Compact, impervious, tenacious, and normally plastic.

Cropland. Land regularly used for crops, except forest crops. Included are rotation pasture, cultivated summer fallow, and other land ordinarily used for crops but temporarily idle.

Erosion, soil. The wearing away or removal of soil material by water or wind.

Fertility, soil. The quality of a soil that enables it to provide compounds, in adequate amounts and in proper balance, for the growth of specified plants, when other growth factors such as light, moisture, temperature, and the physical condition of the soil are favorable.

First bottom. Recent natural levees or the normal flood plain of a stream, subject to frequent or occasional flooding.

Forest. Land that bears a stand of trees of any age or size, including seedlings, provided these trees are of kinds that attain a minimum average height of 6 feet at maturity; or land from which such a stand has been removed, but which has been put to no other use; forests on farms are commonly called woodland or farm forests.

Genesis, soil. Mode of origin of the soil. Soil genesis refers particularly to the processes causing the development of the solum from unconsolidated parent material.

Great soil group. A broad group of soils that have common internal soil characteristics.

Horizon, soil. A layer of soil, approximately parallel to the soil surface, with distinct characteristics produced by soil-forming processes.

A horizon. The master horizon consisting of (1) one or more mineral horizons of maximum organic accumulation; or (2) surface or subsurface horizons that are lighter in color than the underlying horizon and that have lost clay minerals, iron, and aluminum with resultant concentration of the more resistant minerals; or (3) horizons belonging to both of these categories.

B horizon. The master horizon of altered material characterized by (1) an accumulation of clay, iron, or aluminum, with accessory organic material; or (2) blocky or prismatic structure together with other characteristics, such as stronger colors, unlike those of the A horizons or the underlying horizons of nearly unchanged material; or (3) characteristics of both of these categories. Commonly, the lower limit of the B horizon corresponds to the lower limit of the solum.

C horizon. A layer of unconsolidated material, relatively little affected by the influence of organisms and, in chemical, physical, and mineral composition, presumed to be similar to the material from which at least part of the overlying solum has developed.

D horizon. Any stratum underlying the C, or the B if no C is present, which is unlike the C, or unlike the material from which the solum has been formed.

Internal drainage. The movement of water through the soil profile. The rate of movement is affected by the texture of the surface soil and subsoil, and by the height of the ground water table, either permanent or perched. Relative terms for expressing internal drainage follow: *None, very slow, slow, medium, rapid,* and *very rapid.*

Leaching, soil. The removal of materials in solution by the passage of water through the soil.

Loam. Soil having approximately equal amounts of sand, silt, and clay.

Low bottom. Broad slack-water areas where the clay sediments of backwater have settled from suspension.

Morphology, soil. The physical constitution of the soil, including the texture, structure, consistence, color, and other physical and chemical properties of the various soil horizons that make up the soil profile.

Mottling, soil. Contrasting color patches that vary in number and size. Descriptive terms are as follows:

Abundance. Few, common, and many.

Contrast. Faint, distinct, and prominent.

Size. Fine, medium, and coarse.

The size measurements are as follows: Fine, commonly less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; medium, commonly ranging between 5 and 15 millimeters (about 0.2 to 0.6 inch) along the greatest dimension; and coarse, commonly more than 15 millimeters (about 0.6 inch) along the greatest dimension.

Natural drainage. Refers to those conditions that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by such factors as sudden deepening of channels or filling or blocking of drainage outlets. The following terms are used to describe natural drainage: *Excessively drained, somewhat excessively drained, well drained, moderately well drained, imperfectly* or *somewhat poorly drained, poorly drained,* and *very poorly drained.*

Normal soil. A soil having a profile in near equilibrium with its environment; developed under good, but not excessive, drainage from parent material of mixed mineral, physical, and chemical composition; and expressing in its characteristics the full effects of the forces of climate and living matter.

Nutrients, plant. The elements taken in by the plant, essential to its growth, and used by it in the elaboration of its food and tissue. Nutrients obtained from the soil include nitrogen, phosphorus, calcium, potassium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps others; nutrients obtained mainly from air and water are carbon, hydrogen, and oxygen.

Old natural levee. The higher areas of old alluvium adjacent to streams where coarse-textured and medium-textured sediments have settled from suspension in water.

Parent material. The unconsolidated mass from which the soil profile develops.

Permeability, soil. That quality of the soil that enables it to transmit water or air.

Phase, soil. A subdivision of the soil type covering variations that are chiefly in such external characteristics as relief, stoniness, or accelerated erosion.

Plowsole. A dense compacted layer underneath the plow layer. It restricts the movement of water and air and the depth of the root zone. It limits the fertility and the supply of available moisture.

Profile, soil. A vertical section of the soil through all its horizons and extending into the parent material. (Also see Horizon, soil.)

Reaction, soil. The degree of acidity or alkalinity of a soil expressed in words or in pH values, as follows:

	pH		*pH*
Extremely acid	below 4.5	Mildly alkaline	7.4 to 7.8
Very strongly acid	4.5 to 5.0	Moderately alkaline	7.9 to 9.0
Strongly acid	5.1 to 5.5	Strongly alkaline	8.5 to 9.0
Medium acid	5.6 to 6.0	Very strongly alkaline	9.1 and higher
Slightly acid	6.1 to 6.5		
Neutral	6.6 to 7.3		

Recent natural levee. The first bottom or normal flood plain of a stream, subject to frequent or occasional flooding.

Relief. The elevations or inequalities of the land surface, considered collectively.

Sand. (1) Individual rock or mineral fragments that range in diameter from 0.05 millimeter (0.002 inch) to 2.0 millimeters (0.079 inch). Usually sand grains consist chiefly of quartz, but they may be of any mineral composition. (2) As a textural class, soil that is 85 percent or more sand and not more than 10 percent clay.

Series, soil. A group of soils that, except for texture of the surface layer, have genetic horizons similar as to differentiating characteristics and arrangement in the soil profile, and developed from a particular type of parent material. A series may include two or more soil types that differ from one another in the texture of the surface soil.

Silt. (1) Individual mineral particles that range in diameter from 0.002 millimeter to 0.05 millimeter. (2) As a textural class, soil that is 80 percent or more silt and less than 12 percent clay. (3) Sediments deposited from water in which the individual grains are approximately the size of silt, although the term is sometimes applied loosely to sediments containing considerable sand and clay.

Slack-water soil. A soil formed on sediments that settled from still stream water.

Slope classes. As used in this report, slope classes are as follows:

	Gradient
Level	0 to ½ percent.
Nearly level	½ to 2 percent.
Gently sloping	2 to 5 percent.

Soil. The natural medium for the growth of land plants. A soil is a natural three-dimensional body on the surface of the earth, unlike the adjoining bodies.

Stratified. Composed of, or arranged in, strata, or layers, such as stratified alluvium. The term is confined to geological materials. Layers in soils that result from the processes of soil formation are called horizons; those inherited from the parent material are called strata.

Structure, soil. The arrangement of the individual grains into aggregates that make up the soil mass; the term may refer to the natural arrangement of the grains when the soil is in place and undisturbed or when the soil is at any degree of disturbance.

Subsoil. Technically, the B horizon of a soil with a distinct profile; commonly, that part of the profile below plow depth.

Substratum. Any layer lying beneath the solum, or true soil. (Also see Horizon, soil; and Parent material.)

Surface runoff. Water removed by flow over the surface of the soil. The amount and rapidity of runoff are affected by texture, structure, and porosity of the surface soil; the plant cover; the prevailing climate; and the slope. These are the terms used to describe relative degrees of runoff: *Very rapid, rapid, medium, slow, very slow,* and *ponded.*

Surface soil. Technically, the A horizon; commonly, the upper part of the profile usually stirred by plowing.

Terrace (geological). An old alluvial plain, usually flat or undulating, that borders a stream; frequently called second bottom, as contrasted with flood plain; seldom subject to overflow.

Texture, soil. The relative proportions of the various size groups of individual soil grains in a mass of soil; specifically, the proportions of sand, silt, and clay. A coarse-textured soil is one high in content of sand; a fine-textured one contains a large proportion of clay.

Type, soil. A subdivision of the soil series based on texture of the surface soil.

Workability. The ease with which tillage, harvesting, and other farming operations can be accomplished.

GUIDE TO MAPPING UNITS

NRCS Accessibility Statement