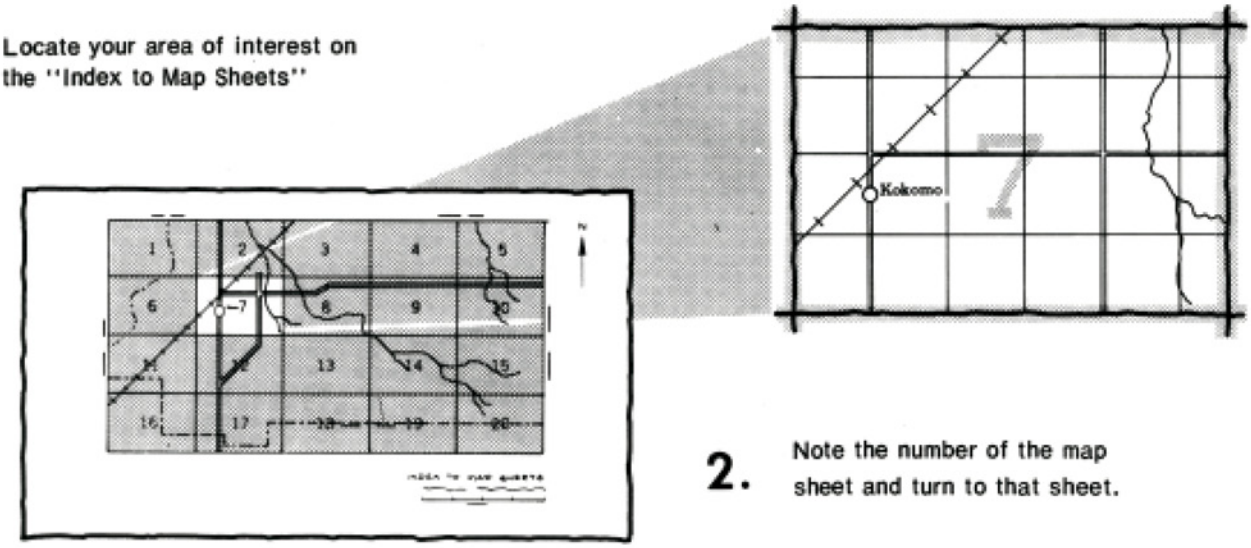
United States Department of Agriculture
Soil Conservation Service
in cooperation with the
Brazoria County Commissioners Court and
Texas Agricultural Experiment Station

soil survey of

brazoria county, texas

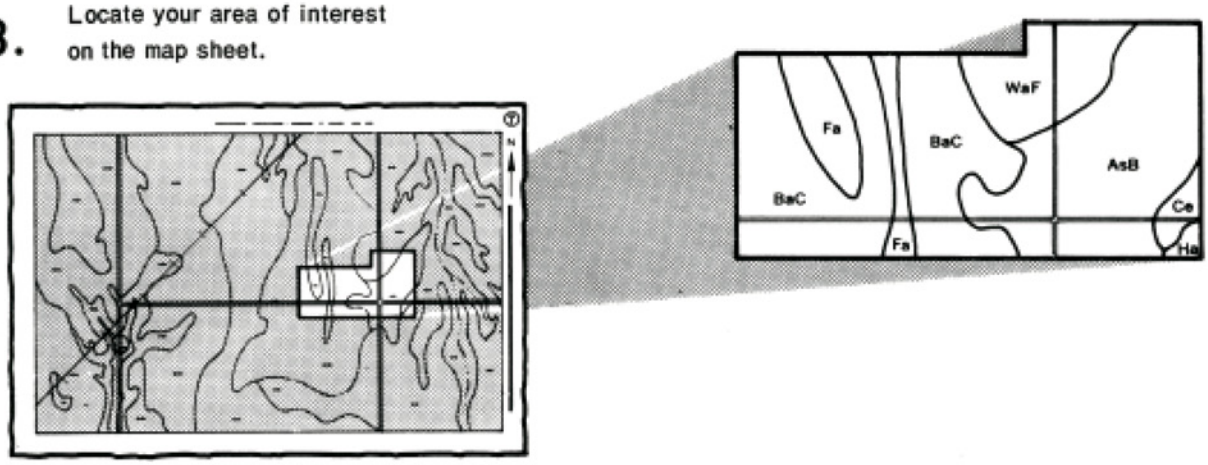
HOW TO USE

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

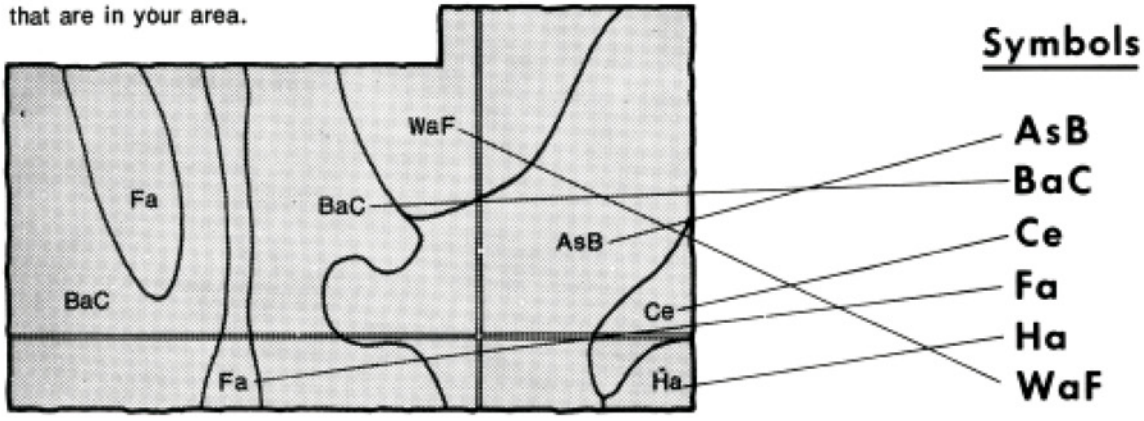


2. Note the number of the map sheet and turn to that sheet.

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

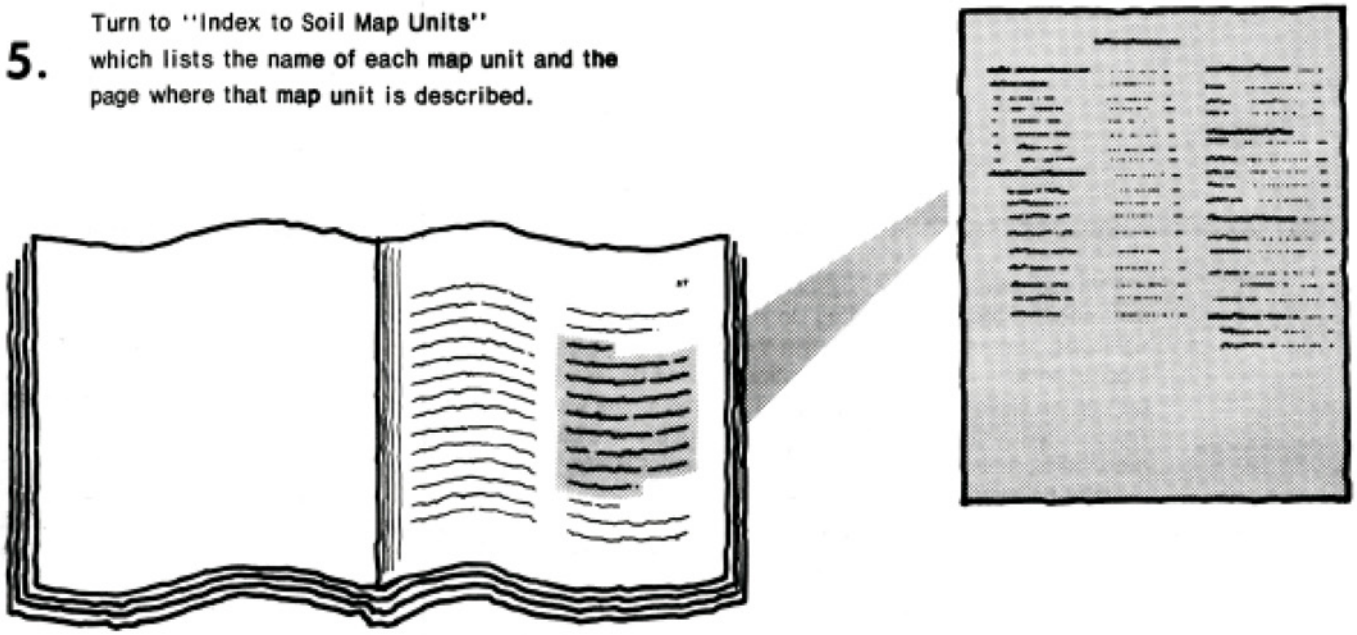


4. List the map unit symbols that are in your area.

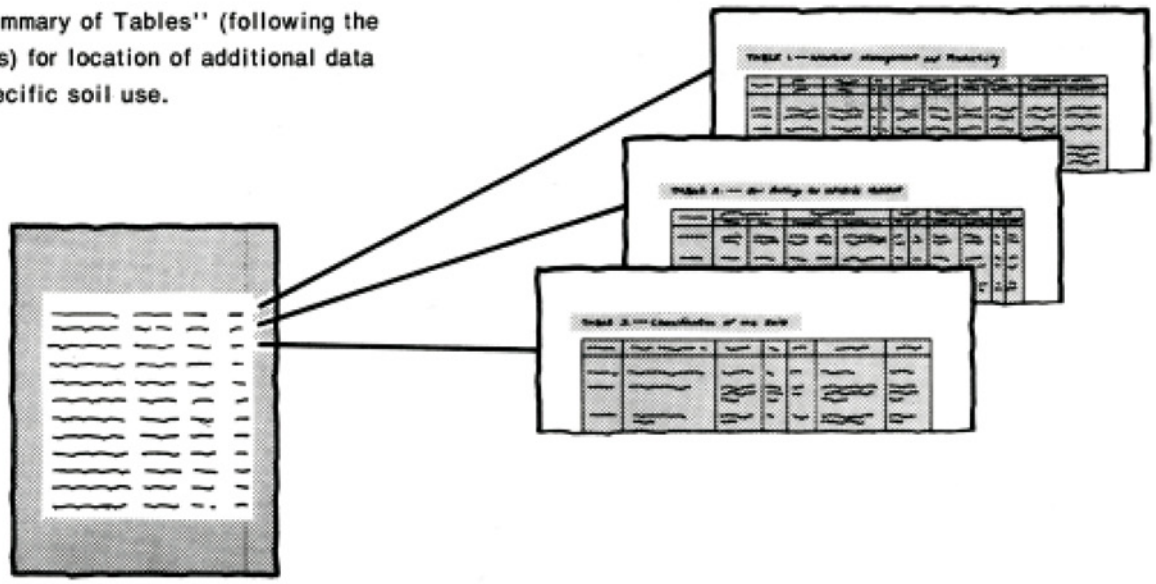


THIS SOIL SURVEY

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



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



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

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

Major fieldwork for this soil survey was performed in the period 1972-78. Soil names and descriptions were approved in 1978. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1978. This survey was made cooperatively by the Soil Conservation Service, the Brazoria County Commissioners Court, and the Texas Agricultural Experiment Station. It is part of the technical assistance furnished to the Waters Davis Soil and Water Conservation District.

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

This survey supersedes the soil survey of Brazoria Area published in 1902 (*18*).

Cover: This rice, in an area of the Bernard-Edna complex, is ready for harvest.

contents

soil series

Issued June 1981

index to map units

summary of tables

foreword

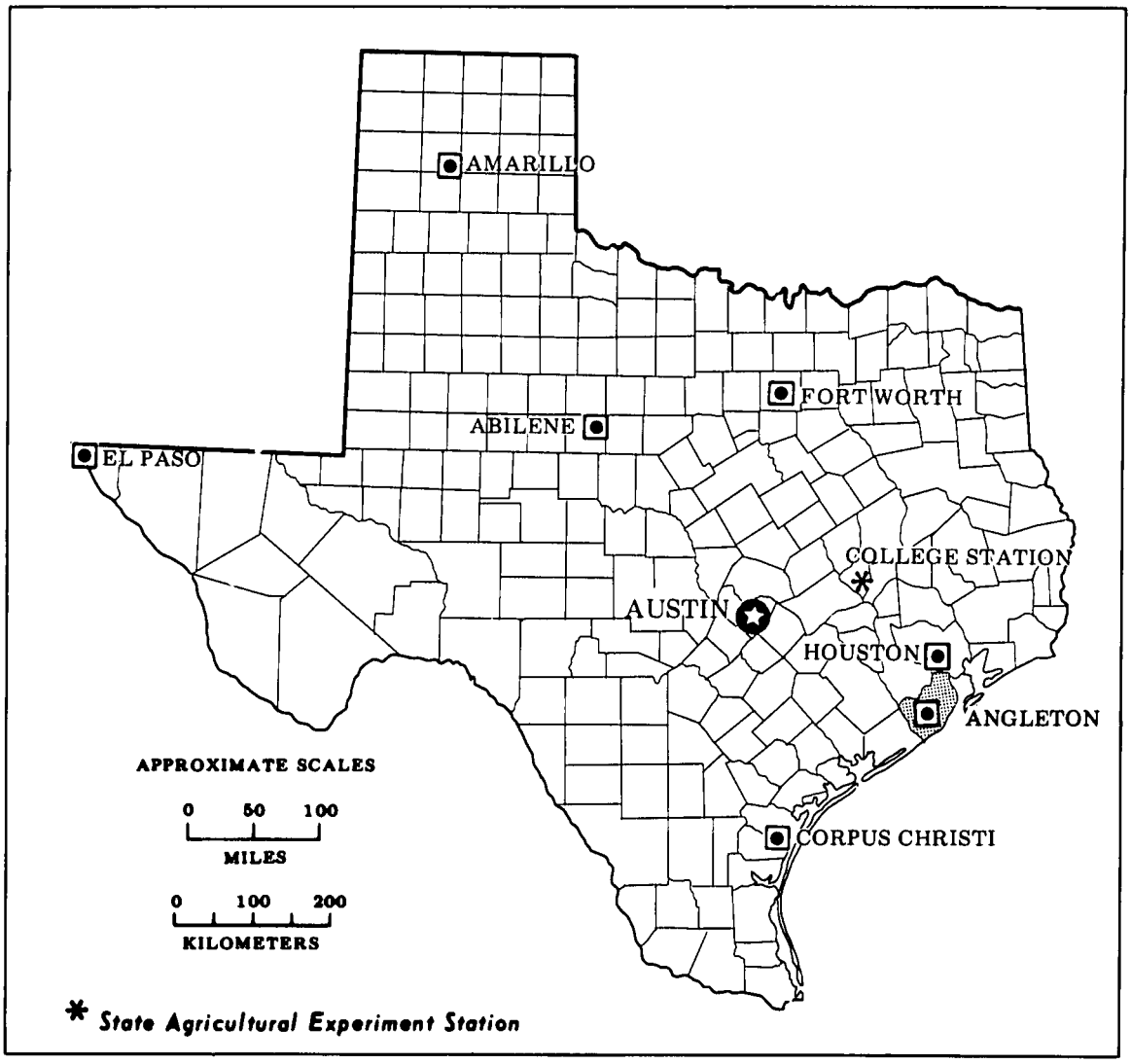
This soil survey contains information that can be used in land-planning programs in Brazoria County. It contains predictions of soil behavior for selected land uses. The survey also highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact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

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

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

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

George C. Marks
State Conservationist
Soil Conservation Service



Location of Brazoria County in Texas.

soil survey of
Brazoria County, Texas

By Gerald W. Crenwelge, Jack D. Crout, Edward L. Griffin,
Michael L. Golden, and Janet K. Baker,
Soil Conservation Service

United States Department of Agriculture, Soil Conservation Service,
in cooperation with Brazoria County Commissioners
Court and Texas Agricultural Experiment Station

general nature of the survey area

Brazoria County is located in the southeastern part of Texas, along the Gulf of Mexico. Most of the county is in the Gulf Coast Prairies Major Land Resource Area. The lower part of the county, which is dominantly salty soils, is in the Gulf Coast Marsh Resource Area.

The county is rectangular in general shape, measuring about 35 miles from north to south and about 40 miles from east to west. It covers 1,503 square miles, or 961,920 acres. There is 68,010 acres of water areas larger than 40 acres. The land surface can be characterized generally as broad and nearly level. The few sloping areas are mostly adjacent to the San Bernard River, Brazos River, and Oyster Creek. The land surface slopes upward from the southeast to the northwest. The elevation rises from sea level at the Gulf of Mexico to about 75 feet in the northwestern part of the county; however, Damon Mound, which is in the northwestern part, reaches an elevation of 146 feet. Most drainage flows to the southeast through Linville Bayou, San Bernard River, Oyster Creek, Brazos River, Bastrop Bayou, Chocolate Bayou, Halls Bayou, Mustang Bayou, and Clear Creek. The San Bernard River and the Brazos River empty directly into the Gulf of Mexico. The other bayous and creeks empty into the bays adjacent to the Gulf of Mexico.

Farming and ranching are the main enterprises in the county. According to the Conservation Needs Inventory (*17*) the county is about 24 percent pastureland, 18 percent woodland, 14 percent irrigated cropland, 13 percent nonirrigated cropland, 15 percent rangeland, 8 percent urban and built-up land, 7 percent water, and 1 percent land that is used mainly for farmsteads and rural nonfarm homes. Rice, milo, soybeans, and cotton are the main cultivated crops. Beef cattle are the principal ranching stock.

The soils in this county are dominantly clayey and loamy, dark colored soils with very little slope. Because of the topography and the abundant rainfall, nearly all of the soils are wet during some period of the year. Some of the soils, such as those in tidal areas, are wet continuously.

Although the county experiences periods of drought, the periods usually are short. During these droughts, plants continue to grow, but at a reduced rate. Plants will recover quickly when adequate moisture becomes available.

Descriptions, names, and delineations of soils in this survey do not fully agree with those on soil maps for adjacent counties. Differences are the result of better knowledge of soils, modifications in series concepts, differences in intensity of mapping, or differences in the extent of soils within the survey areas.

climate

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

In Brazoria County the long summers are hot and humid, but the coast is frequently cooled by sea breezes. Winters are warm and are only occasionally interrupted by incursions of cool air from the north. Rains occur throughout the year, and precipitation is adequate for all crops. Every few years a hurricane crosses the area.

Table 1 gives data on temperature and precipitation for the survey area as recorded at Angleton, Texas, in the period 1951 to 1976. Table 2 shows probable dates of the first freeze in fall and the last freeze in spring. Table 3 provides data on length of the growing season.

In winter the average temperature is 55 degrees F, and the average daily minimum temperature is 44 degrees. The lowest temperature on record, which occurred at Angleton on January 12, 1962, is 14 degrees. In summer the average temperature is 81 degrees, and the average daily maximum temperature is

91 degrees. The highest recorded temperature, which occurred on June 27, 1967, is 103 degrees.

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

The total annual precipitation is 52 inches. Of this, 29 inches, or about 60 percent, usually falls in April through September, which includes the growing season for most crops. In 2 years out of 10, the rainfall in April through September is less than 19 inches. The heaviest 1-day rainfall during the period of record was 11.30 inches at Angleton on June 12, 1973. Thunderstorms occur on about 70 days each year, and most occur in summer.

Snowfall is rare. In 95 percent of the winters, there is no measurable snowfall. In 5 percent, the snowfall, usually of short duration, is no more than 4 inches. The heaviest 1-day snowfall on record was more than 2 inches.

The average relative humidity in midafternoon is about 60 percent. Humidity is higher at night, and the average at dawn is about 90 percent. The sun shines 60 percent of the time possible in summer and 60 percent in winter. The prevailing wind is from the south-southeast. Average windspeed is highest, 10 miles per hour, in March.

history

The first recorded inhabitants of the survey area were the Karankawa Indians (*11*). In 1821, pioneers and settlers began streaming into the area and buying land under Mexican law at a cost of less than 5 cents an acre (*25*). The congress of the Republic of Texas established Brazoria County on March 17, 1836.

Brazoria County was one of the most prosperous counties in Texas in the mid-1800's. Under the plantation system, the county became a major producer of sugarcane and was known as the "sugar bowl of Texas." Albert Sidney Johnston's China Grove Plantation was the first in Texas to make crude brown sugar. In the late 1800's, sugar production slowly decreased and cotton production increased to twice that of any other Texas county. Agriculture has continued to grow and diversify. Presently, crops such as cotton, grain sorghum, rice, and soybeans are grown, and a beef cattle industry utilizes the good grazing lands.

agriculture

The main agricultural enterprises in Brazoria County are growing crops such as rice, grain sorghum, cotton, and soybeans and raising beef cattle. In some places farm income is supplemented by leasing hunting rights for geese, ducks, and deer.

Livestock operations are mainly cow-calf. On prairie rangeland and pasture, supplemental feeding is usually needed in winter. The marsh rangeland is used extensively by some larger operators to overwinter cattle. Little supplemental feeding is needed on marsh rangeland.

Rice is generally produced by tenant farmers who have a short term lease from the land owners. Rice is commonly grown on a field for two years. Then the field is fallowed or is used as pasture or for grain sorghum or soybeans for one year. Because of the high cost of the land more and more areas are being used for grain sorghum and soybean production instead of being fallowed.

Corn, alfalfa, and vegetable crops are also produced in the survey area.

natural resources

Brazoria County has an abundance of natural resources.

The soils, except for those in the marshes, are productive croplands and pasturelands. The marshes are productive rangelands. They not only provide grazing for cattle but also produce abundant organic matter, which is a necessary part of the food chain for the marine ecosystem. The marshes are also a nursery area for many marine animals. In addition, they provide food for a large population of ducks and geese.

Oil and gas are abundant in the county.

The extensive bays and bayous and the Gulf of Mexico provide abundant water recreation, which attracts people from adjoining counties.

how this survey was made

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

The soil scientists recorded the characteristics of the profiles they studied and compared those profiles with others in nearby counties and in more distant places. They classified and named the soils according to nationwide uniform procedures. They drew the boundaries of the soils on aerial photographs. These photographs show trees, buildings, fields, roads, and

other details that help in drawing boundaries accurately. The soil maps at the back of this publication were prepared from aerial photographs.

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

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

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

general soil map units

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

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

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

Land areas make up 93 percent of the total acreage. Water areas make up the rest.

soil descriptions

Deep, nonsaline soils

This group of map units makes up about 82 percent of the county. The major soils are those in the Aris, Asa, Bernard, Brazoria, Edna, Lake Charles, Norwood, and Pledger series. They are on broad, nearly level areas that are far enough inland that they are not affected by salts from the Gulf of Mexico. With the exception of the Asa and Norwood soils, which are loamy throughout and are well drained, all of the soils are somewhat poorly drained to poorly drained and have a very slowly permeable subsoil.

These soils have high potential for most agricultural uses. Most of the soils are, or have been, cultivated to rice, grain sorghum, cotton, and soybeans. These soils also produce good pastures. Soils of the native wooded areas also have good potential for crops but are used mainly as pasture. The productivity of these soils is usually better where a surface drainage system has been installed.

The main restrictive features for urban uses are soil wetness and the shrink-swell potential of the soil.

1. Lake Charles

Clayey, somewhat poorly drained, very slowly permeable soils; on coastal terraces

The soils of this map unit have slopes that are generally less than 0.2 percent but that range to 8 percent. The unit makes up about 30 percent of the county.

The map unit is about 85 percent Lake Charles soils and 15 percent soils of minor extent.

Lake Charles soils have plane, nearly level slopes. Typically, the surface layer is firm, very dark gray clay about 7 inches thick. The layer from 7 to 50 inches is very dark gray clay. The next layer is gray clay to a depth of 64 inches.

Of minor extent in this map unit are Beaumont and Bernard soils.

The soils in this map unit are used mainly as cropland and pastureland.

The potential of the soils for cultivated crops is high. Rice production is extensive in this unit. Grain sorghum, soybeans, and cotton are also grown.

The potential of the soils for use as pastureland is high. In most places, a combination of common bermudagrass and dallisgrass is used. In wooded areas, however, native woodland understory plants are used for grazing. The composition of the understory varies considerably with the differences in density of the overstory canopy.

The potential for rangeland use is high. The native range plants are bluestem, indiangrass, and eastern gamagrass.

The potential of the soils for most urban uses is medium. Wetness and the clayey texture and high shrink-swell potential of the soil are the most limiting features.

2. Pledger-Brazoria

Clayey, somewhat poorly drained, very slowly permeable soils; on bottom lands

The soils of this unit have slopes that are dominantly less than 0.3 percent but that range to 5 percent in a few places. The unit makes up about 19 percent of the county.

This unit is about 70 percent Pledger soils, 25 percent Brazoria soils, and 5 percent other soils.

Pledger soils have plane, nearly level slopes. Typically, the surface layer is firm black clay about 26 inches thick. Below that, to a depth of 64 inches, is reddish brown silty clay to clay.

Brazoria soils have slightly concave, nearly level slopes and are at a slightly lower elevation than the

Pledger soils. Typically, the surface layer is a firm, dark reddish brown clay about 20 inches thick. Below that, to a depth of 65 inches, is dark reddish brown clay. The soil is calcareous throughout.

Of minor extent in this map unit are Asa and Sumpf soils.

The soils of this unit are used mainly as pastureland.

The potential of the soils for cultivated crops is high. Grain sorghum, soybeans, and corn are the main cultivated crops.

The potential of the soils for use as pastureland is high. In wooded areas, the native understory plants are managed for grazing. The composition of the understory varies considerably with differences in the density of the overstory canopy. In areas that have been cleared, common bermudagrass and dallisgrass are commonly grown.

The potential of the soils for most urban uses is medium to low. Wetness, the clayey texture and shrink-swell potential, and the susceptibility to flooding are the most limiting features.

3. Bernard-Edna

Loamy, somewhat poorly drained and poorly drained, very slowly permeable soils; on coastal terraces

The soils of this map unit have slopes that are mostly less than 1 percent but that range to 5 percent in a few places. The unit makes up about 15 percent of the county.

The map unit is about 40 percent Bernard soils, 35 percent Edna soils, and 25 percent soils of minor extent.

Bernard soils are on broad, nearly level flats at elevations slightly higher than those of the Lake Charles soils. Typically, the surface layer is very dark gray clay loam about 13 inches thick. The underlying layer to a depth of 65 inches is clay that is very dark gray in the upper part grading to light brownish gray in the lower part.

Of minor extent in this map unit are Aris, Lake Charles, and Leton soils.

Edna soils are at elevations slightly higher than those of the Bernard soils and are generally associated with ancient stream meanders. Typically, the surface layer is dark gray fine sandy loam about 8 inches thick. Below that, to a depth of 60 inches, is clay that is very dark gray in the upper part and light brownish gray in the lower part.

The soils in this map unit are used as cropland, pastureland, and rangeland.

The potential of the soils for cultivated crops is high. The crops include rice, grain sorghum, soybeans, and cotton.

The potential of the soils for pastureland is also high. In most places, a combination of common bermudagrass and dallisgrass is grown.

The potential of the soils for rangeland use is high. The native range plants are mainly bluestem, indiangrass, paspalum, and eastern gamagrass.

The potential of the soils for most urban uses is medium. The wetness and the high shrink-swell potential of the soil are the most limiting features.

4. Asa-Norwood

Loamy, well drained, moderately permeable soils; on bottom lands

The soils of this map unit have slopes that are mostly less than 0.3 percent but range to 8 percent in a few places. The unit makes up about 7 percent of the county.

The map unit is about 65 percent Asa soils, 20 percent Norwood soils, and 15 percent soils of minor extent.

Asa soils have nearly level, convex slopes. They are on high river and stream terraces. Typically, the surface layer is a brown silty clay loam about 14 inches thick. The underlying layer, to a depth of 60 inches, is reddish brown calcareous silty clay loam in the upper part and yellowish red in the lower part.

Norwood soils have nearly level, convex slopes. They are adjacent to major streams at slightly higher elevations than the Asa soils. Typically, the surface layer is a reddish brown silt loam about 48 inches thick. Below that, to a depth of 65 inches, the soil is yellowish red very fine sandy loam in the upper part and reddish brown silt loam in the lower part. The Norwood soil is calcareous throughout.

Of minor extent in this map unit are Brazoria, Clemville, Pledger, and Sumpf soils.

The soils in this map unit are used mainly as cropland and pastureland.

The potential of the soils for cultivated crops is high. The main crops are grain sorghum, soybeans, corn, and some vegetable crops.

The potential of the soils for pastureland is high. In most places, a combination of common bermudagrass and dallisgrass is planted. In wooded areas, however, native understory plants are used for grazing. The composition of the understory varies with differences in the density of the overstory canopy.

The potential of the soils for rangeland use is low. The main grasses are longleaf uniola and lurid sedge.

The potential of the soils for most urban uses is medium. The susceptibility to flooding is the most limiting feature.

5. Edna-Aris

Loamy, poorly drained and somewhat poorly drained, very slowly permeable soils; on coastal terraces

The soils of this map unit have slopes that are mostly less than 1 percent but that range to 5 percent in a few places. The unit makes up about 4 percent of the county.

The map unit is about 40 percent Edna soils, 35 percent Aris soils, and 25 percent soils of minor extent.

Edna soils are on the nearly level flats. Typically, the surface layer is dark gray fine sandy loam about 8 inches thick. Below that, to a depth of 60 inches, the soil is very dark gray clay that grades to light brownish gray clay.

Aris soils are on slightly convex areas at elevations slightly higher than those of the surrounding Edna soils. They are commonly immediately adjacent to the remnants of old stream meanders. Typically, the surface layer is grayish fine sandy loam about 13 inches thick. From 13 to 20 inches the soil is gray sandy clay loam. From 20 to 50 inches it is grayish clay. Below that, to a depth of 60 inches, it is reddish yellow sandy clay loam.

Of minor extent in this map unit are Bernard and Leton soils.

The soils in this map unit are used as pastureland, rangeland, and cropland.

The potential of the soils for cultivated crops is medium. The main crops are grain sorghum and soybeans.

The potential of the soils for pastureland is medium. The relatively low natural fertility of the soil and the tendency of plants to show drought stress during dry periods are the most limiting features.

The potential of the soils for rangeland use is high. Drought stress in plants during the drier months and relatively low natural fertility of the soil result in somewhat lower yields. The native range plants are mainly bluestem, paspalum, indiangrass, and eastern gamagrass.

The potential of the soils for most urban uses is medium. Wetness and the shrink-swell potential of the soil are the most limiting features.

Deep, saline soils

This group of map units makes up about 18 percent of the county. The major soils are those in the Francitas, Harris, Mustang, Narta, Surfside, Velasco, and Veston series. They are on narrow to broad, nearly level areas that are affected by salts from the Gulf of Mexico. They are generally unsuitable for pastureland and cropland. The soils adjacent to the Gulf of Mexico are primarily sandy and are generally progressively more clayey further inland. The electrical conductivity of these soils ranges up to about 40 millimhos per centimeter.

Agriculturally, these soils are suited only to rangeland. Most areas produce high yields of native grasses. However, poor access to livestock and soil wetness make it difficult to manage these areas to their grazing potential.

These soils have low potential for most urban uses because of the wetness and salinity of the soil and the hazard of flooding.

6. Surfside-Velasco

Clayey, poorly drained and very poorly drained, very slowly permeable soils; in marshes

The soils of this unit have slopes of less than 0.5 percent. The unit makes up about 7 percent of the county.

This unit is about 60 percent Surfside soils, 11 percent Velasco soils, and 29 percent soils of minor extent.

The Surfside soils are in slightly convex to nearly level areas. Typically, the surface layer is very dark gray, saline clay 14 inches thick. The layer from 14 to 32 inches is dark gray, saline clay. The next layer, to a depth of 72 inches, is dark reddish brown, saline clay.

The Velasco soils are on broad, nearly level flats that are at elevations slightly lower than those of the Surfside soils. Typically, the surface layer is dark reddish brown, saline clay about 8 inches thick. The layer from 8 to 30 inches is dark brown, saline clay. The underlying layer to a depth of 65 inches is gray saline clay mottled with browns, reds, and grays.

Of minor extent in this map unit are Asa, Ijam, Harris, Pledger, and Veston soils.

The soils of this unit are used as rangeland and wildlife habitat. Wetness and salinity preclude their use for pastureland and cropland.

The potential of the soils for rangeland use is high. Gulf cordgrass and marshhay cordgrass are the dominant plants.

The potential of the soils for most urban uses is low. The wetness, the clayey texture and high shrink-swell potential, the salinity, and the susceptibility to flooding are the most limiting features.

7. Harris-Veston

Clayey and loamy, very poorly drained and poorly drained, very slowly permeable and slowly permeable soils; in marshes

The soils of this map unit have slopes of less than 0.5 percent. The unit makes up about 5 percent of the county.

The map unit is about 50 percent Harris soils, 8 percent Veston soils, and 42 percent soils of minor extent.

Harris soils are on broad, nearly level flats. Typically, these soils are saline clay to a depth of 60 inches. The saline clay is very dark gray in the upper part grading to gray in the lower part.

Veston soils have nearly level plane and convex slopes and are at a slightly higher elevation than the Harris soils. Typically, the surface layer is dark gray saline loam about 11 inches thick. From 11 to 26 inches the soil is light brownish gray, saline silty clay loam. Below that, to a depth of 60 inches, it is light brownish gray saline loam.

Of minor extent in this unit are Follet, Ijam, Mustang, Tatlum, and Tracosa soils.

The soils in this unit are used as rangeland and as wildlife habitat. Salinity, wetness, and the susceptibility to flooding during high tide prohibit the use of the soils for cropland and pastureland.

The potential for rangeland use is high. The native range plants consist primarily of a combination of marshhay cordgrass and seashore saltgrass on the Harris soils and gulf cordgrass on the higher lying Veston soils.

The potential of the soils for most urban uses is low. The salinity, wetness, and clayey texture of the soil, and the hazard of flooding are the main limiting features.

8. Francitas-Narta

Clayey and loamy, poorly drained and somewhat poorly drained, very slowly permeable soils; on coastal terraces

The soils of this map unit have slopes of less than 0.5 percent. The unit makes up about 4 percent of the county.

The map unit is about 40 percent Francitas soils, 35 percent Narta soils, and 25 percent soils of minor extent.

Francitas soils are on broad, nearly level flats. Typically, the surface layer is very dark gray, saline clay about 18 inches thick. From 18 to 52 inches the soil is dark gray, brownish saline clay. Below that to a depth of 80 inches it is saline clay.

Narta soils are on broad, nearly level flats and are generally at a slightly higher elevation than the Francitas soils. Typically, the surface layer is dark gray, saline fine sandy loam about 7 inches thick. To a depth of 11 inches the soil is dark grayish brown, saline loam. To a depth of 18 inches it is dark grayish brown, saline clay. The underlying layer to a depth of 74 inches is saline clay loam.

Of minor extent in this unit are Edna, Harris, Lake Charles, Leton, and Veston soils.

The soils in this map unit are used mainly as rangeland. In a few areas they are used for cropland.

The potential of the soils for cultivated crops is low. Only the Francitas soils have potential to produce crops, and for these soils, intensive management is required to produce adequate yields. The main crop is rice.

The potential of the soils for pastureland is low. The salinity of the soil makes it difficult to manage for pasture grasses.

The potential of the soils for rangeland use is high. Gulf cordgrass is the dominant native range plant.

The potential of the soils for most urban uses is low. The wetness, clayey texture, and shrink-swell potential of the soils, and the susceptibility to flooding are the most limiting features.

9. Mustang-Veston

Sandy and loamy, poorly drained, rapidly permeable and slowly permeable soils; in marshes

The soils in this map unit have slopes of less than 1 percent. The unit makes up about 2 percent of the county.

The map unit is about 30 percent Mustang soils, 25 percent Veston soils, and 45 percent soils of minor extent.

Mustang soils have plane or convex, nearly level slopes. Typically, the surface layer is neutral, gray fine sand about 8 inches thick. From 8 to 40 inches the soil is neutral, saline, light gray fine sand. Below that, to a depth of 60 inches, the soil is neutral, grayish brown, saline fine sand. Some of these soils are nonsaline to a depth of about 30 inches.

Veston soils are on nearly level flats. Typically, the surface layer is a friable, dark gray saline loam about 11 inches thick. Below that, to a depth of 60 inches, the soil is light brownish gray, saline silty clay loam in the upper part grading to light brownish gray, saline loam in the lower part.

Of minor extent in this map unit are Beaches and Follet, Galveston, and Ijam soils.

The soils in this map unit are used as wildlife habitat, recreation areas, and rangeland. Salinity, wetness, and the susceptibility to tidal flooding make the soils unsuitable for cropland and pastureland.

The potential of the soils for rangeland use is medium. The native range plants are salt-tolerant grasses.

The potential of the soils for most urban uses is low. The wetness, salinity, and sandy texture of the soil, and the susceptibility to flooding are the most limiting features.

detailed soil map units

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

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

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

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

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

Some map units are made up of two or more major soils. These map units are called soil complexes. A *soil complex* consists of two or more soils in such an intricate pattern or in such small areas that they cannot be shown separately on the soil maps. The pattern and proportion of the soils are somewhat similar in all areas. Edna-Aris complex is an example.

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

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Beaches is an example. Miscellaneous areas are shown on the soil maps.

Table 4 gives the acreage and proportionate extent of each map unit. Other tables (see "Summary of tables") give properties of the soils and the limitations, capabilities, and potentials for many uses. The Glossary defines many of the terms used in describing the soils.

soil descriptions

1—Aris fine sandy loam. This is a nearly level, nonsaline soil. Slopes average about 0.3 percent and range up to 1.5 percent. Areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, this soil has a surface layer of neutral, dark gray fine sandy loam about 8 inches thick. The next layer, to a depth of 13 inches, is slightly acid, grayish brown fine sandy loam. The upper part of the subsoil, to a depth of 20 inches, is mostly firm, neutral, gray sandy clay loam and about 20 percent grayish brown loam. The middle part, to a depth of 50 inches, is grayish clay that has yellowish brown mottles. The lower part to a depth of 60 inches is neutral, reddish yellow sandy clay loam.

This soil is somewhat poorly drained. Surface runoff is slow. Permeability is very slow. This soil has a perched water table above the subsoil during rainy periods. Under unusual weather conditions some areas are flooded.

Included in mapping are small areas of Edna, Leton, Morey, and Bernard soils. Also included is a soil that is similar to the Aris soil except that the upper part of the subsoil is not mixed with loam. The included soils make up as much as 30 percent of a map area.

This soil is used mainly as pastureland. In a few small areas it is used for corn, soybeans, and grain sorghum. In a few other areas it is used as rangeland.

The potential for cultivated crops is high. In some areas a drainage system is beneficial because of excess surface water. Leaving crop residue on the soil surface helps to conserve soil moisture during the summer months. Fertilizer is needed for good crop production. For rice production, some form of land leveling is needed.

The potential for pasture plants is high. Fertilizer should be used to increase forage production. Plant vigor can be maintained by proper stocking and rotation grazing. In some places a drainage system is beneficial because of excess surface water.

The potential of this soil for most urban uses is medium. The soil is wet for short periods following rains. Uncoated steel used in construction should be protected from corrosion.

This soil supports two kinds of native vegetation—a tall grass prairie and a mixed stand of pine and hardwood trees with an understory of grasses and forbs.

On the tall grass prairie the potential plant community is, by weight, 90 percent grasses and 10 percent forbs. Typically, it is 45 percent little bluestem, 10 percent indiangrass, 10 percent switchgrass, 5 percent big bluestem, and 5 percent brownseed paspalum. The rest of the plant community is forbs such as buttonsnakeroot, Maximilian sunflower, bundleflower, and gayfeather. Forage production on rangeland in excellent condition ranges from 5,000 to 8,500 pounds per acre per year.

Indiangrass, switchgrass, and big bluestem are preferred by livestock and are reduced under heavy grazing. As those plants decrease, brownseed paspalum, longspike tridens, and little bluestem increase. Under continued heavy grazing, broomsedge bluestem, smutgrass, and carpetgrass invade the rangeland. As the condition of the rangeland deteriorates further, brush species such as waxmyrtle, yaupon, eastern baccharis, and Chinese tallow, along with mesquite in some parts of the county, become dominant.

Under a dense tree canopy the understory typically consists of longleaf uniola, sedge, and low panicum and paspalum. Under heavy grazing, those plants are replaced by carpetgrass and other low quality weeds and grasses.

The prairie provides habitat for dove and quail. Deer use the wooded areas for cover and the prairie for forage. The wooded areas provide habitat for squirrel, furbearing animals, and the cottontail rabbit.

This soil is in capability subclass IIIw. It is in the Loamy Prairie range site.

2—Asa silt loam. This is a nearly level, nonsaline soil. Slopes average about 0.3 percent and range from 0.2 to 0.8 percent. Areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, this soil has a surface layer of neutral, very dark grayish brown silt loam about 12 inches thick. The subsoil to a depth of 37 inches is moderately alkaline, calcareous, light brown loam. Below that, to a depth of 51 inches, it is firm, moderately alkaline, calcareous, reddish yellow silty clay loam. The underlying layer to a depth of 61 inches is firm, moderately alkaline, calcareous, reddish brown very fine sandy loam.

This soil is well drained. It is rarely flooded. Surface runoff is slow. Permeability is moderate.

Included in mapping are small areas of Brazoria, Norwood, Clemville, and Pledger soils and small areas of Asa silty clay loam. Also included is a soil that is similar to the Asa soil except that it does not have visible secondary carbonates. These included soils make up as much as 25 percent of a map area.

The soil is used mainly as pastureland and cropland. Grain sorghum, corn, and soybeans are the main crops.

The potential of the soil for use as cropland is high. Leaving crop residue on the soil surface helps to maintain fertility and to conserve soil moisture during dry years when such crops as soybeans may show drought stress. Crop yields can be increased by using the proper kinds and amounts of fertilizer. This soil is not suited to rice because it is moderately permeable.

The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. These practices are needed in areas where the tree canopy is dense and in areas that have been cleared. Under a dense canopy, production is low because there is not enough sunlight to promote vigorous grass growth. In these areas, production can be increased by removing some trees so that more sunlight reaches the grasses. In many areas this has been done. Production can be further increased by the proper use of fertilizer.

The potential of the soil for most urban uses is medium, mainly because of the hazard of flooding. The potential for these uses is high if the soil is protected from flooding.

The vegetation that is in a native state consists of a dense stand of hardwood trees. Under a dense canopy the pastureland is typically 10 percent longleaf uniola, 15 percent lurid sedge, 10 percent Virginia wildrye, 5 percent switchcane, 5 percent low panicum, and 5 percent nimblewill muhly. The rest of the understory is forbs, such as elephantfoot and Drummond waxmallow, and vines and shrubs, such as greenbrier, poison-ivy, yaupon, and possumhaw. Forage production under a dense canopy ranges from 250 to 2,200 pounds per acre per year.

Longleaf uniola, Virginia wildrye, and sedges are preferred by livestock; therefore, they are grazed out first. They are replaced by nimblewill muhly, low panicum, and carpetgrass. Under continued heavy grazing, these plants will largely be eliminated. They will be replaced by low quality weeds and grasses.

This soil supports habitat for wildlife, mainly fox squirrel, gray squirrel, white-tailed deer, rabbits, furbearing animals, and a great variety of birds.

This soil is in capability class I. Because it is dominantly wooded, it is not assigned to a range site.

3—Asa silty clay loam. This is a nearly level, nonsaline soil. Slopes average about 0.3 percent. Areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, this soil has a surface layer of neutral, very dark grayish brown silty clay loam about 14 inches thick. The subsoil from 14 to 60 inches is moderately alkaline, calcareous silty clay loam that is reddish brown in the upper part and yellowish red in the lower part.

This soil is well drained. It is rarely flooded. Surface runoff is slow. Permeability is moderate.

Included in mapping are small areas of Brazoria, Norwood, Clemville, and Pledger soils and Asa silt loam. Also included is a soil that is similar to the Asa soil except that it does not have visible secondary carbonates. Included soils make up as much as 25 percent of a map area.

The soil is used mainly as pastureland and cropland. Grain sorghum, corn, and soybeans are the main crops (fig. 1).

The potential of the soil for use as cropland is high. Leaving crop residue on the soil surface helps to maintain fertility and to conserve soil moisture during dry years, when such crops as soybeans may show drought stress. Using fertilizer increases crop yields. This soil is not used for rice because it is moderately permeable.

The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. These practices are needed in areas where the tree canopy is dense and in areas where most of the trees have been removed. Under a dense canopy, production is low because there is not enough sunlight to promote vigorous grass growth. In these areas, production can be increased by removing some trees so that more sunlight reaches the grasses. Production can be further increased by using fertilizers.

The potential of the soil for most urban uses is medium, mainly because of the hazard of flooding. The potential for urban uses is high if the soil is protected from flooding.

The vegetation that is in a native state consists of a dense stand of hardwood trees. Under a dense canopy

Figure 1.—Corn is an important crop on Asa silty clay loam.

the understory pastureland is typically 10 percent longleaf uniola, 15 percent lurid sedge, 10 percent Virginia wildrye, 5 percent switchcane, 5 percent low panicum, and 5 percent nimblewill muhly. The rest of the understory is forbs, such as elephantfoot and Drummond waxmallow and vines and shrubs, such as greenbrier, poison-ivy, yaupon, and possumhaw. Forage production under a dense canopy ranges from 250 to 2,200 pounds per acre per year.

Longleaf uniola, Virginia wildrye, and sedges are preferred by livestock; therefore, they are grazed out first. They are replaced by nimblewill muhly, low panicum, and carpetgrass. Continued heavy grazing will largely eliminate all these plants. They will be replaced by low quality weeds and grasses.

This soil supports habitat for wildlife such as fox squirrel, gray squirrel, white-tailed deer, rabbits, furbearing animals, and a great variety of birds.

This map unit is in capability class I. Because it is dominantly wooded, it is not assigned to a range site.

4—Asa-Urban land complex. This complex consists of nearly level, nonsaline soils and Urban land. Slopes average about 0.3 percent. Areas are irregular in shape and range from 5 to about 50 acres in size.

This complex is about 45 percent Asa soils, 40 percent Urban land, and 15 percent soils of minor extent. These soils and Urban land are so intricately mixed that mapping them separately is not practical at the scale used.

Typically, the Asa soils have a surface layer of mildly alkaline, very dark gray silt loam about 14 inches thick. The subsoil, to a depth of 34 inches, is moderately alkaline, calcareous, reddish brown silty clay loam. The underlying layer, to a depth of 60 inches, is moderately alkaline, calcareous, yellowish red silty clay loam.

This complex is subject to rare flooding. The Asa soils are moderately permeable and well drained. Runoff is slow.

Urban land consists of soils that have been altered or covered with buildings or other urban structures, making classification of the soils impractical. Typical structures are single and multiple unit dwellings, garages, sidewalks, driveways, streets, schools, churches, shopping centers, office buildings, and parking lots. Areas of the Asa soils that have been altered by cutting, grading, and filling make up some of the Urban land. In some areas, the soil has been covered by as much as 20 inches of fill material.

Of minor extent in this unit are small areas of Brazoria, Norwood, and Pledger soils.

The potential of the Asa soils for urban uses is medium. The main limitation is flooding.

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

5—Beaches. This miscellaneous area takes in the land adjacent to the Gulf of Mexico between low tide and the fronts of the coastal dunes. Slopes average about 0.6 percent. Areas are long and narrow and are 25 to several hundred acres.

Beaches consist of sandy marine deposits that contain varying amounts of shell fragments. They are reworked by both the tide and waves. The lower part of the unit is flooded daily during high tide. The upper part is inundated regularly during tides that are slightly higher than normal. The water table is at or near the soil surface throughout the year.

Included in mapping are small areas of Galveston and Mustang soils.

The Beaches are used only for recreation. They are barren and are not capable of supporting plant growth.

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

6—Beaumont clay. This is a nearly level, nonsaline soil. Slopes average about 0.1 percent. Areas are irregular in shape and range from 5 to several thousand acres in size.

Typically, this soil to a depth of 80 inches is grayish clay that is mottled with browns, yellows, and reds. It is medium to strongly acid in the upper part and moderately alkaline in the lower part.

This soil is poorly drained. It is rarely flooded. Surface runoff is very slow. Permeability is very slow. The water table is above a depth of 2 feet in winter.

Included in mapping are small areas of Bernard, Edna, and Lake Charles soils. Also included is a soil that is similar to the Beaumont soil except that it is ponded. Included soils make up as much as 10 percent of a map area.

This soil is used mainly as cropland. Most of the cropland is used for rice. Grain sorghum and soybeans are grown also. In some areas this soil is used as pasture. In some areas it is used as rangeland.

The potential for cultivated crops is high. For good production a drainage system is needed to remove excess surface water following rains. Because this soil is clayey, it is difficult to work when dry. As the soil dries, deep cracks form and progressively widen. In this condition, the soil absorbs water readily. However, as the soil becomes moist the cracks close and water enters the soil very slowly. Incorporating crop residue into the surface layer makes plowing easier, promotes soil aeration, allows plant roots to penetrate the soil more easily, and helps to increase the water intake rate. Crop yields can be increased by using fertilizer. With drainage, this soil is suited to rice.

The potential for pasture grasses is high. For consistent production, a drainage system is needed to remove excess surface water. Plant vigor should be maintained by proper stocking and rotation grazing. Some areas, primarily along drainageways, are wooded. In most of these areas, the tree canopy is too dense for good grass growth. In order to increase production, some trees should be removed so that sunlight reaches

the grasses. Production can be further increased by using fertilizer.

The potential of the soil for most urban uses is low. The main restrictive features are wetness and the high shrink-swell potential of the soil. Uncoated steel used in construction should be protected from corrosion.

This soil supports two kinds of native vegetation—a tall grass prairie and a dense mixed stand of pine and hardwood trees.

On the tall grass prairie the potential plant community is, by weight, about 95 percent grasses and 5 percent forbs. Typically, it is 55 percent little bluestem, 10 percent indiangrass, 10 percent eastern gamagrass, 10 percent switchgrass, 5 percent big bluestem, and 5 percent sedges. The rest of the plant community is forbs such as Maximilian sunflower, gayfeather, prairie clover, and blackeyed Susan. Forage production on rangeland in excellent condition ranges from 5,500 to 9,000 pounds per acre per year.

Indiangrass, eastern gamagrass, and big bluestem are preferred by livestock; therefore, under heavy use they are grazed out first. As those plants decrease, little bluestem, silver bluestem, knotroot bristlegrass, and longspike tridens increase. Under continued heavy grazing, broomsedge bluestem, buffalograss, smutgrass, fogfruit, annual weeds and grasses, and woody plants such as eastern baccharis, Macartney rose, sesbania, and Chinese tallow invade the rangeland.

Under a dense canopy of the pine and hardwoods, the understory pastureland vegetation is longleaf uniola, Virginia wildrye, sedge, nimblewill muhly, American beautyberry, and greenbrier. Under heavy grazing the Virginia wildrye and uniola are replaced by carpetgrass and annual weeds and grasses.

This soil supports habitat for dove and quail. On the prairie the food supply for deer is good, but protective cover is insufficient. The wooded areas provide habitat for fox squirrel, furbearing animals, and many species of songbirds. In wooded areas, protective cover for deer is good, but the food supply may be inadequate at certain times of the year.

This soil is in capability subclass IIIw. It is in the Blackland range site.

7—Bernard clay loam. This is a nearly level, nonsaline soil. Slopes average about 0.2 percent. Areas are irregular in shape and range from 5 to 1,000 acres in size.

Typically, this soil has a surface layer of very dark gray clay loam about 13 inches thick. The subsoil to a depth of 65 inches is clay that is very dark gray to dark gray in the upper part, dark grayish brown in the middle part, and light brownish gray in the lower part. Brownish mottles occur throughout. This soil is typically medium acid in the upper part and grading to mildly alkaline in the lower part.

This soil is somewhat poorly drained. Surface runoff is very slow. Permeability is very slow. The water table is above a depth of 3 feet during winter. Under unusual weather conditions, some areas are flooded.

Included in mapping are small areas of Edna, Lake Charles, and Morey soils. Also included are a few small areas of Bernard soils that have slopes of slightly more than 1 percent. The included soils make up as much as 15 percent of a mapped area.

This soil is used mainly as cropland. The main crops are cotton, corn, rice, grain sorghum, and soybeans. Some areas are used as pastureland or rangeland.

The potential for cultivated crops is high. A drainage system is beneficial in most cultivated areas.

The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. In some places, this soil is wooded and the canopy is too dense for vigorous grass growth. To increase production, some trees should be removed so that sunlight reaches the grasses. Forage yields can be further increased by using fertilizer. In some places, this soil is used as a native hay meadow.

The potential of the soil for most urban and recreation uses is medium. The main restrictive features are the wetness and the shrink-swell potential of the soil. Steel pipe placed underground should be protected from corrosion.

This soil supports two types of native vegetation—a tall grass prairie and a dense mixed stand of hardwood trees.

On the tall grass prairie the potential plant community is, by weight, about 90 percent grasses and 10 percent forbs. It is 50 percent little bluestem, 10 percent indiangrass, 5 percent eastern gamagrass, 10 percent switchgrass, 5 percent big bluestem, and 5 percent Florida paspalum. The rest of the plant community is forbs such as western indigo, Maximilian sunflower, gayfeather, prairie clover, and blackeyed Susan. Forage production on rangeland in excellent condition ranges from 5,500 to 9,000 pounds per acre per year.

Indiangrass, eastern gamagrass, and big bluestem are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, little bluestem, silver bluestem, knotroot bristlegrass, and longspike tridens increase. Under continued heavy grazing broomsedge bluestem, buffalograss, smutgrass, and fogfruit, annual weeds and grasses and woody plants such as eastern baccharis, Macartney rose, sesbania, and Chinese tallow and, in some parts of the county, yaupon, mesquite, and huisache invade the rangeland.

In the stands of mixed hardwoods, the understory pastureland vegetation is typically longleaf uniola, Virginia wildrye, sedge, nimblewill muhly, yaupon, and greenbrier. Under heavy grazing Virginia wildrye and uniola are replaced by carpetgrass and annual weeds and grasses.

The prairie provides habitat for wildlife such as dove and quail. The food supply for deer is good, but protective cover is insufficient. The wooded areas

provide habitat for wildlife such as fox squirrel, furbearing animals, and many species of songbirds. Protective cover for deer is good, but the food supply may be inadequate at certain periods in the year.

This soil is in capability subclass IIIw. It is in the Blackland range site.

8—Bernard-Edna complex. This complex consists of nearly level, nonsaline soils. The surface is mainly plane and has many distinct knolls or pimple mounds about 0.5 foot high and 10 to 15 feet in diameter. Slopes average about 0.2 percent. Areas are irregular in shape and range from 5 to several hundred acres in size.

This complex is about 60 percent Bernard clay loam and 20 percent Edna fine sandy loam. The Bernard soil is generally on the flats between the knolls and pimple mounds. The Edna soil is mainly on the knolls and mounds. In most places, the surface of the mound has been partially removed by leveling. The rest of the complex is made up mainly of Aris, Lake Charles, and Leton soils and, in the center of the mounds, a soil that is similar to the Edna soil and has a loamy surface layer more than 10 inches thick. The soils in this complex are so intricately mixed that it is not feasible to map them separately at the scale used.

Typically, the Bernard soil has a surface layer of very dark grayish brown clay loam about 12 inches thick. The subsoil to a depth of 60 inches is clay that is dark gray in the upper part and grayish brown in the lower part. This soil is slightly acid to neutral throughout.

Typically, the Edna soil has a surface layer of slightly acid, dark gray fine sandy loam about 9 inches thick. The subsoil to a depth of 60 inches is dark gray clay that is slightly acid in the upper part and neutral in the lower part.

The soils in this complex are somewhat poorly drained to poorly drained. Surface runoff is very slow. Permeability is very slow. The Bernard soil has a water table above a depth of about 3 feet in winter. The Edna soil has a perched water table above a depth of 1.5 feet. Under unusual weather conditions some areas are flooded.

This complex is used mainly as cropland and pastureland. The main crops are rice, grain sorghum, and soybeans. In some places the soils are used as rangeland.

The potential for cultivated crops is high. In most places, some form of land leveling has been used to make farming operations easier and has been found beneficial, especially if rice is grown. In a few places, leveling makes the area where a mound was located too salty for good production. Under good management, however, the site can become more productive in a few years. Land leveling equipment can be used in most places. A drainage system is necessary in most places. Production can be increased by the use of fertilizer.

The potential for pastureland is high. A drainage system is beneficial in most areas. Plant vigor can be maintained by proper stocking and rotation grazing. Production can be increased by using fertilizer.

The potential of the soils for most urban uses is medium. The main restrictive features are wetness and the shrink-swell potential of the soils. Uncoated steel pipe placed underground should be protected from corrosion.

The native vegetation on this complex is that of a tall grass prairie. On the Bernard soil the potential plant community is, by weight, about 95 percent grasses and 5 percent forbs. It is typically 50 percent little bluestem, 10 percent indiangrass, 5 percent eastern gamagrass, 5 percent switchgrass, 5 percent big bluestem, and 5 percent brownseed paspalum. The rest of the plant community is forbs such as Maximilian sunflower, gayfeather, bundleflower, and blackeyed Susan. Forage production on rangeland in excellent condition ranges from 5,000 to 8,000 pounds per acre per year.

Indiangrass, eastern gamagrass, and big bluestem are preferred by livestock; therefore, they are grazed out first under heavy use. As these plants decrease, little bluestem, silver bluestem, knotroot bristlegrass, and longspike tridens increase. Under continued heavy grazing broomsedge bluestem, carpetgrass, smutgrass, and threeawn, annual weeds and grasses, and woody plants such as eastern baccharis, Macartney rose, sesbania, and Chinese tallow and, in some parts of the county, yaupon, mesquite, and huisache invade the rangeland.

On the Edna soil the potential plant community is, by weight, about 90 percent grasses and 10 percent forbs. It is typically 50 percent little bluestem, 20 percent indiangrass and switchgrass, and 10 percent brownseed paspalum. The rest of the plant community is forbs such as bundleflower, sensitive brier, and yellow neptunia. Forage production on rangeland in excellent condition ranges from 4,500 to 6,500 pounds per acre per year.

Indiangrass and switchgrass are preferred by livestock; therefore, they are grazed out first under heavy use. As these plants decrease, brownseed paspalum and knotroot bristlegrass increase. Under continued heavy grazing broomsedge bluestem, smutgrass, carpetgrass, threeawn, and gulf muhly and woody plants such as eastern baccharis, McCartney rose, sesbania, and Chinese tallow and, in some parts of the county, yaupon, mesquite, and huisache invade the rangeland.

The soils in this complex support habitat for white-tailed deer, dove, and quail. The prairie provides food for deer but not enough protective cover.

This complex is in capability subclass IIIw. The Bernard soil is in the Blackland range site, and the Edna soil is in the Claypan Prairie range site.

9—Bernard-Urban land complex. This complex consists of nearly level, nonsaline soils and Urban land. Slopes average about 0.2 percent. Areas are irregular in shape and range from 5 acres to several hundred acres in size.

This complex is about 45 percent Bernard soils and 40 percent Urban land. Soils of minor extent such as Aris, Edna, and Lake Charles soils make up the rest. The soils and Urban land are so intricately mixed that it is not practical to map them separately at the scale used.

Typically, the Bernard soils have a surface layer of neutral, very dark gray clay loam about 5 inches thick. The subsoil to a depth of 60 inches is clay that is very dark in the upper part and gray in the lower part. These soils are neutral in the upper part grading to mildly alkaline in the lower part.

The Bernard soils are somewhat poorly drained and very slowly permeable. The water table is above a depth of about 3 feet in the winter. Under unusual weather conditions some areas are flooded.

Urban land consists of soils that have been altered or covered with buildings or other urban structures making classification of the soil impractical. Typical structures are single and multiple unit dwellings, garages, sidewalks, driveways, streets, schools, churches, shopping centers, office buildings, and parking lots. Bernard soils that have been altered by cutting, grading, and filling make up some of the Urban land. In some places the soils have not been altered but have been covered with as much as 20 inches of fill material.

The potential of the soils for most urban uses is medium. The most restrictive features are the wetness and the high shrink-swell potential of the Bernard soils. Uncoated underground steel pipe will corrode.

This complex is not assigned to a capability subclass or to a range site.

10—Brazoria clay, 0 to 1 percent slopes. This is a nearly level, nonsaline soil. Slopes average about 0.1 percent. Areas are irregular in shape and range from 10 to several thousand acres in size.

This soil is typically dark reddish brown, calcareous, moderately alkaline clay to a depth of more than 60 inches. It has a few concretions of calcium carbonate throughout.

This soil is somewhat poorly drained. It is rarely flooded. Surface runoff is slow. Permeability is very slow. The water table is at a depth of 1 to 3 feet during winter.

Included in mapping are small areas of Asa, Norwood, and Pledger soils. A soil similar to the Brazoria soil is in slight depressions. Also included is a soil that is similar to the Brazoria soil except that it is noncalcareous in the upper part. The included soils make up less than 10 percent of a map area.

This soil is used mainly as pastureland. In some areas this soil is used as cropland. The main crops are soybeans, grain sorghum, and corn. This soil is not generally suited to rice because of the moderate alkalinity.

The potential for cultivated crops is high. A drainage system is needed for consistent high yields. However, in most areas, drainage outlets are inadequate. Because the soil is clayey, it is difficult to work when dry. Cracks form during dry summer periods. In this condition, the soil absorbs water readily. However, as the soil becomes moist, the cracks close and water enters the soil very slowly. Incorporating crop residue into the surface layer aids tilth, promotes aeration, makes plowing easier, allows plant roots to penetrate the soil more easily, and helps increase the intake rate. Production can be increased by using fertilizer.

The potential for pasture grasses is high. In most areas this soil does not have adequate water outlets; however, good drainage systems can be installed where adequate outlets exist. Plant vigor should be maintained by proper stocking and rotation grazing. In most areas of pasture there are dense stands of hardwood trees. Under these stands the grass production is low because there is not enough sunlight. Production can be increased by removing some of the trees. Production can be further increased by using fertilizer.

The potential of the soil for most urban uses is low. The restrictive features are the wetness and high shrink-swell potentials of the soil and the susceptibility to flooding. Uncoated underground steel pipe can corrode.

The vegetation that is in a native state consists of a dense stand of hardwood trees. Under a dense canopy, the understory pastureland vegetation is typically 35 percent lurid sedge, 10 percent Virginia wildrye, 10 percent nimblewill muhly, 5 percent longleaf uniola, and 5 percent rustyseed paspalum. The rest of the understory is vines and shrubs, such as greenbrier, Alabama supplejack, yaupon, and American elder. Forage production under a dense canopy ranges from 250 to 750 pounds per acre per year.

Longleaf uniola, Virginia wildrye, and rustyseed paspalum are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, nimblewill muhly, greenbrier, and sedges increase. Under continued heavy grazing all these plants will be eliminated. They will be replaced by dwarf palmetto and yaupon. If the tree canopy is reduced the understory vegetation will be greatly changed.

This soil supports habitat mainly for fox squirrel, gray squirrel, white-tailed deer, swamp rabbits, furbearing animals, and a variety of birds.

This soil is in capability subclass IIw. Because it is dominantly wooded, it is not assigned to a range site.

11—Brazoria clay, 1 to 5 percent slopes. This is a gently sloping, nonsaline soil. It is parallel to drainage channels. Slopes average about 3 percent. Areas are elongated and range from 5 to about 100 acres.

Typically, this soil is moderately alkaline, calcareous clay to a depth of 70 inches. It is dark reddish brown in the upper part, very dark grayish brown in the middle part, and reddish brown in the lower part.

This soil is somewhat poorly drained. It is rarely flooded. Runoff is slow. Permeability is very slow. The water table is at a depth of 1 to 3 feet during winter.

Included with this soil in mapping are areas of Pledger, Clemville, Asa, and Sumpf soils. These soils make up as much as 30 percent of a map area.

This soil is used mainly for pasture.

The potential for cultivated crops is low. Although crop yields are good, most areas are too long and narrow to be managed properly in order to prevent erosion. Contour farming and terracing are needed to control erosion on cropland. Production can be increased by using fertilizer. The slope makes this soil impractical for rice production.

The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. In areas that have a dense tree canopy, the forage production is low. Some trees should be removed so that more sunlight reaches the grasses. Production can be further increased by using fertilizer.

The potential of the soil for most urban uses is low. The main restrictive features are the wetness, and shrink-swell potential of the soil, and the hazard of flooding. Uncoated underground steel pipe can corrode.

The vegetation that is in a native state consists of a dense stand of hardwood trees. Under a dense canopy, the understory pastureland vegetation is typically 25 percent lurid sedge, 10 percent Virginia wildrye, 10 percent nimblewill muhly, 5 percent longleaf uniola, 5 percent rustyseed paspalum, and 10 percent forbs, such as violet, dayflower, and tickclover. The rest of the understory is vines and shrubs, such as greenbrier, Alabama supplejack, yaupon, and American elder. Forage production under a dense canopy ranges from 250 to 750 pounds per acre per year.

Longleaf uniola, Virginia wildrye, and rustyseed paspalum are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, nimblewill muhly, greenbrier, and sedge increase. Under continued heavy grazing all these plants will be eliminated. They will be replaced by dwarf palmetto and yaupon. If the canopy is reduced, the understory vegetation will be greatly changed.

This soil supports habitat mainly for fox squirrel, gray squirrel, white-tailed deer, swamp rabbits, furbearing animals, and a variety of birds.

This soil is in capability subclass IIIe. Because it is dominantly wooded, it is not assigned to a range site.

12—Clemville silty clay loam. This is a nearly level, nonsaline soil. Slopes average about 0.4 percent. Areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, this soil is moderately alkaline, calcareous silty clay loam to a depth of about 30 inches. It is reddish brown in the upper part and yellowish red in the lower part. To a depth of 60 inches is reddish brown calcareous, moderately alkaline silty clay that grades to clay in the lower part.

This soil is well drained. It is rarely flooded. Surface runoff is slow. Permeability is slow.

Included in mapping are small areas of Asa, Norwood, and Pledger soils. Also included is a soil that is similar to the Clemville soils except that it has a dark colored surface layer. The included soils make up as much as 20 percent of a map area.

This soil is used mainly as cropland. In a few areas it is used as pastureland. The main crops are grain sorghum, cotton, soybeans, and corn.

The potential for cultivated crops is high. Incorporating crop residue into the surface layer helps to maintain soil tilth. Production can be increased by using fertilizer. This soil is not suited to rice because of slow permeability.

The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. In most places, the dense hardwood tree canopy native to the site has been removed in order to increase forage production. In areas that still have the dense canopy, forage production will be low unless the canopy is thinned to allow sunlight to the grasses. Production can be further increased by the use of fertilizer.

The potential of the soil for most urban uses is medium, mainly because of the hazard of flooding.

The vegetation that is in a native state consists of a dense stand of hardwood trees. Under a dense canopy, the dominant understory pastureland vegetation is typically 15 percent lurid sedge, 10 percent Virginia wildrye, 10 percent longleaf uniola, 5 percent switchcane, 5 percent low panicum, 5 percent nimblewill muhly, and 10 percent forbs such as elephantfoot and Drummond waxmallow. The rest of the understory is vines and shrubs, such as greenbrier, poison-ivy, yaupon, and possumhaw. Forage production under a dense canopy ranges from 250 to 2,250 pounds per acre per year.

Longleaf uniola, Virginia wildrye, and sedges are preferred by livestock; therefore, they are grazed out first. As those plants decrease, nimblewill muhly, low panicum, and carpetgrass increase. Under continued heavy grazing these plants will largely be eliminated. They will be replaced by numerous low quality weeds and grasses. If the canopy is reduced, the understory vegetation will be greatly changed.

This soil supports habitat for wildlife, mainly fox squirrel, gray squirrel, white-tailed deer, rabbits, furbearing animals, and a variety of birds.

This soil is in capability class I. Because it is dominantly wooded, it is not assigned to a range site.

13—Edna fine sandy loam, 0 to 1 percent slopes. This is a nearly level, nonsaline soil. Slopes average about 0.2 percent. Areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, this soil has a surface layer of slightly acid, dark gray fine sandy loam about 8 inches thick. The subsoil to a depth of 60 inches is clay that is neutral and very dark gray to gray in the upper part and moderately alkaline and light brownish gray in the lower part.

This soil is poorly drained. It has a perched water table above a depth of 1.5 feet during most winter months. Surface runoff is very slow. Permeability is very slow. Although the rooting zone is deep, the clayey subsoil tends to impede the movement of air, water, and roots. Under unusual weather conditions some areas are flooded.

Included in mapping are small areas of Aris, Bernard, and Leton soils. The included soils make up as much as 15 percent of a map area.

This soil is used mainly as cropland and pastureland. The main crops are rice, grain sorghum, and soybeans. In some places, this soil is used as rangeland.

The potential for cultivated crops is medium. A drainage system is needed in most places to remove excess surface water. This soil tends to be droughty during dry summers. If dryland crops are grown, plowing, planting, and cultivating should be done in a timely manner. The soil becomes extremely hard during these dry periods. Incorporating crop residue into the surface layer helps to conserve moisture and promotes good tilth. Fertilizer is needed to maintain or to increase production. With some leveling, this soil produces good yields of rice.

The potential for pasture grasses is medium. Installing a drainage system is beneficial in most areas in order to remove excess surface water. During dry summers, the plants on this soil commonly are the first to show drought stress. Forage production can be increased by using fertilizer.

The potential of the soil for most urban uses is medium. The main restrictive features are the wetness and the high shrink-swell potential of the soil.

This soil has two kinds of vegetation—a tall grass prairie and a dense mixed stand of hardwood trees.

On the tall grass prairie the potential plant community is, by weight, about 90 percent grasses and 10 percent forbs. Typically, it is 50 percent little bluestem, 20 percent indiangrass and switchgrass, and 10 percent brownseed paspalum. The rest of the plant community is forbs such as bundleflower, sensitive brier, and yellow neptunia. Forage production on rangeland in excellent condition ranges from 4,500 to 6,500 pounds per acre per year.

Indiangrass and switchgrass are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, brownseed paspalum and knotroot bristlegrass increase. Under continued heavy grazing, smutgrass, carpetgrass, and gulf muhly and woody plants such as waxmyrtle, Chinese tallow, and eastern baccharis and, in some parts of the county, yaupon, mesquite, and huisache invade the rangeland.

In the stands of mixed hardwoods, the pastureland vegetation under a dense canopy is longleaf uniola, sedge, and low panicum. Under heavy grazing, these plants are replaced by carpetgrass and low quality weeds and grasses.

The prairie provides habitat for dove and quail. Deer use the fringe areas of prairies adjacent to wooded areas, which furnish cover. The wooded areas provide habitat mainly for fox squirrel, white-tailed deer, bobwhite quail, mourning dove, cottontail rabbit, and furbearing animals.

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

14—Edna fine sandy loam, 1 to 5 percent slopes. This is a gently sloping, nonsaline soil. It is on slopes adjacent to drains and bayous and on slopes around salt domes. Slopes average about 3 percent. Areas are irregular in shape and range from 5 to several hundred acres in size.

Typically, this soil has a surface layer of a medium acid, dark gray fine sandy loam about 4 inches thick. The subsoil to a depth of 60 inches is clay that is dark gray and medium acid in the upper part and light brownish gray and neutral in the lower part.

This soil is poorly drained. Surface runoff is very slow. Permeability is very slow. This soil has a perched water table above a depth of 1.5 feet during most winter months. The rooting zone is deep, but the clayey layers below the surface layer tend to impede the movement of water, air, and roots. Under unusual weather conditions, some areas are flooded.

Included in mapping are small areas of Bernard soils, a similar soil that has a browner surface layer and a less clayey subsoil, and a soil that has a fine sandy loam surface layer that is thicker than that of the Edna soil. The included soils make up as much as 15 percent of a map area.

This soil is used mainly as pastureland and rangeland.

The potential for cultivated crops is low. Although yields are adequate, few areas are used as cropland. The areas that are adjacent to drains are mostly too long and narrow to be managed adequately. Contour farming, terracing, and grassed waterways are needed to control erosion on cropland. If a few inches of the surface layer erodes, the upper part of the dense subsoil becomes part of the plow layer. Crop yields then decrease because seedbed preparation is difficult and root growth and development are slower. Fertilizer is needed to obtain the best crop yields. The slope makes this soil unsuited to rice.

The potential for pasture grasses is medium. Plant vigor can be maintained by proper stocking and rotation grazing. During dry summers, the plants grown on this soil are the first to show drought stress. Production can be increased by using fertilizer.

The potential of the soil for most urban uses is medium. The main restrictive features are the wetness and the high shrink-swell potential of the soil. Uncoated underground steel pipe can corrode.

This soil has two kinds of vegetation—a tall grass prairie and a dense mixed stand of hardwood trees.

On the tall grass prairie the potential plant community is, by weight, about 90 percent grasses and 10 percent forbs. Typically, it is 50 percent little bluestem, 20

percent indiangrass and switchgrass, and 10 percent brownseed paspalum. The rest of the plant community is forbs such as bundleflower, sensitive brier, and yellow neptunia. Forage production on rangeland in excellent condition ranges from 4,500 to 6,500 pounds per acre per year.

Indiangrass and switchgrass are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, brownseed paspalum and knotroot bristlegrass increase. Under continued heavy grazing, smutgrass, carpetgrass, and gulf muhly and woody plants such as waxmyrtle, Chinese tallow, and eastern baccharis and, in some parts of the county, yaupon, mesquite, and huisache invade the rangeland.

In the stands of mixed hardwoods, the pastureland vegetation under a dense canopy is longleaf uniola, sedge, and low panicum. Under heavy grazing, these plants are replaced by carpetgrass and low-quality weeds and grasses.

The prairie provides habitat for dove and quail. Deer use the fringe areas adjacent to wooded areas. The wooded areas provide habitat mainly for fox squirrel, white-tailed deer, bobwhite quail, mourning dove, cottontail rabbit, and furbearing animals.

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

15—Edna-Aris complex. This complex consists of nearly level, nonsaline soils. They are generally associated with older meander stream systems. The surface is mainly plane and has many distinctive knolls, or pimple mounds, about 1.5 feet high and generally 15 to 25 feet in diameter. Slopes average about 0.3 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

This complex is about 60 percent Edna soils, 25 percent Aris soils, and 15 percent Bernard and Leton soils, a soil that is similar to the Bernard soil that is gray in the upper part of the subsoil, and soil that has a thicker surface layer than that of the Edna soils. The Edna soils are on the flats between the knolls and pimple mounds. The Aris soils are on convex knolls and in circular pimple mounds. The soils in this complex are so intricately mixed that mapping them separately is not practical at the scale used.

Typically, the Edna soils have a surface layer of friable, medium acid, dark grayish brown fine sandy loam about 8 inches thick. The subsoil to a depth of 60 inches is dark gray clay that is slightly acid in the upper part and neutral in the lower part.

Typically, the Aris soils have a surface layer of neutral, dark grayish brown fine sandy loam about 8 inches thick. The next layer, to a depth of 23 inches, is neutral, gray loam. The subsoil to a depth of 33 inches is neutral, gray clay loam that is mixed with gray loam. From 33 to 60 inches it is mildly alkaline, light brownish gray clay that has dark yellowish brown mottles.

The Edna soils are poorly drained. Surface runoff is very slow. The Aris soils are somewhat poorly drained. Surface runoff is slow. Permeability in the soils of this complex is very slow. These soils have a perched water table above a depth of about 2 feet during most winter months. Under unusual weather conditions, some areas are flooded.

The soils in this complex are used mainly as pastureland and rangeland (fig. 2). In some areas they are used as cropland.

The potential for cultivated crops is medium. Extensive land leveling is needed to smooth the mounds. In some places, leveling will make the areas where the mounds were located too salty for good production. Under good management, however, the site can become more productive in a few years. A drainage system is needed to remove excess surface water. Crop yields can be increased by using fertilizer. These soils are suited to rice, but extensive land leveling is required.

The potential for pasture grasses is medium. A drainage system is needed in some places to remove excess surface water. Plant vigor can be maintained by proper stocking and rotation grazing. Forage yields can be increased by using fertilizer.

The potential of the soils for most urban uses is medium. The most restrictive features are the wetness and the high shrink-swell potential of the soil.

This complex supports two kinds of vegetation—a tall grass prairie and a dense stand of hardwood or mixed pine and hardwood trees.

On the tall grass prairie the potential plant community is, by weight, 90 percent grasses and 10 percent forbs. On the Edna soils the plant community is typically 50 percent little bluestem, 20 percent indiangrass and switchgrass, and 10 percent brownseed paspalum. The rest of the plant community is forbs such as bundleflower, sensitive brier, and yellow neptunia. Forage production on rangeland in excellent condition ranges from 4,500 to 7,000 pounds per acre per year.

Indiangrass and switchgrass are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, brownseed paspalum and knotroot bristlegrass increase. Under continued heavy grazing, smutgrass, carpetgrass, gulf muhly, and woody plants such as waxmyrtle and eastern baccharis and, in some parts of the county, yaupon, mesquite, and huisache invade the rangeland.

On the Aris soils, the potential plant community is typically 45 percent little bluestem, 10 percent indiangrass, 10 percent switchgrass, 5 percent big bluestem, and 5 percent brownseed paspalum. The rest of the plant community is forbs such as buttonsnakeroot, Maximilian sunflower, bundleflower, and gayfeather.

Indiangrass, switchgrass, and big bluestem are preferred by livestock and are reduced by heavy grazing. As those plants decrease, brownseed paspalum, longspike tridens, and little bluestem increase. Under continued heavy grazing, broomsedge bluestem, smutgrass, and carpetgrass invade the rangeland. As the

Figure 2.—This area of the Edna-Aris complex is in native rangeland. The mounds are Aris soils.

condition of the rangeland deteriorates further, brush species such as waxmyrtle, eastern baccharis, and Chinese tallow and, in some parts of the county, yaupon, mesquite, and huisache become dominant.

In the stands of hardwood or mixed pine and hardwood, the pastureland vegetation under a dense canopy is typically longleaf uniola, sedge, and low panicum and paspalum. Under heavy grazing, these plants are replaced by carpetgrass and other low-quality weeds and grasses.

The prairie provides habitat for dove and quail. Deer forage in the fringe areas that adjoin wooded areas.

This complex is in capability subclass IIIw. The Edna soils are in the Claypan Prairie range site, and the Aris soils are in the Loamy Prairie range site.

16—Follet clay loam. This is a nearly level, saline soil. This soil is in marshes that are less than 1 foot above sea level. Slopes average about 0.1 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, this soil is gray, strongly saline, moderately alkaline clay loam to a depth of 60 inches. It has yellowish and brownish mottles throughout.

This soil is very poorly drained. Water stands on or near the surface most of the year. Surface runoff is very slow. Permeability is very slow. The soil is flooded daily during high tide.

Included in mapping are small areas of Tatlum and Mustang soils. These included soils make up as much as 20 percent of a mapped area.

This soil is used mainly as rangeland and as habitat for wildlife. Because of flooding, salinity, and the high water table, the soil is not suitable for cropland and pastureland. The potential for native range grasses is medium. Although this soil will produce high yields of marsh grasses, primarily smooth cordgrass, few areas can be used to their potential for grazing. Cattle grazing is restricted because the soil is flooded daily during high tide and is nearly always boggy.

The vegetation on this soil is that of a regularly flooded tidal marsh. It is about 90 percent smooth cordgrass (fig. 3). The rest of the plant community is needlegrass rush, saline aster, and maritime saltwort.

Figure 3.—Follet clay loam produces high yields of smooth cordgrass. Its use for grazing, however, is limited because it is boggy and is flooded daily during high tide.

Cattle seldom graze more than 50 percent of the smooth cordgrass because of limited access due to high tide. During periods of no rainfall, smooth cordgrass builds up a high concentration of salt crystals on the leaf surface that causes lower palatability. Rainfall eventually washes away the crystals. Under heavy grazing, the stand of smooth cordgrass will thin out.

Retrogression of the vegetation is usually caused by tides. During low tides when the water level drops, maritime saltwort, needlegrass rush, Virginia glasswort, and bushy sea-oxeye invade the marshland.

The marsh provides habitat for a variety of birds and marine life. From 5 to 8 tons of detritus (decaying plant material) per acre have been produced on this soil. The detritus is mostly from smooth cordgrass and is the beginning of the marine ecosystem. Oysters, crab, and many species of fish depend on this community to supply nutrients. Post-larval shrimp must have smooth cordgrass as a nursery ground.

This soil has low potential for urban uses because of flooding during high tide.

This soil is in capability subclass VIIw. It is in the Tidal Flat range site.

17—Francitas clay. This is a nearly level, slightly saline soil. Slopes average about 0.3 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, this soil has a surface layer of mildly alkaline, slightly saline, very dark gray clay about 18 inches thick. From 18 to 77 inches the soil is moderately alkaline, moderately saline clay that is dark gray in the upper part and pale brown in the lower part.

This soil is poorly drained. It is rarely flooded. Surface runoff is very slow. Permeability is very slow. This soil has a perched water table above a depth of about 2 feet during winter.

Included in mapping are small areas of Edna, Lake Charles, and Narta soils. These included soils make up as much as 25 percent of a map area.

This soil is used mainly as rangeland (fig. 4). In a few areas it has been used for crops, primarily rice, with limited success. Because of salinity, this soil has low potential for use as nonirrigated cropland and pastureland.

The potential for cultivated crops is low. The only crop that can be grown in most areas is rice. Good yields of rice require management to prevent salt buildup in the

soil and salinity during critical stages of the rice growth cycle.

The potential for most urban uses is low. The most restrictive features are the wetness and the high shrink-swell potential of the soil, and, because of the low elevation, the possibility of flooding during hurricanes.

The potential plant community on this soil is that of a salty prairie. It is, by weight, about 95 percent grasses and 5 percent forbs. It is typically 70 percent gulf cordgrass, 5 percent little bluestem, 5 percent switchgrass, 5 percent marshhay cordgrass, 5 percent longspike tridens, 5 percent seashore saltgrass, and 5 percent forbs such as bushy sea-oxeye. Forage production on rangeland in excellent condition ranges from 5,500 to 8,500 pounds per acre per year.

Under initial heavy grazing by cattle, minor species are eliminated and the amount of gulf cordgrass increases. However, continued heavy grazing greatly reduces the amount of gulf cordgrass, and plants such as baccharis, sumpweed, and snow-on-the prairie invade the rangeland.

In winter the prairie provides habitat for migrating ducks and geese. Geese prefer freshly burned or closely grazed areas. Progressively burning the prairie to provide geese with new grazing areas is a good management practice. However, the mottled duck nests in the mature cordgrass, and burning the area during nesting season can destroy their valuable cover and their nests, eggs, and ducklings. This prairie also provides habitat for dove and quail.

This soil is in capability subclass IVw. It is in the Salty Prairie range site.

18—Galveston fine sand, undulating. This is a non-saline, sandy soil. This soil is mostly on coastal dunes in marshes mainly parallel to the Gulf of Mexico. A few areas of this soil are on coastal terraces and barrier islands that are inland from the Gulf. Slope averages about 0.7 percent overall and ranges from 1 to 8 percent on individual dunes. Areas are oblong and range from 10 to several hundred acres.

Typically, this soil is loose, moderately alkaline, light gray fine sand to a depth of about 60 inches. From 60 to 66 inches the soil is a loose, moderately alkaline, gray

Figure 4.—Francitas clay is used mainly as rangeland. The main grass is gulf cordgrass.

fine sand. From 66 to 80 inches it is loose, moderately alkaline, light gray fine sand.

This soil is somewhat excessively drained. Surface runoff is very slow. Permeability is very rapid. The water table is as high as 3 feet below the surface following heavy rains. The water in most places is saline, although the soil above the water table is nonsaline. Because of proximity to the Gulf of Mexico, most areas are occasionally flooded with salt water during hurricanes. If this soil is left unprotected, it is highly susceptible to wind erosion.

Included in mapping are small areas of Mustang soils and Beaches. These inclusions make up less than 15 percent of mapped areas.

This soil is used mainly as recreation areas and as rangeland. It is not suited to pastureland and cropland. It is susceptible to salt spray, wind erosion, and drought. Natural fertility is low. Many areas are inaccessible to livestock.

The potential of the soil for most urban uses is low. The most restrictive features are the sandy texture, lateral water seepage, and the possibility of flooding during hurricanes. The hazard of erosion when the soil is disturbed is also an important factor.

The potential plant community on the coastal sand dunes is, by weight, about 70 percent grasses and 30 percent forbs. It is 35 percent bitter panicum, 20 percent sea-oats, 10 percent marshhay cordgrass, 15 percent soilbind morningglory, and 5 percent beach morningglory. The rest of the plant community is forbs such as gulf croton, pennywort, saltwater mustard, and camphorweed. Forage production on rangeland in excellent condition ranges from 2,500 to 6,500 pounds per acre per year.

Sea-oats is preferred by livestock, and therefore, is grazed out first under heavy use. The plant community is very delicate and unstable. The vegetation has adapted to the beach environment. However, heavy grazing or soil disturbance will cause soil blowing. The dunes then become barren and erode, and blowouts develop in some places. Thus, the areas need to be protected from heavy grazing and vehicle traffic.

This soil supports habitat for various species of shore birds and marine animals. The natural barrier of dunes protects inland vegetation, property, and wildlife from tidal storm damage.

This soil is in capability subclass VIe. It is in the Coastal Dune range site.

19—Harris clay. This is a nearly level, saline soil. This soil is in marshes. Slopes average about 0.1 percent. Areas are irregular in shape and range from 10 to several thousand acres in size.

Typically, this soil is saline clay to a depth of 60 inches. It is very dark gray and neutral in the upper part and grades to gray and moderately alkaline in the lower part. Brownish and grayish mottles occur throughout.

This soil is very poorly drained. Surface runoff is very slow. Permeability is very slow. The soil is flooded occasionally during abnormally high tides. The water table is above a depth of 20 inches throughout most of the year.

Included in mapping are small areas of Follet, Tatlum, Tracosa, Velasco, and Veston soils. Also included is a soil that is similar to the Harris soil except that it has a dark surface layer less than 10 inches thick. These included soils make up less than 10 percent of a mapped area.

This soil is used primarily as rangeland and as wildlife habitat. It is not suited to cropland and pastureland because of the soil salinity and wetness. It supports habitat for many of the wetland wildlife game species.

The potential of the soil for most urban uses is low. The main restrictive features are the wetness, salinity, clayey texture, and low strength of the soil and the susceptibility to flooding during high tides and hurricanes.

The native vegetation on this soil is that of a salt marsh. It is, by weight, about 85 percent grasses, 10 percent rushes, and 5 percent forbs. It is typically 50 percent marshhay cordgrass, 25 percent seashore saltgrass, 10 percent seashore paspalum, and 10 percent Olney bulrush. The rest of the plant community is forbs such as saltmarsh aster, bushy sea-oxeye, and Bacopa. Forage production on rangeland in excellent condition ranges from 8,000 to 14,000 pounds per acre per year.

Marshhay cordgrass, coast cockspur, and seashore saltgrass are preferred by livestock, and seashore saltgrass and seashore paspalum are preferred by geese. To keep these areas in a productive condition, proper grazing and prescribed burning are needed to prevent a heavy accumulation of grass rough.

Because of the heavy concentrations of mosquitoes in summer and the danger of hurricanes in late summer and fall, these areas are normally grazed by cattle during the winter months. After heavy grazing or following a damaging burn, seashore saltgrass becomes dominant and marshhay cordgrass decreases. At this time, shoregrass and maritime saltwort are invaders, especially in the more saline areas.

This soil supports important habitat for a great variety and number of birds and animals. Mottled ducks use the marsh for nesting. Thousands of migratory ducks, geese, rails, coots, and cranes are on these areas in fall and winter. Areas of Olney bulrush provide excellent habitat for muskrat. The areas where waters are fresher and less saline are the preferred habitat of the alligator.

This soil is in capability subclass VIIw. It is in the Salt Marsh range site.

20—Harris-Tracosa complex. This complex is made up of nearly level, saline soils. These soils are in broad tidal areas in marshes. The surface is plane with numerous depressions. Most of the depressions contain water throughout the year. Some are dry for a short period in the summer. Slopes average about 0.1 percent. Areas are irregular in shape and range from 10 to about 1,000 acres in size.

This complex is about 45 percent Harris clay and 40 percent Tracosa mucky clay. The Harris soil is on the flats, and the Tracosa soil is in the circular to oblong depressional areas. The rest of the complex is made up of a soil that is similar to the Harris soil except that it has a dark surface layer less than 10 inches thick and a soil that is similar to Harris and Tracosa soils but is loamy throughout. The soils in this complex are so intricately mixed that it is not feasible to map them separately at the scale used.

Typically, the Harris soil is saline clay to a depth of 60 inches. It is very dark gray in the upper part and gray in the lower part and has grayish and brownish mottles.

Typically, the surface layer of the Tracosa soil is saline, dark gray mucky clay about 5 inches thick. Saline, gray clay that has brownish and grayish mottles is at a depth of 5 to 60 inches.

The soils in this complex are very poorly drained. Surface runoff is very slow. Permeability is very slow. The water table is at a depth of less than 20 inches throughout the year. Areas are occasionally to frequently flooded.

These soils are used as rangeland and as habitat for wetland wildlife. Wetness and salinity make them unsuitable for crops and pasture grasses.

The potential of the soils for most urban uses is low. The major restrictive features are the wetness, clayey texture, salinity, and susceptibility to flooding during abnormally high tides and during hurricanes.

The native vegetation on this complex is that of a salt marsh and is, by weight, 85 percent grasses, 10 percent rushes, and 5 percent forbs.

On Harris clay the plant community is 50 percent marshhay cordgrass, 25 percent seashore saltgrass, 10 percent seashore paspalum, 10 percent Olney bulrush, and 5 percent forbs such as saltmarsh aster, bushy sea-oxeye, and Bacopa. Under very heavy grazing or following a damaging burn, seashore saltgrass tends to become dominant. Forage production on rangeland in excellent condition ranges from 4,000 to 9,000 pounds per acre per year.

Because of heavy concentrations of mosquitoes in summer and the hurricanes in late summer and fall, areas of this complex are commonly grazed by cattle during winter. Marshhay cordgrass, coast cockspur, and seashore saltgrass are preferred by livestock. Seashore saltgrass and seashore paspalum are preferred by geese. Proper grazing and prescribed burning are needed to prevent a heavy accumulation of grass rough, which lowers production.

The Tracosa soil is largely barren of vegetation. Widgeongrass, which is used primarily by migratory waterfowl, grows in the water in some of the depressions. Because of the water on the Tracosa soil, access to all areas of this complex is difficult for cattle.

These soils support habitat for a great variety and number of birds and animals. Mottled ducks use these areas for nesting. Thousands of migratory ducks, geese, rails, coots, and cranes frequent these areas in fall and winter. Areas where the soils support Olney bulrush are excellent habitat for muskrat. The areas where waters are less saline are the preferred habitat of the alligator.

This complex is in capability subclass VIIw. The Harris soil is in the Salt Marsh range site. Because the Tracosa soil is barren of vegetation, it is not assigned to a range site.

21—Ijam clay. This is a saline soil. This soil is in marshes adjacent to bodies of water such as the Intracoastal Waterway, Brazos River, and Bastrop Bayou. It is typically nearly level but ranges to sloping. It consists of dredge and spoil material, and areas are plane to undulating. Slopes average about 0.8 percent. Areas are generally oblong and range from 5 acres to several hundred acres.

Typically, this soil has a surface layer of moderately alkaline, saline, dark grayish brown clay about 9 inches thick. The surface layer has yellowish brown mottles. The next layer to a depth of 60 inches is moderately alkaline, saline, light brownish gray clay that has yellowish brown and gray mottles.

This soil is very poorly drained. It is rarely flooded. Surface runoff is very slow. Permeability is very slow. The water table is at a depth of about 2 feet during most of the winter months.

Included in mapping are small areas of Follet, Harris, Narta, Surfside, Tracosa, and Velasco soils. Also included is a soil that is similar to the Ijam soil except that it is loamy throughout. The included soils make up as much as 15 percent of a map area.

This soil is used as rangeland. Salinity and wetness make the soil unsuitable for cropland and pastureland.

The potential of the soil for most urban uses is low, mainly because of the wetness, clayey texture, and high shrink-swell potential of the soil, the possibility of flooding, and inaccessibility by public road.

The potential plant community on this soil is that of a salty prairie. It is, by weight, about 95 percent grasses and 5 percent forbs. Because of the dredge and spoil material, the plant community is highly variable. Parts of low-lying, highly saline areas and areas of fresh spoil are mostly barren. In other areas, the plant community is 50 percent gulf cordgrass, 5 percent seashore saltgrass, and 5 percent forbs such as bushy sea-oxeye. Forage production on rangeland in excellent condition ranges from 4,000 to 7,000 pounds per acre per year.

Under heavy grazing, the lesser species are grazed out and gulf cordgrass dominates the plant community. Continued heavy grazing or improper burning greatly reduces the production of gulf cordgrass, and plants such as eastern baccharis, sumpweed, and snow-on-the-prairie may invade the rangeland.

Areas of Ijam clay are generally at elevations higher than those of the other soils in the marsh. They provide a refuge for cattle during extremely high tides. They also provide areas for bedding.

In winter this soil supports habitat for wildlife such as migratory ducks and geese. Geese prefer freshly burned or closely grazed areas. Progressively burning the marsh to provide geese with new grazing areas is a good management practice. However, the mottled duck nests in the mature cordgrass, and burning the area during nesting season can destroy their valuable cover and their nests, eggs, and ducklings. This soil also supports habitat for dove and quail.

The soil is in capability subclass VIIw. It is in the Salty Prairie range site.

22—Ijam-Urban land complex. This complex is adjacent to the Intracoastal Waterway and the Brazos River. The nearly level, saline, clayey Ijam soil is in marshes in industrial areas. Slopes average about 0.2 percent. Areas are irregular in shape and range from 5 to several hundred acres in size.

This complex is about 50 percent Ijam clay, 40 percent Urban land, and 10 percent soils that are similar to the Ijam soil except that they are loamy throughout. Areas of the soil and Urban land are so intricately mixed that mapping them separately is not practical at the scale used.

Typically, the Ijam soil has a surface layer of moderately alkaline, dark grayish brown clay about 6 inches thick mottled with grayish brown and yellowish brown. The next layer, from 6 to 60 inches, is moderately alkaline, saline, light olive gray clay that has brownish and grayish mottles.

This soil is very poorly drained. It is rarely flooded. Permeability is very slow. The water table is above a depth of 2 feet during most of the winter months.

Urban land consists of soils that have been altered or covered with buildings or other urban structures, making classification of the soils impractical. Typical structures include streets, office buildings, parking lots, and industrial sites. Areas of the Ijam soil and other soils have been altered by cutting, grading, and filling. In some areas, the soil has not been altered but has been covered with 6 to 20 inches of fill material.

The potential of the Ijam soil for most urban uses is low. The most restrictive features are wetness, clayey texture, and high shrink-swell potential, salinity, low strength, and susceptibility to flooding during hurricanes. This soil is not well suited to urban uses. It is, however, extensively used for urban development because it is adjacent to or near a navigable watercourse.

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

23—Kenney loamy fine sand, 0 to 3 percent slopes. This is a nearly level to gently sloping soil. Slopes average about 1.5 percent. Areas are irregular in shape and range from 20 to several hundred acres in size.

Typically, this soil has a surface layer of loose, medium acid, dark brown loamy fine sand about 16 inches thick. The next layer, to a depth of 70 inches, is loose, medium acid, very pale brown loamy fine sand. The subsoil to a depth of 77 inches is red sandy clay loam.

This soil is well drained. Surface runoff is very slow. Permeability is moderately rapid.

Included in mapping are small areas of soils that are similar to the Kenney soil except that they have a sandier subsoil. The included soils make up as much as 20 percent of a map area.

This soil is used mostly as pastureland. In places, it is used as rangeland.

The potential for cultivated crops is low because the soil is droughty and is lower in natural fertility than the adjacent soils. The soil is not suited to rice because it is well drained.

The potential for pasture grasses is medium. Plant vigor should be maintained by proper stocking and rotation grazing. The soil is droughty during dry summer periods. Using fertilizer increases forage production. Because the soil is sandy, the fertilizer should be added frequently and in small increments to minimize loss through leaching.

The potential of the soil for most urban uses is medium. The restrictive feature is the sandy texture. Seepage is a hazard, especially if the soil is used for waste disposal.

This soil supports two kinds of vegetation—a tall grass prairie and a water oak and live oak savannah.

On the tall grass prairie the potential plant community is, by weight, about 90 percent grasses and 10 percent forbs. It is 45 percent little bluestem, 20 percent indiangrass, 10 percent crinkleawn, and 10 percent brownseed paspalum. The rest of the plant community is forbs such as partridge pea, trailing wildbean, snoutbean, and herbaceous mimosa. Forage production on rangeland in excellent condition ranges from 4,500 to 8,000 pounds per acre per year.

Little bluestem and indiangrass are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, brownseed paspalum, sand lovegrass, and gulf muhly increase. Under continued heavy grazing red lovegrass, broomsedge bluestem, yankeeweed, bullnettle, dewberry, and an abundance of annual weeds invade the rangeland.

On the savannah the potential plant community is mainly purpletop, switchgrass, indiangrass, little bluestem, and sedges. Under heavy grazing those plants are eliminated, and they are replaced by threeawn, berry vines, yaupon, and low-quality weeds and grasses.

This soil provides habitat mainly for white-tailed deer, fox squirrel, cottontail rabbit, other furbearing animals, bobwhite quail, mourning dove, and numerous species of nongame birds.

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

24—Lake Charles clay, 0 to 1 percent slopes. This is a nearly level soil. Slopes average about 0.1 percent.

Areas are irregular in shape and range from 5 to about 50,000 acres in size.

Typically, this soil is very dark gray clay to a depth of about 50 inches. To a depth of 64 inches it is gray clay. The underlying layer to a depth of 90 inches is clay mottled with grays, browns, and yellows. This soil is slightly acid in the upper part and grades to moderately alkaline in the lower part.

This soil is somewhat poorly drained. The water table is above a depth of 2 feet during most winter months. Surface runoff is very slow. Permeability is very slow. Under unusual weather conditions, some areas are flooded.

Included in mapping are small areas of Beaumont, Bernard, Edna, and Pledger soils. The included soils make up less than 5 percent of any map area.

This soil is used as cropland, pastureland, and rangeland. The main crops are rice, soybeans, grain sorghum, and cotton. In most of the wooded areas it is used as native pastureland (fig. 5).

The potential for cultivated crops is high. Drainage systems are needed to remove excess surface water and have been installed in most places where it is feasible. Because this soil is clayey, it is difficult to till when dry. As the soil dries, large cracks form. In this condition, the soil absorbs water readily. However, as the soil becomes moist, the cracks seal and water enters very slowly. Incorporating crop residue into the surface layer maintains good tilth and aeration and helps to increase the intake rate. Crop yields can be increased by using fertilizer. This soil is used extensively for rice because it does not require extensive leveling for even flooding (fig. 6). A drainage system is beneficial, however, because of excess surface water.

The potential for pasture grasses is high. Drainage systems should be installed wherever feasible in order to remove excess surface water. Plant vigor should be maintained by proper stocking and rotation grazing. In areas that are wooded, the production will be low if the tree canopy has not been thinned to allow sunlight to reach the grasses. Forage yields can be increased by using fertilizer. This is one of the main soils used as a native hay meadow. In most of these hay meadows, the soil surface eventually becomes uneven, making cutting difficult.

The potential of the soil for most urban uses is medium, mainly because of the wetness, clayey texture, and high shrink-swell potential of the soil.

This soil has two native vegetative types—a tall grass prairie and a dense mixed stand of hardwood forest.

On the tall grass prairie the potential plant community, by weight, is about 95 percent grasses and 5 percent forbs. It is 50 percent little bluestem, 10 percent indiangrass, 5 percent eastern gamagrass, 5 percent switchgrass, 5 percent big bluestem, and 5 percent Florida paspalum. The rest of the plant community is forbs such as Maximilian sunflower, gayfeather, prairie clover, and blackeyed Susan. Forage production on rangeland in excellent condition ranges from 6,000 to 9,500 pounds per acre per year.

Indiangrass, eastern gamagrass, and big bluestem are preferred by livestock; therefore, they are grazed out first under heavy grazing. As those plants decrease, little bluestem, silver bluestem, knotroot bristlegrass, and longspike tridens increase. Under continued heavy grazing, broomsedge bluestem, buffalograss, smutgrass, fogfruit, annual weeds and grasses, and woody plants such as eastern baccharis, Macartney rose, sesbania, and Chinese tallow and, in some parts of the county, mesquite and huisache invade the rangeland.

In the areas of mixed hardwood trees which have a dense canopy, the understory pastureland vegetation is longleaf uniola, Virginia wildrye, sedge, nimblewill muhly, yaupon, and greenbrier. Under heavy grazing, Virginia wildrye and uniola will be replaced by carpetgrass and annual weeds and grasses. The average production under a dense canopy ranges from 250 to 750 pounds per acre per year.

This soil supports habitat for dove and quail. On the prairie the food supply for deer is good; however, the protective cover is insufficient. The wooded areas provide habitat for fox squirrel, furbearing animals, and many species of songbirds. The protective cover for deer is good, but the food supply may be inadequate at certain periods in the year.

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

25—Lake Charles clay, 1 to 8 percent slopes. This is a gently sloping soil. It is on slopes along the larger streams and rivers. Slopes average about 6 percent. Areas are generally oblong and range from 5 to several hundred acres.

Typically, this soil to a depth of about 50 inches is slightly acid clay that is very dark gray in the upper part and dark gray in the lower part. To a depth of 70 inches is clay that is brown and mildly alkaline in the upper part and yellowish brown and moderately alkaline in the lower part.

This soil is somewhat poorly drained. Surface runoff is slow. Permeability is very slow. The water table is above a depth of 2 feet during most winter months. Under unusual weather conditions, some areas are flooded.

Included in mapping are small areas of Bernard and Edna soils. Also included are areas of nearly level Lake Charles soils. These included soils make up as much as 15 percent of a map area.

This soil is used mainly as pasture and as habitat for wildlife. In places, it is used as rangeland.

The potential for cultivated crops is medium. Although the soil can produce high yields of many crops, it is used as cropland in few areas because of the extra effort that is required to prevent erosion and maintain production. Some areas are narrow strips or bands along

Figure 5.—Most wooded areas of Lake Charles clay, 0 to 1 percent slopes, are used as native pastureland. Forage yields are low in heavily wooded areas such as this.

drainageways and are difficult to manage. Contour farming, terracing, and grassed waterways help to control erosion. Production can be increased by using fertilizer. This soil is not suited to rice because of the slope.

The potential for growing pasture plants is high. Plant vigor should be maintained by proper stocking and rotation grazing. Under a dense canopy, production is low. Production can be increased by removing some trees so that more sunlight reaches the grasses. Production can be further increased by using fertilizer.

The potential of the soil for most urban uses is medium, mainly because of the wetness, clayey texture, and high shrink-swell potential of the soil.

This soil has two native vegetative types—tall grass prairie and a dense stand of mixed hardwood or pine and hardwood trees.

On the tall grass prairie the potential plant community, by weight, is about 95 percent grasses and 5 percent forbs. It is 50 percent little bluestem, 10 percent indiangrass, 5 percent eastern gamagrass, 5 percent switchgrass, 5 percent big bluestem, and 5 percent Florida paspalum. The rest of the plant community is forbs such as Maximilian sunflower, gayfeather, prairie clover, and blackeyed Susan. Forage production on rangeland in excellent condition ranges from 6,000 to 9,500 pounds per acre per year.

Indiangrass, eastern gamagrass, and big bluestem are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, little bluestem, silver bluestem, knotroot bristlegrass, and longspike tridens increase. Under continued heavy grazing, broomsedge bluestem, buffalograss, smutgrass, fogfruit, annual weeds and grasses, and woody plants such as eastern baccharis, Macartney rose, Sesbania, and Chinese tallow invade the rangeland.

In areas of mixed hardwoods, the understory pastureland vegetation is longleaf uniola, Virginia wildrye, sedge, nimblewill muhly, yaupon, and greenbrier. Under heavy grazing, Virginia wildrye and uniola are replaced by carpetgrass and annual weeds and grasses. The average production under a dense canopy ranges from 250 to 750 pounds per acre per year.

The prairie provides habitat for wildlife such as dove and quail. The food supply for deer is good; however, protective cover is insufficient. The wooded areas provide habitat for fox squirrel, furbearing animals, and many songbirds. The protective cover for deer is good, but the food supply may be short at certain periods in the year.

This soil is in capability subclass IVe. It is in the Blackland range site.

26—Lake Charles-Urban land complex. This complex is made up of nearly level, nonsaline soils and Urban land. Slopes average 0.1 percent. Areas are irregular in shape and range from 5 to several hundred acres in size.

This complex is about 55 percent Lake Charles soils, 35 percent Urban land, and 10 percent soils such as

Figure 6.—Lake Charles clay, 0 to 1 percent slopes, is extensively used for rice because land leveling is not required.

Beaumont and Bernard soils. Areas of the soils and Urban land are so intricately mixed that mapping them separately is not feasible at the scale used.

Typically, the Lake Charles soils are clay to a depth of 60 inches or more. They are very dark gray in the upper part, dark gray in the middle part, and mottled with grays and browns in the lower part. They are typically mildly alkaline to moderately alkaline.

The Lake Charles soils are somewhat poorly drained. Surface runoff is very slow. Permeability is very slow. The water table is above a depth of 2 feet during most winter months. Under unusual weather conditions, some areas are flooded.

Urban land consists of soils that have been so altered or obscured by buildings or other structures that classification is impractical. Typical structures are single and multiple unit dwellings, garages, sidewalks, driveways, streets, schools, churches, shopping centers, office buildings, parking lots, and industrial sites. Areas of the Lake Charles soils and other soils have been altered by cutting, grading, and filling. In some areas, the soils have not been altered but have been covered with 6 to 20 inches of fill material.

The potential for most urban uses is medium. The main restrictive features are the wetness, clayey texture, and shrink-swell potential of the soil.

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

27—Leton loam. This is a nearly level, nonsaline soil. This soil is on abandoned stream meanders and in depressional areas. Slopes average about 0.3 percent. Areas are generally oblong in the old stream meanders and circular in the depressional areas, which are not associated with stream meanders. They range from 5 to about 100 acres.

Typically, this soil has a surface layer of neutral loam about 23 inches thick. The surface layer is dark gray in the upper part and gray in the lower part. The subsoil to a depth of 29 inches is neutral, gray clay loam with common tongues and streaks of light brownish gray loam. From 29 to 62 inches the soil is gray clay loam that is neutral in the upper part and mildly alkaline in the lower part.

This soil is poorly drained. Areas flood occasionally. Surface runoff is very slow or ponded. Permeability is slow. In areas that have not been drained, up to 1 foot of water remains on the surface in winter. The water table is above a depth of 1.5 feet most of the year.

Included in mapping are small areas of Aris, Edna, and Lake Charles soils. These soils make up as much as 15 percent of a map area.

This soil is used as cropland, pastureland, and rangeland.

The potential for cultivated crops is medium. The main crop is rice. A drainage system is needed to remove excess surface water. Incorporating crop residue with the surface layer helps to maintain good tilth and aeration. Production can be increased by using fertilizer. This soil is suited to rice, but some land leveling is required.

The potential for pasture grasses is high. Drainage is needed to produce consistently good yields. Plant vigor should be maintained by proper stocking and rotation grazing. Production can be increased by using fertilizer.

This soil has low potential for most urban uses because of the susceptibility to flooding.

The native vegetation on this soil is that of a wet prairie and is, by weight, about 95 percent grasses and sedges and 5 percent forbs. It is 20 percent switchgrass, 20 percent maidencane, 15 percent eastern gamagrass, and 20 percent sedge. The rest of the plant community is forbs such as Maximilian sunflower, sumpweed, and smartweed. Forage production on rangeland in excellent condition ranges from 4,000 to 7,500 pounds per acre per year.

Maidencane and eastern gamagrass are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, longtom, brownseed paspalum, broomsedge bluestem, and bushy bluestem increase. Under continued heavy grazing soft rush, carpetgrass, bitter sneezeweed, sesbania, smartweed, and other sedges and rushes invade the wet prairie.

In summer and fall when the site is dry, this soil supports habitat for wildlife such as dove and quail. When water stands on the surface and food plants are available, this soil supports habitat for migratory ducks. Mottled ducks use areas of this soil mainly for nesting cover.

This soil is in capability subclass IVw. It is in the Lowland range site.

28—Leton-Aris complex. This complex is made up of nearly level, nonsaline soils. They are associated with old stream meanders. The complex consists of circular to oblong depressional areas and circular mounds, or knolls. The mounds are 15 to 40 feet in diameter and are about 2 feet higher than the surrounding intermound areas. Slopes average about 0.3 percent. Areas are generally oblong and range from 10 to several hundred acres.

This complex is about 40 percent Leton soils and 35 percent Aris soils. The Leton soils are in the circular to oblong depressional areas. The Aris soils are on the circular mounds, or knolls, and in some of the intermound areas. Of minor extent are Edna and Bernard soils, which are in the intermound areas. In areas that have been leveled, much of the surface layer of the Aris soils has been removed and added to the surface layer of the Leton soils. The soils in this complex are so intricately mixed that mapping them separately is not practical at the scale used.

Typically, the Leton soils have a surface layer of neutral loam about 21 inches thick. The surface layer is dark grayish brown in the upper part and gray in the lower part. The subsoil to a depth of 33 inches is gray clay loam that is about 25 percent loam in tongues and

streaks. From 33 to 45 inches the subsoil is neutral gray sandy clay loam. The underlying layer to a depth of 60 inches is gray mildly alkaline clay loam.

The Leton soils are poorly drained. Runoff is very slow to ponded. Permeability is slow. Areas flood occasionally.

Typically, the Aris soils have a surface layer of neutral, dark grayish brown fine sandy loam about 6 inches thick. The next layer, to a depth of 20 inches, is grayish brown, slightly acid loam. The subsoil to a depth of 31 inches is gray, medium acid clay loam that is about 25 percent grayish brown loam. From 31 to 60 inches the subsoil is grayish clay loam that is strongly acid in the upper part and slightly acid in the lower part.

The Aris soils are somewhat poorly drained. Permeability is moderate. Runoff is slow. These soils have a perched water table above a depth of 2 feet during periods of heavy rainfall. Under unusual weather conditions, some areas flood.

The soils in this complex are used as cropland, pastureland, and rangeland.

The potential for cultivated crops is low. The soils require extensive land leveling, especially for rice. For crops, a well designed drainage system is also needed to remove excess surface water from the depressional areas. In most places, installing the drainage system and leveling the land make the conversion of this soil to cropland expensive. In some areas, production is low if a site is leveled because the area where the mound was located becomes too salty. Under good management, however, the site can become more productive in a few years.

The potential for pasture grasses is medium. A good drainage system is needed to remove excess surface water. Plant vigor should be maintained by proper stocking and rotation grazing. Production can be increased by using fertilizer.

The potential for most urban uses is low because the Leton soils are subject to flooding and the Aris soils have high shrink-swell potential. Wetness and the uneven topography are additional limitations to urban uses.

The native vegetation on these soils is that of a tall grass prairie. By weight, it is about 95 percent grasses and sedges and 5 percent forbs.

On the Leton soils the plant community is 20 percent switchgrass, 20 percent maidencane, 15 percent eastern gamagrass, and 20 percent sedge. The rest of the plant community is forbs such as Maximilian sunflower, sumpweed, and smartweed. Forage production on rangeland in excellent condition ranges from 4,000 to 7,500 pounds per acre per year.

Maidencane and eastern gamagrass are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, longtom, brownseed paspalum, broomsedge bluestem, and bushy bluestem increase. Under continued heavy grazing, soft rush, carpetgrass, bitter sneezeweed, Sesbania, smartweed, and other sedges and rushes invade.

On the Aris soils the plant community is 30 percent little bluestem, 20 percent switchgrass, 10 percent maidencane, 10 percent indiangrass, 10 percent eastern gamagrass, 10 percent sedges, and 5 percent forbs such as Maximilian sunflower, sumpweed, and smartweed. Forage production on rangeland in excellent condition ranges from 4,500 to 8,000 pounds per acre per year.

Switchgrass, indiangrass, maidencane, and eastern gamagrass are preferred by livestock; therefore, they are grazed out under heavy use. As those plants decrease, longtom, brownseed paspalum, and bushy bluestem increase. Under continued heavy grazing, those plants decrease and carpetgrass, smutgrass, broomsedge bluestem, bitter sneezeweed, and woody plants such as Sesbania, Chinese tallow, and eastern baccharis invade the prairie.

These soils support habitat for wildlife such as dove and quail. Mottled ducks use these areas mainly for nesting cover. Migratory ducks occupy the depressional areas of the Leton soils where water stands on the surface and food plants are available.

This complex is in capability subclass IVw. The Leton soils are in the Lowland range site, and the Aris soils are in the Loamy Prairie range site.

29—Morey silt loam. This is a nearly level, nonsaline soil. Slopes average about 0.2 percent. Areas are irregular in shape and range from 5 to about 100 acres in size.

Typically, this soil has a surface layer of strongly acid, very dark gray silt loam about 11 inches thick. The subsoil to a depth of 36 inches is medium acid silty clay loam that is very dark gray in the upper part and dark gray in the lower part. From 36 to 60 inches the subsoil is clay that is grayish brown and neutral in the upper part and gray and moderately alkaline in the lower part.

This soil is poorly drained. Surface runoff is very slow. Permeability is slow. The water table is above a depth of 2 feet during most winter months. Under unusual weather conditions, some areas flood.

Included in mapping are small areas of Edna and Leton soils. Also included is a soil that is similar to the Morey soil except that it has a clayey subsoil. The included soils make up less than 20 percent of any map area.

This soil is used mainly as cropland. The main crops are rice, grain sorghum, and soybeans.

The potential for cultivated crops is high. A drainage system is beneficial because of excess surface water. Incorporating crop residue into the surface layer helps to maintain soil tilth and soil aeration. Crop yields can be increased by using fertilizer. With good drainage and some land leveling, the soil is suited to rice.

The potential for pasture grasses is high. A drainage system is needed in some places to remove surface runoff. Plant vigor should be maintained by proper stocking and rotation grazing. Production can be increased by using fertilizer.

The potential of the soil for most urban uses is medium. Wetness is the main limitation to those uses.

In a few places, this soil supports a tall grass prairie. Typically, the potential plant community is about 90 percent grasses and 10 percent forbs. It is 10 percent indiangrass, 10 percent eastern gamagrass and switchgrass, 5 percent little bluestem, 5 percent big bluestem, and 5 percent brownseed paspalum. The rest of the plant community is forbs such as buttonsnakeroot, Maximilian sunflower, bundleflower, and gayfeather. Forage production on rangeland in excellent condition ranges from 5,000 to 8,500 pounds per acre per year.

Indiangrass, switchgrass, and big bluestem are preferred by livestock and are grazed out first under heavy use. As those plants decrease, brownseed paspalum, longspike tridens, and little bluestem increase. Under continued heavy grazing broomsedge bluestem, smutgrass, and carpetgrass invade the rangeland. As the condition of the rangeland deteriorates further, brush species such as waxmyrtle, eastern baccharis, and Chinese tallow become dominant.

This soil supports habitat for wildlife such as dove and quail.

This soil is in capability subclass IIIw. It is in the Loamy Prairie range site.

30—Mustang fine sand. This is a nearly level, nonsaline soil. It is in marshes. Slopes average about 0.2 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, this soil has a surface layer of mildly alkaline, light brownish gray fine sand about 4 inches thick. The next layer is moderately alkaline, light gray fine sand about 27 inches thick. The underlying layer, to a depth of 72 inches, is moderately alkaline, saline, light gray fine sand.

This soil is poorly drained. Areas flood frequently. Surface runoff is very slow. Permeability is rapid above the water table. The water table occurs at a depth of 6 to 40 inches. The water is generally saline, although the soil is nonsaline.

Included in mapping are small areas of Galveston soils, Veston soils, and Mustang fine sand, saline. These included soils make up as much as 15 percent of a map area.

This soil is used as rangeland and wildlife habitat. The wetness, the salinity in the lower layers, and the sandy texture make the soil unsuitable for crop production and pastureland.

The potential for most urban uses is low. The primary restrictive features are the wetness, salinity, and sand texture of the soil and the hazard of flooding during abnormally high tides and hurricanes.

The native vegetation on this soil is that of a coastal grassland and is, by weight, about 85 percent grass, 5 percent woody plants, and 10 percent forbs. The plant community is typically 30 percent gulfdune paspalum, and 20 percent marshhay cordgrass. The rest of the plant community is herbaceous mimosa, beach groundcherry, waxmyrtle, and eastern baccharis. Forage production on rangeland in excellent condition ranges from 2,500 to 6,500 pounds per acre per year.

Gulfdune paspalum is preferred by livestock. It is grazed out first under heavy use and is replaced by marshhay cordgrass, bushy bluestem, and broomsedge bluestem. Under continuous heavy grazing, red lovegrass and annual weeds and grasses invade the rangeland. As the condition of the rangeland deteriorates further, woody plants such as baccharis and waxmyrtle become dominant.

This soil supports habitat for various shore and marsh birds. Areas are used for resting, scavenging, and nesting.

This soil is in capability subclass VIw. It is in the Low Coastal Sand range site.

31—Mustang fine sand, saline. This is a nearly level, saline soil on coastal flats and depressions in marshes. Slopes average about 0.2 percent. Areas are irregular in shape and range from 5 to about 100 acres in size.

This soil has a surface layer of neutral, saline, light gray fine sand about 8 inches thick. The next layer is neutral, saline, light gray fine sand about 32 inches thick. The underlying layer to a depth of 60 inches is neutral, saline, grayish brown fine sand.

The soil is poorly drained. Surface runoff is very slow. Permeability is rapid above the water table. The water table occurs at a depth of 6 to 20 inches. The water is saline. This soil is frequently flooded during abnormally high tides.

Included in mapping are small areas of Veston soils and nonsaline Mustang fine sand. These included soils make up as much as 20 percent of a mapped area.

This soil is used as rangeland and wildlife habitat. The salinity and wetness and the flooding during high tides make this soil unsuitable for cropland and pastureland.

The potential for most urban uses is low. The main restrictive features are the salinity and wetness of the soil and the susceptibility to flooding during high tides and hurricanes.

The native vegetation on this soil is that of a coastal marsh that is, by weight, about 90 percent grasses and grasslike plants and 10 percent forbs. The plant community is typically 25 percent marshhay cordgrass and 25 percent sedges and rushes. The rest of the plant community is largely fimbry, gulfdune paspalum, and sea-lavender. Forage production on rangeland in excellent condition ranges from 2,000 to 5,500 pounds per acre per year.

Marshhay cordgrass and gulfdune paspalum are preferred by livestock; therefore, they are grazed out first under heavy use. As those plants decrease, sedges, rushes, seashore dropseed, and sea-lavender increase. Under continued heavy grazing, bushy bluestem, shoregrass, seacoast sumpweed, Carolina wolfberry, and glasswort invade the rangeland.

This soil supports habitat that is important to shore birds, terns, and many other waterfowl.

This soil is in capability subclass VIw. It is in the Saline Sand range site.

32—Narta fine sandy loam. This is a nearly level, saline soil. This soil is on a salty prairie. Slopes average about 0.3 percent. Areas are irregular in shape and range from 5 to about 1,000 acres in size.

Typically, this soil has a surface layer of dark gray fine sandy loam about 7 inches thick. The subsoil to a depth of 18 inches is dark grayish brown loam that grades to clay in the lower part. From 18 to 74 inches the subsoil is clay loam that is light brownish gray in the upper part and light gray in the lower part. Brownish and yellowish mottles occur throughout this layer. This soil is moderately alkaline and saline throughout.

This soil is somewhat poorly drained. Surface runoff is very slow. This soil has a perched water table in the upper part of the subsoil in winter. Under unusual weather conditions, some areas are flooded.

Included in mapping are small areas of Bernard, Edna, Francitas, and Veston soils. The included soils make up as much as 20 percent of a map area.

This soil is used as rangeland and wildlife habitat. The salinity makes the soil unsuited to cropland and pastureland.

The potential for most urban uses is low. The main restrictive features are the wetness, salinity, and texture of the soil and the susceptibility to flooding during hurricanes.

The native vegetation on this soil is that of a salty prairie and is, by weight, about 95 percent grasses and 5 percent forbs. The plant community is typically 60 percent gulf cordgrass, 5 percent marshhay cordgrass, 5 percent switchgrass, 5 percent little bluestem, and 5 percent seashore saltgrass. The rest of the plant community is mainly forbs such as bushy sea-oxeye. Forage production on rangeland in excellent condition ranges from 4,000 to 7,000 pounds per acre per year.

Under initial heavy grazing, the lesser species decrease and gulf cordgrass increases. However, continued heavy grazing or improper burning eventually reduces the amount of gulf cordgrass, and plants such as eastern baccharis, sumpweed, and snow-on-the-prairie invade the rangeland. Some areas may even become partly barren.

Because the soil is usually drier than the surrounding soil, it is used by livestock as a bedding area. Therefore, some areas tend to be heavily grazed and abused.

In winter this soil provides habitat for wildlife such as migratory ducks and geese. Geese prefer freshly burned or closely grazed areas. Progressively burning the marsh to provide geese with new grazing areas is a good practice. However, mottled ducks nest in the mature cordgrass, and burning the area during nesting season can destroy their valuable cover and their nests, eggs, and ducklings. This soil also supports habitat for dove and quail.

This soil is in capability subclass VIs. It is in the Salty Prairie range site.

33—Norwood silt loam, 0 to 1 percent slopes. This is a nearly level, nonsaline soil. It is on natural levees parallel to the larger bayous and rivers. Slopes average about 0.3 percent. Areas are generally oblong and range from 5 acres to several hundred acres.

Typically, this soil is reddish brown silt loam to a depth of about 48 inches. From 48 to 54 inches, it is yellowish red very fine sandy loam, and from 54 to 64 inches, it is reddish brown silt loam. This soil is calcareous and moderately alkaline throughout.

The soil is well drained. It is rarely flooded. Surface runoff is slow. Permeability is moderate.

Included in mapping are small areas of Asa and Clemville soils. Also included is a soil similar to the Norwood soil except that it is sandy throughout. The included soils make up as much as 15 percent of a map area.

The soil is used mainly as cropland and pastureland. The main crops are grain sorghum, soybeans, corn, peanuts, and some vegetable crops (fig. 7).

The potential for cultivated crops is high. Incorporating crop residue into the surface layer helps to maintain soil tilth and soil aeration. Crop yields can be increased by using fertilizer. Because the soil is moderately permeable it is not suited to rice.

The potential for pasture grasses is high. In the few areas that still have dense stands of hardwoods, production is low. Production can be increased in these areas by removing some trees so that more sunlight reaches the grasses. Plant vigor should be maintained by proper stocking and rotation grazing. Production can be increased by using fertilizer.

The potential of the soil for most urban uses is medium, mainly because of the possibility of flooding.

The vegetation that is in a native state consists of a dense stand of hardwood trees. Under a dense canopy the understory is 15 percent lurid sedge, 5 percent longleaf uniola, 5 percent Virginia wildrye, 5 percent switchcane, 5 percent low panicum, 5 percent nimblewill muhly. The rest of the understory is forbs, such as elephantfoot and Drummond waxmallow, and vines and shrubs, such as greenbrier, poison-ivy, yaupon, and possumhaw. The average production under a dense canopy ranges from 250 to 2,000 pounds per acre per year.

Longleaf uniola, Virginia wildrye, and sedges are preferred by livestock; therefore, they are grazed out first. As those plants decrease, nimblewill muhly, low panicums, and carpetgrass increase. Continued heavy grazing will largely eliminate these plants. They will be replaced by numerous low-quality weeds and grasses. If the canopy is reduced, the understory vegetation will be greatly changed.

This soil supports habitat mainly for fox squirrel, gray

Figure 7.—Peanuts growing in an area of Norwood silt loam.

squirrel, white-tailed deer, rabbits, furbearing animals, and a great variety of birds.

This soil is in capability class I. Because it is dominantly wooded, it is not assigned to a range site.

34—Norwood silt loam, 1 to 5 percent slopes. This is a gently sloping, nonsaline soil. It is adjacent to drains, bayous, and old sloughs. Slopes average about 2.5 percent. Areas are irregular in shape and range from 5 to about 50 acres in size.

Typically, the soil to a depth of about 40 inches is calcareous, moderately alkaline silt loam that is stratified with reddish brown and yellowish red. From 40 to 60 inches it is reddish brown silty clay loam.

This soil is well drained. It is rarely flooded. Surface runoff is slow. Permeability is moderate.

Included in mapping are small areas of Aris, Brazoria, and Pledger soils. The included soils make up as much as 20 percent of a map area.

This soil is used mainly as cropland and pastureland. The main crops are grain sorghum and soybeans.

The potential for cultivated crops is medium. The soil requires intensive management to prevent water erosion. Therefore, in many areas, farm operators prefer to use this soil as pastureland. Terracing, contour farming, and grassed waterways are needed. Leaving crop residue on the surface maintains soil tilth. Production can be increased by using fertilizer. Because of slope and drainage this soil is not suited to rice.

The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. In areas that still have a dense stand of hardwoods, production is low. Production can be increased by removing some trees so that adequate

sunlight reaches the grasses. Production can be increased further by using fertilizer.

The potential of the soil for most urban uses is medium, mainly because of the possibility of flooding.

The vegetation that is in a native state consists of a dense stand of hardwood trees. Under a dense canopy the understory is 10 percent lurid sedge, 10 percent Virginia wildrye, 5 percent longleaf uniola, 5 percent switchcane, 5 percent low panicum, and 5 percent nimblewill muhly. The rest of the understory is forbs, such as elephantfoot and Drummond waxmallow and vines and shrubs, such as greenbrier, poison-ivy, yaupon, and possumhaw. The average production under a dense canopy ranges from 250 to 2,500 pounds per acre per year.

Longleaf uniola, Virginia wildrye, and sedges are preferred by livestock; therefore, they are grazed out first. As those plants decrease, nimblewill muhly, low panicum, and carpetgrass increase. Continued heavy grazing will largely eliminate all these plants. They will be replaced by numerous low-quality weeds and grasses. If the canopy is reduced, the understory vegetation will be greatly changed.

The major wildlife species inhabiting this plant community are fox squirrel, gray squirrel, white-tailed deer, rabbits, furbearing animals, and a great variety of birds.

This soil is in capability subclass IIe. Because it is dominantly wooded, it is not assigned to a range site.

35—Norwood-Asa complex, 1 to 8 percent slopes. This complex consists of gently sloping to sloping, nonsaline soils. They are adjacent to the major bayous, creeks, and rivers. Slopes average about 6 percent. Areas are mostly long and narrow and range from 5 to several hundred acres.

This complex is 50 percent Norwood soils and 40 percent Asa soils. The Norwood soils are generally on the upper part of the slope. The Asa soils are on the middle and lower parts of the slope. Of minor extent are Clemville, Pledger, and Sumpf soils and some soils that are similar to the Asa and Norwood soils but are noncalcareous throughout. The soils in this complex are so intricately mixed that mapping them separately is not practical at the scale used.

Typically, the Norwood soils to a depth of about 55 inches are moderately alkaline, calcareous silty clay loam that is reddish brown in the upper part, yellowish red in the middle part, and reddish brown in the lower part. To a depth of 63 inches is yellowish red fine sandy loam.

Typically, the Asa soils have a surface layer of neutral, very dark grayish brown silty clay loam about 11 inches thick. The subsoil to a depth of 60 inches is moderately alkaline, calcareous, reddish brown silty clay loam that contains a few soft masses of calcium carbonate.

The soils in this complex are well drained. Surface runoff is slow. Permeability is moderate. Areas are rarely flooded.

These soils are used mainly as pastureland and wildlife habitat.

The potential for most cultivated crops is low. Most areas are long and very narrow, which makes management and tillage operations difficult. Terracing and contour farming are needed on cropland. Grassed waterways are also needed in some of the wider areas of this soil and in areas that drain adjacent soil areas. Production can be increased by using fertilizer. Because the soils are well drained and are sloping, they are not suited to rice.

The potential for pasture grasses is high. Plant vigor should be maintained by proper stocking and rotation grazing. In areas where the tree canopy is dense, production is low. Production can be increased by removing some trees to allow sunlight to reach the grasses. Production can be further increased by using fertilizer.

The potential of the soil for most urban uses is medium, mainly because of the possibility of flooding.

In places the soils support a dense stand of hardwood trees. Under a dense canopy the understory pastureland is 10 percent lurid sedge, 10 percent Virginia wildrye, 5 percent longleaf uniola, 5 percent low panicum, and 5 percent nimblewill muhly. The rest of the understory is forbs, such as elephantfoot and Drummond waxmallow, and vines and shrubs, such as greenbrier, poison-ivy, yaupon, and possumhaw. The average production under a dense canopy is from 250 to 2,500 pounds per acre per year.

Longleaf uniola, Virginia wildrye, and sedges are preferred by livestock; therefore, they are grazed out first. As those plants decrease nimblewill muhly, low panicum, and carpetgrass increase. Continued heavy grazing will largely eliminate all these plants. They will be replaced by numerous low-quality weeds and grasses. If the canopy is reduced, the understory vegetation will be greatly changed.

The major wildlife species inhabiting this plant community are fox squirrel, gray squirrel, white-tailed deer, rabbits, furbearing animals, and a great variety of birds.

This complex is in capability subclass IVe. Because it is dominantly wooded, it is not assigned to a range site.

36—Pledger clay. This is a nearly level, nonsaline soil. Slopes average about 0.1 percent. Areas are irregular in shape and range from 10 to several thousand acres in size.

Typically, this soil has a surface layer of mildly alkaline black clay about 26 inches thick. The subsoil to a depth of 50 inches is moderately alkaline, calcareous, reddish brown silty clay. The underlying layer to a depth of about 64 inches is moderately alkaline, calcareous, reddish brown clay.

This soil is somewhat poorly drained. It is rarely flooded. Surface runoff is slow. Permeability is very slow. This soil has a perched water table above a depth of about 2 feet in winter.

Included in mapping are small areas of Asa, Brazoria, Norwood, and Sumpf soils. The included soils make up as much as 15 percent of a map area.

This soil is used mainly as pastureland. In some areas it is used as cropland. The main crops are grain sorghum, soybeans, and corn. A few areas are used for rice.

The potential for cultivated crops is high. A good drainage system is beneficial because of excess surface water. Because the soil is clayey, it is difficult to till when dry. Incorporating crop residue into the surface layer promotes good soil tilth and aeration. Cracks form as the soil dries. In this condition, the soil absorbs water readily. However, as the soil becomes moist, the cracks close and water enters the soil very slowly. Production can be increased by using fertilizer.

In most areas, this soil is suited to rice; however, three factors should be considered before rice is grown. First, in areas that have been recently cleared of trees, water loss may be abnormally high during the flooding period because of rapid movement of water down old tree root channels that have not yet been filled with soil. Second, in some places where the soil is moderately alkaline, rice production usually is marginal. Third, adequate sources of irrigation water are generally not readily available in some areas of this soil.

The potential for pasture grasses is high. Drainage systems are beneficial because of excess surface water. Plant vigor should be maintained by proper stocking and rotation grazing. In areas that have a dense hardwood overstory, some trees should be removed so that more sunlight reaches the grasses. Production can be further increased by using fertilizer.

The potential for most urban uses is medium. The main restrictive features are wetness, the clayey texture and high shrink-swell potential, and the susceptibility to flooding.

The vegetation that is in a native state consists of a dense stand of hardwood trees. Under a dense canopy the understory pastureland is 25 percent lurid sedge, 10 percent longleaf uniola, 10 percent nimblewill muhly, 10 percent Virginia wildrye, and 5 percent rustyseed paspalum. The rest of the understory is forbs, such as violet, dayflower, and tickclover, and vines and shrubs, such as greenbrier, Alabama supplejack, yaupon, and American elder. Average production under a dense canopy ranges from 250 to 750 pounds per acre per year.

Longleaf uniola, Virginia wildrye, and rustyseed paspalum are preferred by livestock; therefore, they are grazed out first. As those plants decrease, nimblewill muhly, greenbrier, and sedges increase. Continued heavy grazing will largely eliminate these plants. They will be replaced by dwarf palmetto and yaupon. If the canopy is reduced, the understory vegetation will be greatly changed.

The major wildlife species inhabiting this plant community are fox squirrel, gray squirrel, white-tailed deer, swamp rabbits, furbearing animals, and a great variety of birds.

This soil is in capability subclass IIs. Because it is dominantly wooded, it is not assigned to a range site.

37—Pledger-Urban land complex. This complex is nearly level, nonsaline soils and Urban land. Slopes average about 0.1 percent. This complex floods rarely. Areas are irregular in shape and range from 5 to several hundred acres in size.

This complex is about 45 percent Pledger soils, 40 percent Urban land, and 15 percent Brazoria, Surfside, and Asa soils. Areas of the soils and Urban land are so intricately mixed that mapping them separately is not practical at the scale used.

Typically, Pledger soils have a surface layer of black, mildly alkaline clay about 26 inches thick. The subsoil to a depth of 60 inches is moderately alkaline reddish brown clay.

The Pledger soils are somewhat poorly drained. Permeability is very slow. Runoff is slow. The water table is above a depth of 2 feet during most winter months.

Urban land consists of soils that have been altered or covered with buildings or other urban structures, making classification of the soils impractical. Typical structures are single and multiple unit dwellings, garages, sidewalks, driveways, streets, schools, churches, shopping centers, office buildings, parking lots, and industrial sites. Areas of Pledger soils and other soils that have been altered by cutting, grading, and filling make up some Urban land. In some places the soils have not been altered but have been covered with 6 to 20 inches of fill material. Runoff is rapid from the Urban land.

The potential of the soils for most urban uses is medium. The main restrictive features are the wetness, high shrink-swell potential, and clayey texture of the soil and the susceptibility to flooding.

This complex is not assigned to a capability subclass or to a range site.

38—Sumpf clay. This is a nearly level, nonsaline soil. It occupies depressional areas and remnants of old river meanders. Slopes average about 0.4 percent. Areas are generally circular and range from 5 to several hundred acres.

Typically, this soil to a depth of about 60 inches is calcareous, moderately alkaline clay that is dark brown in the upper few inches and dark reddish brown below. From 60 to 69 inches the soil is light gray, neutral fine sandy loam.

This soil is very poorly drained. Surface runoff is very slow. Permeability is very slow. This soil is ponded for several months during the year unless artificially drained. It receives additional surface runoff from the surrounding soils.

Included in mapping is a soil that is similar to the Sumpf soil except that it is noncalcareous and a soil that

has a dark colored surface layer less than 24 inches thick. The included soils make up as much as 35 percent of a map area.

This soil is used primarily as wildlife habitat. In areas where artificial drainage has been installed, it is used for pastureland and cropland. The main crops grown are grain sorghum and soybeans. In most places this soil supports good wetland wildlife habitat.

The potential for most cultivated crops is low. A drainage system is required to remove the excess surface water that ponds on this soil. Long and deep drainage ditches are usually needed because this soil is on the lowest part of the landscape in most places.

The potential for pasture grasses is medium. In areas that have a good drainage system, the forage production is high. A drainage system usually requires a long and deep ditch that also crosses some of the surrounding soils. In most places, the installation of such a system is presently not economically feasible. Production on undrained soil will vary depending upon the duration of ponding and the depth of the water. In areas that have shallow water, the production is moderate. However, in areas that have deeper water, the production is low. Also, cattle prefer not to graze in undrained areas.

The potential of the soil for most urban uses is low. The most restrictive features are soil wetness, surface wetness, clayey texture, high shrink-swell potential, and the susceptibility to flooding.

The native vegetation on this soil is that of a fresh water marsh with scattered trees and is, by weight, about 90 percent grasses and grasslike plants and 10 percent forbs. The plant community is 20 percent giant cutgrass, 25 percent maidencane, and 10 percent cattail. The rest of the plant community is mainly water-loving plants such as waterlettuce, arrowhead, and waterlily. Trees such as Carolina ash, swamp-privet, green ash, and cypress occur in some areas of the marsh. The understory vegetation is mainly maidencane and soft rush. Forage production on rangeland in excellent condition ranges from 7,500 to 9,000 pounds per acre per year.

Maidencane and giant cutgrass are preferred by livestock, and therefore, are grazed out first under heavy use. As those plants decrease, cattail, longtom, cockspur, and soft rush increase. Under continued heavy grazing smartweed, alligatorweed, waterhyacinth, and Sesbania invade the marshland.

In most places, this soil supports good habitat for wetland wildlife such as waterfowl.

This soil is in capability subclass VIw. It is in Clayey Bottomland range site.

39—Surfside clay. This is a nearly level, saline soil. This soil is in marshes. Slopes average about 0.2 percent. Areas are irregular in shape and range from 5 to several thousand acres in size.

Typically, the surface layer is mildly alkaline, saline, very dark gray clay about 14 inches thick. The next layer, to a depth of 32 inches, is mildly alkaline, saline, dark gray clay. The subsoil to a depth of 72 inches is moderately alkaline, calcareous, saline, dark reddish brown clay.

This soil is poorly drained. It is rarely flooded. Surface runoff is very slow. Permeability is very slow. The water table is above a depth of about 2 feet during most winter months.

Included in mapping are small areas of Harris and Veston soils. These included soils make up as much as 15 percent of a map area.

This soil is used mainly as rangeland. The salinity makes the soil unsuited to cropland and pastureland.

The potential for most urban uses is low. The primary restrictive features are wetness, clayey texture, high shrink-swell potential, salinity, and the susceptibility to flooding.

The native vegetation is that of a salty prairie. It is, by weight, about 95 percent grasses and 5 percent forbs. The plant community is typically 80 percent gulf cordgrass. The rest of the plant community is mainly grass, but there are some forbs such as bushy sea-oxeye. Forage production on rangeland in excellent condition ranges from 7,500 to 13,000 pounds per acre per year.

Under initial heavy grazing by cattle, the minor species are largely eliminated and gulf cordgrass increases. However, under continued heavy grazing or improper burning gulf cordgrass greatly decreases and plants such as eastern baccharis, sumpweed, and snow-on-the-prairie invade the rangeland. Prescribed burning can be used to maintain plant vigor.

In winter this soil provides habitat for migratory ducks and geese. Geese prefer freshly burned or closely grazed areas, and progressive burning to provide fresh grazing areas for the geese is a good management practice. However, the mottled duck nests in the mature cordgrass, and burning the areas during nesting season can destroy their valuable cover and their nests, eggs, and ducklings. This soil also supports habitat for dove and quail.

This soil is in capability subclass VIw. It is in the Salty Prairie range site.

40—Tatlum clay loam. This is a nearly level, saline soil. This soil is in broad tidal areas in marshes. It is flooded daily during high tide. Slopes average less than 0.1 percent. Areas are irregular in shape and range from 10 to about 1,000 acres in size.

Typically, this soil is gray clay loam to a depth of about 28 inches. To a depth of 60 inches it is gray stratified clay and clay loam. The soil is saline and moderately alkaline throughout.

This soil is very poorly drained. Surface runoff is very slow. Permeability is very slow. The soil remains saturated to the surface throughout the year because it is flooded daily during high tide. The upper 20 to 40 inches of the soil is soft and generally will not support the weight of livestock unless a dense vegetative cover is on the surface.

Included in mapping are small areas of Follet and Veston soils. Included soils make up as much as 20 percent of a map area.

This Tatlum soil is used as habitat for nongame wetland wildlife. Wetness and salinity make the soil unsuitable for use as cropland and pastureland. Because the soil will not support the weight of livestock, it is generally not suitable for rangeland unless a thick plant cover is maintained on the surface.

The potential of the soil for urban uses is low. The main restrictive features are wetness, low strength, the salinity of the soil, and flooding.

The native vegetation on this soil is that of a regularly flooded tidal marsh—about 90 percent grasses and 10 percent rushes and other salt-tolerant plants. Typically, the dominant plant is smooth cordgrass, which makes up about 90 percent of the plant community. Other plants on this unit are needlegrass rush, saline aster, and maritime saltwort.

Retrogression is mainly caused by climate changes. During extended periods when tides are low and the water level drops, maritime saltwort, needlegrass rush, Virginia glasswort, and bushy sea-oxeye invade the marshland.

This marsh plant community provides habitat for a great variety of birds and marine life. It produces from 3.5 to 7 tons of detritus per acre annually. This detritus, which comes mostly from smooth cordgrass that is decomposing, is the beginning of the marine ecosystem. Oysters, crabs, and many species of fish depend on the marsh plant community to supply nutrients. Post-larval shrimp must have smooth cordgrass as nursery ground.

This soil is in capability subclass VIIIw. It is in the Tidal Flat range site.

41—Tracosa mucky clay. This is a nearly level, saline soil. This soil is in broad tidal areas along bays and bayous in marshes. Slopes average less than 0.1 percent. Areas are irregular in shape and range from 10 to about 1,000 acres in size.

Typically, this soil has a surface layer of mildly alkaline, strongly alkaline, dark gray mucky clay about 5 inches thick. From 5 to about 60 inches is clay that is dark gray in the upper part and gray in the lower part. This soil is alkaline and saline throughout.

This soil is very poorly drained. Surface runoff is very slow. Permeability is very slow. The soil remains saturated to the surface throughout the year because of flooding daily during high tide.

Included in mapping are small areas of Follet, Harris, and Veston soils. The included soils make up as much as 20 percent of a map area.

This soil is used mainly as wildlife habitat. The salinity and wetness make the soil unsuitable for cropland and pastureland. This soil is used extensively by nongame wetland wildlife.

The potential of the soil for most urban uses is low. The main restrictive features are wetness, salinity, high shrink-swell potential, and flooding.

Few areas of this soil are used as rangeland because the soil is wet most of the year. Only strong, healthy cattle can effectively graze these areas.

The native vegetation on this soil is salt-tolerant plants of a regularly flooded tidal marsh that is, by weight, about 90 percent grasses and 10 percent rushes and other salt-tolerant vegetation. The plant community is 90 percent smooth cordgrass. The rest of the plant community is needlegrass rush, saline aster, and maritime saltwort.

Cattle seldom graze more than 50 percent of the smooth cordgrass because of limited access due to flooding during high tide. At times, a high concentration of salt crystals builds up on the surface of smooth cordgrass making the plant less palatable. Rainfall readily washes away the crystals, however. Under heavy grazing, the grass stand gradually thins out.

Retrogression on this soil is caused mostly by climate changes. During extended periods when tides are low and the water level drops, maritime saltwort, needlegrass rush, Virginia glasswort, and bushy sea-oxeye invade the marshland.

The marsh plant community provides habitat for a great variety of birds and marine life. It usually produces 6 to 9 tons of detritus per acre. This detritus, which comes mostly from decaying smooth cordgrass, is the beginning of the marine ecosystem. Oysters, crab, and many species of fish depend on this marsh plant community to supply nutrients. Post-larval shrimp must have smooth cordgrass as a nursery ground.

This soil is in capability subclass VIIw. It is in the Tidal Flat range site.

42—Velasco clay. This is a nearly level, saline soil. This soil is in marshes. Slopes average about 0.1 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, this soil is moderately alkaline, saline clay to a depth of about 65 inches. To a depth of 8 inches it is dark reddish brown, from 8 to 30 inches it is dark brown, and from 30 to 65 inches it is mottled with reds, browns, and grays.

This soil is very poorly drained. Areas are frequently flooded. Surface runoff is very slow. Permeability is very slow. A water table is within 20 inches of the soil surface throughout msot of the year.

Included in mapping are small areas of Harris, Surfside, and Veston soils. Also included is a soil that is similar to the Velasco soil except that it is not calcareous in the upper part. The included soils make up as much as 15 percent of a map area.

The soil is used mainly as rangeland and wildlife habitat. The salinity and wetness make this soil unsuitable for cropland and pastureland.

The potential for most urban uses is low. The main restrictive features are wetness, salinity, clayey texture, and susceptibility to flooding.

The native vegetation is that of a salt marsh and is, by weight, 80 percent grasses, 10 percent rushes, and 10

percent forbs. The plant community is 60 percent marshhay cordgrass, 15 percent seashore saltgrass, and 15 percent seashore paspalum. The rest of the plant community is coast cockspur and Olney bulrush and forbs such as Carolina wolfberry and Bacopa. Forage production on rangeland in excellent condition is 8,000 to 14,000 pounds per acre per year.

Marshhay cordgrass, coast cockspur, and seashore saltgrass are preferred by livestock, and seashore saltgrass and seashore paspalum are preferred by geese. To keep areas of these preferred grasses productive, proper grazing or prescribed burning is needed to prevent a heavy accumulation of grass rough.

Because of mosquitoes in the summer and the danger of hurricanes late in summer and fall, these areas are generally grazed by cattle only during the winter months. With heavy grazing or following a damaging burn, seashore saltgrass or seashore paspalum tends to dominate the areas, and bushy sea-oxye and needlegrass rush invade the marsh.

This soil supports important habitat for a variety of birds and animals. Mottled ducks use areas of this soil for nesting. In addition, thousands of migratory ducks, geese, rails, coots, and cranes frequent these areas in the fall and winter. Areas with Olney bulrush are excellent habitat for muskrat. The areas where waters are less saline are the preferred habitat of the alligator.

This soil is in capability subclass VIIw. It is in the Salt Marsh range site.

43—Veston loam. This is a nearly level, saline soil. This soil is in marshes. Slopes average about 0.3 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, this soil has a surface layer of dark gray loam about 11 inches thick. From 11 to 26 inches the soil is light brownish gray silty clay loam. The underlying layer to a depth of 60 inches is light brownish gray loam that has brownish mottles. This soil is saline and moderately alkaline throughout.

This soil is poorly drained. Surface runoff is very slow. Permeability is slow. The water table is at a depth of 2 feet or less during most winter months. This soil is frequently flooded.

Included in mapping are small areas of Follet, Mustang, and Narta soils. The included soils make up as much as 15 percent of a map area.

This soil is used mainly as rangeland and wildlife habitat. The salinity makes the soil unsuitable for cropland and pastureland.

The potential for most urban uses is low. The main restrictive features are wetness, salinity, and the susceptibility to flooding.

The native vegetation consists of salt-tolerant plants of a salty prairie and is, by weight, about 95 percent grasses and 5 percent forbs. The plant community is typically 50 percent gulf cordgrass, 20 percent marshhay cordgrass, and 10 percent indiangrass. The rest of the plant community is common reed, switchgrass, seashore saltgrass, and forbs such as bushy sea-oxeye. Forage production on rangeland in excellent condition ranges from 7,500 to 11,500 pounds per acre per year.

Under initial heavy grazing, the lesser plants are eliminated and gulf cordgrass increases. Under continued heavy grazing or improper burning, gulf cordgrass greatly decreases, and plants such as eastern baccharis, sumpweed, and snow-on-the-prairie may invade the rangeland.

Because areas of this soil are on the higher, drier positions on the landscape, they are used by livestock as bedding areas and as a refuge during high tides. Therefore, it is easy to overgraze these areas.

In winter this soil supports habitat for migratory ducks and geese. Geese prefer freshly burned or closely grazed areas. Progressively burning the marsh to provide the geese with new grazing areas is a good management practice. However, mottled ducks nest in the mature cordgrass, and burning the area during nesting season can destroy their valuable cover and their nests, eggs, and ducklings. This soil also supports habitat for dove and quail.

This soil is in capability subclass VIw. It is in the Salty Prairie range site.

44—Veston silty clay loam, strongly saline. This is a nearly level, saline soil. This soil is in marshes. Slopes average about 0.2 percent. Areas are irregular in shape and range from 10 to several hundred acres in size.

Typically, this soil has a surface layer of moderately alkaline, saline, dark gray silty clay loam about 10 inches thick. The next layer, to a depth of 28 inches, is moderately alkaline, strongly saline, gray clay loam. The underlying layer to a depth of 60 inches is a moderately alkaline, strongly saline, light grayish brown clay loam.

This soil is poorly drained. Surface runoff is very slow. Permeability is slow. This soil is flooded if the tide is unusually high. The water table is at a depth of less than 10 inches. The soil salinity fluctuates according to the tide, rainfall, and temperature.

Included in mapping are small areas of Harris, Follet, and Veston soils. The included soils make up as much as 15 percent of a map area.

This soil is used mainly as wildlife habitat. Some areas are used as rangeland. The salinity and wetness make the soil unsuitable for cropland and pastureland.

The potential for most urban uses is low. The main restrictive features are wetness, salinity, and the susceptibility to flooding.

The native vegetation is that of a coastal salt flat and is, by weight, about 40 percent grasses, 10 percent woody plants, and 50 percent forbs. The plant community is typically 35 percent shoregrass and 10

percent bushy sea-oxeye. The rest of the plant community is mainly maritime saltwort and Virginia glasswort. Forage production on rangeland in excellent condition ranges from 1,500 to 4,000 pounds per acre per year.

Under continuous heavy grazing, shoregrass, bushy sea-oxeye, and Carolina wolfberry decrease and other salt-tolerant plants increase. The plant community is highly variable, depending mainly on the water table.

This soil supports habitat and resting areas for shore birds, herons, small crustaceans, and various kinds of ducks.

This soil is in capability subclass VIIs. It is in the Salt Flat range site.

use and management of the soils

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

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

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

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

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

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

crops and pasture

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

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

More than 496,000 acres in the county was used as cropland and pastureland in 1967, according to the Conservation Needs Inventory (*17*). Of this total, 228,000 acres was used as permanent pastureland; 39,000 acres was used for row crops, such as grain sorghum, cotton, and soybeans; 55,000 acres was used for irrigated rice; 165,000 acres was used for rotation hay and pasture; and 2,800 acres was used as hayland. The rest was idle cropland.

The soils in Brazoria County have good potential for increased production of food. About 37,000 acres of potentially good cropland is used as rangeland; 227,000 acres is used as pastureland; and 167,000 acres is used as grazed woodland. In addition to this potential increase in cropland acreage, food production can be increased by using the latest crop production technology on all cropland. This soil survey can help facilitate the application of this technology.

The acreage of cropland and pastureland is steadily decreasing as more and more land is converted to urban uses. Also, some land is idle because landowners are holding the land primarily for appreciation and for future urban uses. The use of the soil survey in helping to make land use decisions that will influence the future role of farming in the survey area is discussed in the section "General soil map units."

Surface drainage is the major concern on the cropland and pastureland in Brazoria County. Because all the soils have a drainage problem to some degree, and because the slopes are mostly nearly level, the soil remains wet for significant periods of time. Prolonged wetness affects plant growth. Drainage systems have been installed in many areas. In other places, inadequate natural outlets make any improvement difficult and expensive. The well drained Asa, Clemville, and Norwood soils are the only soils which do not need drainage.

Preparing a good seedbed is difficult on clayey soils, such as Lake Charles, Beaumont, and Pledger soils. However, farmers are generally familiar with this difficulty and deal effectively with it.

Soil erosion is generally not a major concern in the county (*20*) because nearly all the soils used for cropland are nearly level. Normally, soil loss is within the allowable limits under normal tillage. Erosion is a

concern if soils that have slopes greater than 1 percent are cropped. However, most farmers do not crop such soils.

Soil tilth is an important factor in seed germination and water infiltration. The surface layer of the soil should be granular and porous. Clayey soils, such as Lake Charles and Pledger soil, are usually dense and require tillage to break up the soil enough to make a good seedbed. Regular additions of crop residue improve the soil structure which, in turn, improves soil tilth.

Special crops that are grown commercially in the survey area include a variety of vegetable crops, tree crops, and corn. They are grown on the better drained soils, such as Asa, Clemville, and Norwood soils. The main tree crop is pecan. It is suited to many of the soils in the county but is most easily managed on Asa, Clemville, and Norwood soils because they are better drained. A few peach trees are grown on Asa, Clemville, and Norwood soils.

management of cultivated cropland

In Brazoria County, drainage and maintenance of soil tilth and fertility are the main management concerns.

In many areas suitable for cropland, excess water moves from the surface very slowly because the soils are flat to nearly level and are slowly to very slowly permeable. These soils are wet for considerable periods following rains. Wetness makes it difficult to carry out necessary land treatment in a timely manner. Drainage systems, if installed properly, help to remove the excess surface water. Many areas are not drained because adequate outlets are not available. The availability of adequate outlets should be considered before a drainage system is installed. Also, the system should be planned so that it does not hinder the operation of farm equipment. Row direction should also be considered.

Soil tilth is important because it determines soil aeration. Fertility is important because it determines the amount of commercial fertilizers needed. Tilth and fertility are maintained mainly by maintaining or increasing the organic matter content of the soil through the addition of crop residue. If crop residue is not left on the surface of the soil, rain breaks up the natural soil aggregates, lowering the intake rate, increasing runoff, and accelerating soil erosion. The crop residue contributes to better water infiltration, tilth, and aeration and to higher natural fertility.

Other management concerns are the control of erosion and the conservation of moisture. Erosion is detrimental because it takes away the most fertile upper part of the soil and clogs bayous, creeks, and rivers with sediment. Soil erosion by water is generally underestimated in cropland because it is not easily noticed. However, the normal cropping sequence and tillage practices on the soils that are nearly level generally control erosion within acceptable limits. On the more sloping soils in the county, erosion can be controlled by intensive management. But, because installing and maintaining these management practices and controls is expensive and because the acreages involved are small, most landowners do not crop these areas.

Although at times the soil is too wet, conserving soil moisture is important with crops that may go into drought stress during the summer when rainfall is below normal. Conserving soil moisture through timely planting, proper tillage, and residue management enables the plants to produce a crop in most years.

Several other management practices can be used to maintain soil productivity. Proper tillage should be used on all soils. Tillage should be used only to prepare a good seedbed and to control weeds. Excessive tillage or tillage when the soil is too wet causes loss of organic matter, destroys good soil tilth, and is an added expense. It can also cause a plowpan, which is a compact layer immediately below the plow layer. A plowpan restricts air and water movement and is difficult for roots to penetrate. It increases soil runoff and restricts plant growth.

Some form of minimum tillage is recommended in most areas. Minimum tillage involves reducing the trips over the field with farm equipment. It also leaves more crop residue on the soil surface than conventional tillage. The residue reduces the compaction and increases the water-intake rate, the available water capacity, and the natural fertility of the soil.

All cultivated soils in the county respond to additions of commercial fertilizers. The kind and amount of fertilizer needed varies according to the soil, crop, desired production, previous land use, and season of the year. A soil test helps to determine the kinds and amounts to apply. An additional amount of nitrogen fertilizer can be added when crop residue is abundant. The additional nitrogen increases the rate at which the crop residue decomposes into humus. While the residue is decaying, much nitrogen is tied up by micro-organisms decomposing the organic matter. Adding commercial nitrogen fertilizer assures that there is enough nitrogen for both the micro-organisms and the growing crop. The nitrogen used by these organisms is not lost but is released back to the soil later in the season.

The method of fertilization depends on the crop and the stage of plant growth. It is best to fertilize row crops by banding the fertilizer below and to the side of the seed or plant roots. Broadcast fertilization is best for broadcast planted crops.

Most of the soils have a favorable soil reaction, or pH range, for the crops commonly grown. Also, most soils have a high capacity to buffer the pH so that the soils will not get too acid. It may, however, be desirable to apply lime to some soils when plants that do best under alkaline conditions are grown. Applications should be based on the results of a recent soil test.

Another management practice is the use of a cropping system, or crop rotation, that improves soil tilth; protects

the soil during heavy rains; helps to control weeds, insects, and plant diseases; and provides an economic return. Although a good cropping system can consist of only one crop, it generally consists of several crops grown in a sequence, or rotation, so that crops that return little residue to the soil are balanced with crops that return an abundant amount of residue. Under a good cropping system, the soils will produce good yields indefinitely. Rice is commonly grown in rotation with pasture or milo or soybeans. The most common rotations are: rice-milo, rice-soybeans, milo-soybeans, and milo-cotton.

Rice— Many of the soils in the county are well suited to rice because the topography is flat and the subsoil is very slowly permeable. The main rice-producing soils are Bernard, Beaumont, Lake Charles, and Edna soils. Rice production is especially extensive in the eastern part of the county.

Rice is grown by flood irrigation. Irrigation water is supplied mainly by canal systems. Most of the management practices used for other crops are also important for rice production. Because the rice is grown under flood irrigation, however, there are some differences. For example, good soil aeration is important while the rice is young and not flooded but is not a factor when the crop is older and is continuously flooded. During the time that the rice is not flooded, adequate surface drainage is important. Good surface drainage permits timely seedbed preparation, planting, and harvesting. After the soil has been flooded for several months, it becomes boggy and soft. If a good drainage system has been installed, the field will dry more quickly after the excess water has been removed. Also, excess rainfall, which may occur during harvest, will drain off readily.

Some type of landforming is a common practice when growing rice. Landforming can be done either with a land plane or by water land leveling. The objective is to make the land as smooth and level as possible within the irrigation borders so that a uniform water depth is maintained. Water land leveling consists of flooding the field and moving the soil hydraulically from the high areas to the low areas within the border by using blades attached to farm tractors. Water land leveling decreases the number of irrigation borders needed and keeps the existing ones straight. When designed properly, landforming also improves drainage.

A good irrigation system is also needed. It should distribute water uniformly and in a timely manner. To insure adequate flow during critical or low flow periods, reservoirs are used in some places to supplement the water supply from canals. In some places, a tailwater recovery system is used in conjunction with reservoirs in order to reuse the water that is drained from the field.

Because rice is continuously flooded from the time the plant reaches a height of about 6 inches to shortly before harvesting, conventional ground equipment is not used to apply chemicals or fertilizer. Airplanes are used instead.

management of pastureland and hayland

Pasture is extensively used by livestock operations in the county. Dallisgrass and common bermudagrass are popular choices among livestock operations because they produce high forage yields, are adapted to a variety of soils, and can tolerate marginal drainage (fig. 8). These grasses are also desirable because they are suited to intensive as well as extensive pasture management.

Most operators have overseeded the pastures with white clover, which improves the quality of the forage for cattle. Pensacola bahiagrass and gordo bluestem are used in some pastures. They are warm season plants. Some pastures are overseeded with ryegrass, which furnishes grazing in winter.

The major management practices needed on pastureland are fertilization, weed control, rotation grazing, and drainage. The type of soil, the kind of plants, and the desired level of production determine the rate of fertilization.

A variety of broadleaf weeds, Macartney rose, and smutgrass are the most common weeds. Broadleaf weeds are controlled by good grazing management, chemicals, and mowing. Macartney rose can be controlled by chemicals. Smutgrass can be controlled by both chemicals and mowing.

Surface drainage is needed to remove excess surface water following rains. Drainage improves soil aeration, which in turn promotes better plant growth. The lack of adequate outlets prevents the installation of good drainage systems in some areas.

Wooded areas are used extensively for pasture in Brazoria County. Most of these areas have a dense canopy of trees and can only be managed for the native plants. The plant species vary greatly, according to the type of soil, the type of tree canopy, and the density of the canopy.

Management in these areas consists mainly of proper grazing. Most livestock operations do not use intensive management, which begins with opening the canopy to allow more sunlight to reach the ground.

Opening the canopy allows higher quality forage plants to grow. It also allows a thicker stand of plants to grow, thus increasing the forage production.

Most of the operators that want more intense management prefer to reduce the canopy to less than 25 percent. Most of these operators prefer to manage for common bermudagrass and dallisgrass rather than native plants once the canopy is less than 25 percent. They then have the option of using fertilizer to increase production further.

In Brazoria County, hay is made from improved bermudagrass, improved bluestems, forage sorghum, and native grasses. The areas of native grasses are commonly referred to as "native hay meadows." They support a mixture of grasses dominated by bluestems and paspalums. They are mowed several times a year. If

Figure 8.—Much of the improved pasture in Brazoria County is common bermudagrass and dallisgrass overseeded with clover. This pasture is in an area of Pledger clay.

properly managed, these areas can provide good quality, low-cost hay. However, because of the demand for land for other uses, the number of native hay meadows is slowly decreasing.

Management of native hay meadows consists mainly of mowing at the proper height and at the proper time to insure that plant vigor is maintained.

yields per acre

The average yields per acre that can be expected of the principal crops under a high level of management are shown in table 5. In any given year, yields may be higher or lower than those indicated in the table because of variations in rainfall and other climatic factors.

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

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

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

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

Crops other than those shown in table 5 are grown in the survey area, but estimated yields are not listed because the acreage of such crops is small. The local office of the Soil Conservation Service or of the Cooperative Extension Service can provide information about the management and productivity of the soils.

land capability classification

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

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

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

Class I soils have slight limitations that restrict their use.

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

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

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

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

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

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

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

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

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

Capability units are soil groups within a subclass. The soils in a capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-4 or IIIe-6.

The acreage of soils in each capability class and subclass is shown in table 6. The capability classification of each map unit is given in the section "Detailed soil map units."

rangeland

By Edward Seidensticker, range conservationist, Soil Conservation Service.

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

A *range site* is a distinctive kind of rangeland that produces a characteristic natural plant community that differs from natural plant communities on other range sites in kind, amount, and proportion of range plants. For example, the Salt Marsh range site can produce a large volume of cordgrass and associated plants, but the potential vegetation on the Blackland range site is bluestems and associated plants. In some places in the survey area, the characteristics of one range site may change to those of another because of changes in water depth or salinity. The relationship between soils and vegetation was established during this survey; thus, range sites generally can be determined directly from the soil map. Soil properties that affect moisture supply and plant nutrients have the greatest influence on the productivity of range plants. Soil reaction, salt content, and a seasonal high water table are also important.

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

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

The objective in range management is to control grazing so that the plants growing on a site are about the same in kind and amount as the potential natural plant community for that site. Such management generally results in the optimum production of plants,

reducing undesirable brush species, conserving water, and controlling water erosion and soil blowing. Sometimes, however, a range condition somewhat below the potential meets grazing needs, provides wildlife habitat, and protects soil and water resources.

According to the Conservation Needs Inventory (*17*), about 15 percent of the county is rangeland and 24 percent is pastureland. These areas along with idle riceland furnish grazing for more than 92,000 cattle. The cattle are mostly crosses of Brahma and English breeds. Rangeland does not furnish high-quality forage throughout the year. To improve their grazing and feeding programs, ranchers usually use some supplemental pasture, improved pasture, and feed supplements. In Brazoria County, marsh and prairie are the two distinct areas of rangeland. Each is made up of several range sites.

Marsh rangeland is the most extensive and productive. It covers an area of more than 120,000 acres bordering the Gulf of Mexico and the associated bays and bayous. The landforms consist of marshes, tidal areas, flood plains, coastal flats, and some dunes. Most of the soils are salty and wet most of the year. The vegetation consists of salt- and water-tolerant plants. Follet, Francitas, Harris, Ijam, Mustang, Narta, Surfside, Tatlum, Tracosa, Galveston, Velasco, and Veston soils are in this rangeland area.

Most plants are responsive to the salt levels in the soil and water, the soil texture, tidal inundation, and depth to the water table. The plant community in the marshes adapts itself to a specific combination of these conditions. Altering any of these conditions changes the plant community. The rancher can alter or preserve the balance of the plant community, but he needs to understand the effect of the change on the use of the marsh as wildlife habitat and the effect on the marine ecosystem.

The usual grazing period on the marsh rangeland is October to April. Except during severe storms or cold wet weather, cattle adapted to the marsh rangeland do well during this time of the year. The abundance of insects, particularly mosquitoes, make it necessary to move the cattle to other areas during the rest of the year.

Marsh rangeland is divided into seven range sites: Tidal Flat, Salt Flat, Salt Marsh, Saline Sand, Coastal Dune, Low Coastal Sand, and Salty Prairie range sites. These range sites correspond to map units 6, 7, 8, and 9 on the general soil map.

Prairie rangeland is of minor extent and is less important than the marsh rangeland. It occurs on the higher lying coastal plains and is mostly small scattered areas. Because most of the soils are suitable for crop production, most of the original grassland has been plowed and farmed at one time or another. Aris, Beaumont, Bernard, Edna, Kenney, Leton, Morey, and Lake Charles soils are in this rangeland area.

Prairie soils are low in content of available phosphorus, and the forage produced on them generally lacks enough protein for a balanced diet during fall and winter. Mineral supplements are needed. Insects are not a serious problem on the prairie rangeland.

Prairie rangeland is divided into seven range sites: Blackland, Loamy Prairie, Claypan Prairie, Lowland, Loamy Bottomland, Clayey Bottomland, and Sandy Prairie range sites. These range sites correspond to map units 1, 2, 3, 4, and 5 on the general soil map.

management practices

Good production of livestock and forage on rangeland is obtained primarily by managing the time of grazing and limiting the amount of growth removed. The green parts of plants manufacture food for growth and store part of it for regrowth and seed production. Good grazing management permits this process to take place.

Proper grazing use is practiced on both marsh and prairie rangeland. Its objective is to control grazing at an intensity which will maintain enough cover to protect the soil and maintain or improve the quality and quantity of desirable vegetation.

Deferred grazing is practiced on both the marsh rangeland and the prairie rangeland. It is the deferment or restriction of grazing until the better plants have completed most of their seasonal growth or have made seed. It is one way to help keep the desirable plants healthy and vigorous. Frequent use of deferred grazing permits plants that have been depleted to increase.

Fencing is used on both marsh rangeland and prairie rangeland to exclude livestock from areas that should be protected from grazing, confine livestock to an area, subdivide grazing land to permit use of a grazing system, and protect new seedlings or plantings from grazing.

Fencing must be carefully planned, particularly in the marsh. Fences should be planned in such a way that cattle have access to high ground during periods of high tides or rainfall. They should also be planned so that they fit into a good burning program. Because of the inherent salinity of the soils and water in the marsh, fresh water should be provided within each fenced area. The high maintenance cost for fences because of the corrosive salt spray is an important consideration.

A fresh water supply should be provided for livestock at various places in the grazing area so that grazing pressure is decreased around the watering place and grazing of the entire range is more uniform.

Water in the marshes is generally salty and most of the natural lakes and drains that overflow into the marshes are affected by salts. Therefore, wells, dug pits, and ditches are generally necessary. Pits dug in spoil banks along canals and walkways can also be used to trap and hold rainfall or fresh water draining from inland areas. In some areas where earthen pits are used as the water supply, cattle may be infested with liver flukes.

Shelters and windbreaks are common on marsh rangeland but are also important on the prairie rangeland. Structures providing protection for livestock

during severe cold wet winds in winter are needed where no natural protection is available for cattle.

Cattle walkways are used in marsh rangeland. They are small earthen bridges built into the marsh areas that are the least grazed. They are used to provide more uniform grazing, to provide bedding grounds for livestock, to facilitate ranching operations, and to make the marsh more accessible to livestock, ranchers, and hunters. In constructing walkways, the borrow pits should be staggered to prevent drainage of the marsh and to permit cattle to enter the grazing area on both sides of the embankment. The pit will hold some fresh water for livestock and wildlife use.

Prescribed burning is widely used on marsh rangeland but is seldom used on prairie rangeland. Livestock operators and wildlife managers burn off dense mature marsh vegetation in order to stimulate new succulent growth for both cattle and wildlife and to increase the availability of forage. However, vegetation can be severely damaged by burning during periods when the soil surface is dry because fire can reach the plant crowns and roots. Therefore, livestock operators and wildlife managers usually attempt to burn the same area every other year at a time when the ground surface is covered with water. Uniform grazing, walkways, pits, and canals all help in controlling any unplanned or accidental burns.

Control of water depth and salinity is a concern on marsh rangeland. The depth and salinity of water on marsh rangeland greatly influence the amount and kind of vegetation produced and increase the problem of range management. In many areas, salt water from the Gulf periodically intrudes into the marsh areas through rivers, bayous, and drainage and transportation canals. Marshes can be greatly damaged by prolonged coverage with water that has heavy concentrations of salt.

In periods of drought when the movement of fresh water into the Gulf is severely reduced, salt water sometimes flows up the canals. Heavy south winds also blow salt water inland for considerable distances, causing it to spread over marsh rangeland areas adjacent to drainageways. When these conditions exist, the salt water covering the marsh is not diluted by any fresh water. The relatively dry soils readily absorb this salty water, greatly increasing the level of salinity of the soil. Many marsh plants can tolerate this increased salinity for a short period, but are stunted or die if the condition exists for a prolonged period.

During periods of drought when shallow water areas in the marsh have a low water level and are subsequently flooded during high tide, the salt concentration is greatly increased. As the water evaporates, the salt concentration becomes so great that soils and vegetation are both damaged, and various forms of aquatic wildlife habitat may be destroyed.

Care needs to be taken on roads, ditches, dikes, and other structures that are built in the marshes. Structures should be built so as to insure a natural flow of water and to control and maintain the water levels. Some water control structures are now used to maintain optimum water depth and salinity.

woodland management and productivity

By Janet K. Baker, soil scientist, and Sandra Thorne-Brown, forester, Soil Conservation Service.

Most of the woodland in Brazoria County is west of the Brazos River. Smaller areas are along Chocolate Bayou, Hall's Bayou, and Clear Creek.

In the western part of the county, the tree population consists mainly of water oak, sugarberry, pecan, cedar elm, and ash. Trees along Chocolate Bayou include cedar elm, green ash, loblolly pine, and various oaks such as water oak, willow oak, post oak, cherrybark oak (a variety of southern red oak), and swamp chestnut oak. Along Hall's Bayou, the population is very diverse and includes some species typical of the East Texas Timberlands. Cherrybark oak and water oak are dominant; other species include American elm and cedar elm, sweetgum and blackgum, post oak and swamp chestnut oak, green ash and white ash, and loblolly pine. Along Clear Creek, loblolly pine, cherrybark oak, and water oak and willow oak are abundant. These wooded areas are valuable for limited livestock grazing, wildlife habitat, and recreation.

Although 35 percent of the county is wooded, there is virtually no commercial harvesting for several reasons. Timber yields and timber quality are comparatively lower than those of the East Texas Timberlands. There is a lack of easily accessible markets, and economic returns are presently greater if the land is used for urban development or cleared for pasture or cropland.

Lack of timber management has contributed to the poor form and low quality of local timber. However, under good management, most of the wooded areas are capable of yielding marketable timber. With the increasing demand for wood products, particularly firewood in this rapidly urbanizing area, the potential for commercial timber production should be considered in land use planning.

Table 7 can be used by woodland owners or forest managers in planning the use of soils for wood crops. Only those soils suitable for wood crops are listed. The table lists the ordination (woodland suitability) symbol for each soil. Soils assigned the same ordination symbol require the same general management and have about the same potential productivity.

The first part of the *ordination symbol*, a number, indicates the potential productivity of the soils for important trees. The number 1 indicates very high productivity; 2, high; 3, moderately high; 4, moderate; and 5, low. The second part of the symbol, a letter, indicates the major kind of soil limitation. The letter *w* indicates excessive water in or on the soil; *c*, clay in the upper part of the soil; *s*, sandy texture; *f*, high content of

coarse fragments in the soil profile; and *r*, steep slopes. The letter *o* indicates that limitations or restrictions are insignificant. If a soil has more than one limitation, the priority is as follows: x, w, t, d, c, s, f, and r.

In table 7, *slight, moderate,* and *severe* indicate the degree of the major soil limitations to be considered in management.

Ratings of the *erosion hazard* indicate the risk of loss of soil in well managed woodland. The risk is *slight* if the expected soil loss is small, *moderate* if measures are needed to control erosion during logging and road construction, and *severe* if intensive management or special equipment and methods are needed to prevent excessive loss of soil.

Ratings of *equipment limitation* reflect the characteristics and conditions of the soil that restrict use of the equipment generally needed in woodland management or harvesting. A rating of *slight* indicates that use of equipment is not limited to a particular kind of equipment or time of year; *moderate* indicates a short seasonal limitation or a need for some modification in management or in equipment; and *severe* indicates a seasonal limitation, a need for special equipment or management, or a hazard in the use of equipment.

Seedling mortality ratings indicate the degree to which the soil affects the mortality of tree seedlings. Plant competition is not considered in the ratings. The ratings apply to seedlings from good stock that are properly planted during a period of sufficient rainfall. A rating of *slight* indicates that the expected mortality is less than 25 percent; *moderate*, 25 to 50 percent; and *severe*, more than 50 percent.

Ratings of *plant competition* indicate the degree to which undesirable plants are expected to invade where there are openings in the tree canopy. The invading plants compete with native plants or planted seedlings. A rating of *slight* indicates little or no competition from other plants; *moderate* indicates that plant competition is expected to hinder the development of a fully stocked stand of desirable trees; *severe* indicates that plant competition is expected to prevent the establishment of a desirable stand unless the site is intensively prepared, weeded, or otherwise managed to control undesirable plants.

The *potential productivity* of merchantable or *common trees* on a soil is expressed as a *site index*. This index is the average height, in feet, that dominant and codominant trees of a given species attain in a specified number of years. The site index was determined at age 30 for eastern cottonwood, age 35 for American sycamore, and at age 50 for all other species. The site index applies to fully stocked, even-aged, unmanaged stands. Commonly grown trees are those that woodland managers generally favor in intermediate or improvement cuttings. They are selected on the basis of growth rate, quality, value, and marketability.

Trees to plant are those that are suited to the soils and to commercial wood production.

recreation

The soils of the survey area are rated in table 8 according to limitations that affect their suitability for recreation. The ratings are based on restrictive soil features, such as wetness, slope, and texture of the surface layer. Susceptibility to flooding is considered. Not considered in the ratings, but important in evaluating a site, are the location and accessibility of the area, the size and shape of the area and its scenic quality, vegetation, access to water, potential water impoundment sites, and access to public sewerlines. The capacity of the soil to absorb septic tank effluent and the ability of the soil to support vegetation are also important. Soils subject to flooding are limited for recreation use by the duration and intensity of flooding and the season when flooding occurs. In planning recreation facilities, onsite assessment of the height, duration, intensity, and frequency of flooding is essential.

In table 8, the degree of soil limitation is expressed as slight, moderate, or severe. *Slight* means that soil properties are generally favorable and that limitations are minor and easily overcome. *Moderate* means that limitations can be overcome or alleviated by planning, design, or special maintenance. *Severe* means that soil properties are unfavorable and that limitations can be offset only by costly soil reclamation, special design, intensive maintenance, limited use, or by a combination of these measures.

The information in table 8 can be supplemented by other information in this survey, for example, interpretations for septic tank absorption fields in table 12 and interpretations for dwellings without basements and for local roads and streets in table 11.

Camp areas require site preparation such as shaping and leveling the tent and parking areas, stabilizing roads and intensively used areas, and installing sanitary facilities and utility lines. Camp areas are subject to heavy foot traffic and some vehicular traffic. The best soils have mild slopes and are not wet or subject to flooding during the period of use. The surface absorbs rainfall readily but remains firm and is not dusty when dry. Strong slopes can greatly increase the cost of constructing campsites.

Picnic areas are subject to heavy foot traffic. Most vehicular traffic is confined to access roads and parking areas. The best soils for picnic areas are firm when wet, are not dusty when dry, are not subject to flooding during the period of use, and do not have slopes that increase the cost of shaping sites or of building access roads and parking areas.

Playgrounds require soils that can withstand intensive foot traffic. The best soils are almost level and are not wet or subject to flooding during the season of use. The surface is firm after rains and is not dusty when dry. If grading is needed, the depth of the soil over a hardpan should be considered.

Paths and trails for hiking, horseback riding, and bicycling should require little or no cutting and filling. The

best soils are not wet, are firm after rains, are not dusty when dry, and are not subject to flooding more than once a year during the period of use. They have moderate slopes.

Golf fairways are subject to heavy foot traffic and some light vehicular traffic. Cutting or filling may be required. The best soils for use as golf fairways are firm when wet, are not dusty when dry, and are not subject to prolonged flooding during the period of use. They have moderate slopes. The suitability of the soil for tees or greens is not considered in rating the soils.

wildlife habitat

By Jim E. Neaville, assistant refuge manager, U.S. Fish and Wildlife Service.

Wildlife is an important source of recreation and income in Brazoria County. Most of the land supporting wildlife populations is leased for hunting. Waterfowl hunting and saltwater fishing rank as major sporting events engaged in by both resident and nonresident sportsmen.

A wide variety of wildlife exists in the county because there is a great diversity of soil types and, therefore, vegetation. Important game species include ducks, geese, white-tailed deer, bobwhite quail, mourning doves, and tree squirrels. Other game species, such as coots, snipe, rails, and sandhill cranes, are present but are seldom hunted. Furbearing animals include bobcat, raccoon, nutria, mink, muskrat, river otter, beaver, coyote, fox, skunk, and opossum. Some occur only in limited numbers. Raptorial birds, song birds, marsh birds, and water birds are prevalent. Saltmarsh mosquito, deer flies, gnats, and other insects are often very abundant because of the marine climate. Fish, reptiles, and amphibians are also abundant, primarily because of the vast amount of water and variety of wetland habitat. Important "baywater" fish, for example, speckled trout, redfish, and southern flounder, are always in demand by the sports fisherman. Saltmarsh water snake, water moccasin, turtles, and alligators are among the common reptiles. Frogs, toads, and other amphibians are well distributed throughout the county.

In table 9, the soils in the survey area are rated according to their potential for providing habitat for various kinds of wildlife. This information can be used in planning parks, wildlife refuges, nature study areas, and other developments for wildlife; in selecting soils that are suitable for establishing, improving, or maintaining specific elements of wildlife habitat; and in determining the intensity of management needed for each element of the habitat.

The potential of the soil is rated good, fair, poor, or very poor. A rating of *good* indicates that the element or kind of habitat is easily established, improved, or maintained. Few or no limitations affect management, and satisfactory results can be expected. A rating of *fair* indicates that the element or kind of habitat can be established, improved, or maintained in most places. Moderately intensive management is required for satisfactory results. A rating of *poor* indicates that limitations are severe for the designated element or kind of habitat. Habitat can be created, improved, or maintained in most places, but management is difficult and must be intensive. A rating of *very poor* indicates that restrictions for the element or kind of habitat are very severe and that unsatisfactory results can be expected. Creating, improving, or maintaining habitat is impractical or impossible.

The elements of wildlife habitat are described in the following paragraphs.

Grain and seed crops are domestic grains and seed-producing herbaceous plants. Soil properties and features that affect the growth of grain and seed crops are depth of the root zone, texture of the surface layer, available water capacity, wetness, slope, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of grain and seed crops are corn, Japanese millet, small-seeded sunflower, browntop millet, grain sorghum, and reseeding soybeans.

Grasses and legumes are domestic perennial grasses and herbaceous legumes. Soil properties and features that affect the growth of grasses and legumes are depth of the root zone, texture of the surface layer, available water capacity, wetness, flood hazard, and slope. Soil temperature and soil moisture are also considerations. Examples are gulf ryegrass, oats, tall fescue, bermudagrass, lespedezas, clover, and winter peas.

Wild herbaceous plants are native or naturally established grasses and forbs, including weeds. Soil properties and features that affect the growth of these plants are depth of the root zone, texture of the surface layer, available water capacity, wetness, and flood hazard. Soil temperature and soil moisture are also considerations. Examples of wild herbaceous plants are bluestem, hard seeded paspalum and panicum grasses, sunflower, wooly croton, black medic, sweetclover, snow-on-the-prairie, and western ragweed.

Hardwood trees and woody understory produce nuts or other fruit, buds, catkins, twigs, bark, and foliage. Soil properties and features that affect the growth of hardwood trees and shrubs are depth of the root zone, the available water capacity, and wetness. Examples of these plants are oak, mulberry, pecan, black walnut, elm, hackberry, osageorange, eastern persimmon, and hawthorn.

Shrubs are bushy woody plants that produce fruit, buds, twigs, bark, and foliage. Soil properties and features that affect the growth of shrubs are depth of the root zone, available water capacity, salinity, and soil moisture. Examples of shrubs are yaupon, coralberry, arrowwood viburnum, possumhaw, American elder, American beautyberry, grapes, greenbrier, Carolina snailseed, honeysuckle, dewberry, and blackberry.

Wetland plants are annual and perennial wild herbaceous plants that grow on moist or wet sites.

Submerged or floating aquatic plants are excluded. Soil properties and features affecting wetland plants are texture of the surface layer, wetness, reaction, salinity, and slope. Examples of wetland plants are wild millet, cordgrass, sprangletop, smartweed, bulrush, spikesedge, burhead, Bacopa, and arrowhead.

Shallow water areas have an average depth of less than 5 feet. Some are naturally wet areas. Others are created by dams, levees, or other water-control structures. Soil properties and features affecting shallow water areas are wetness, slope, and permeability. Examples of shallow water areas are marshes, waterfowl feeding areas, and ponds. Examples of brackish and fresh water plants are widgeongrass, dwarf spikerush, naiad, muskgrass, burhead, pondweeds, watershield, American lotus, and banana waterlily.

The habitat for various kinds of wildlife is described in the following paragraphs.

Habitat for openland wildlife consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. These areas produce grain and seed crops, grasses and legumes, and wild herbaceous plants.

Both irrigated and nonirrigated agricultural land are openland habitat. Rice is the most important irrigated crop used by waterfowl, followed by nonirrigated crops such as grain sorghum, soybeans, hay, and minor crops such as cotton, field corn, sugar cane, and various truck crops. Many of these crops supply food for seed-eating birds such as doves, quail, and redwing blackbirds; insectivorous birds such as the nighthawk, eastern kingbird, and sparrow hawk; and white-tailed deer, raccoons, rabbits, and many other wildlife species.

Improved pastures of bermudagrass, dallisgrass, pensacola bahiagrass, and tall fescue, when allowed to set seed, furnish bobwhite quail and doves additional sources of food. Many of the bermudagrass and tall fescue pastures are overseeded to Louisiana S-1 white clover. These overseeding practices not only improve the forage variety and quality for livestock but also for rabbits and deer. Skunks also frequent pastures at night, feeding largely on adult and larval insects, frogs, toads, spiders, mice, and bird eggs.

If pastures are in large open areas, depredation by waterfowl may often become severe.

Many pastures, when they are in a deteriorated condition, become infested with noxious plants such as rattail smutgrass, carpetgrass, annual sumpweed, bitter sneezeweed, snow-on-the-prairie, western ragweed, prickly sida, and a few undesirable species of trees and brush such as Chinese tallow and Macartney rose. These conditions improve habitat quality for wildlife, allowing doves, quail, and other wildlife populations to increase as more food and cover become available.

Habitat for woodland wildlife consists of areas of deciduous plants or coniferous plants, or both, and associated grasses, legumes, and wild herbaceous plants. The wooded areas are mostly along the rivers and major drainage corridors where the rich bottom land soils such as Asa and Pledger soils are farmed. The highest populations of white-tailed deer, feral hogs, and tree squirrels are in the wooded areas along the Brazos River. Many other wildlife species such as opossum, owls, crows, cardinals, woodpeckers, wild bees, and armadillos also occupy these areas. Snakes such as the poisonous water moccasin, coral snake, and broad-banded copperhead favor this habitat type if suitable conditions are present. The endangered southern bald eagle nests in the river bottom woodlands; two of the seven active nests found in Texas in 1978 were in Brazoria County.

Habitat for wetland wildlife consists of open brackish water marshes and shallow water bays (*15*). Most of this habitat is managed for wildlife as the inherent characteristics of the soils preclude most uses other than rangeland. Perhaps the most important function of this habitat is that it represents the food pantry for the oceans. This natural resource base is the cornerstone of a very important commercial and sport fishing industry based on the harvest and sale of seafood. Millions of tons of penaid shrimp, portunid crabs, finfish, oysters, clams, and other shellfish and other marine life forms are dependent on the biological richness afforded by these estuaries.

This habitat type also serves as the winter home for thousands of migratory waterfowl. Hundreds of thousands of fall- and spring-transient shore birds, gulls, terns, pelicans, rails, herons, egrets, ibis, gallinules, grebes, cormorants, cranes, curlews, plover, and snipe, songbirds, and many other birds benefit from the existence of these coastal ecosystems. Many of these birds pass through the county enroute to, and returning from, Central and South America. The endangered Arctic peregrine falcons are also seen along the beaches and barrier islands each year during their migration.

Habitat for rangeland wildlife consists of areas of shrubs and wild herbaceous plants. It is on the coastal prairie soils that support stands of native grasses and other related plants. The few fertile prairies remaining in the county are on a few of the larger ranches and are used as native hay meadow or rangeland. These prairies are being steadily lost.

Wildlife species of the prairies include endangered Attwater prairie chicken, coyote, bobwhite quail, doves, eastern meadowlark, horned lark, and other songbirds; rodents such as rats and mice; reptiles such as the ornate box turtle; and various hawks, owls, and vultures. Closely cropped areas on the prairie ridges and around livestock watering and bedding grounds are often excellent sites for Canada geese, sandhill cranes, and prairie chickens. The Canada goose feeds primarily on winter annuals, such as California burclover, black medic, annual bluegrass, Carolina geranium, chickweed, and filaree. The lesser sandhill cranes are more selective, feeding only in areas supporting stands of purple peatleaf, various nutgrasses, and related bulb-

producing plants. Prairie chickens use these same overgrazed areas as "booming areas" each spring. Use of the prairies by bobwhite quail and mourning dove often increases as the result of prescribed burns, heavy grazing pressure, or mechanical disturbance. Use by many other species, such as white-tailed deer, feral hogs, and skunks, increases if different habitat types, such as woodland, are nearby. The poisonous western diamondback rattlesnake, which prefers the prairie areas, is in significant numbers in the county. Because fire has been abandoned as a management practice and overgrazing has occurred, encroachment by various trees has reduced the overall acreage of prairie habitat by several thousand acres.

concerns in habitat management

Most wildlife species require various cover types and foods and have other special needs. They often require a certain degree of interspersion of these factors.

Cover is quite variable—it may consist of plants, rocks, soil, or other living or nonliving things affording wildlife shelter, concealment, or protection. Many wildlife species require cover for courtship, nesting, brooding, roosting, and escape and for protection from wind, rain, and snow and from other types of inclement weather. Cover is not necessarily dense vegetation; for example, loafing cover for diving ducks may be a large body of open water, or courtship cover for the Attwater prairie chicken may be a sparsely vegetated area.

Food includes water, fruits, berries, seeds, leaves, twigs buds, and roots, and insects and other animal life.

Special needs are characteristic of many wildlife species. For example, aquatic life forms require a certain level of dissolved oxygen. Many birds require grit. Large mammals such as white-tailed deer often require supplemental minerals such as salt, vitamins, or other dietary components.

Interspersion is generally related to increasing the "edge effect" and is of utmost importance in that all elements needed by a species must occur within a limited area often referred to as the "home range" of the animal.

For successful habitat management, a wildlife manager should know the essential habitat needs of a certain species or group of similar species, recognize the limiting factor(s) or deficiencies within the area, and select the proper habitat factors to improve conditions. By determining the types of soils and becoming informed as to their properties, potentials, and limitations, the manager can select adapted plants to foster healthy wildlife populations on a given farm or ranch.

management of marsh habitat

The wetlands and rice fields of Brazoria County are well known for their abundance of migratory waterfowl, in addition to two resident species of ducks—the mottled duck and wood duck. These areas play an important role in providing essential habitat elements to over twenty species of duck and six species and subspecies of geese.

The dabbling ducks, as a group, are the most sought after game species in the county. They tend to favor the fresher and slightly brackish water marshes for feeding, resting, and other purposes. Most of their preferred foods are the seeds of plants which occur in the early stages of plant succession—the subdominant plants. These plants include grasses, sedges, and various forbs. Other plant parts, such as the roots, tubers, stems, and leaves of many emergent and submerged plants, are also important in their diet. Shallow flooded rice fields offer ducks excellent feeding areas because waste grain, weed seeds, and red rice shattered during harvesting are available. A water depth of 1 inch to 6 inches represents ideal feeding habitat in both marsh and rice fields for most dabblers, such as northern mallards, pintails, teal, and mottled duck. A range of 12 to 15 inches approaches the maximum feeding depth that these species will tolerate.

The most abundant species of geese in Brazoria County is snow geese, represented by both the white and blue. Canada geese are present in significant but declining numbers, the majority being the Richardson's Canada goose followed by the lesser Canada goose. White-fronted geese are also present. Most dark geese such as the Canadas and white-fronts prefer the rice field habitat to the marshes.

Snow geese are essentially grubbers, or root and tuber eaters. Preferred foods are found in the fresher portions of the brackish marshes supporting stands of Olney bulrush and saltmarsh bulrush. These two plants are subdominant, struggling against the climax dominant marshhay cordgrass. When marshhay cordgrass marshes are correctly burned, snow geese feed on the succulent green regrowth, young sprouts, and various underground plant parts. They prefer to feed in large open areas where vegetation is only a few inches tall. Shallow flood conditions create optimum feeding sites. Often, favorite feeding sites used by geese become completely devoid of all standing vegetation. These exploited areas are called "eatouts." Depending on weather and related conditions, these areas will become revegetated with many annuals, creating high-quality feeding areas for the following year. Examples of these "successional" annuals include spikesedges, sprangletops, wild millet, erect burhead, and Colorado river hemp.

In dry years, when the preferred food plants are in short supply, the geese feed on seashore saltgrass, a more salt-tolerant species. Winter pastures planted for livestock receive heavy damage by large flocks of both

light and dark geese when quality green browse is in short supply. These depredation problems are reduced if rotational marsh burns are used throughout the wintering period, especially during January and February. The preferred roosting habitat of snow geese is mainly the larger shallow marsh flats or fresh water impoundments.

Prescribed marsh burning—the use of fire in the marshes can have both good and bad effects. When the good exceed the bad, burning can be a valuable waterfowl management tool for maintaining or improving desirable vegetation. Prescription burns are used to accomplish the following objectives with minimal adverse effects: (1) Restore or improve habitat for waterfowl by reversing plant succession trends to favor the emergence and growth of a variety of subdominant plants; (2) improve production of food for waterfowl and provide lush green browse; (3) increase availability and use of food; (4) remove excessive grass roughs from areas which cannot practically be reduced by grazing or other means in order to reduce the hazard of wild fires; (5) suppress the encroachment or growth of unwanted bigleaf sumpweed, eastern baccharis, and sesbania; and (6) improve grazing distribution and facilitate marsh travel. Many other minor objectives that are often beneficial to waterfowl are achieved when proper grazing is used in conjunction with planned burning and water control.

The time of burning is important. Controlled burns to benefit snow geese should be conducted on selected areas of marsh where standing water exists one to three weeks prior to the initial mass migration of geese. A good burn removes the tall rank vegetation and makes roots, tubers, and regrowth readily available.

The normal burning season begins in October in wet years and ends in mid-February. Most wildlife managers recommend progressive burns spaced about one month apart. Under this system, large flocks of geese are more likely to rotate their grazing areas, reducing the probability of severe damage. The benefits of a good burn usually last two to three years if conditions are normal. Prolonged use by geese, especially near marsh potholes or where beds of bulrushes are unearthed, improves the habitat for a variety of ducks. Geese expose buried seeds and stir up aquatic grubs, which are fed upon by ducks such as the pintail, gadwall, baldpate, and green-winged teal.

Early and late burns should be rotated on a unit basis, as much as possible; for example, areas burned in October of one year should be burned during a later month of the next burn cycle year. In this way, plants benefited by late or early season burning will receive equal consideration in chances of germination, emergence, and growth, resulting in a productive waterfowl area.

Water level management—Water management is another habitat management tool in marshlands. Maintaining proper water levels is very important, as the depth and changes in water levels affect waterfowl diversity, use, and abundance. Low water tidal weirs, earthen plugs, and flashboard risers are widely used to hold water for waterfowl. Structures such as the weirs serve several useful purposes. They reduce water level fluctuations and rate of tidal exchange, prevent drastic salinity changes, minimize water turbidity, reduce water temperature fluctuations, and increase the area and duration of flooding; all of which are essential to the production of vegetation attractive to waterfowl.

Earthen plugs and flashboard risers often have similar water level stabilization effects as the weirs on semi-impounded areas; all can be used to benefit waterfowl and related wetland wildlife. Prescribed burning may be employed to a finer degree where the use of these structures makes intensive water control possible.

Proper grazing use—Carefully controlled cool season marsh grazing also benefits waterfowl. Proper grazing opens up dense stands of grasses, sedges, and rushes, which increases the availability of food for waterfowl, and acts as a stimulating agent in encouraging plant retrogression. Achieving varying degrees of retrogressive plant succession is the fundamental goal in marsh management for ducks and geese. The retrogressing of the plant community to a vegetative composition of 30 percent or less marshhay cordgrass and 70 percent mixed rushes and related plants is an optimum goal.

Moderate grazing following a satisfactory burn often increases the benefits of burning by prolonging the time tender green sprouts are available as goose browse. Grazing is also a more dependable method of management because excessive rainfall and poor marsh drainage often prevent scheduled burning, sometimes for several growing seasons in succession. The churning effect of the hooves of cattle as they walk on the soft marsh floor unearths many seeds buried too deep in the organic duff to germinate. The presence of cattle induces the emergence of many plants which may not become fixed in the plant community until some type of disturbance affords the opportunity for further promotion of sub-climax species.

other management practices

Land used for cropland, pastureland, or woodland also furnishes quality habitat for many kinds of wildlife when practices such as the following examples are effectively applied: planned crop rotation, crop residue management, fallow spring disking of idle field borders, and leaving small areas of unharvested grain next to good cover.

Conservation practices such as carefully planned mechanical mowing, deferred grazing, prescribed grazing systems, selective brush management, planned pollination, and maintaining shrub field borders are often beneficial to wildlife on improved pastureland.

Clearing and thinning selectively; planting winter annuals on pipeline rights-of-way and firebreaks and in

open areas; protecting den trees and quality mast-producing trees; and using prescribed burning to insure growth of low growing shrubs, and vines are a few of many management practices which are often employed in woodland areas.

Some practices are harmful to wildlife.Those most often include indiscriminate burning and use of chemicals for killing weeds and insects, heavy grazing, complete clean mowing early in the growing season, clean fall plowing, clear cutting of timber, draining of wetland depressions, and removal of all den- and mast-producing trees.

Technical assistance in the planning or application of any of these wildlife management practices can be obtained from the Soil Conservation Service, the Texas Agricultural Extension Service, and the Texas Parks and Wildlife Department.

landscaping

By Sandra Thorne-Brown, forester, and Janet K. Baker, soil scientist, Soil Conservation Service. Bill Basham, director, Houston Arboretum, and Bill Adams, Harris County extension horticulturist, helped prepare table 10.

A knowledge of soils is important in landscaping. If the plants are suited to the soils, they will thrive, and costly replacements or extensive soil additives will not be necessary.

Table 10 lists the soils in the county that are suited to landscaping and some of the suitable native and adapted ornamental shrubs and trees. There is no clearcut distinction between trees and shrubs. Some plants, such as willows, may grow either as trees or shrubs. For the purpose of this survey, a shrub is lower than a tree and generally produces several stems from the base rather than a single trunk. Many more plants than those shown in the table are well suited to each soil. You can obtain additional information on adapted plants by consulting a nursery and by observing the plants doing well on similar soils.

Another factor to consider in landscaping is proximity to the coast. Because of the salt-laden winds and breezes, it is hard to establish some kinds of trees and shrubs within about 3 miles of the coastline. Soils that are ideally suited to landscaping have a deep root zone; a loamy texture; a balanced supply of plant nutrients; favorable pH; plenty of organic matter; a medium to high available water capacity; good drainage; and granular structure that allows free movement of water roots. Many soils in Brazoria County have one or more features that make them less than ideally suited to landscaping.

The degree of acidity or alkalinity of the soil is important. Most plants do well in neutral to slightly acid soil. Azaleas and hollies prefer acid soil. Plants growing in alkaline soil are subject to chlorosis, yellowing of the leaves, unless they are adapted to an alkaline soil. See table 16, for the pH range of each soil.

Many of the soils in the county are clayey and have drainage problems. These problems can be overcome by planting species that can tolerate or will thrive in tight wet soils, by constructing drainage ditches, and by building up planting beds.

Adding organic matter improves the soil for planting. Not only does organic matter make the soil more fertile but it also improves the soil aeration. Organic matter in the form of compost, pine bark, decomposed wood chips, manure, or rice hulls will improve the tilth of both clayey and sandy soils. For clayey soil, the addition of loamy topsoil, perlite, calcined clay, vermiculite, or gypsum will also improve aeration and drainage. If a soil is too acid, it can be neutralized with lime, bone meal, or wood ashes. If an acid soil is desired, sulfur or commercially available soil acidifiers can be incorporated.

Native plants should be considered during urban development. Leaving as much of the desirable natural vegetation as possible will decrease the cost of landscaping because less topsoil, fertilizer, and organic material will be needed. Consider leaving selected trees and shrubs in groups to be part of the landscape design. Many trees around construction sites are killed by excavation, grade changes, compacted soil, or too much pavement over tree roots. The local Soil Conservation Service office, Texas Agricultural Extension Service, Texas State Forest Service, and private consultants on urban forestry can provide guidelines for protecting and selecting vegetation to be left during construction.

engineering

Nelton Salch, civil engineer, Soil Conservation Service, helped prepare this section.

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

Information in this section is intended for land use planning, for evaluating land use alternatives, and for planning site investigations prior to design and construction. The information, however, has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet. Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

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

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were

not considered in preparing the information in this section. Local ordinances and regulations need to be considered in planning, in site selection, and in design.

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

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

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

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

building site development

Table 11 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, local roads and streets, and lawns and landscaping. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where the soil limitations are severe.

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

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

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

Lawns and landscaping require soils on which turf and ornamental trees and shrubs can be established and maintained. The ratings are based on soil properties, site features, and observed performance of the soils. Soil reaction, a high water table, the available water capacity in the upper 40 inches, and the content of salts, sodium, and sulfidic materials affect plant growth. Flooding, wetness, slope, and the amount of sand, clay, or organic matter in the surface layer affect trafficability after vegetation is established.

sanitary facilities

Table 12 shows the degree and the kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features

are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

Table 12 also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

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

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

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

Table 12 gives ratings for the natural soil that makes up the lagoon floor. The surface layer and, generally, 1 or 2 feet of soil material below the surface layer are excavated to provide material for the embankments. The ratings are based on soil properties, site features, and observed performance of the soils. Considered in the ratings are slope, permeability, a high water table, flooding, and content of organic matter.

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

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

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

The ratings in table 12 are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, slope, and flooding affect both types of landfill. Texture, highly organic layers, soil reaction, and content of salts and sodium affect trench type landfills. Unless otherwise stated, the ratings apply only to that part of the soil within a depth of about 6 feet. For deeper trenches, a limitation rated slight or moderate may not be valid. Onsite investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained offsite, transported to the landfill, and spread over the waste.

Soil texture, wetness, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to soil blowing.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over a water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

construction materials

Table 13 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good, fair,* or *poor* as a source of roadfill and topsoil. They are rated as a probable or improbable source of sand and gravel. The ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is evaluated to a depth of 5 or 6 feet.

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet high and less exacting in design than higher embankments.

The ratings are for the soil material below the surface layer to a depth of 5 or 6 feet. It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

The ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. The ease of excavation is affected by a high water table and slope. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel or both. They have at least 5 feet of suitable material, low shrink-swell potential, and slopes of 15 percent or less. Depth to the water table is more than 3 feet. Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have moderate shrink-swell potential or slopes of 15 to 25 percent. Depth to the water table is 1 to 3 feet. Soils rated *poor* have a plasticity index of more than 10, a high shrink-swell potential, or slopes of more than 25 percent. They are wet, and the depth to the water table is less than 1 foot. They may have layers of suitable material, but the material is less than 3 feet thick.

Sand and gravel are natural aggregates suitable for commercial use with a minimum of processing. Sand and gravel are used in many kinds of construction. Specifications for each use vary widely. In table 13, only the probability of finding material in suitable quantity is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil) and the thickness of suitable material. Acidity and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a probable source has a layer of clean sand or gravel or a layer of sand or gravel that is up to 12 percent silty fines. This material must be at least 3 feet thick. All other soils are rated as an improbable source.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches of a soil is evaluated for use as topsoil. Also evaluated is the reclamation potential of the borrow area.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. The ease of excavating, loading, and spreading is affected by slope, a water table, soil texture, and thickness of suitable material. Reclamation of the borrow area is affected by slope, a water table, and toxic material.

Soils rated *good* have friable loamy material to a depth of at least 40 inches. They have slopes of less than 8 percent. They are low in content of soluble salts, are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, loamy soils that have a relatively high content of clay, soils that have only 20 to 40 inches of suitable material, soils that have an appreciable amount of soluble salts, or soils that have slopes of 8 to 15 percent. The soils are not so wet that excavation is difficult.

Soils rated *poor* are very sandy or clayey, have less than 20 inches of suitable material, have a large amount of soluble salts, have slopes of more than 15 percent, or have a seasonal water table at or near the surface.

The surface layer of most soils is generally preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

water management

Table 14 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increase in construction costs, and possibly increased maintenance are required.

This table also gives for each soil the restrictive features that affect drainage, irrigation, and grassed waterways.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches. The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet high, constructed to impound water or to protect land against overflow. In this table, the soils are rated as a source of material for embankment fill. The ratings apply to the soil material below the surface layer to a depth of about 5

feet. It is assumed that soil layers will be uniformly mixed and compacted during construction.

The ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect performance and safety of the embankment. Generally, deeper onsite investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet of suitable material and a high content of organic matter or salts or sodium. A high water table affects the amount of usable material. It also affects trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground-water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff and embankment ponds that impound water 3 feet or more above the original surface. Excavated ponds are affected by depth to a permanent water table, permeability of the aquifer, and quality of the water as inferred from the salinity of the soil.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on depths to layers that affect the rate of water movement; permeability; depth to a high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; and subsidence of organic layers. Excavating and grading and the stability of ditchbanks are affected by slope and the hazard of cutbanks caving. The productivity of the soil after drainage is adversely affected by extreme acidity or by toxic substances in the root zone, such as salts, sodium, or sulfur. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. The design and management of an irrigation system are affected by depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope. The performance of a system is affected by the depth of the root zone, the amount of salts or sodium, and soil reaction.

Grassed waterways are natural or constructed channels, generally broad and shallow, that conduct surface water to outlets at a nonerosive velocity. Wetness and slope affect the construction of grassed waterways. Low available water capacity, restricted rooting depth, toxic substances such as salts or sodium, and restricted permeability adversely affect the growth and maintenance of the grass after construction.

soil properties

Data relating to soil properties are collected during the course of the soil survey. The data and the estimates of soil and water features, listed in tables, are explained on the following pages.

Soil properties are determined by field examination of the soils and by laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and to delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in table 18.

Estimates of soil properties are based on field examinations, on laboratory tests of samples from the survey area, and on laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classifications, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

engineering index properties

Table 15 gives estimates of the engineering classification and of the range of index properties for the major layers of each soil in the survey area. Most soils have layers of contrasting properties within the upper 5 or 6 feet.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under "Soil series and their morphology."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If a soil contains particles coarser than sand, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the Glossary.

Classification of the soils is determined according to the Unified soil classification system (*2*) and the system adopted by the American Association of State Highway and Transportation Officials (*1*).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as Pt. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

If laboratory data are available, the A-1, A-2, and A-7 groups are further classified as A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, or A-7-6. As an additional refinement, the suitability of a soil as subgrade material can be indicated by a group index number. Group index numbers range from 0 for the best subgrade material to 20 or higher for the poorest. The AASHTO classification for soils tested, with group index numbers in parentheses, is given in table 18.

Rock fragments larger than 3 inches in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the survey area and in nearby areas and on estimates made in the field.

Liquid limit and *plasticity index* (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the survey area or from nearby areas and on field examination.

physical and chemical properties

Table 16 shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the survey area. The estimates are based on field observations and on test data for these and similar soils.

Clay as a soil separate consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and to retain moisture. They influence shrink-swell potential, permeability, and plasticity, the ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems, septic tank absorption fields, and construction where the rate of water movement under saturated conditions affects behavior.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on many field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, in evaluating soil amendments for fertility and stabilization, and in determining the risk of corrosion.

Salinity is a measure of soluble salts in the soil at saturation. It is expressed as the electrical conductivity of the saturation extract, in millimhos per centimeter at 25 degrees C. Estimates are based on field and laboratory measurements at representative sites of nonirrigated soils. The salinity of irrigated soils is affected by the quality of the irrigation water and by the frequency of water application. Hence, the salinity of soils in individual fields can differ greatly from the value given in the table. Salinity affects the suitability of a soil for crop production, the stability of soil if used as construction material, and the potential of the soil to corrode metal and concrete.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed.

Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The change is based on the soil fraction less than 2 millimeters in diameter. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, greater than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion by water. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average annual rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, sand, and organic matter (up to 4 percent) and on soil structure and permeability. Values of K range from 0.05 to 0.69. The higher the value the more susceptible the soil is to sheet and rill erosion by water.

Erosion factor T is an estimate of the maximum average annual rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Organic matter is the plant and animal residue in the soil at various stages of decomposition.

In table 16, the estimated content of organic matter of the plow layer is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

The content of organic matter of a soil can be maintained or increased by returning crop residue to the soil. Organic matter affects the available water capacity, infiltration rate, and tilth. It is a source of nitrogen and other nutrients for crops.

soil and water features

Table 17 gives estimates of various soil and water features. The estimates are used in land use planning that involves engineering considerations.

Hydrologic soil groups are used to estimate runoff from precipitation. Soils not protected by vegetation are assigned to one of four groups. They are grouped according to the intake of water when the soils are thoroughly wet and receive precipitation from long-duration storms.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist mainly of deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well drained or well drained soils that have moderately fine texture to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water or soils of moderately fine texture or fine texture. These soils have a slow rate of water transmission.

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

Flooding, the temporary inundation of an area, is caused by overflowing streams, by runoff from adjacent slopes, or by tides. Shallow water standing for short periods after rainfall and water in swamps and marshes are not considered flooding.

Nearly all the soils in the county are subject to flooding under certain storm conditions. The nearly level topography and the lack of channels or outlets combined with high intensity rainfall cause water to accumulate and cause flooding of short duration, usually a few hours to a few days. The frequency and duration cannot be predicted accurately on these soils. The flooding is largely determined by the watershed above the site, land use above the site, the position of the site in the watershed, the elevation of the site above sea level, and the intensity of rainfall.

Table 17 gives the frequency and duration of flooding and the time of year when flooding is most likely.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, common, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions; *common* that it is likely under normal conditions; *occasional* that it occurs on an average of once or less in 2 years; and *frequent* that it occurs on an average of more than once in 2 years. Duration is expressed as *very brief* if less than 2 days, *brief* if 2 to 7 days, and *long* if more than 7 days. Probable dates are expressed in months; November-May, for example, means that flooding can occur during the period November through May.

The information is based on evidence in the soil profile, namely thin strata of sand, silt, or clay deposited by floodwater and irregular decrease in organic matter content with increasing depth.

Also considered are local information about the extent and levels of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The depth to a seasonal high water table applies to undrained soils. The estimates are based mainly on the evidence of a saturated zone, namely grayish colors or mottles in the soil. Indicated in table 17 are the depth to the seasonal high water table; the kind of water table—that is, perched, artesian, or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than 1 month is not indicated in table 17.

An apparent water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil. An artesian water table is under hydrostatic head, generally beneath an impermeable layer. When this layer is penetrated, the water level rises in an uncased borehole. A perched water table is water standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Only saturated zones within a depth of about 6 feet are indicated. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. The first numeral in the range indicates how high the water rises above the surface. The second numeral indicates the depth below the surface.

Subsidence is the settlement of organic soils or of saturated mineral soils of very low density. Subsidence results from either dessication and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. Table 17 shows the expected initial subsidence, which usually is a result of drainage, and annual subsidence, which usually is a result of oxidation.

Not shown in the table is subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table.

Risk of corrosion pertains to potential soil-induced

electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors creates a severe corrosion environment. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

engineering index test data

Table 18 shows laboratory test data for several pedons sampled at carefully selected sites in the survey area. The pedons are typical of the series and are described in the section "Soil series and their morphology." The soil samples were tested by the Texas State Department of Highways and Public Transportation.

The testing methods generally are those of the American Association of State Highway and Transportation Officials (AASHTO) or the American Society for Testing and Materials (ASTM).

The tests and methods are: AASHTO classification—M 145 (AASHTO), D 3282 (ASTM); Unified classification—D 2487 (ASTM); Mechanical analysis—T 88 (AASHTO), D 2217 (ASTM); Liquid limit—T 89 (AASHTO), D 423 (ASTM); Plasticity index—T 90 (AASHTO), D 424 (ASTM); Specific gravity (Particle index)—T100 (AASHTO), D 653 (ASTM); Shrinkage—T 92 (AASHTO), D 427 (ASTM).

classification of the soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*21*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field or inferred from those observations or from laboratory measurements. In table 19, the soils of the survey area are classified according to the system. The categories are defined in the following paragraphs.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Aquent (*Aqu*, meaning water, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Haplaquents (*Hapl*, meaning minimal horizonation, plus *aquent*, the suborder of the Entisols that have an aquic moisture regime).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Haplaquents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Mostly the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, depth of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is fine-silty, mixed, nonacid, hyperthermic Typic Haplaquents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can differ within a series.

soil series and their morphology

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

Characteristics of the soil and the material in which it formed are identified for each series. The soil is compared with similar soils and with nearby soils of other series. A pedon, a small three-dimensional area of soil, that is typical of the series in the survey area is described. The detailed description of each soil horizon follows standards in the Soil Survey Manual (*19*). Many of the technical terms used in the descriptions are defined in Soil Taxonomy (*21*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "Detailed soil map units."

Aris series

The Aris series consists of nearly level, somewhat poorly drained soils. These soils formed in ancient fluvial deposits. Slopes range from 0.2 to 1 percent.

Typical pedon of Aris fine sandy loam; from the intersection of Texas Highway 35 and Farm Road 2403 about 1 mile south of Alvin, 1.7 miles northeast on Texas Highway 35, 0.9 mile south on paved road, 0.1 mile south on shell road, 200 feet east on shell road, and 150 feet south of road in pastureland:

A1—0 to 8 inches; dark gray (10YR 4/l) fine sandy loam, gray (10YR 5/1) dry; weak fine granular structure;

hard, friable, nonsticky and nonplastic; many fine and few coarse roots; few fine pockets of uncoated sand; neutral; gradual wavy boundary.

A2—8 to 13 inches; grayish brown (10YR 5/2) fine sandy loam, light brownish gray (10YR 6/2) dry; common fine faint brownish yellow (10YR 6/6) mottles; moderate medium subangular blocky structure; hard, friable, nonsticky and nonplastic; many fine and few coarse roots; few fine pockets of uncoated sand; slightly acid; gradual wavy boundary.

Bg&Ag—13 to 20 inches; gray (10YR 5/1) sandy clay loam, light brownish gray (10YR 6/2) dry (Bg); few fine faint brownish yellow and few fine distinct strong brown (7.5YR 5/6) mottles in Bg material; moderate fine subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; grayish brown (10YR 5/2) loam Ag material occurs as tongues and interfingers and makes up about 22 percent of the horizon by volume; common pockets of very pale brown (10YR 7/4) uncoated fine sand 3 to 6 millimeters in diameter; common black concretions 1 millimeter to 5 millimeters in diameter; neutral; gradual wavy boundary.

B21tg—20 to 35 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; common fine distinct yellowish brown (10YR 5/8) and few fine faint brown mottles; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; common fine black and brown concretions; few pitted concretions of calcium carbonate up to 4 centimeters in diameter; neutral; gradual smooth boundary.

B22tg—35 to 50 inches; light gray (10YR 7/2) clay, white (10YR 8/2) dry; few fine faint yellow mottles; moderate fine subangular blocky structure; very hard, very firm, sticky and plastic, many pitted concretions of calcium carbonate up to 2 centimeters in diameter; few fine black and brown concretions; moderately alkaline; clear smooth boundary.

B3—50 to 60 inches; reddish yellow (7.5YR 6/6) sandy clay loam, reddish yellow (7.5YR 7/6) dry; few fine faint strong brown and light gray mottles; moderate medium subangular blocky structure; extremely hard, very firm, slightly sticky and slightly plastic; few fine pitted concretions of calcium carbonate; few fine black concretions up to 3 millimeters in diameter; neutral.

The solum is more than 60 inches thick.

The A horizon ranges from 12 to 28 inches in thickness. It is medium acid to neutral. The A1 horizon is dark gray, dark grayish brown, or grayish brown. The A2 horizon is dark grayish brown or grayish brown.

The B&A horizon is dominantly sandy clay loam B material. It is 15 to 25 percent tongues of fine sandy loam A material.

The B2tg horizon is mainly clay but ranges to clay loam or silty clay loam. It is gray, light brownish gray, or light gray. It is strongly acid through moderately alkaline. The B3 horizon is clay loam or sandy clay loam.

The Aris soils in this survey area are a taxadjunct to the Aris series. The B22tg horizon is more alkaline than the range described for the series and contains concretions of calcium carbonate. The B3 horizon is sandier and redder than the range described for the series. These differences do not affect the use and management of the soils.

Asa series

The Asa series consists of nearly level to sloping, well drained, nonsaline soils. These soils formed in recent loamy fluvial deposits. Slopes range from 0.2 to 8 percent.

Typical pedon of Asa silty clay loam; from the intersection of Farm Road 521 and Farm Road 524 about 4 miles southeast of Sweeny, 1.1 miles south on county road, and 25 feet east of road, in field:

A1—0 to 14 inches; very dark grayish brown (10YR 3/2) silty clay loam, dark grayish brown (10YR 4/2) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many fine roots; many very fine pores; common wormcasts; neutral; gradual smooth boundary.

B21—14 to 32 inches; reddish brown (5YR 4/4) silty clay loam, reddish brown (5YR 5/4) dry; weak medium subangular blocky structure; slightly hard, friable, slightly sticky and plastic; few fine and very fine roots; common fine pores; few wormcasts; few wormholes filled with material from overlying horizon; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—32 to 55 inches; yellowish red (5YR 4/6) silty clay loam, yellowish red (5YR 5/6) dry; weak medium subangular blocky structure; hard, firm, slightly sticky and plastic; few very fine pores; few wormcasts; few soft masses of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

C—55 to 61 inches; yellowish red (5YR 4/6) silty clay loam, yellowish red (5YR 5/6) dry; massive; hard, firm, slightly sticky and plastic; few fine concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 30 to 60 inches in thickness.

The A horizon is silty clay loam or silt loam. It is black, very dark gray, dark brown, very dark brown, or very dark grayish brown. It is neutral to moderately alkaline.

The B horizon is light reddish brown, reddish brown, yellowish red, reddish yellow, yellowish brown, brownish yellow, light brown, brown, strong brown, or pale brown.

The C horizon is fine sandy loam, very fine sandy loam, silt loam, or silty clay loam.

Beaumont series

The Beaumont series consists of nearly level, poorly drained, nonsaline soils. These soils formed in ancient clayey coastal deposits. Slopes range from 0.1 to 0.3 percent.

Typical pedon of Beaumont clay; from the intersection of Farm Road 2004 and Farm Road 2917 about 9 miles south of Liverpool, 2.3 miles northeast on Farm Road 2004, 1.1 miles southeast on shell road, 3,500 feet northeast on ricefield road, and 50 feet north in cropland:

Ap1—0 to 3 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; common fine distinct yellowish brown (10YR 5/4) and dark yellowish brown (10YR 4/6) mottles; weak fine subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine and medium roots; few black concretions 1 millimeter to 3 millimeters in diameter; few small seams of uncoated sand grains; medium acid; abrupt smooth boundary.

Ap2—3 to 8 inches; mottled gray (10YR 5/1) and dark gray (10YR 4/1) clay; common medium distinct strong brown (7.5YR 5/6) and few fine prominent strong brown (7.5YR 5/8) mottles; weak fine blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine and fine roots; common yellowish red organic stains; strongly acid; clear smooth boundary.

A1g—8 to 28 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; common fine prominent strong brown (7.5YR 5/8) and yellowish red (5YR 5/8) and few medium distinct yellowish brown (10YR 5/4) mottles; weak fine blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few black concretions 1 millimeter to 3 millimeters in diameter; few vertical seams of dark gray from overlying horizon; few pressure faces that are part of intersecting slickensides; strongly acid; gradual wavy boundary.

AC1g—28 to 59 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; common medium distinct yellowish brown (10YR 5/4, 5/8) and brownish yellow (10YR 6/6) and few fine faint yellowish brown mottles; weak coarse blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few vertical seams of dark gray from overlying horizon; few pressure faces that are part of intersecting slickensides; few black concretions 2 to 4 millimeters in diameter; medium acid; gradual wavy boundary.

AC2g—59 to 75 inches; mottled gray (10YR 6/1) and brownish yellow (10YR 6/6) clay; common medium faint brownish yellow (10YR 6/8) and few fine distinct strong brown (7.5YR 5/6) mottles; weak coarse blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few vertical seams of gray from overlying horizon; few pressure faces that are part of intersecting slickensides; moderately alkaline; gradual wavy boundary.

AC3g—75 to 80 inches; mottled gray (10YR 6/1), reddish yellow (7.5YR 6/6), and strong brown (7.5YR 5/8) clay; weak coarse blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine roots; few black concretions 1 millimeter to 4 millimeters in diameter; moderately alkaline.

The solum is more than 60 inches thick. When these soils are dry, cracks as much as 2 inches wide extend from the surface to a depth of more than 20 inches. Cycles of microknolls and microdepressions are repeated each 6 to 12 feet. In undisturbed areas the microknolls are 6 to 15 inches higher than the microdepressions.

The A horizon ranges from 8 to 30 inches in thickness and is thickest in the microdepressions. It is gray, dark gray, or very dark gray. It is very strongly acid through medium acid.

The AC horizon is light gray or gray and is mottled with yellowish brown, brownish yellow, or strong brown. This horizon is very strongly acid through slightly acid.

Some pedons have a C horizon. The C horizon is light gray or gray and is mottled with yellowish brown or brownish yellow. It is very strongly acid to moderately alkaline.

These soils are a taxadjunct to the Beaumont series because they are less acid in the AC and C horizons than is typical for the series. This difference does not affect the use and management of the soils.

Bernard series

The Bernard series consists of nearly level, somewhat poorly drained, nonsaline soils. These soils formed in clayey ancient coastal deposits. Slopes range from 0.1 to 0.4 percent.

Typical pedon of Bernard clay loam; from the intersection of Farm Road 2917 and Farm Road 2403 about 7 miles south of Alvin, 0.4 mile southeast on Farm Road 2917, 0.3 mile northeast on county road, and 150 feet southeast in pastureland:

A1—0 to 13 inches; very dark gray (10YR 3/1) clay loam, dark gray (10YR 4/1) dry; weak fine subangular blocky structure; very hard, friable, sticky and plastic; few coarse and many fine roots; medium acid; clear smooth boundary.

B1g—13 to 24 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few fine faint yellowish brown mottles; moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; common fine roots; few clay films on faces of peds; slightly acid; gradual wavy boundary.

B21tg—24 to 32 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine faint yellowish brown mottles; moderate medium blocky structure; very hard, firm, very sticky and plastic; few fine roots; few seams 3 to 15 millimeters wide filled with material from overlying horizon; few clay films on faces of peds; few pressure faces; neutral; gradual wavy boundary.

B22tg—32 to 39 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; few fine faint and distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few seams 3 to 15 millimeters wide are filled with material from overlying horizons; few clay films on faces of peds; few pressure faces; few fine black and brown concretions; neutral; gradual wavy boundary.

B23tg—39 to 52 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; common fine distinct yellowish brown (10YR 5/4) mottles; moderate medium blocky structure; very hard, very firm; very sticky and plastic; material from A1 and B1 horizons fills cracks that are 3 to 20 millimeters wide; few pressure faces; few clay films on faces of peds; few pitted concretions of calcium carbonate begin at about 46 inches; neutral; gradual wavy boundary.

B3g—52 to 65 inches; light brownish gray (10YR 6/2) clay, light gray (10YR 7/2) dry; few fine faint dark grayish brown and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few clay films on faces of peds; common pitted concretions of calcium carbonate; few fine black and brown concretions; mildly alkaline.

Thickness of the solum ranges from 50 to more than 70 inches. The mollic epipedon, which includes the A and B1 horizons, and in some pedons, part of the B2tg horizon, is 16 to 50 inches thick. It is wavy and cyclical and has a horizontal spacing of 8 to 15 feet between the highs and lows.

The A horizon is black or very dark gray. It is medium acid through neutral.

The B1g horizon is clay or clay loam. It is black or very dark gray. It is medium acid to neutral.

The B2g horizon is gray, grayish brown, dark gray, dark grayish brown, olive gray, very dark gray, or very dark grayish brown. It has common mottles of yellow and brown in most pedons. It is slightly acid to mildly alkaline. In most pedons, a few hard and pitted concretions of calcium carbonate are below 36 inches.

Some pedons have a C horizon. The C horizon is gray or grayish brown. It has common mottles of olive, yellow, and brown im most pedons. It is clay or clay loam. It is neutral to moderately alkaline. In a few places, it is calcareous.

Brazoria series

The Brazoria series consists of nearly level to gently sloping, somewhat poorly drained, nonsaline soils. These soils formed in recent clayey fluvial deposits. Slopes range from 0.1 to 5 percent.

Typical pedon of Brazoria clay, 0 to 1 percent slopes; from the intersection of Texas Highway 288 and Farm Road 1462 at Rosharon, 5.7 miles west on Farm Road 1462, and 200 feet south in pastureland:

A1—0 to 20 inches; dark reddish brown (5YR 3/3) clay, reddish brown (5YR 4/3) dry; moderate medium subangular blocky and granular structure; very hard, firm, sticky and plastic; common fine roots; few pitted concretions of calcium carbonate; calcareous; moderately alkaline; clear smooth boundary.

B21—20 to 35 inches; dark reddish brown (5YR 3/2) clay, dark reddish gray (5YR 4/2) dry; moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; few fine roots; few fine pores; common pressure faces and intersecting slickensides; few old cracks partly filled with material from the A1 horizon; few small soft masses and few pitted concretions of calcium carbonate; calcareous; moderately alkaline; gradual smooth boundary.

B22—35 to 65 inches; dark reddish brown (5YR 3/4) clay, reddish brown (5YR 4/4) dry; moderate medium and fine subangular blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few slickensides; few cracks and few old tree root channels partly filled with darker soil material; few pitted concretions of calcium carbonate up to 10 millimeters in diameter; few soft masses of calcium carbonate; calcareous; moderately alkaline.

The solum is 40 inches to more than 60 inches thick.

The A horizon is dark grayish brown, dark brown, or very dark brown. It is mildly or moderately alkaline.

The B horizon is weak red, reddish brown, dusky red, dark reddish brown, reddish gray, dark reddish gray, brown, or dark brown.

The C horizon typically is clay or silty clay. In some pedons, it has thin strata of loamier textures. It has colors similar to those of the B horizon.

Clemville series

The Clemville series consists of nearly level, somewhat poorly drained, nonsaline soils. These soils formed in recent loamy fluvial deposits that are underlain by clayey deposits. Slopes range from 0.2 to 0.5 percent.

Typical pedon of Clemville silty clay loam; from the intersection of Texas Highway 288 and Farm Road 1462 in Rosharon, 6.0 miles west on Farm Road I462, and 10 feet south of road right-of-way, in cropland:

Ap—0 to 5 inches; reddish brown (5YR 4/3) silty clay loam, reddish brown (5YR 5/3) dry; weak fine

subangular blocky structure; hard, firm, sticky and plastic; common fine roots; common fine pores; common wormcasts; calcareous; moderately alkaline; abrupt smooth boundary.

A1—5 to 16 inches; reddish brown (5YR 4/3) silty clay loam, reddish brown (5YR 5/3) dry; weak fine subangular blocky structure; hard, firm, sticky and plastic; common fine roots; common fine pores; common fine wormcasts; few snail shells; few strata of sand; calcareous; moderately alkaline; clear smooth boundary.

C—16 to 30 inches; yellowish red (5YR 5/6) silty clay loam, reddish yellow (5YR 6/6) dry; massive; hard, firm, slightly sticky and slightly plastic; few fine roots; few very fine pores; few wormcasts; few thin strata of very fine sand; calcareous; moderately alkaline; clear wavy boundary.

Bb1—30 to 50 inches; reddish brown (5YR 5/4) silty clay, light reddish brown (5YR 6/4) dry; moderate fine subangular blocky structure; hard, firm, sticky and plastic; few fine concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

Bb2—50 to 62 inches; reddish brown (5YR 4/3) clay, reddish brown (5YR 5/3) dry; moderate medium subangular blocky structure; hard, firm, very sticky and plastic; calcareous; moderately alkaline.

Depth to horizons that are more than 35 percent clay ranges from 24 to 36 inches.

The A horizon is reddish brown, brown, yellowish red, strong brown, dark grayish brown, or dark brown.

The C horizon is silty clay loam or silt loam. It is reddish brown, yellowish red, brown, or strong brown.

Some pedons have an Ab horizon. The Ab horizon is silty clay loam or clay. It is reddish gray, dark reddish gray, reddish brown, yellowish red, brown, dark brown, or strong brown.

The Bb horizon is reddish brown or yellowish red. It is silty clay loam or clay. In some pedons, it is not calcareous.

Edna series

The Edna series consists of nearly level and gently sloping, poorly drained, nonsaline soils. These soils formed in clayey ancient coastal deposits. Slopes range from 0.1 percent to 5 percent.

Typical pedon of Edna fine sandy loam, 0 to 1 percent slopes; from the intersection of Farm Road 1462 and Texas Highway 36 in Damon, 3.4 miles south on Texas Highway 36, and 150 feet west in pastureland:

A1—0 to 8 inches; dark gray (10YR 4/l) fine sandy loam, gray (10YR 5/l) dry; weak fine subangular blocky structure; very hard, friable, nonsticky and slightly plastic; common fine roots; slightly acid; abrupt wavy boundary.

B21tg—8 to 25 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct yellowish red (5YR 5/6) mottles; very hard, very firm, sticky and plastic; few fine roots; few pressure faces; few clay skins on faces of peds, old cracks filled with material from overlying horizon; few fine black concretions; neutral; gradual wavy boundary.

B22tg—25 to 35 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; few fine faint brownish yellow and common fine distinct yellowish red (5YR 4/6) mottles; moderate medium subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots; few clay films on faces of peds; few pressure faces; few fine black concretions; neutral; gradual wavy boundary.

B31g—35 to 48 inches; light brownish gray (10YR 6/2) clay, light gray (10YR 7/2) dry; common fine distinct yellowish brown (10YR 5/4, 5/6) mottles; moderate coarse blocky structure; very hard, very firm, sticky and plastic; patchy clay skins on faces of peds; few pitted concretions of calcium carbonate up to 10 millimeters in diameter; few fine black concretions; moderately alkaline; gradual wavy boundary.

B32g—48 to 60 inches; light brownish gray (2.5Y 6/2) clay, light gray (2.5Y 7/2) dry; common coarse distinct strong brown (7.5YR 5/6), common fine distinct yellowish brown (10YR 5/6), and few medium faint light gray (10YR 7/2) mottles; moderate medium blocky structure; very hard, very firm, sticky and plastic; common pitted concretions of calcium carbonate up to 25 millimeters in diameter; few fine black concretions; moderately alkaline.

The solum ranges from 60 to more than 80 inches in thickness.

The A horizon is 4 to 9 inches thick. It is gray, dark gray, or very dark gray. It is strongly acid to slightly acid.

The B2tg horizon is mainly clay but ranges to clay loam. It is light brownish gray, gray, grayish brown, dark gray, very dark gray, dark grayish brown, light olive gray, or olive gray. It is neutral to medium acid.

The B3g horizon is gray or light brownish gray. It is medium acid to moderately alkaline.

Follet series

The Follet series consists of nearly level, very poorly drained, saline soils. These soils are in marshes. They formed in loamy recent marine deposits. Slopes are less than 0.1 percent.

Typical pedon of Follet clay loam; from the intersection of the Intracoastal Waterway and Bastrop Bayou about 15 miles east of Angleton, 1.5 miles southwest along Intracoastal Waterway, 1.2 miles east along dredged channel, 400 feet northeast along small bayou, and 50 feet south in rangeland:

A1g—0 to 4 inches; gray (10YR 5/1) clay loam, gray (10YR 6/1) dry; massive; flows easily between fingers and leaves small residue in hand when squeezed; firm, slightly sticky and slightly plastic; common fine and medium roots; strongly saline; mildly alkaline; clear smooth boundary.

C1g—4 to 22 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common fine distinct brownish yellow (10YR 6/6) and brown (10YR 5/3) mottles; massive; firm, slightly sticky and slightly plastic; few fine roots; strongly saline; moderately alkaline; gradual smooth boundary.

C2g—22 to 48 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common fine distinct brownish yellow (10YR 6/6) and brown (10YR 5/3) mottles; massive; firm, slightly sticky and slightly plastic; strongly saline; moderately alkaline; gradual smooth boundary.

C3g—48 to 62 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common fine distinct brown (10YR 5/3) and yellowish brown (10YR 5/4) mottles; massive; firm, slightly sticky and slightly plastic; strongly saline; moderately alkaline.

The water table is at or very near the soil surface throughout the year. Electrical conductivity ranges from 20 to 60 millimhos per centimeter. The content of exchangeable sodium is more than 15 percent throughout the control section. The soil is neutral to moderately alkaline. In some pedons, the surface layer may be slightly fluid to semifluid but is less than 20 inches thick.

The A horizon is light gray, light brownish gray, gray, grayish brown, dark gray, dark grayish brown, very dark gray, or very dark grayish brown. In some pedons, it is mottled with gray, yellow, and brown. Some pedons have a peaty or mucky layer 2 to 8 inches thick on the surface.

The C horizon is stratified loam, sandy clay loam, silty clay loam, and clay loam. It is white, light gray, light brownish gray, gray, grayish brown, dark gray, or dark grayish brown. In most pedons, it is mottled with gray, brown, greenish gray, or yellow. In some pedons, it has black concretions.

Francitas series

The Francitas series consists of nearly level, poorly drained, saline, clayey soils. These soils formed in thick ancient clayey coastal deposits. Slopes range from 0.1 to 0.5 percent.

Typical pedon of Francitas clay; from the intersection of Farm Road 2004 and Farm Road 2917 about 9 miles southeast of Liverpool, 1.2 miles southwest on Farm Road 2004, 0.25 mile southeast on private road, 1.4 miles southwest, and 200 feet north in pastureland:

A11—0 to 18 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate fine blocky and subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine roots, common fine pores; slightly saline; mildly alkaline; gradual wavy boundary.

A12—18 to 36 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate fine subangular blocky structure; very hard, very firm, very sticky and very plastic; common fine roots; few fine pores; few coarse intersecting slickensides; few pressure faces; moderately saline; moderately alkaline; gradual wavy boundary.

AC1g—36 to 52 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct yellowish brown mottles; moderate fine blocky structure; very hard, very firm, very sticky and very plastic; few fine roots; few fine pores; few coarse intersecting slickensides; few pitted concretions of calcium carbonate 1 millimeter to 2 millimeters in diameter; few black concretions up to 2 millimeters in diameter; moderately saline; moderately alkaline; gradual wavy boundary.

AC2—52 to 77 inches; pale brown (10YR 6/3) clay, very pale brown (10YR 7/3) dry; few fine distinct gray (10YR 6/1) and common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; very hard, very firm, very sticky and very plastic; common coarse intersecting slickensides; few pressure faces; common pitted concretions of calcium carbonate up to 2 millimeters in diameter; few black concretions up to 1 millimeter in diameter; moderately saline; moderately alkaline; gradual wavy boundary.

C—77 to 80 inches; light yellowish brown (10YR 6/4) clay, very pale brown (10YR 7/4) dry; common fine distinct gray (10YR 6/1) and common fine distinct yellowish brown (10YR 5/6) mottles; massive; very hard, very firm, very sticky and very plastic; few coarse slickensides; few pitted concretions of calcium carbonate up to 2 millimeters in diameter; few black concretions up to 1 millimeter in diameter; strongly saline; moderately alkaline.

The solum ranges from 40 to more than 60 inches in thickness.

The A11 horizon is slightly acid to mildly alkaline.

The A12 horizon is very dark gray or dark gray. It is neutral to moderately alkaline.

The AC horizon is gray, grayish brown, dark gray, dark grayish brown, pale brown, or brown. It is moderately saline to strongly saline.

Galveston series

The Galveston series consists of undulating, somewhat excessively drained, nonsaline, sandy soils. These soils are on coastal dunes in marshes. They formed in sandy recent coastal deposits that have been modified by wind. Slopes range from 1 to 8 percent.

Typical pedon of Galveston fine sand, undulating; from the intersection of Texas Highway 332 and Farm Road 523 about 3 miles northeast of Freeport, 3.6 miles southeast on Texas Highway 332, 8.6 miles northeast on paved county road, 0.05 mile southeast on unimproved road to beach, and 100 feet north from the front of the dunes, in rangeland:

C1—0 to 19 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose, nonsticky and nonplastic; common very fine and medium roots; common shell fragments; moderately alkaline; clear smooth boundary.
C2—19 to 33 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose; few very fine roots; moderately alkaline; clear smooth boundary.
C3—33 to 60 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose, nonsticky and nonplastic; few light yellowish brown stains; moderately alkaline; gradual smooth boundary.
C4—60 to 66 inches; gray (10YR 6/1) fine sand, light gray (10YR 7/1) dry; single grained; loose, nonsticky and nonplastic; few shell fragments; moderately alkaline; gradual smooth boundary.
C5—66 to 80 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose, nonsticky and nonplastic; few shell fragments; few brownish yellow stains; moderately alkaline.

The depth to loamy strata is greater than 72 inches. Fragments of marine shells are in some to all parts of the pedon. This soil is medium acid to moderately alkaline. Some pedons are slightly saline. The soil is white, light gray, light brownish gray, or gray. It is mainly fine sand but ranges to sand.

Harris series

The Harris series consists of nearly level, very poorly drained, saline, clayey soils. These soils are in marshes. They formed in recent clayey marine deposits. Slopes are less than 0.1 percent.

Typical pedon of Harris clay; from the west junction of Bastrop Bayou and Cox Lake about 14 miles southeast of Angleton, 1.3 miles south across Cox Lake to south shoreline, 0.6 mile southeast along shoreline, and 400 feet south in rangeland:

A11g—0 to 8 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; many fine and medium roots; few strong brown stains along root canals; saline; neutral; gradual smooth boundary.
A12g—8 to 14 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few fine distinct yellowish brown (10YR 5/4) and gray (10YR 5/1) mottles; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; many fine and medium roots; common strong brown stains in pores and old root channels; saline; mildly alkaline; clear wavy boundary.
A13g—14 to 16 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few fine distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; common fine roots; few thin strata of light gray fine sand; few brown stains along root channels; saline; mildly alkaline; clear wavy boundary.
AC1g—16 to 35 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few single grains of light gray fine sand; few black concretions up to 3 millimeters in diameter; saline; mildly alkaline; clear wavy boundary.
AC2g—35 to 50 inches; gray (10YR 5/l) clay, gray (10YR 6/l) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few black concretions up to 3 millimeters in diameter; saline; moderately alkaline; diffuse smooth boundary.
Cg—50 to 60 inches; gray (10YR 6/1) clay, light gray (5Y 7/1) dry; common fine distinct yellowish brown (10YR 5/6), few fine faint light gray, and few fine distinct dark gray (10YR 4/1) mottles; massive; very hard, very firm, very sticky and plastic; few fine black concretions up to 2 millimeters in diameter; saline; moderately alkaline.

The salinity throughout the soil is slight to strong.

The Ag horizon ranges from 10 to 24 inches in thickness. In most pedons, it is mottled with brown. It is neutral to moderately alkaline.

The ACg horizon and Cg horizon are gray, dark gray, or very dark gray. In most pedons, they are mottled with brown.

Ijam series

The Ijam series consists of nearly level to undulating, poorly drained, saline, clayey soils. These soils are in marshes. They formed in recent clayey marine deposits that resulted from dredging operations. Slopes range from 0.5 to 8 percent.

Typical pedon of Ijam clay; from the intersection of Farm Road 523 and Texas Highway 332 about 3 miles northeast of Freeport, 1.2 miles east on Texas Highway 332, and 300 feet south in rangeland:

A1—0 to 9 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; common fine distinct

yellowish brown (10YR 5/6) mottles; massive; very hard, very firm, very sticky and plastic; few fine roots; few black concretions less than 1.0 millimeter in diameter; moderately alkaline; saline; diffuse smooth boundary.

Cg—9 to 60 inches; light brownish gray (2.5Y 6/2) clay, light gray (2.5Y 7/2) dry; common fine distinct yellowish brown (10YR 5/6) and gray (10YR 6/1) mottles; massive; very hard, very firm, very sticky and plastic; few shell fragments; common concretions of calcium carbonate 1 millimeter to 3 millimeters in diameter; few thin strata of fine sand; saline; moderately alkaline.

The salinity throughout is moderate to strong.

The A horizon ranges from 0 to 10 inches in thickness. It is dark gray, gray, light gray, or dark grayish brown. It is neutral to moderately alkaline.

The Cg horizon is light olive gray, dark gray, gray, light gray, light brownish gray, or dark grayish brown. It is mottled with gray and brown. It is typically moderately alkaline. In some pedons, it does not have concretions of calcium carbonate, shells, and shell fragments.

Kenney series

The Kenney series consists of nearly level and gently sloping, well drained, nonsaline, sandy soils. These soils formed in ancient sandy fluvial deposits under prairie. Slopes range from 0.5 to 3 percent.

Typical pedon of Kenney loamy fine sand, 0 to 3 percent slopes; from the intersection of Texas Highway 288 and county road in Sandy Point, 0.4 mile west on county road, and 600 feet south in pastureland:

Ap—0 to 16 inches; dark brown (10YR 4/3) loamy fine sand, brown (10YR 5/3) dry; single grained; loose, nonsticky and nonplastic; many fine roots; medium acid; diffuse wavy boundary.

A2—16 to 70 inches, very pale brown (10YR 7/4) loamy fine sand, very pale brown (10YR 8/4) dry; single grained; loose, nonsticky and nonplastic; few fine roots; medium acid; gradual smooth boundary.

B21t—70 to 77 inches, red (2.5YR 4/6) sandy clay loam, red (2.5YR 5/6) dry; moderate medium subangular blocky structure; slightly hard, firm, slightly sticky and nonplastic; few fine pores; slightly acid.

The solum ranges from 65 to more than 80 inches in thickness. It is slightly acid to strongly acid throughout.

The A horizon ranges from 40 to 72 inches in thickness. It is dark grayish brown, dark brown, light brownish gray, pale brown, brown, or grayish brown.

The A2 horizon is brown, light brown, dark grayish brown, light brownish gray, pale brown, or very pale brown.

The B2t horizon is mainly sandy clay loam or clay loam, but ranges to fine sandy loam. It is red or yellowish red. It is mottled with red, brown, and yellow in some pedons.

Lake Charles series

The Lake Charles series consists of nearly level to sloping, somewhat poorly drained, nonsaline soils. These soils formed in ancient clayey coastal deposits. Slopes range from 0.l to 8 percent.

Typical pedon of Lake Charles clay, 0 to 1 percent slopes; from the intersection of Texas Highway 36 and Farm Road 1462 in Damon, 0.7 mile south on Texas Highway 36, 2.5 miles east on county road, 0.6 mile east on shell road, 0.25 mile southeast on private road, 2l6 feet west along fence line, and 203 feet south in pastureland:

Ap—0 to 7 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; few fine faint yellowish brown mottles; moderate fine blocky and subangular blocky structure; very hard, firm, very sticky and plastic; many fine roots; few medium pores; slightly acid; clear smooth boundary.

A12—7 to 13 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry, few fine faint yellowish brown mottles; moderate medium subangular and moderate fine blocky structure; very hard, firm, very sticky and plastic; few small pressure faces; common fine roots; few fine pores; few black concretions; slightly acid; gradual wavy boundary.

A13—13 to 23 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry, common fine faint yellowish brown (10YR 5/4) mottles; strong medium coarse blocky structure parting to fine and medium subangular blocky; very hard, firm, very sticky and plastic; few small intersecting slickensides and pressure faces; few fine roots; few black concretions; slightly acid; gradual wavy boundary.

A14—23 to 32 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry, few fine faint yellowish brown and strong brown mottles; strong fine and medium blocky structure; very hard, firm, very sticky and plastic; common small pressure faces and intersecting slickensides; few fine roots; neutral; gradual wavy boundary.

A15—32 to 50 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry, common fine faint yellowish brown (10YR 5/4) and few medium distinct olive brown (2.5Y 4/4) mottles; strong medium and coarse blocky and moderate medium subangular blocky structure; very hard, firm, very sticky and plastic; common medium pressure faces and intersecting slickensides; neutral; few fine roots; clear wavy boundary.

ACg—50 to 64 inches; gray (10YR 5/1) clay, gray (10YR 6/1) dry, few fine faint yellowish brown and common medium distinct light olive brown (2.5Y 5/4) mottles; strong medium and coarse blocky structure;

common wedge-shaped peds; very hard, firm, very sticky and plastic; common coarse intersecting slickensides; mildly alkaline; clear wavy boundary.

C1—64 to 80 inches; mottled gray (10YR 6/1) and light olive brown (2.5Y 5/4) clay; few fine faint olive yellow mottles; massive; very hard, firm, very sticky and plastic; common large intersecting slickensides; common pitted concretions of calcium carbonate 0.5 millimeter to 6 millimeters in size; moderately alkaline; gradual wavy boundary.

C2—80 to 90 inches; mottled gray (10YR 6/1), light brownish gray (2.5Y 6/2), and light olive brown (2.5Y 5/4) clay; many coarse distinct olive yellow (2.5Y 6/6) and brownish yellow (10YR 6/6) mottles; massive; very hard, firm, very sticky and plastic; common intersecting slickensides; many pitted concretions of calcium carbonate 0.5 millimeter to 6 millimeters in size; calcareous; moderately alkaline; smooth gradual boundary.

IIC—90 to 103 inches; mottled yellowish red (5YR 5/6) and gray (10YR 6/1) clay; common fine distinct brownish yellow (10YR 6/6) mottles; massive; very hard, firm, very sticky and plastic; common fine and coarse pockets of soft lime; calcareous; moderately alkaline.

In undisturbed areas, the microrelief consists of microknolls that are 6 to 8 inches higher than the adjacent microdepressions. The distance between the center of a microknoll and the center of a microdepression is 6 to 10 feet.

The A horizon ranges from 12 to 50 inches in thickness. It is very dark gray or black. It is mottled with yellow or brown in some pedons. Reaction is medium acid to mildly alkaline.

The AC horizon is dark gray or gray. It is mottled with red, brown, olive, and yellow in most pedons. It is neutral to moderately alkaline. In some pedons, it is calcareous.

The C horizon is dark gray, gray, or light brownish gray. It is mottled with gray, brown, and yellow in most pedons. It is mildly alkaline to moderately alkaline. It is noncalcareous or is calcareous in some to all parts of the pedon.

Some pedons have a IIC horizon. It is at a depth of 50 to more than 80 inches. It is red, yellow, brown, and gray.

The soils in map unit 25 are a taxadjunct to the Lake Charles series because they have chroma of 3 or 4 in the AC horizon, which is browner than is allowed for the series. This difference does not affect the use and management of the soils.

Leton series

The Leton series consists of nearly level, poorly drained, nonsaline soils. These soils formed in loamy ancient fluvial deposits. Slopes range from 0.1 to 0.5 percent.

Typical pedon of Leton loam; from Liverpool, 1.8 miles southeast on county road, 2.3 miles southwest on county road, 3.4 miles south on canal road, and 600 feet northwest in pastureland:

A1—0 to 6 inches; dark gray (10YR 4/1) loam, gray (10YR 6/1) dry; weak medium subangular blocky structure; hard, friable, nonsticky and nonplastic; common fine and medium roots; few yellowish brown stains along root channels; few seams of uncoated sand grains less than 0.5 millimeter wide; few fine black concretions; neutral; abrupt smooth boundary.

A2—6 to 23 inches; gray (10YR 5/1) loam, light gray (10YR 7/1) dry; common medium faint light brownish gray (10YR 6/2) and few fine faint yellowish brown (10YR 5/6) mottles; weak medium subangular blocky structure; hard; friable, nonsticky and nonplastic; common very fine and fine roots; few fine pores; few yellowish brown organic stains along root channels; few seams of uncoated sand grains less than 0.5 millimeter wide; few fine black concretions; neutral; abrupt smooth boundary.

B&A—23 to 29 inches; gray (10YR 5/1) clay loam (B2t), common medium faint light brownish gray (10YR 6/2) and common fine distinct yellowish brown (10YR 5/4) mottles; tongues up to 2 inches wide of gray (10YR 5/1) loam (A2) make up 25 percent of the horizon, common medium faint gray (10YR 6/1) mottles; weak medium subangular blocky structure; clay loam is very hard, firm, sticky and plastic; loam is hard, friable, slightly sticky and slightly plastic; few fine roots; neutral; clear wavy boundary.

B2tg—29 to 50 inches; gray (10YR 6/1) clay loam, light gray (10YR 7/1) dry; common medium and coarse prominent yellowish brown (10YR 5/6) mottles; weak fine blocky structure; extremely hard, very firm, sticky and plastic; few fine roots; few clay films; few seams of uncoated sand grains; few crayfish holes; few fine black concretions; neutral; gradual smooth boundary.

Cg—50 to 62 inches; gray (10YR 6/1) clay loam; common medium and coarse prominent yellowish brown (10YR 5/6) mottles; massive; extremely hard, very firm, sticky and plastic; mildly alkaline.

The solum ranges from 40 to more than 60 inches in thickness.

The A horizon ranges from 10 to 23 inches in thickness. It is light brownish gray, gray, grayish brown, dark gray, and dark grayish brown. It is mottled with brown in some pedons. It is strongly acid to neutral.

The A2 horizon is mainly loam but ranges to silt loam and very fine sandy loam. It is gray, light brownish gray, or grayish brown. It is mottled with brown, gray, or yellow in most pedons.

The B&A horizon is 70 to 85 percent B material and 15 to 30 percent vertical streaks of A material. The B&A

horizon has similar properties to those of the A2 and B2 horizons.

The B2tg horizon is loam, clay loam, sandy clay loam, silty clay loam, clay, or sandy clay. It is light gray, light brownish gray, gray, or grayish brown. Brownish, yellowish, or grayish mottles are in most pedons. The horizon is medium acid to moderately alkaline.

Some pedons do not have a C horizon.

Morey series

The Morey series consists of poorly drained, nonsaline soils. These soils formed in loamy ancient fluvial deposits. Slopes range from 0.1 to 0.3 percent.

Typical pedon of Morey silt loam; from the Chocolate Bayou bridge on Farm Road 2004 about 14 miles east of Angleton, 3.7 miles southwest on Farm Road 2004, 0.1 mile south on county road, and 50 feet west in cropland:

A1—0 to 11 inches; very dark gray (10YR 3/1) silt loam, dark gray (10YR 4/1) dry; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine granular structure; hard, friable, sticky and plastic; many fine and medium roots; common fine pores; few wormcasts; strongly acid; clear smooth boundary.

B1g—11 to 16 inches; very dark gray (10YR 3/1) silty clay loam, dark gray (10YR 4/1) dry; common fine distinct yellowish brown (10YR 5/4) mottles; weak medium subangular blocky structure; very hard, firm, sticky and plastic; common fine roots; common fine pores; few wormcasts; few white sand grains on ped surfaces; medium acid; clear smooth boundary.

B21tg—16 to 36 inches; dark gray (10YR 4/1) silty clay loam, gray (10YR 5/1) dry; few fine faint yellowish brown mottles; weak medium subangular blocky structure; very hard, very firm, sticky and plastic; few fine roots and pores; few wormcasts; few black concretions less than 1 millimeter in size; common fine white sand grains on ped surfaces; medium acid; gradual wavy boundary.

B22tg—36 to 58 inches; grayish brown (10YR 5/2) clay, light brownish gray (10YR 6/2) dry; few fine distinct yellowish brown (10YR 5/4) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few black concretions 1 millimeter to 2 millimeters in size; neutral; gradual wavy boundary.

B23tg—58 to 61 inches; gray (10YR 6/1) clay, light gray (10YR 7/1) dry; common fine distinct yellowish brown (10YR 5/6) mottles; moderate medium subangular blocky structure; very hard, firm, sticky and plastic; few black concretions 1 millimeter to 3 millimeters in size; few pockets of soft calcium carbonate; common concretions of calcium carbonate up to 4 millimeters in size; moderately alkaline.

The A and B1 horizons are very dark gray, very dark grayish brown, very dark brown, or black. They are strongly acid to neutral. The B1 horizon is silt loam or silty clay loam.

The upper part of the B2tg horizon is silty clay loam or clay loam. It is grayish brown, gray, or dark gray. It is medium acid to moderately alkaline.

The lower part of the B2tg horizon is silty clay loam, clay loam, or clay. It is gray, grayish brown, or light brownish gray and has brownish mottles. It is slightly acid to moderately alkaline. In some pedons, it has concretions of calcium carbonate below 30 inches.

Mustang series

The Mustang series consists of nearly level, poorly drained, nonsaline to saline soils. These soils are in marshes. They formed in recent sandy coastal deposits. Slopes range from 0.1 to 0.5 percent.

Typical pedon of Mustang fine sand; from the intersection of Farm Road 1495 and Texas Highway 288 south of Freeport, 1.7 miles southeast on Farm Road 1495, 0.8 mile southwest on shell road, 0.5 mile southeast to beach, 0.2 mile northeast along beach, and 270 feet from the back of the dunes in rangeland:

A1—0 to 4 inches; light brownish gray (10YR 6/2) fine sand, light gray (10YR 7/2) dry; single grained; loose, nonsticky and nonplastic; common very fine to medium roots; moderately alkaline; clear wavy boundary.

C1g—4 to 25 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose, nonsticky and nonplastic; common strong brown and yellowish red organic stains along root channels; common very fine and fine roots; moderately alkaline; clear smooth boundary.

C2g—25 to 31 inches; light gray (10YR 7/2) fine sand, white (10YR 8/2) dry; single grained; loose, nonsticky and nonplastic; common very fine decomposed organic matter disseminated in horizon; few very fine and fine roots; moderately alkaline; gradual smooth boundary.

C3g—31 to 72 inches; light gray (10YR 7/2) fine sand, white (10YR 8/1) dry; single grained; loose, nonsticky and nonplastic; saline; moderately alkaline.

The depth to loamy strata or to layers of marine shells is greater than 40 inches. This soil is neutral to moderately alkaline throughout.

The A horizon is dark gray, dark grayish brown, gray, grayish brown, light brownish gray, or light gray. It is nonsaline to strongly saline, depending on the depth to the water table and on the amount of flooding during high tide.

The C horizon is sand or fine sand. It is gray, grayish brown, light brownish gray, light gray, or white. It is mottled with gray, brown, or yellow in some pedons. In some pedons, this soil is nonsaline above the water

table, but it is commonly saline in the water table, which is at a depth of 6 to 40 inches.

Narta series

The Narta series consists of nearly level, somewhat poorly drained, saline soils. These soils are in marshes. They formed in ancient clayey coastal deposits. Slopes range from 0.2 to 0.5 percent.

Typical pedon of Narta fine sandy loam; from the intersection of Farm Road 2004 and Farm Road 2917 about 8 miles southeast of Liverpool, 2.3 miles northeast on Farm Road 2004, 0.8 mile southeast on shell road, 0.2 mile southwest, 1.6 miles south, 2.1 miles southeast, and 120 feet south in rangeland:

A1—0 to 7 inches; dark gray (10YR 4/1) fine sandy loam, gray (10YR 5/1) dry; weak fine subangular blocky structure parting to weak fine blocky; hard, friable, slightly sticky and slightly plastic; common fine roots; few fine brownish yellow organic stains; moderately alkaline; saline; clear smooth boundary.

B21tg—7 to 11 inches; dark grayish brown (10YR 4/2) loam, grayish brown (10YR 5/2) dry; few fine faint brownish yellow mottles; moderate fine blocky structure; hard, firm, sticky and plastic; few fine roots; few dark gray clay films on faces of peds; few fine black concretions; moderately alkaline; saline; clear wavy boundary.

B22tg—11 to 18 inches; dark grayish brown (10YR 4/2) clay, grayish brown (10YR 5/2) dry; few fine faint brownish yellow mottles; weak medium and fine blocky structure; very hard, firm, very sticky and very plastic; few fine roots; few fine discontinuous random irregularly shaped pores; common continuous dark gray clay films; few streaks of gray loam from B21tg horizon in old cracks; few fine black concretions; moderately alkaline; saline; clear wavy boundary.

B23tg—18 to 50 inches, light brownish gray (2.5Y 6/2) clay loam, light gray (2.5Y 7/2) dry; common fine and medium faint olive yellow (2.5Y 6/6) and yellow (2.5Y 7/8) mottles and few fine distinct brownish yellow (10YR 6/8) mottles; moderate medium and coarse blocky structure parting to moderate fine subangular blocky; very hard, very firm, very sticky and very plastic; few fine roots; few fine discontinuous random irregularly shaped pores; few streaks of gray loam from the B22tg horizon in old cracks; few fine black concretions; common pockets of pitted concretions of calcium carbonate; few intersecting slickensides; moderately alkaline; saline; gradual wavy boundary.

Cg—50 to 74 inches; light gray (2.5Y 7/2) clay loam, light gray (10YR 7/1) dry; few fine faint light brownish gray and gray (N 6/0) mottles and common medium distinct light yellowish brown (2.5Y 6/4) and olive yellow (2.5Y 6/6) mottles; massive; very hard, firm, very sticky and very plastic; few fine black concretions; common fine and medium pitted concretions of calcium carbonate; moderately alkaline; saline; calcareous.

The solum ranges from 40 to 60 inches in thickness.

The A horizon is gray, grayish brown, dark gray, or dark grayish brown. It is neutral to moderately alkaline and is slightly saline to moderately saline.

The B2t horizon is clay, clay loam, or sandy clay loam. It is light brownish gray, gray, grayish brown, dark gray, or dark grayish brown. It is mottled with yellow, brown, and gray in most pedons. It is moderately saline to strongly saline. The content of exchangeable sodium ranges from 15 to 45 percent.

The C horizon is clay loam and clay. It is light gray, light brownish gray, and gray. It is mottled with yellow, brown, and gray in most pedons.

Norwood series

The Norwood series consists of deep, nearly level to sloping, well drained, nonsaline soils. These soils formed in recent loamy fluvial deposits. Slopes range from 0.2 to 8 percent.

Typical pedon of Norwood silt loam, 0 to 1 percent slopes; from the Brazos River bridge on Farm Road I462 about 7 miles west of Rosharon, 0.9 mile east on Farm Road I462, 0.6 mile north on county road, and 300 feet east in cropland:

Ap—0 to 6 inches; reddish brown (5YR 4/3) silt loam, reddish brown (5YR 5/3) dry; weak fine granular structure; hard, friable, nonsticky and nonplastic; few fine roots; few fragments of snail shells; calcareous; moderately alkaline; abrupt smooth boundary.

A12—6 to 13 inches; reddish brown (5YR 5/4) silt loam, light reddish brown (5YR 6/4) dry; weak fine granular and subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine roots; few fine pores; few wormcasts; few fragments of snail shells; calcareous; moderately alkaline; clear wavy boundary.

B2—13 to 34 inches; reddish brown (5YR 5/4) silt loam, pink (5YR 7/4) dry; moderate fine and medium subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine roots; common fine pores; many wormcasts; few threads of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.

C1—34 to 48 inches; reddish brown (5YR 4/4) silt loam, light reddish brown (5YR 5/4) dry; massive; few bedding planes; hard, friable, nonsticky and nonplastic; calcareous; moderately alkaline; clear smooth boundary.

C2—48 to 54 inches; yellowish red (5YR 4/6) very fine sandy loam, reddish yellow (5YR 6/6) dry; massive; few bedding planes; slightly hard, friable, nonsticky

and nonplastic; calcareous; moderately alkaline; clear smooth boundary.
C3—54 to 65 inches; reddish brown (5YR 4/4) silt loam, light reddish brown (5YR 6/4) dry; strata of very fine sandy loam and silty clay; massive; few bedding planes; hard, friable, nonsticky and nonplastic; calcareous; moderately alkaline.

The solum ranges from 15 to 40 inches in thickness.

The A horizon is silt loam or silty clay loam. It is reddish brown, brown, light brown, light reddish brown, or yellowish red. It is mildly to moderately alkaline.

The B2 horizon is silt loam, silty clay loam, or loam. It is light reddish brown, yellowish red, yellowish brown, or reddish yellow.

The C horizon is loam, silt loam, silty clay loam, or very fine sandy loam. In a few pedons, it has thin strata of coarser and finer textures. This horizon is reddish brown, light reddish brown, reddish yellow, or yellowish red.

Pledger series

The Pledger series consists of deep, nearly level, somewhat poorly drained, nonsaline soils. These soils formed in recent clayey fluvial deposits. Slopes range from less than 0.1 percent to 0.6 percent.

Typical pedon of Pledger clay; from the intersection of Farm Road 521 and Texas Highway 36 in Brazoria, 3.1 miles south on Farm Road 521, and 200 feet north in pastureland:

A1—0 to 26 inches; black (N 2/0) clay, black (5YR 2/1) dry; moderate fine granular and fine subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few fine pores; shiny pressure faces; mildly alkaline; gradual wavy boundary.
B21—26 to 50 inches; reddish brown (5YR 4/3) silty clay, reddish brown (5YR 5/3) dry; weak fine and medium blocky structure; very hard, firm, sticky and plastic; few fine roots; few medium pitted concretions of calcium carbonate; calcareous; moderately alkaline; clear wavy boundary.
C—50 to 64 inches; reddish brown (5YR 4/4) clay, reddish brown (5YR 5/4) dry; massive; very hard, firm, sticky and plastic; few fine pitted concretions of calcium carbonate; calcareous; moderately alkaline.

The solum ranges from 30 to 70 inches in thickness.

The A horizon ranges from 20 to 40 inches in thickness. It is very dark gray, very dark grayish brown, very dark brown, or black. It is slightly acid to moderately alkaline. In some pedons, this horizon is calcareous.

The B horizon is mainly clay but ranges to silty clay. It is dark grayish brown, reddish brown, dark brown, or dark reddish brown. In some pedons, it has hard concretions of calcium carbonate.

The C horizon is reddish brown or brown. In some pedons, it has strata of silty and sandy materials. Some pedons have a buried dark colored A horizon below 40 inches.

Sumpf series

The Sumpf series consists of nearly level, very poorly drained, nonsaline soils. These soils formed in recent clayey fluvial deposits. Slopes range from 0.1 to 0.5 percent.

Typical pedon of Sumpf clay; from the intersection of Texas Highway 288 and Farm Road 655 about 9 miles north of Angleton, 5.1 miles west on Farm Road 655, 0.7 mile north on field road, 0.1 mile east, 0.7 mile north, 0.9 mile east, 1,300 feet north along field road, and 300 feet west in pastureland:

A11—0 to 5 inches; dark brown (7.5YR 3/2) clay, dark brown (7.5YR 4/2) dry; moderate fine subangular blocky structure; very hard, very firm, very sticky and plastic; many fine roots; calcareous; moderately alkaline; clear smooth boundary.
A12—5 to 36 inches; dark reddish brown (5YR 3/2) clay, dark reddish gray (5YR 4/2) dry; few fine distinct gray (10YR 5/1) mottles; moderate medium subangular blocky structure; very hard, very firm, very sticky and plastic; common fine roots; few wormcasts; few pressure faces, calcareous; moderately alkaline; clear smooth boundary.
AC—36 to 60 inches; dark reddish brown (5YR 3/3) clay, reddish brown (5YR 4/3) dry; few fine distinct gray (10YR 5/1) mottles; moderate medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few black concretions 2 to 3 millimeters in diameter; calcareous; moderately alkaline; gradual smooth boundary.
IIC—60 to 69 inches; light gray (10YR 7/2) fine sandy loam, white (10YR 8/2) dry; few fine distinct yellowish brown (10YR 5/4) mottles; weak fine subangular blocky structure; hard, firm, slightly sticky and plastic; few thin strata of light gray fine sandy loam; neutral; gradual smooth boundary.
IIIC—69 to 80 inches; dark reddish brown (5YR 3/3) clay, reddish brown (5YR 4/3) dry; few fine distinct gray (10YR 5/1) and few fine faint yellowish brown mottles; massive; very hard, very firm, very sticky and plastic; calcareous; moderately alkaline.

Thickness of the solum ranges from 40 to more than 60 inches. The soil is commonly calcareous throughout, but in some pedons, it is noncalcareous in the upper 10 inches.

The A horizon is dark reddish brown or dark brown. It is mottled with gray in most pedons. It is mildly to moderately alkaline.

The AC horizon is reddish gray, reddish brown, dark reddish gray, dark reddish brown, brown, and dark brown. In many pedons, it is mottled with gray. In some pedons, it is stratified with loamy material.

The IIC horizon is at a depth of 40 to 80 inches. It is light reddish brown, reddish brown, reddish yellow, yellowish red, brown, strong brown, light gray, or light brown. Some pedons have loamier and sandier strata of varying thickness. These strata have contrasting colors that commonly differ from those described for this horizon.

Surfside series

The Surfside series consists of deep, nearly level, poorly drained, saline soils. These soils are in marshes. They formed in recent clayey fluvial deposits. Slopes range from 0.1 to 0.6 percent.

Typical pedon of Surfside clay; from the intersection of Texas Highway 332 and Farm Road 523 about 3 miles northeast of Freeport, 0.3 mile southeast on Texas Highway 332, and 300 feet south in rangeland:

A11g—0 to 14 inches; very dark gray (10YR 3/1) clay, dark gray (10YR 4/1) dry; moderate medium subangular blocky structure; very hard, very firm, very sticky and very plastic; many fine and medium roots; many strong brown stains along old root channels; saline; mildly alkaline; gradual smooth boundary.

A12g—14 to 32 inches; dark gray (10YR 4/1) clay, gray (10YR 5/1) dry; few fine distinct yellowish brown (10YR 5/4) and few fine faint gray mottles; moderate coarse prismatic structure parting to moderate medium and fine blocky; few prism faces thinly coated with light gray silt material; very hard, very firm, very sticky and very plastic; few fine roots; saline; mildly alkaline; clear smooth boundary.

B2g—32 to 72 inches; dark reddish brown (5YR 3/3) clay, reddish brown (5YR 4/3) dry; common fine and medium distinct gray (10YR 6/1) and few fine distinct very dark gray (10YR 3/1) mottles; weak medium blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few concretions of calcium carbonate up to 10 millimeters in diameter; calcareous; saline.

The solum ranges from 40 to more than 60 inches in thickness.

The Ag horizon is dark gray, very dark gray, dark grayish brown, very dark grayish brown, black, or very dark brown. It is neutral to moderately alkaline and slightly saline to moderately saline.

The B2g horizon is reddish brown, yellowish red, brown, strong brown, dark brown, or dark reddish brown. It is mildly to moderately alkaline. It is commonly calcareous, but in some pedons it is noncalcareous.

Some pedons have a Cg horizon, which has the same texture and color range as the B horizon. A few strata of loamy and sandy materials are in some pedons at depths greater than 50 inches.

Tatlum series

The Tatlum series consists of nearly level, very poorly drained, saline soils. These soils are in marshes. They formed in recent loamy marine deposits. Slopes are less than 0.1 percent.

Typical pedon of Tatlum clay loam; from the intersection of Cold Pass and Churchill Bayou on Follets Island, across Cold Pass at a compass heading of 20 degrees, and 60 feet north of the bank, in rangeland:

A1g—0 to 18 inches; gray (10YR 5/1) clay loam, common medium distinct dark yellowish brown (10YR 4/4) mottles; massive; flows easily between fingers and leaves small residue in hand when squeezed; slightly sticky and slightly plastic; common fine and medium roots; extremely saline; moderately alkaline; clear boundary.

C1g—18 to 28 inches; gray (10YR 5/1) clay loam; massive; flows with some difficulty between fingers and leaves small residue in hand when squeezed; slightly sticky and slightly plastic; extremely saline; moderately alkaline; gradual smooth boundary.

C2g—28 to 42 inches; gray (10YR 5/1) clay; few strata of clay loam; common medium faint gray (N 5/0) mottles; massive; firm, slightly sticky and slightly plastic; extremely saline; moderately alkaline; gradual smooth boundary.

C3g—42 to 60 inches; gray (N 5/0) stratified clay loam and clay, common medium distinct strong brown (7.5YR 5/8) and many medium distinct grayish brown (10YR 5/2) mottles; few fine black concretions; massive; firm, slightly sticky and slightly plastic; extremely saline; moderately alkaline.

The water table is at or very near the surface throughout the year. The surface layer is 20 to 40 inches thick and has a slightly fluid to fluid consistence. Electrical conductivity ranges from 25 to 90 millimhos per centimeter, and the content of exchangeable sodium is more than 30 percent. Most pedons have a 1- to 6-inch-thick organic mat of decomposing plant material on the surface.

The A horizon is gray, dark gray, very dark gray, or black. It is mottled with brown and gray in most pedons.

The C horizon is mainly stratified clay loam and loam but ranges from fine sandy loam to clay. It is light gray, light brownish gray, grayish brown, dark gray, dark grayish brown, or gray. It is mottled with gray, brown, and greenish gray in many pedons. Below 40 inches, some pedons have brown clayey horizons, which are commonly calcareous.

Tracosa series

The Tracosa series consists of nearly level, very poorly drained, saline soils. These soils are in marshes. They formed in recent clayey marine deposits. Slopes are less than 0.1 percent.

Typical pedon of Tracosa mucky clay; from the intersection of the Intracoastal Waterway and Bastrop Bayou about 15 miles southeast of Angleton, 0.9 mile southeast along Intracoastal Waterway, 0.3 mile east along dredged channel, and 600 feet south in rangeland:

A1g—0 to 4 inches; dark gray (10YR 4/1) mucky clay; massive; flows easily between fingers and leaves small residue in hand when squeezed; slightly sticky and slightly plastic; many medium and fine roots; extremely saline; mildly alkaline; clear smooth boundary.

C1g—4 to 19 inches; gray (10YR 5/1) clay; massive; firm, very sticky and very plastic; common fine roots; extremely saline; moderately alkaline; gradual smooth boundary.

C2g—19 to 42 inches; gray (10YR 5/1) clay, common fine distinct brown (10YR 5/3) mottles; massive; firm, very sticky and very plastic; extremely saline; moderately alkaline; gradual smooth boundary.

C3g—42 to 62 inches; gray (10YR 5/1) clay, few fine distinct brown (10YR 5/3) and few fine prominent dark greenish gray (5BG 4/1) mottles; massive; firm, very sticky and very plastic; extremely saline; moderately alkaline.

The water table is at or very near the surface throughout the year. Electrical conductivity ranges from 20 to 90 millimhos per centimeter. The content of exchangeable sodium is more than 20 percent. The soil is neutral through moderately alkaline throughout. In some pedons, the surface layer has a slightly fluid or semifluid consistence, but it is less than 20 inches thick.

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

The C horizon is clay loam, silty clay loam, silty clay, or clay. It is light gray, gray, light brownish gray, grayish brown, dark gray, or dark grayish brown. This horizon is mottled with gray, brown, and greenish gray in some pedons. Some pedons are calcareous below 40 inches.

Velasco series

The Velasco series consists of nearly level, very poorly drained, saline soils. These soils are in marshes. They formed in recent clayey alluvial deposits. Slopes are less than 0.2 percent.

Typical pedon of Velasco clay; from the intersection of the Brazos River and the Intracoastal Waterway about 3 miles south of Freeport, 1.2 miles west along the Intracoastal Waterway, and 200 feet north in rangeland:

A11—0 to 8 inches; dark reddish brown (5YR 3/3) clay, reddish brown (5YR 4/3) dry; common fine and medium distinct dark gray (10YR 4/1) mottles; moderate coarse blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few concretions of calcium carbonate; calcareous; saline; moderately alkaline; clear smooth boundary.

A12g—8 to 30 inches; dark brown (7.5YR 3/2) clay, dark brown (7.5YR 4/2) dry; many medium and coarse dark gray (N 4/0) and light gray (N 6/0) mottles; weak medium and coarse blocky structure; very hard, very firm, very sticky and plastic; common fine roots; calcareous; saline; moderately alkaline; clear smooth boundary.

ACg—30 to 65 inches; mottled reddish brown (2.5YR 4/4), yellowish red (5YR 4/6), and dark gray (10YR 4/1) clay; moderate coarse blocky structure; very hard, very firm, very sticky and plastic; few fine roots; few concretions of calcium carbonate; calcareous; saline; strongly alkaline.

The solum ranges from 40 to more than 60 inches in thickness. It is calcareous throughout. The soil is moderately to strongly saline throughout.

The A horizon is clay, but in some pedons a thin layer of silty clay is on the surface. The horizon is dark reddish brown, dark brown, very dark grayish brown, dark brown, or very dark brown. It is neutral to strongly alkaline.

The AC horizon is reddish gray, dark reddish gray, dark reddish brown, reddish brown, yellowish red, brown, dark brown, or strong brown or is mottled with these colors and with grays. Some pedons have thin buried horizons that have other colors. In some pedons loamy or sandy material is below a depth of 50 inches. The AC horizon is mildly to strongly alkaline.

Veston series

The Veston series consists of nearly level, poorly drained, saline soils. These soils are in marshes. They formed in loamy recent marine and fluvial deposits. Slopes range from 0.1 to 0.4 percent.

Typical pedon of Veston loam; from intersection of Farm Road 2004 and Farm Road 2917 about 9 miles southeast of Liverpool, 2.2 miles northeast on Farm Road 2004, 3.0 miles southeast on field road, 1.9 miles easterly on the same road across Halls Bayou, 2.5 miles south, and 200 feet southeast:

A1—0 to 11 inches; dark gray (10YR 4/1) loam, gray (10YR 5/1) dry; few thin strata less than 2 inches thick of fine sandy loam; few fine faint yellowish brown mottles; weak medium subangular blocky structure; hard, friable, nonsticky and nonplastic; common fine roots; few uncoated sand grains; saline; moderately alkaline; abrupt wavy boundary.

C1g—11 to 26 inches; light brownish gray (10YR 6/2) silty clay loam, light gray (10YR 7/2) dry; few strata of fine sandy loam and silt loam, dry; common fine distinct yellowish brown (10YR 5/6) and common fine faint gray (10YR 6/1) mottles; massive; hard, firm, sticky and plastic; few fine roots; few fine pores; few fine black concretions; strongly saline; moderately alkaline; clear wavy boundary.

IIC2g—26 to 60 inches; light brownish gray (2.5Y 6/2) loam, light gray (2.5Y 7/2) dry; few strata of clay loam and fine sandy loam; common fine distinct yellowish brown (10YR 5/6) mottles; few fine faint light gray mottles; massive; hard, friable, nonsticky and nonplastic; few fine black concretions; strongly saline; moderately alkaline.

The A horizon is mainly loam but ranges to silty clay loam. It is gray, light brownish gray, grayish brown, dark gray, dark grayish brown, very dark gray, very dark grayish brown, brown, dark brown, olive gray, or dark olive gray. It is neutral to moderately alkaline and is slightly saline to strongly saline.

The Cg horizon is fine sandy loam, loam, silt loam, silty clay loam, or clay loam. It is dark gray, gray, dark gray, dark grayish brown, grayish brown, light brownish gray, olive gray, or light olive gray. In most pedons, it is mottled with gray and brown.

The IICg horizon is shades of gray and has mottles of gray, olive, yellow, and brown. It is moderately to strongly alkaline.

formation of the soils

This section discusses the factors of soil formation, explains the processes of soil formation, and relates them to the formation of the soils in the survey area.

factors of soil formation

The characteristics of the soil at any given point are determined by five factors. These factors include the physical and mineral composition of the parent material; the climate since the parent material was deposited; the plant and animal life on and in the soil; the relief, or topography of the land; and the length of time since the parent material was deposited. These five factors influence the characteristics of every soil. However, the influence of each factor varies from place to place. For example in Brazoria County the parent material has a dominant influence on the soil, whereas in other counties it may be only one of several important factors.

The interrelationship among these five factors is complex, and the effects of any one factor cannot be isolated and completely evaluated. However, it is convenient to discuss each factor separately and to indicate its effects on the soil.

parent material

Parent material is the unconsolidated mass from which a soil forms. Although parent material can be deposited in many ways, the parent material in Brazoria County was laid down by water and wind. The sediments deposited by water are dominantly clayey and those deposited by wind are dominantly sandy.

By far the most important type of parent material is that which was laid down by water. The soils of Pleistocene age, such as Bernard, Edna, and Lake Charles soils, formed in flood plain sediments of large rivers. These sediments are dominantly clayey. They retard the movement of water and air, making the process of soil development very slow.

Deposition of sediment by distributary channels was an important process during the Pleistocene age. Distributary channels are associated with large rivers that have a low gradient and a large sediment load and given enough time, develop a delta. The streams within the delta are called distributary channels. These distributary channels develop natural levees similar to those associated with other streams. They deposit loamy material as a natural levee on top of the clayey marine material. In Brazoria County, the loamy surface layer of soils such as Aris, Bernard, and Edna soils is related to the natural levees of the distributary channels.

Some water-laid deposits of Holocene age are flood plain sediments of rivers. These sediments are the parent material of soils such as Asa and Pledger soils. In Brazoria County, these sediments are loamy or clayey and alkaline. The loamy deposits are on natural levees of streams and stream meanders. The clayey deposits are associated with the rest of the flood plain. The loamy deposits have developed into soils such as Asa, Clemville, and Norwood. The loamy material does not restrict the movement of water and air, making further soil development relatively easy.

A second type of water-laid deposit of Holocene age is shallow-water marine sediment. Harris soils and Mustang soils, for example, formed in this material. They are sandy to clayey.

The deposits in which wind has played an important role are the parent material of marsh soils such as Galveston and Mustang soils. The parent material of the Galveston and Mustang soils is beach deposits that have been reworked by wind. These sandy deposits are dominantly quartz, which is highly resistant to weathering. Although water and air can move freely in these soils above the water table, the abundance of quartz makes further soil development difficult.

The parent material of the Kenney soil was probably deposited by both wind and water. It was probably deposited during the Holocene age by fluvial processes and reworked by strong westerly winds that carried the material some distance and deposited it again. Although this parent material contained a large amount of sand-sized quartz, it also contained an appreciable amount of silt and clay. Because water and air moved through the parent material quickly, soil development was rapid. Clay-enriched horizons, therefore, have developed easily.

climate

The climate of Brazoria County is humid, or warm and moist. It is presumed to be similar to the climate that existed when the parent material was laid down. The abundant rainfall, which has caused soils such as Kenney soils to develop significant clay-enriched layers, has been the dominant influence of climate on soil development in Brazoria County. The climate has also been an important factor in the abundance of plant and animal life that promotes soil development in the county.

plant and animal life

Plant and animal life include such things as grasses, trees, micro-organisms within the soil, and animals that live in the soil, such as earthworms, crawfish, and some insects. The soil supplies nutrients to plants and animals, and the parent material or soil also receives organic matter from the plants and animals. This plant and animal life also grows and burrows in the soil or parent material changing the structure and making the soil porous. This activity promotes soil development by allowing more movement of air and water than would exist without the plant and animal life.

The abundant vegetation on these soils in the past has resulted in an accumulation of organic matter in the surface layer. The organic matter is largely responsible for the dark colored surface layer of many of the soils in Brazoria County. The accumulation of organic matter is one reason why many of the soils are naturally fertile.

Within recent time, the activity of man has also become an important factor in soil formation.

relief

Relief primarily affects the movement of water on and within the soil. Most of the county is nearly level, and thus, soil erosion is not an important factor affecting soil formation. However, soil drainage is important to the development of the soils in Brazoria County. Whenever excess water remains within the soil for an extended period, the soil will develop gleyed characteristics where this excess water is located. Soils such as Beaumont and Leton soils are gleyed. However, some soils such as Brazoria soil also have excess water, but the drainage capability of the red or brown parent material has retarded the development of the gleyed characteristics. The red subsoil of the Kenney soil is characteristic of better drained soils that do not have excess water.

time

The length of time that the soil forming factors have acted on the parent material determines, to a large degree, the soil characteristics if the soils are on a favorable position on the landscape and have favorable materials for soil development. With the exception of soils like Galveston and Mustang, the soils in Brazoria County have favorable positions and favorable materials for soil development.

processes of soil horizon differentiation

Several processes were involved in the formation of horizons in the soils of Brazoria County: accumulation of organic matter, leaching of calcium carbonate, reduction and transfer of iron, and translocation of silicate clay minerals. In some soils, more than one of these processes have been active in the development of horizons.

The accumulation of organic matter in the upper part of a profile helps to form an A1 horizon. This horizon is the part of the soil where the most biological activity occurs. It is the part of the soil where plant roots can most easily find nutrients. Soils such as Edna, Galveston, and Kenney soils have a low amount of organic matter. The darker colored soils, such as Asa, Bernard, and Lake Charles soils, have a medium amount of organic matter.

The reduction and movement of iron, caused by the process of gleying, is evident in the poorly drained soils in the county. The gray color in the subsoil indicates this process. Some horizons have yellowish to black mottles and concretions, indicating a segregation of iron. The Leton soil, for example, is poorly drained, is gray, and has black concretions in the subsoil.

The Kenney soil is an example of a soil that has had translocation of clay minerals, which has contributed to horizon development. The B2t horizon has an accumulation of clay in the pores and on faces of peds.

The Asa soil shows the accumulation of calcium carbonate. The calcium carbonate has been moved from the upper part of the profile and has accumulated in the lower part.

surface geology

By Dr. Saul Aronow, Department of Geology, Lamar University, Beaumont, Texas

Brazoria County is within the West Gulf Coast subdivision of the Atlantic and Gulf Coastal Plains geomorphic province of the United States (*7*). The surface sediments dip gently Gulfward and are Holocene or Pleistocene in age.

The general soil map units can be roughly correlated with the geologic units shown on maps of the Geologic Atlas of Texas (*22, 23*). The relationships between the geologic units and the general soil map units are summarized in table 20. The environments of deposition of the Pleistocene and Holocene sediments listed in table 20 are only a rough approximation of the many such environments in the county. More detailed maps and environmental distinctions are given by Fisher (*6*) and McGowen (*9*).

The geologic formations can be broadly divided into two groups: the Beaumont Formation of the Pleistocene and the Holocene deposits.

During a time of high sea level, possibly similar to the present, the ancient counterparts of the Brazos and Colorado Rivers deposited the major part of the Beaumont Formation, which probably extended Gulfward beyond the present shoreline. Sometime during or shortly after the deposition of those sediments the several segments of Ingleside barrier island, or strand plain, were deposited. These events probably occurred during the Sangamon interglacial stage between the Illinoian and Wisconsin glacial stages over 60,000 years ago, or between the more recent substages of the Wisconsin Glaciation.

Since its deposition the Beaumont Formation tilted slightly Gulfward. This tilting has depressed the deltaic terminations of the ancestral Brazos and Colorado Rivers below sea level.

A glacial readvance followed the deposition of the Beaumont Formation 17,000 to 20,000 years ago. During this advance the sea level declined to perhaps 275 to 400 feet below the present level. The counterparts of the Colorado, Brazos, and Trinity Rivers and the coastal streams in the rest of the world lowered their flood plains and channels by erosion and were graded to the lower, more distant ocean.

When the sea level rose again, the lower reaches of the channels and flood plains flooded and a series of bays, or estuaries, formed. The Trinity River bay, or estuary, is an existing example. Some of the major Gulf Coast streams, such as the Brazos and Colorado Rivers, have completely filled their estuaries.

The present sea level is generally estimated to have been stabilized between 3,500 and 5,000 years ago. Shoreline features, such as the beaches that fringe the coastal marshes and the spit or barrier island—Follets Island—were all formed after the present sea level was established.

Tectonic events such as the rise of salt domes, deep subsurface faulting, and regional tilting, have occurred in the county since pre-Beaumont time.

The general slope of the Beaumont Formation toward the Gulf is about 2 feet per mile (*5*) in contrast with the slope of the Holocene fluviatile surface, which is about 1.2 to 1.4 feet per mile (*4*). The Pleistocene surface slope is greater because of Gulfward tilting after deposition. Because of the greater regional slope, the northwestern, landward portion of the Beaumont surface is higher than the Holocene surface. Nearer to the coast, the Pleistocene and the Holocene are at the same elevation, while still closer to the coast the Pleistocene is overlapped and covered with the Holocene fluviatile and coastal deposits. Therefore, near the coast the elevation and drainage of the soils of both the Pleistocene and the Holocene origin are similar; and distinctions based on differences in elevation and age tend to diminish.

The Francitas-Narta map unit is the near-coast, poorly drained part of the Beaumont Formation. The Surfside-Velasco map unit is the poorly drained part of the Holocene fluviatile deposits.

Most of the Pleistocene fluviatile parent material was probably deposited by the ancestral Brazos and Colorado Rivers.

Two groups of sediments make up the well-preserved depositional topography of the Pleistocene Beaumont Formation—the major group is fluviatile in origin, the minor group is barrier island or strand plain in origin.

Most of the fluviatile parts of the Beaumont Formation are the sites of clayey soils of the Lake Charles map unit, which have formed on relict floodbasin or backswamp deposits. The higher lying loamy soils of the Bernard-Edna and Edna-Aris map units are on the relict meander-belt or distributary deposits of channel, levee, and point-bar origin. The meander ridges in many places exhibit well-preserved serpentine channel segments occupied by the poorly drained Leton soils, which are also found in many small undrained depressions that are too small to delineate at the scale of this soil survey.

The Pleistocene fluviatile parent material underlies the Francitas-Narta map unit near the coast in areas of poor drainage and brackish waters. Narta soil in places is on the meander ridge deposits and is a saline counterpart of Edna soil. Francitas soil, on the flood basin deposits, is the saline equivalent of Lake Charles soil.

The divided, rejoined, segmented, and discontinuous pattern of the meander ridges, sites of the Bernard-Edna and Edna-Aris map units, reflects the changing course of the Brazos River in the Pleistocene. Large segments of the channel were probably abandoned as the flooded river broke through its natural levees and established a new course through lower adjacent flood basins. After a previous course was abandoned, it compacted slightly because of intercalated clays, underwent gully erosion and mass-wasting, and was partly or completely covered by later flood basin deposits.

Many of the meander ridges probably escaped burial by the flood basin deposits of both the Pleistocene and Holocene ages because they were elevated slightly through structural or tectonic effects of salt dome rise and through folding and faulting of oil-producing structures. Hoskins Mound, Damon Mound, Danbury Mound, and the Stratton Ridge domes, which are areas of the Bernard-Edna map unit, are examples of domes. Bryan Mound dome preserves only two small circles of Lake Charles clay above the surrounding Holocene deposits. Of the eight salt domes in the county (*16*)—structures made by the upward movement of cylinders, or columns, of salt from depths of thousands of feet as they dome up, pierce, and cause the faulting of overlying strata—at least five (Damon Mound, West Columbia, Bryan Mound, Stratton Ridge, and Hoskins Mound) have produced topographic hills, sinks, or isolated geologic and pedologic anomalies. Many oil-producing structures, mostly northeast-trending short anticlines cut by similarly oriented, normal faults that dip toward the Gulf, have influenced both the way the Pleistocene Formation crops out and, directly or indirectly, the surface drainage patterns. Areas of the Bernard-Edna map unit overlying the Manvel, Bailey's Prairie, Sweeney, and Danciger oilfields are examples of meanders preserved by oil-producing structures.

The drainage patterns of the Pleistocene surface are determined to some extent by the distribution of meander ridges on this depositional topography (*3*), and their modifications and distortions are due to tectonic effects. The upper reaches of the San Bernard River, for example, flow in a topographically low part of the Lake Charles map unit that formed on flood basin deposits, as do parts of Chocolate, Austin, Persimmon, and Mustang bayous. The upper reaches of Mustang Bayou near the town of Alvin flow in a relict meandering course on a meander ridge.

The relict Ingleside barrier island system (*12,13*) is only a minor part of the Beaumont Formation in Brazoria County and is the parent material for that part of the Mustang-Veston map unit east of Chocolate Bay and for the elongated area of the Edna-Aris map unit east of Hoskins Mound.

The Ingleside barrier island system extends from western Louisiana to Corpus Christi, Texas. From just east of Galveston Bay in Chambers County to its south end, the island maintains an elevation above sea level comparable to that of the modern barrier islands, indicating that it may have been deposited when the sea level was similar to that of the present.

The sands of the Ingleside System near Hoskins Mound have given rise to the Aris soils of the Leton-Aris complex on the detailed soil map. Aris fine sandy loam is on the pimple mounds, and Leton loam is in the depressional areas. Some areas have less than 2 feet of loam in the upper part, which is thin for a barrier island sand, but the soils fall well within the Pleistocene group and would be difficult to account for otherwise. The soil on Rattlesnake Mound, on the east side of Chocolate Bay, is Galveston fine sand. This area is nearer the concept of a barrier island because the sand is more than 6 feet thick. The disparities between the sand thicknesses and the degree of profile development of these two parts of the Ingleside System cannot be easily resolved. Perhaps the upper portion of an originally thicker barrier island sand in the vicinity of Hoskins Mound was removed by wind or by hurricane surges and deposited on the Narta soils to the landward.

A strand plain origin, rather than a barrier island origin, for the Ingleside System has been proposed (*24*). The major difference between a strand plain and a barrier island is the absence of a well-defined lagoon or of extensive lagoonal deposits landward of a strand plain. Shallow subsurface geologic information for the area is lacking, and the soils data are inconclusive. The Narta soils landward of the western Ingleside segment near Hoskins Mound may have formed on relict lagoonal deposits with eolian or storm surge increments or on Pleistocene fluviatile sediments that conceal earlier lagoonal deposits. Landward of Rattlesnake Mound (the eastern segment of the Ingleside System) Holocene coastal marsh sediments, which make up the substrata of the Harris-Veston map unit, may likewise hide Pleistocene lagoonal sediments.

Modern barrier islands along the Gulf Coast and other parts of the Ingleside System display a surface morphology of closely spaced subparallel to parallel beach and foredune ridges. This ridged pattern was destroyed in Brazoria County, possibly by the action of the wind, hurricane storm surges, or by whatever processes contribute to the formation of pimple mounds.

Two kinds of microrelief features, namely small depressions and pimple mounds, control to some extent the location of several soil series. In Brazoria County, this microrelief is restricted to the Beaumont Formation. The depressions are round to elliptical, less than 400 feet in diameter, and up to 4 feet deep. On the general soil map they are characteristic features within the Bernard-Edna and Edna-Aris map units. On the detailed

soil maps they are characteristic features in the Leton-Aris complex. Depressional areas of the Leton soils that are too small to be mapped separately are included on the detailed maps in areas of the Edna-Aris complex. Some of the depressions are probably wind deflation hollows (blowouts) formed during previous dry periods. Others are segmented and partly filled stream channels or swales on point bar surfaces or oxbows—all relicts of a fluviatile topography. All have apparently been modified by wind action. On the Ingleside barrier island surface (see table 20) some depressions, in addition to being blowouts, are probably segmented interbeach ridge swales, or segmented hurricane washover and tidal channels.

The pimple mounds are circular to elongate knolls, generally less than 4 feet high, and less than 200 feet across. In most places, the mounds are the sites of soils that have a loamy A horizon, such as the soils of the Aris and Edna series. The intermound areas are sites of less sandy soils or loamy soils that have a thinner surface layer. On the minor relict Ingleside barrier part of the Beaumont Formation, the mounds are the sites of loamy Aris soil and sandy Galveston soil.

Many theories for the genesis of pimple mounds have been proposed, virtually all of which have pedogenic consequences. Some of the more plausible theories suggest that the mounds are: (a) remnants left after sheet flood or wind erosion of the surface; (b) accumulations of wind-transported clay, silt, and sand around clumps of vegetation whose relief was later enhanced by erosional processes; and (c) the "fluffing-up" (the reduction of bulk density) of surface materials by the burrowing activities of animals and, possibly, the addition of eolian material.

The microrelief of the pimple mounds should not be confused with the "hog-wallowed," or gilgai, topography of soils like the Lake Charles series, which is caused by expansion and contraction of the clay during wetting and drying.

Many sand pits have been opened around the meander ridges. Examination of these pits shows that the sands are of fluviatile origin but are overlain by finer sediments, which are the parent materials of the present day soils. These sands are mostly below a depth of 6 feet.

The Holocene deposits, like those of the Pleistocene, can be divided into a major fluviatile and a minor littoral group.

In Brazoria County, the Holocene fluviatile sediments were deposited by the Brazos, San Bernard, and Colorado Rivers and by several minor streams that ran across deposits originally laid down by those major rivers.

Analogously, the Holocene sediments and their soils can be divided into flood basin (Pledger-Brazoria map unit), meander-ridge (Norwood-Asa map unit), and poorly drained and very poorly drained saline (Surfside-Velasco map unit) groups.

The present course of the Brazos River subparallels an older, prehistoric course, now Oyster Creek. The Oyster Creek course was abandoned by the Brazos River about 1,000 years ago (*4*). This old course divides near Stratton Ridge. Of the two courses presently near Stratton Ridge, Oyster Creek and Big Slough, the one to the east is probably older.

The narrow strips of meander ridge deposits on which portions of the Asa-Norwood map unit rest in the Sweeney-Four Corners area are probably, in part, abandoned courses of the San Bernard River and part of the Linnville Bayou.

The ancient Colorado River, when it flowed in the course that is now Caney Creek in Matagorda County, probably contributed some of the flood basin sediments of the Pledger-Brazoria map unit south of the community of Four Corners. Estimates on the amount of time since the Colorado's abandoning of the Caney Creek course range from a few hundred (*8*) to several thousand years (*14*).

Cedar Lake Creek now flows in the topographically depressed flood basin between this Caney Creek meander ridge (in Matagorda County) and the meander ridge southeast of Four Corners.

The Holocene deposits of the Brazos and Colorado Rivers have a characteristic reddish-brown, or yellowish-red color, as can be seen in the lower part of the profiles of the Pledger-Brazoria and Asa-Norwood map units. This reddish ferric-oxide pigment is traditionally thought to be derived from the Permian red beds into which the drainage basins of these streams penetrate several hundred miles to the north and west. The reddish colors are also occasionally seen in deep excavations in the Pleistocene deposits of these streams.

In some of the poorly and very poorly drained saline soils of the Surfside-Velasco map unit, formed mostly on flood basin fluviatile sediments, reducing conditions have promoted the formation of grayish hydrated ferrous oxides and hydroxides. The reddish substrates of these soils identify them as being of fluviatile origin.

The parent materials of the Harris-Veston map unit are the Holocene coastal marsh deposits. Hurricane storm surges, very high tides, sheet flows from higher ground during heavy rains, and overflow from tidal streams, large and small, all transport clays, silts, sands, and organic detrius into the marsh where it is trapped and held together by marsh vegetation. The dark, grayish colors of the marsh soils are probably due in part to their high organic content and in part to the reduced ferrous oxides and hydroxides.

The sands of the Mustang-Veston map unit border the Gulf. The major part of the soil map unit is beach deposits. Rattlesnake Mound is the only large inland area of this soil map unit and is part of the older Pleistocene barrier island sediments. Follets Island, which encloses Christmas Bay, is also a kind of spit or small barrier island.

The long-term littoral and longshore drift of sand along the shore, which maintains and nourishes the beaches,

runs from northeast to southwest (*8*). Sources of sand include stream-derived sediment, shoreline erosion updrift, and shoreward transport of drowned littoral deposits in shallow parts of the continental shelf.

From the mid-1850's to 1974 about half of the shoreline of the county underwent net erosion and retreat (*10*) at the rate of about 2 feet to 15 feet per year. The other half of the shoreline, approximately between the old mouth of the Brazos River, at the towns of Surfside and Quintana, and the new mouth (opened in 1929), has shown net accretion in the same period of about 3 feet per year to over 45 feet per year, the greater accretion occurring in the vicinity of the new channel. The retreat of most of the shoreline is considered the continuation of a prehistoric trend. Possibly a major factor in causing this retreat was a decrease in rainfall reducing stream discharge and hence reducing sedimentation of the Gulf. Long term regional tilting toward the Gulf and subsidence and the compaction of clayey sediments are probably also important factors. Man's influence, for example, the trapping of river sediment behind dams, may have contributed to this trend.

references

(1) American Association of State Highway [and Transportation] Officials. 1970. Standard specifications for highway materials and methods of sampling and testing. Ed. 10, 2 vol., illus.

(2) American Society for Testing and Materials. 1974. Method for classification of soils for engineering purposes. ASTM Stand. D 2487-69. *In* 1974 Annual Book of ASTM Standards, Part 19, 464 pp., illus.

(3) Barton, D.C. 1930. Surface geology of coastal southeast Texas. Amer. Assoc. Petrol. Geol. Bull., vol. 14, pp. 1301-1320.

(4) Bernard, H.A., R. J. LeBlanc, and C. F. Majors. 1962. Recent and Pleistocene geology of southeast Texas. *In* Rainwater, E.H., and R. P. Zingula, eds., Geology of the Gulf Coast and Central Texas, pp. 175-224. Houston Geol. Soc.

(5) Bernard, H.A. and R. J. LeBlanc. 1965. Resume of the Quaternary geology of the northwestern Gulf of Mexico Province. *In* Wright, H.E. and D.G. Frey, The Quaternary of the United States. Princeton: Princeton Univ. Press, pp. 137-185.

(6) Fisher, W.L., J.H. McGowen, and C. G. Groat. 1972. Environmental geologic atlas of the Texas coastal zone—Galveston-Houston area. Univ. Texas Bur. Econ. Geol., Austin, Texas, 91 pp.

(7) Hunt, C.B. 1974. Natural regions of the United States and Canada. San Francisco; W.H. Freeman and Co., 725 pp.

(8) LeBlanc, R.J., and W.D. Hodgson. 1959. Origin and development of the Texas shoreline. Trans. Gulf Coast Assoc. Geol. Soc., vol. 9, pp. 197-220.

(9) McGowen, J.H., L. F. Brown, T.J. Evans, W.L. Fisher, and C.G. Groat. 1976. Environmental geologic atlas of the Texas coastal zone—Bay City-Freeport area. Univ. Texas Bur. Econ. Geol., Austin, Texas, 98 pp.

(10) Morton, R.A., and M.J. Pieper. 1975. Shoreline changes in the vicinity of the Brazos River delta (San Luis Pass to Brown Cedar Cut)—an analysis of historic changes of the Texas Gulf shoreline. Univ. Texas Bur. Econ. Geol. Circ. 75-4, 74 pp.

(11) Newcomb, W.W., Jr. 1961. The Indians of Texas from prehistoric to modern times. Austin: The University of Texas Press, p. 62.

(12) Price, J.A. 1933. Role of diastrophism in topography of Corpus Christi area, south Texas. Amer. Assoc. Petrol. Geol. Bull., vol. 17, pp. 907-962.

(13) Price, J.A. 1947. Equilibrium of form and forces in tidal basins of coast of Texas and Louisiana. Amer. Assoc. Petrol. Geol. Bull., vol. 31, pp. 1619-1633.

(14) Rogers, J.J.W., and J.C. Longshore. 1965. Late Pleistocene and recent history of a portion of the Colorado River Valley, Texas. Trans. Gulf Coast Assoc. Geol. Soc., vol. 15, pp. 161-166.

(15) Show, S.P., and C.G. Fredine. 1956. Wetlands of the United States. Circ. 19, 67 pp.

(16) Sundeen, W.M., and J.B. Wesselman. 1973. Groundwater resources of Brazoria County, Texas. Texas Water Dev. Bd. Rep. 163, 199 pp.

(17) Texas Conservation Needs Committee. 1970. Conservation needs inventory. U.S. Dep. Agric., Soil Conserv. Serv., 297 pp., illus.

(18) United States Department of Agriculture. 1902. Soil survey of Brazoria Area, Texas. *In* Field operations of the Bureau of Soils, pp. 349-364.

(19) United States Department of Agriculture. 1951. Soil survey manual. U.S. Dep. Agric. Handb. 18, 503 pp., illus. [Supplements replacing pp. 173-188 issued May 1962]

(20) United States Department of Agriculture. 1965. Predicting rainfall-erosion losses from cropland east of the Rocky Mountains. U.S. Dep. Agric. Handb. 282, 47 pp.

(21) United States Department of Agriculture. 1975. Soil taxonomy: A basic system of soil classification for making and interpreting soil surveys. Soil Conserv. Serv., U.S. Dep. Agric. Handb. 436, 754 pp., illus.

(22) University of Texas Bureau of Economic Geology. 1968. Geologic atlas of Texas, Houston sheet.

(23) University of Texas Bureau of Economic Geology. 1975. Geologic atlas of Texas, Beeville-Bay City sheet.

(24) Wilkinson, B.H., J.H. McGowen, and C.R. Lewis. 1975. Ingleside strand plain sand of central Texas coast. Amer. Assoc. Petrol. Geol. Bull., vol. 59, pp. 347-352.

(25) Wortham, L.J. 1924. A History of Texas from wilderness to commonwealth. Fort Worth: Wortham-Molyneaux Company, p. 155.

glossary

AC soil. A soil having only an A and a C horizon. Commonly such soil formed in recent alluvium or on steep rocky slopes.

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

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

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

Area reclaim (in tables). An area difficult to reclaim after the removal of soil for construction and other uses. Revegetation and erosion control are extremely difficult.

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

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as—

	Inches
Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	More than 12

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

Blowout. A shallow depression from which all or most of the soil material has been removed by wind. A blowout has a flat or irregular floor formed by a resistant layer or by an accumulation of pebbles or cobbles. In some blowouts the water table is exposed.

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

Boulders. Rock fragments larger than 2 feet (60 centimeters) in diameter.

Calcareous soil. A soil containing enough calcium carbonate (commonly combined with magnesium carbonate) to effervesce visibly when treated with cold, dilute hydrochloric acid.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

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

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

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

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

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

Coarse fragments. If round, mineral or rock particles 2 millimeters to 25 centimeters (10 inches) in diameter; if flat, mineral or rock particles (flagstone) 15.2 to 38.1 centimeters (6 to 15 inches) long.

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

Complex slope. Irregular or variable slope. Planning or constructing terraces, diversions, and other water-control measures on a complex slope is difficult.

Complex, soil. A map unit of two or more kinds of soil in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils are somewhat similar in all areas.

Concretions. Grains, pellets, or nodules of various sizes, shapes, and colors consisting of concentrated

compounds or cemented soil grains. The composition of most concretions is unlike that of the surrounding soil. Calcium carbonate and iron oxide are common compounds in concretions.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers. Terms commonly used to describe consistence are—
Loose.—Noncoherent when dry or moist; does not hold together in a mass.
Friable.—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.
Firm.—When moist, crushes under moderate pressure between thumb and forefinger, but resistance is distinctly noticeable.
Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.
Sticky.—When wet, adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.
Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger.
Soft.—When dry, breaks into powder or individual grains under very slight pressure.
Cemented.—Hard; little affected by moistening.

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

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

Cover crop. A close-growing crop grown primarily to improve and protect the soil between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

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

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

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

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

Drainage class (natural). Refers to the frequency and duration of periods of saturation or partial saturation during soil formation, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven classes of natural soil drainage are recognized:
Excessively drained.—Water is removed from the soil very rapidly. Excessively drained soils are commonly very coarse textured, rocky, or shallow. Some are steep. All are free of the mottling related to wetness.
Somewhat excessively drained.—Water is removed from the soil rapidly. Many somewhat excessively drained soils are sandy and rapidly pervious. Some are shallow. Some are so steep that much of the water they receive is lost as runoff. All are free of the mottling related to wetness.
Well drained.—Water is removed from the soil readily, but not rapidly. It is available to plants throughout most of the growing season, and wetness does not inhibit growth of roots for significant periods during most growing seasons. Well drained soils are commonly medium textured. They are mainly free of mottling.
Moderately well drained.—Water is removed from the soil somewhat slowly during some periods. Moderately well drained soils are wet for only a short time during the growing season, but periodically they are wet long enough that most mesophytic crops are affected. They commonly have a slowly pervious layer within or directly below the solum, or periodically receive high rainfall, or both.
Somewhat poorly drained.—Water is removed slowly enough that the soil is wet for significant periods during the growing season. Wetness markedly restricts the growth of mesophytic crops unless artificial drainage is provided. Somewhat poorly drained soils commonly have a slowly pervious layer, a high water table, additional water from seepage, nearly continuous rainfall, or a combination of these.
Poorly drained.—Water is removed so slowly that the soil is saturated periodically during the growing season or remains wet for long periods. Free water is commonly at or near the surface for long enough during the growing season that most mesophytic crops cannot be grown unless the soil is artificially drained. The soil is not continuously saturated in layers directly below plow depth. Poor drainage results from a high water table, a slowly pervious layer within the profile, seepage, nearly continuous rainfall, or a combination of these.
Very poorly drained.—Water is removed from the soil so slowly that free water remains at or on the surface during most of the growing season. Unless the soil is artificially drained, most mesophytic crops cannot be grown. Very poorly drained soils are commonly level or depressed and are frequently ponded. Yet, where rainfall is high and nearly continuous, they can have moderate or high slope gradients.

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

Edge effect. A diverse community of contrasting vegetation where an open area and a wooded area meet.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.
Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.
Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of the activities of man or other animals or of a catastrophe in nature, for example, fire, that exposes the surface.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Excess salts (in tables). Excess water-soluble salts in the soil that restrict the growth of most plants.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, tilth, and other growth factors are favorable.

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

Flood plain. A nearly level alluvial plain that borders a stream and is subject to flooding unless protected artificially. Flooding frequencies for this landform do not correspond to the 100-year flooding frequencies cited by government agencies. In Brazoria County, the flood plain soils formed only in recent fluvial sediments.

Forb. Any herbaceous plant not a grass or a sedge.

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

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

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

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

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

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

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

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

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an upper case letter represents the major horizons. Numbers or lower case letters that follow represent subdivisions of the major horizons. An explanation of the subdivisions is given in the *Soil Survey Manual*. The major horizons of mineral soil are as follows:
O horizon.—An organic layer of fresh and decaying plant residue at the surface of a mineral soil.
A horizon.—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.
B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these. The combined A and B horizons are generally called the solum, or true soil. If a soil does not have a B horizon, the A horizon alone is the solum.
C horizon.—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the A or B horizon. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the Roman numeral II precedes the letter C.

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

Hydrologic soil groups. Refers to soils grouped according to their runoff-producing characteristics. The chief consideration is the inherent capacity of

soil bare of vegetation to permit infiltration. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Impervious soil. A soil through which water, air, or roots penetrate slowly or not at all. No soil is absolutely impervious to air and water all the time.

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

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

Infiltration capacity. The maximum rate at which water can infiltrate into a soil under a given set of conditions.

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

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

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

Invaders. On range, plants that encroach into an area and grow after the climax vegetation has been reduced by grazing. Generally, invader plants follow disturbance of the surface.

Irrigation. Application of water to soils to assist in production of crops. Methods of irrigation are—

Border.—Water is applied at the upper end of a strip in which the lateral flow of water is controlled by small earth ridges called border dikes, or borders.

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

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

Large stones (in tables). Rock fragments 3 inches (7.5 centimeters) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

Low strength. The soil is not strong enough to support loads.

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

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

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

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

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

Muck. Dark colored, finely divided, well decomposed organic soil material.

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

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

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

Organic matter. Plant and animal residue in the soil in various stages of decomposition.

Pan. A compact, dense layer in a soil that impedes the movement of water and the growth of roots. For

example, *hardpan, fragipan, claypan, plowpan,* and *traffic pan*.

Ped. An individual natural soil aggregate, such as a granule, a prism, or a block.

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square meter to 10 square meters), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

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

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

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

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

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

Piping (in tables). Formation of subsurface tunnels or pipelike cavities by water moving through the soil.

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or evapotranspiration.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

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

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

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

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

Range site. An area of rangeland where climate, soil, and relief are sufficiently uniform to produce a distinct natural plant community. A range site is the product of all the environmental factors responsible for its development. It is typified by an association of species that differ from those on other range sites in kind or proportion of species or total production.

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

	pH
Extremely acid	Below 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

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

Retrogression. The downward trend in the range condition over time. This term often indicates a less desirable plant community.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rooting depth (in tables). Shallow root zone. The soil is shallow over a layer that greatly restricts roots.

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

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

Saline soil. A soil containing soluble salts in an amount that impairs growth of plants. A saline soil does not contain excess exchangeable sodium.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sandstone. Sedimentary rock containing dominantly sand-size particles.

Salty water (in tables.) Water that is too salty for consumption by livestock.

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

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

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

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

Silica. A combination of silicon and oxygen. The mineral form is called quartz.

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

Site index. A designation of the quality of a forest site based on the height of the dominant stand at an arbitrarily chosen age. For example, if the average height attained by dominant and codominant trees in a fully stocked stand at the age of 50 years is 75 feet, the site index is 75 feet.

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

Slow intake (in tables). The slow movement of water into the soil.

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

Sodicity. The degree to which a soil is affected by exchangeable sodium. Sodicity is expressed as a sodium absorption ratio (SAR) of a saturation extract, or the ratio of Na^+ to $Ca^{++} + Mg^{++}$. The degrees of sodicity are—

	SAR
Slight	Less than 13:1
Moderate	13-30:1
Strong	More than 30:1

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles less than 2 mm in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows:

	Millimeters
Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25
Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

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

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

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

Strand plain. A low sandy island near the shore and parallel to it. A strand plain does not have an associated lagoon on the landward side.

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

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

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

Substratum. The part of the soil below the solum.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 centimeters). Frequently designated as the "plow layer," or the "Ap horizon."

Taxadjuncts. Soils that cannot be classified in a series recognized in the classification system. Such soils are named for a series they strongly resemble and are designated as taxadjuncts to that series because they differ in ways too small to be of consequence in interpreting their use and behavior.

Terrace. An embankment, or ridge, constructed across sloping soils on the contour or at a slight angle to the contour. The terrace intercepts surface runoff so that water soaks into the soil or flows slowly to a prepared outlet. A terrace in a field is generally built so that the field can be farmed. A terrace intended

mainly for drainage has a deep channel that is maintained in permanent sod.

Terrace (geologic). An old alluvial plain, ordinarily flat or undulating, bordering a river, a lake, or the sea.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Upland (geology). In Brazoria County, land that formed from sediments not associated with a recent alluvial plain or stream terrace.

Water table. The upper limit of the soil or underlying rock material that is wholly saturated with water.

Water table, perched. A water table standing above an unsaturated zone. In places an upper, or perched, water table is separated from a lower one by a dry zone.

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Wilting point (or permanent wilting point). The moisture content of soil, on an ovendry basis, at which a plant (specifically sunflower) wilts so much that it does not recover when placed in a humid, dark chamber.

tables

TABLE 1.--TEMPERATURE AND PRECIPITATION

[Recorded in the period 1951-76 at Angleton, Texas]

Month	Temperature						Precipitation				
	Average daily maximum	Average daily minimum	Average daily	2 years in 10 will have-- Maximum temperature higher than--	2 years in 10 will have-- Minimum temperature lower than--	Average number of growing degree days[1]	Average	2 years in 10 will have-- Less than--	2 years in 10 will have-- More than--	Average number of days with 0.10 inch or more	Average snowfall
	°F	°F	°F	°F	°F	Units	In	In	In		In
January	64.1	42.5	53.3	80	20	195	3.41	1.28	5.12	6	.1
February	66.4	45.0	55.7	82	24	200	3.78	1.39	5.69	6	.2
March	71.8	50.9	61.4	86	28	364	2.85	.63	4.59	4	.0
April	78.0	59.6	68.8	89	37	564	3.01	.96	4.64	4	.0
May	83.7	65.4	74.6	92	47	763	4.84	1.80	7.28	5	.0
June	88.9	70.5	79.7	96	59	891	5.63	1.55	8.91	5	.0
July	91.7	72.3	82.0	98	66	992	4.08	1.56	6.11	6	.0
August	91.5	71.8	81.7	98	64	983	5.43	2.30	7.97	7	.0
September	88.1	68.3	78.2	97	52	846	6.42	2.15	9.83	8	.0
October	81.6	58.1	69.9	93	39	617	3.75	.87	6.04	5	.0
November	72.6	50.2	61.4	87	27	351	4.22	1.38	6.48	5	.0
December	66.4	44.3	55.4	81	23	209	4.70	2.14	6.77	7	.0
Yearly:											
Average	78.7	58.2	68.5	---	---	---	---	---	---	---	---
Extreme	---	---	---	100	18	---	---	---	---	---	---
Total	---	---	---	---	---	6,975	52.12	37.49	65.69	68	.3

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

TABLE 2.--FREEZE DATES IN SPRING AND FALL

[Recorded in the period 1951-76 at Angleton, Texas]

Probability	Temperature		
	24° F or lower	28° F or lower	32° F or lower
Last freezing temperature in spring:			
1 year in 10 later than--	February 10	March 12	March 28
2 years in 10 later than--	February 1	March 3	March 19
5 years in 10 later than--	January 12	February 12	March 3
First freezing temperature in fall:			
1 year in 10 earlier than--	December 1	November 12	November 6
2 years in 10 earlier than--	December 12	November 22	November 15
5 years in 10 earlier than--	January 1	December 12	November 30

TABLE 3.--GROWING SEASON

[Recorded in the period 1951-76 at Angleton, Texas. The symbol > means more than]

Probability	Daily minimum temperature		
	Higher than 24° F	Higher than 28° F	Higher than 32° F
	Days	Days	Days
9 years in 10	311	268	240
8 years in 10	322	280	251
5 years in 10	>365	302	272
2 years in 10	>365	325	293
1 year in 10	>365	337	304

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

Map symbol	Soil name	Acres	Percent
1	Aris fine sandy loam	5,780	0.6
2	Asa silt loam	13,100	1.4
3	Asa silty clay loam	36,700	3.8
4	Asa-Urban land complex	1,790	0.2
5	Beaches	740	0.1
6	Beaumont clay	19,500	2.0
7	Bernard clay loam	70,100	7.3
8	Bernard-Edna complex	49,400	5.1
9	Bernard-Urban land complex	2,440	0.3
10	Brazoria clay, 0 to 1 percent slopes	44,100	4.6
11	Brazoria clay, 1 to 5 percent slopes	3,310	0.3
12	Clemville silty clay loam	3,810	0.4
13	Edna fine sandy loam, 0 to 1 percent slopes	38,430	4.0
14	Edna fine sandy loam, 1 to 5 percent slopes	5,150	0.5
15	Edna-Aris complex	27,000	2.8
16	Follet clay loam	3,530	0.4
17	Francitas clay	16,050	1.7
18	Galveston fine sand, undulating	1,340	0.1
19	Harris clay	21,600	2.3
20	Harris-Tracosa complex	5,570	0.6
21	Ijam clay	7,200	0.7
22	Ijam-Urban land complex	2,560	0.3
23	Kenney loamy fine sand, 0 to 3 percent slopes	190	*
24	Lake Charles clay, 0 to 1 percent slopes	257,810	26.8
25	Lake Charles clay, 1 to 8 percent slopes	2,200	0.2
26	Lake Charles-Urban land complex	1,120	0.1
27	Leton loam	4,870	0.5
28	Leton-Aris complex	3,660	0.4
29	Morey silt loam	1,550	0.2
30	Mustang fine sand	2,330	0.2
31	Mustang fine sand, saline	3,790	0.4
32	Narta fine sandy loam	14,850	1.5
33	Norwood silt loam, 0 to 1 percent slopes	13,100	1.4
34	Norwood silt loam, 1 to 5 percent slopes	2,290	0.2
35	Norwood-Asa complex, 1 to 8 percent slopes	2,320	0.2
36	Pledger clay	136,200	14.2
37	Pledger-Urban land complex	870	0.1
38	Sumpf clay	5,860	0.6
39	Surfside clay	41,000	4.3
40	Tatlum clay loam	1,780	0.2
41	Tracosa mucky clay	2,010	0.2
42	Velasco clay	8,050	0.8
43	Veston loam	3,910	0.4
44	Veston silty clay loam, strongly saline	4,950	0.5
	Water areas more than 40 acres	68,010	7.1
	Total	961,920	100.0

* Less than 0.1 percent.

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

[Yields in the N columns are for nonirrigated soils; those in the I columns are for irrigated soils. Yields are those that can be expected under a high level of management. Absence of a yield indicates that the soil is not suited to the crop or the crop generally is not grown on the soil]

Map symbol and soil name	Rice		Grain sorghum		Cotton lint		Corn		Soybeans		Improved bermudagrass	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Lb	Lb	Bu	Bu	Bu	Bu	AUM*	AUM*
1---Aris	---	120	60	---	500	---	70	---	30	---	10.0	---
2, 3---Asa	---	---	110	---	650	---	110	---	---	---	10.0	---
4---Asa-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
5. Beaches												
6---Beaumont	---	120	75	---	400	---	70	---	30	---	10	---
7---Bernard	---	120	90	---	500	---	80	---	30	---	10	---
8---Bernard-Edna	---	120	82	---	469	---	67	---	29	---	9.5	---
9---Bernard-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
10---Brazoria	---	---	90	90	500	550	90	100	30	---	10	---
11---Brazoria	---	---	80	---	400	---	45	---	---	---	8	---
12---Clemville	---	---	90	---	600	---	90	---	---	---	9.0	---
13---Edna	---	120	65	---	400	---	40	---	25	---	8.0	---
14---Edna	---	---	60	---	350	---	35	---	20	---	8.0	---
15---Edna-Aris	---	123	63	---	429	---	48	---	27	---	8.6	---
16---Follet	---	---	---	---	---	---	---	---	---	---	---	---
17---Francitas	---	70	35	---	---	---	---	---	---	---	---	---
18---Galveston	---	---	---	---	---	---	---	---	---	---	6	---
19---Harris	---	---	---	---	---	---	---	---	---	---	---	---
20---Harris-Tracosa	---	---	---	---	---	---	---	---	---	---	---	---
21---Ijam	---	---	---	---	---	---	---	---	---	---	---	---
22---Ijam-Urban land	---	---	---	---	---	---	---	---	---	---	---	---

See footnote at end of table.

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

Map symbol and soil name	Rice		Grain sorghum		Cotton lint		Corn		Soybeans		Improved bermudagrass	
	N	I	N	I	N	I	N	I	N	I	N	I
	Bu	Bu	Bu	Bu	Lb	Lb	Bu	Bu	Bu	Bu	AUM*	AUM*
23--Kenney	---	---	---	---	250	---	30	---	---	---	8.0	---
24--Lake Charles	---	130	90	---	500	---	75	---	30	---	10	---
25--Lake Charles	---	---	80	---	400	---	45	---	20	---	8	---
26--Lake Charles-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
27--Leton	---	90	---	---	---	---	---	---	25	---	---	---
28--Leton-Aris	---	106	---	---	---	---	---	---	27	---	---	---
29--Morey	---	120	80	---	450	---	75	---	---	---	---	---
30, 31--Mustang	---	---	---	---	---	---	---	---	---	---	---	---
32--Narta	---	---	---	---	---	---	---	---	---	---	---	---
33--Norwood	---	---	90	120	600	1,000	110	130	40	---	10.0	---
34--Norwood	---	---	80	110	550	950	90	100	---	---	8.5	---
35--Norwood-Asa	---	---	---	---	---	---	---	---	---	---	---	---
36--Pledger	---	110	90	90	500	550	90	100	35	---	10	---
37--Pledger-Urban land	---	---	---	---	---	---	---	---	---	---	---	---
38--Sumpf	---	---	---	---	---	---	---	---	---	---	3.5	---
39--Surfside	---	---	---	---	---	---	---	---	---	---	---	---
40--Tatlum	---	---	---	---	---	---	---	---	---	---	---	---
41--Tracosa	---	---	---	---	---	---	---	---	---	---	---	---
42--Velasco	---	---	---	---	---	---	---	---	---	---	---	---
43, 44--Veston	---	---	---	---	---	---	---	---	---	---	---	---

* Animal-unit-month: The amount of forage or feed required to feed one animal unit (one cow, one horse, one mule, five sheep, or five goats) for 30 days.

TABLE 6.--CAPABILITY CLASSES AND SUBCLASSES

[Miscellaneous areas are excluded. Absence of an entry indicates no acreage]

Class	Total acreage	Major management concerns (Subclass)		
		Erosion (e)	Wetness (w)	Soil problem (s)
		Acres	Acres	Acres
I	67,837	---	---	---
II	547,929	3,218	544,711	---
III	119,814	10,660	108,964	190
IV	24,617	1,392	23,225	---
V	---	---	---	---
VI	69,290	1,340	53,100	14,850
VII	54,573	---	49,623	4,950
VIII	5,570	---	1,780	3,790

TABLE 7.--WOODLAND MANAGEMENT AND PRODUCTIVITY

[Only the soils suitable for production of commercial trees are listed. Absence of an entry indicates that information was not available]

Map symbol and soil name	Ordination symbol	Management concerns				Potential productivity		Trees to plant
		Erosion hazard	Equipment limitation	Seedling mortality	Plant competition	Common trees	Site index	
1---------- Aris	3w	Slight	Moderate	Slight	Moderate	Loblolly pine------- Water oak---------- Cherrybark oak------	80 --- ---	Loblolly pine, slash pine.
2, 3---------- Asa	2o	Slight	Slight	Slight	Slight	Eastern cottonwood-- Pecan---------- White ash----------	100 --- ---	Eastern cottonwood, black walnut, pecan, white ash.
6---------- Beaumont	3w	Slight	Severe	Severe	Severe	Loblolly pine------- Water oak---------- Cherrybark oak------	80 70 70	Loblolly pine, slash pine, water oak, cherrybark oak.
7---------- Bernard	3w	Slight	Moderate	Moderate	Severe	Loblolly pine------- Water oak---------- Cherrybark oak------	80 70 70	Loblolly pine, slash pine, water oak, cherrybark oak.
10, 11---------- Brazoria	5w	Slight	Severe	Severe	Moderate	Pecan---------- Green ash----------	--- 50	Pecan, green ash.
12---------- Clemville	2o	Slight	Slight	Slight	Slight	Eastern cottonwood-- Pecan---------- White ash----------	100 --- ---	Eastern cottonwood, black walnut, pecan, white ash.
13, 14---------- Edna	3w	Slight	Severe	Severe	Severe	Loblolly pine------- Water oak---------- Cherrybark oak------	80 70 70	Loblolly pine, slash pine, water oak, cherrybark oak.
23---------- Kenney	3s	Slight	Moderate	Moderate	Moderate	Cherrybark oak------ Water oak----------	70 70	Loblolly pine, slash pine, cherrybark oak.
24, 25---------- Lake Charles	4w	Slight	Severe	Severe	Severe	Loblolly pine------- Water oak---------- Cherrybark oak------	70 60 60	Loblolly pine, slash pine, water oak, cherrybark oak.
33, 34---------- Norwood	2o	Slight	Slight	Slight	Slight	Eastern cottonwood-- Pecan---------- White ash----------	100 --- ---	Eastern cottonwood, pecan, white ash, black walnut.
35:* Norwood----------	2o	Slight	Slight	Slight	Slight	Eastern cottonwood-- Pecan---------- White ash----------	100 --- ---	Eastern cottonwood, pecan, white ash, black walnut.
Asa----------	2o	Slight	Slight	Slight	Slight	Eastern cottonwood-- Pecan---------- White ash----------	100 --- ---	Eastern cottonwood, black walnut, pecan, white ash.
36---------- Pledger	4w	Slight	Moderate	Severe	Moderate	Pecan---------- Water oak---------- Green ash----------	60 60 ---	Pecan, water oak, green ash.

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

TABLE 8.--RECREATIONAL DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
1---------- Aris	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
2, 3---------- Asa	Severe: floods.	Slight----------	Slight----------	Slight----------	Slight.
4:* Asa----------	Severe: floods.	Slight----------	Slight----------	Slight----------	Slight.
Urban land.					
5:* Beaches					
6---------- Beaumont	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
7---------- Bernard	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
8:* Bernard----------	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
Edna----------	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
9:* Bernard----------	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.
Urban land.					
10, 11---------- Brazoria	Severe: floods, wetness, percs slowly.	Severe: too clayey, percs slowly.	Severe: too clayey, wetness.	Severe: too clayey.	Severe: too clayey.
12---------- Clemville	Severe: floods.	Moderate: percs slowly.	Moderate: percs slowly.	Severe: erodes easily.	Slight.
13, 14---------- Edna	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
15:* Edna----------	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
Aris----------	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
16--- Follet	Severe: floods, percs slowly, excess sodium.	Severe: floods, percs slowly, excess sodium.	Severe: floods, percs slowly, excess sodium.	Severe: floods, erodes easily.	Severe: excess salt, excess sodium, floods.
17--- Francitas	Severe: floods, ponding, percs slowly.	Severe: ponding, too clayey, percs slowly.	Severe: too clayey, ponding, percs slowly.	Severe: ponding, too clayey.	Severe: ponding, too clayey.
18--- Galveston	Severe: floods, too sandy.	Severe: too sandy.	Severe: too sandy.	Severe: too sandy.	Moderate: droughty, floods.
19--- Harris	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: excess salt, wetness.
20:*					
Harris---	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: excess salt, wetness.
Tracosa---	Severe: floods, too clayey, percs slowly.	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey, percs slowly.	Severe: floods, too clayey.	Severe: excess salt, excess sodium, floods.
21--- Ijam	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: excess salt, wetness, too clayey.
22:*					
Ijam---	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: excess salt, wetness, too clayey.
Urban land.					
23--- Kenney	Slight---	Slight---	Slight---	Slight---	Moderate: droughty.
24, 25--- Lake Charles	Severe: wetness, percs slowly, too clayey.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
26:*					
Lake Charles---	Severe: wetness, percs slowly, too clayey.	Severe: wetness, too clayey, percs slowly.	Severe: too clayey, wetness, percs slowly.	Severe: wetness, too clayey.	Severe: wetness, too clayey.
Urban land.					
27--- Leton	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.
28:*					
Leton---	Severe: floods, wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
28:*					
Aris	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, percs slowly.	Severe: wetness, erodes easily.	Severe: wetness.
29---- Morey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness, erodes easily.	Severe: wetness.
30---- Mustang	Severe: floods, wetness, too sandy.	Severe: wetness, too sandy.	Severe: too sandy, wetness, floods.	Severe: wetness, too sandy.	Severe: wetness, floods.
31---- Mustang	Severe: floods, wetness, too sandy.	Severe: wetness, too sandy, excess salt.	Severe: too sandy, wetness, floods.	Severe: wetness, too sandy.	Severe: excess salt, wetness, floods.
32---- Narta	Severe: wetness, percs slowly, excess sodium.	Severe: wetness, excess sodium, excess salt.	Severe: wetness, percs slowly, excess sodium.	Severe: wetness, erodes easily.	Severe: excess salt, excess sodium, wetness.
33---- Norwood	Severe: floods.	Slight----	Slight----	Severe: erodes easily.	Slight.
34---- Norwood	Severe: floods.	Slight----	Moderate: slope.	Severe: erodes easily.	Slight.
35:*					
Norwood	Severe: floods.				
Asa	Severe: floods.	Slight----	Moderate: slope.	Slight----	Slight.
36---- Pledger	Severe: percs slowly, floods, wetness.	Severe: too clayey, wetness, percs slowly.	Severe: percs slowly, too clayey, wetness.	Severe: too clayey, wetness.	Severe: wetness, too clayey.
37:*					
Pledger	Severe: percs slowly, floods, wetness.	Severe: too clayey, wetness, percs slowly.	Severe: percs slowly, too clayey, wetness.	Severe: too clayey, wetness.	Severe: wetness, too clayey.
Urban land.					
38---- Sumpf	Severe: floods, wetness, percs slowly.	Severe: wetness, floods, too clayey.	Severe: too clayey, wetness, floods.	Severe: wetness, too clayey.	Severe: wetness, floods, too clayey.
39---- Surfside	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: too clayey, wetness.	Severe: wetness, too clayey.	Severe: excess salt, wetness.
40---- Tatlum	Severe: floods, percs slowly, excess sodium.	Severe: floods, percs slowly, excess sodium.	Severe: floods, percs slowly, excess sodium.	Severe: floods.	Severe: excess salt.

See footnote at end of table.

TABLE 8.--RECREATIONAL DEVELOPMENT--Continued

Map symbol and soil name	Camp areas	Picnic areas	Playgrounds	Paths and trails	Golf fairways
41---------- Tracosa	Severe: floods, too clayey, percs slowly.	Severe: floods, percs slowly, too clayey.	Severe: floods, too clayey, percs slowly.	Severe: floods, too clayey.	Severe: excess salt, excess sodium, floods.
42---------- Velasco	Severe: floods, wetness, percs slowly.	Severe: wetness, too clayey, excess salt.	Severe: wetness, too clayey.	Severe: wetness, too clayey.	Severe: excess salt, wetness, droughty.
43---------- Veston	Severe: floods, wetness, excess salt.	Severe: wetness, excess salt.	Severe: wetness, floods, excess salt.	Severe: wetness, erodes easily.	Severe: excess salt, wetness, droughty.
44---------- Veston	Severe: floods, wetness, excess sodium.	Severe: wetness, excess sodium.	Severe: wetness, floods, excess sodium.	Severe: wetness, erodes easily.	Severe: excess salt, excess sodium, wetness.

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

TABLE 9.--WILDLIFE HABITAT

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

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
1---------- Aris	Fair	Fair	Good	Fair	---	Good	Good	Fair	Fair	Good	---
2, 3---------- Asa	Good	Good	Fair	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
4:*											
Asa----------	Good	Good	Fair	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
Urban land.											
5.* Beaches											
6---------- Beaumont	Fair	Fair	Poor	Fair	---	Fair	Good	Fair	Fair	Fair	---
7---------- Bernard	Fair	Good	Fair	Good	---	Fair	Fair	Fair	Good	Fair	---
8:*											
Bernard----------	Fair	Good	Fair	Good	---	Fair	Fair	Fair	Good	Fair	---
Edna----------	Fair	Fair	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
9:*											
Bernard----------	Fair	Good	Fair	Good	---	Fair	Fair	Fair	Good	Fair	---
Urban land.											
10, 11---------- Brazoria	Fair	Fair	Fair	Good	Fair	Poor	Fair	Fair	Good	Poor	Fair.
12---------- Clemville	Good	Good	Fair	Good	---	Poor	Very poor.	Good	Good	Very poor.	---
13---------- Edna	Fair	Fair	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
14---------- Edna	Fair	Fair	Fair	Fair	---	Poor	Very poor.	Fair	Fair	Very poor.	---
15:*											
Edna----------	Fair	Fair	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
Aris----------	Fair	Fair	Good	Fair	---	Good	Good	Fair	Fair	Good	---
16---------- Follet	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor	Good	Very poor.	---	Fair	Very poor.
17---------- Francitas	Poor	Fair	Fair	---	Fair	Poor	Good	Poor	---	Fair	Fair.
18---------- Galveston	Poor	Fair	Fair	---	Fair	Very poor.	Fair	Fair	---	Poor	Fair.
19---------- Harris	Very poor.	Very poor.	Poor	---	Very poor.	Good	Good	Very poor.	---	Good	Very poor.
20:*											
Harris----------	Very poor.	Very poor.	Poor	---	Very poor.	Good	Good	Very poor.	---	Good	Very poor.

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
20:* Tracosa	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor	Good	Very poor.	---	Fair	Very poor.
21--- Ijam	Very poor.	Very poor.	Poor	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
22:* Ijam	Very poor.	Very poor.	Poor	Very poor.	---	Good	Good	Very poor.	Very poor.	Good	---
Urban land.											
23--- Kenney	Poor	Fair	Fair	Fair	---	Poor	Very poor.	Poor	Fair	Very poor.	---
24--- Lake Charles	Fair	Fair	Fair	Good	---	Fair	Good	Fair	Good	Fair	---
25--- Lake Charles	Fair	Fair	Fair	Good	---	Poor	Very poor.	Fair	Good	Poor	---
26:* Lake Charles	Fair	Fair	Fair	Good	---	Fair	Good	Fair	Good	Fair	---
Urban land.											
27--- Leton	Poor	Fair	Fair	---	Fair	Good	Good	Fair	---	Good	Fair.
28:* Leton	Poor	Fair	Fair	---	Fair	Good	Good	Fair	---	Good	Fair.
Aris	Fair	Fair	Good	Fair	---	Good	Good	Fair	Fair	Good	---
29--- Morey	Fair	Fair	Fair	Fair	---	Good	Good	Fair	Fair	Good	---
30--- Mustang	Poor	Poor	Fair	---	Fair	Fair	Good	Poor	---	Fair	Fair.
31--- Mustang	Poor	Poor	Poor	---	Poor	Fair	Fair	Poor	---	Fair	Poor.
32--- Narta	Poor	Poor	Very poor.	---	Very poor.	Fair	Fair	Poor	---	Fair	Very poor.
33--- Norwood	Good	Good	Fair	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
34--- Norwood	Good	Good	Fair	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
35:* Norwood	Fair	Good	Fair	---	Fair	Poor	Very poor.	Fair	---	Very poor.	Fair.
Asa	Good	Good	Fair	---	Fair	Poor	Very poor.	Good	---	Very poor.	Fair.
36--- Pledger	Fair	Fair	Fair	Good	Good	Poor	Good	Fair	Good	Fair	Fair.
37:* Pledger	Fair	Fair	Fair	Good	Good	Poor	Good	Fair	Good	Fair	Fair.
Urban land.											

See footnote at end of table.

TABLE 9.--WILDLIFE HABITAT--Continued

Map symbol and soil name	Potential for habitat elements							Potential as habitat for--			
	Grain and seed crops	Grasses and legumes	Wild herbaceous plants	Hardwood trees	Shrubs	Wetland plants	Shallow water areas	Openland wildlife	Woodland wildlife	Wetland wildlife	Rangeland wildlife
38. Sumpf											
39---------- Surfside	Very poor.	Poor	Poor	---	Fair	Fair	Good	Poor	---	Fair	Poor.
40---------- Tatlum	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor	Good	Very poor.	---	Fair	Very poor.
41---------- Tracosa	Very poor.	Very poor.	Very poor.	---	Very poor.	Poor	Good	Very poor.	---	Fair	Very poor.
42---------- Velasco	Very poor.	Poor	Very poor.	---	Very poor.	Fair	Good	Very poor.	---	Fair	Very poor.
43, 44---------- Veston	Very poor.	Fair	Poor	---	Poor	Good	Good	Poor	---	Good	Poor.

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

TABLE 10.--SELECTED PLANTS FOR LANDSCAPING

[Only the soils suitable for shrubs and trees are listed]

Map symbol and soil name	Shrubs	Trees
1, 15* Aris	Azalea, blackhaw, camellia, crapemyrtle, flowering dogwood, flowering quince, gardenia, hawthorn, leucothoe, shrubby althaea, trifoliate orange, yaupon.	American holly, camphor-tree, cherry laurel, dawn redwood, loblolly pine, magnolia, redbud, red maple, river birch, sassafras, slash pine, sweetgum, water oak, white oak.
2, 3, 4* Asa	American beautyberry, arrowwood, Barbados-cherry, guava, hawthorn, lantana, Agarita, pyracantha, wisteria, yaupon.	Anaqua, baldcypress, black walnut, bur oak, green ash, loquat, magnolia, mountain laurel, pecan, red buckeye, redbud, Shumard oak, water oak, western soapberry.
6 Beaumont	American elder, bottlebrush, boxwood, crapemyrtle, ligustrum, Nandina, Pittosporum, pomegranate, privet, pyracantha, yaupon, yew.	Baldcypress, camphor-tree, Chinese elm, golden raintree, green ash, live oak, loblolly pine, Mexican plum, mulberry, redbud, slash pine, Shumard oak, southern crabapple, southern red oak, sweetgum, water oak, willow oak.
7, 8,* 9* Bernard	American beautyberry, American elder, arrowwood, bottlebrush, boxwood, bridalwreath, crapemyrtle, guava, ligustrum, Nandina, Pittosporum, yaupon, yew.	Chinese elm, golden raintree, jujube, live oak, loblolly pine, Mexican plum, mulberry, redbud, Shumard oak, slash pine, southern crabapple, southern red oak, water oak.
10, 11 Brazoria	Boxwood, buttonbush, hawthorn, lantana, ligustrum, Nandina, Pittosporum, privet, pyracantha, sumac, yaupon.	Baldcypress, cedar elm, Chinese elm, Chinese tallow, green ash, hackberry, magnolia, Mexican plum, mulberry, pecan, persimmon, water oak, willow oak.
12 Clemville	American beautyberry, arrowwood, Barbados-cherry, bottlebrush, guava, hawthorn, ligustrum, Nandina, Pittosporum, yaupon.	Black walnut, eastern redcedar, green ash, hackberry, honeylocust, linden, mulberry, Nuttall oak, pecan, red buckeye, Shumard oak, southern crabapple, western soapberry.
13, 14, 15* Edna	American beautyberry, farkleberry, lantana, ligustrum, Pittosporum, possumhaw, pyracantha, shrubby althaea, sumac, trifoliate orange, yaupon.	Blackgum, cherry laurel, Chinese elm, dawn redwood, loblolly pine, magnolia, monkeypuzzle tree, red maple, Shumard oak, slash pine, southern red oak, swamp chestnut oak, sweetgum, water oak.
17 Francitas	Bamboo, bottlebrush, bumelia, oleander, salt cedar, shore juniper, thorny elaeagnus, true myrtle, wax myrtle.	Black locust, Chinese tallow, huisache, Japanese black pine, maritime pine, Mediterranean palm, parkinsonia, Washington palm.
18 Galveston	Acuma, aralia, bay live oak, beach plum, bottlebrush, fig (Benjamin, fiddleleaf, common), Florida anise, natal plum, oleander, rosemary, sago palm, salt cedar, santolina, shore juniper, Texas ebony, thorny elaeagnus, yucca.	Australian pine, cabbage palm, desert willow, dwarf Chinese palm, eucalyptus, Japanese black pine, Mediterranean palm, Mexican avocado, parkinsonia, pindo palm, silk oak, Texas palmetto, Washington palm, windmill palm.
21, 22* Ijam	Bamboo, Barbados-cherry, bumelia, buttonbush, flowery senna, oleander, salt cedar, shore juniper, true myrtle, wax myrtle.	Black locust, Chinese tallow, huisache, Japanese black pine, mesquite, parkinsonia.

See footnote at end of table.

TABLE 10.--SELECTED PLANTS FOR LANDSCAPING--Continued

Map symbol and soil name	Shrubs	Trees
23--Kenny	Arrowwood, azalea, dwarf hollies, farkleberry, flowering dogwood, hawthorn, Oregon-grape, possumhaw, silverbell, yaupon.	American holly, black cherry, camphor-tree, cherry laurel, dawn redwood, loblolly pine, magnolia, mulberry, sassafras, slash pine, southern red oak, tulip tree, white oak.
24, 25, 26*--Lake Charles	Bottlebrush, boxwood, bridalwreath, crapemyrtle, flowering quince, ligustrum, Nandina, Pittosporum, pomegranate, pyracantha, yaupon, yew.	Baldcypress, Chinese elm, golden raintree, honeylocust, live oak, loblolly pine, loquat, Mexican plum, redbud, Shumard oak, slash pine, southern crabapple, southern red oak, sweetgum, water oak, willow oak.
27, 28--Leton	Arrowwood, boxwood, euonymus, hawthorn, leucothoe, ligustrum, Nandina, Pittosporum, privet, pyracantha, sumac, yaupon.	Baldcypress, bur oak, Chinese elm, loblolly pine, magnolia, Mexican plum, red maple, river birch, slash pine, southern red oak, sweetgum, water oak, willow oak.
29--Morey	Bottlebrush, boxwood, buttonbush, gauva, lantana, ligustrum, Nandina, Pittosporum, wisteria, yaupon, yew.	Baldcypress, black walnut, Chinese tallow, green ash, hackberry, honeylocust, loquat, Mexican plum, pecan, southern crabapple, water oak, weeping willow, willow oak.
30--Mustang	Bay live oak, beach plum, dwarf palmetto, natal plum, oleander, sago palm, salt cedar, shore juniper, thorny elaeagnus, true myrtle, wax myrtle, yucca.	Desert willow, dwarf Chinese palm, eucalyptus, Japanese black pine, maritime pine, Mediterranean palm, Mexican avocado, parkinsonia, pindo palm, Texas palmetto, Washington palmetto, windmill palm.
32--Narta	Bottlebrush, boxwood, dwarf palmetto, ligustrum, oleander, pyracantha, sago palm, salt cedar, shore juniper, thorny elaeagnus, true myrtle.	Black locust, Chinese tallow, huisache, Japanese black pine, maritime pine, Mediterranean palm, parkinsonia, Washington palm.
33, 34, 35--Norwood	Agarita, American beautyberry, American hornbeam, arrowwood, Barbados-cherry, guava, hawthorn, ligustrum, possumhaw, pyracantha, yaupon.	Aleppo pine, Arizona cypress, black walnut, eastern red cedar, green ash, honeylocust, linden, mountain-laurel, mulberry, pecan, red buckeye, redbud, Shumard oak, southern crabapple.
36, 37--Pledger	Arrowwood, common fig, lantana, ligustrum, Pittosporum, possumhaw, privet, pyracantha, sumac, wisteria, yaupon, yew.	Camphor-tree, cedar elm, Chinese elm, eastern red cedar, green ash, hackberry, loquat, pecan, southern crabapple, southern red oak, water oak, weeping willow, willow oak.
38--Sumpf (requires drainage)	Bamboo, Barbados-cherry, buttonbush, ligustrum, oleander, Pittosporum, privet, true myrtle, wax myrtle.	Baldcypress, cedar elm, Chinese tallow, green ash, hackberry, pecan, water oak, weeping willow, willow oak.
39--Surfside	Bamboo, bottlebrush, bumelia, lantana, oleander, salt cedar, shore juniper, thorny elaeagnus, true myrtle, wax myrtle.	Black locust, Chinese tallow, huisache, Japanese black pine, maritime pine, Mediterranean palm, parkinsonia, Washington palm.

See footnote at end of table.

TABLE 10.--SELECTED PLANTS FOR LANDSCAPING--Continued

Map symbol and soil name	Shrubs	Trees
43---------- Veston	Bamboo, bumelia, buttonbush, lantana, oleander, salt cedar, shore juniper, thorny elaeagnus, true myrtle, wax myrtle.	Cabbage palmetto, honeylocust, huisache, Japanese black pine, maritime pine, Mediterranean palm, parkinsonia, Washington palm.

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

TABLE 11.--BUILDING SITE DEVELOPMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
1---------- Aris	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
2, 3---------- Asa	Slight----------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.	Slight.
4:* Asa---------- Urban land.	Slight----------	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.	Slight.
5.* Beaches						
6---------- Beaumont	Severe: cutbanks cave, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness, too clayey.
7---------- Bernard	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
8:* Bernard----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
Edna----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
9:* Bernard---------- Urban land.	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
10, 11---------- Brazoria	Severe: cutbanks cave, wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, shrink-swell.	Severe: too clayey.
12---------- Clemville	Moderate: too clayey.	Severe: floods.	Severe: floods, shrink-swell.	Severe: floods.	Severe: low strength.	Slight.
13, 14---------- Edna	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
15:* Edna----------	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
15:*						
Aris	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
16---- Follet	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Severe: excess salt, excess sodium, floods.
17---- Francitas	Severe: cutbanks cave, ponding.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: floods, ponding, shrink-swell.	Severe: low strength, ponding, shrink-swell.	Severe: ponding, too clayey.
18---- Galveston	Severe: cutbanks cave.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Moderate: droughty, floods.
19---- Harris	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.	Severe: excess salt, wetness.
20:*						
Harris	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.	Severe: excess salt, wetness.
Tracosa	Severe: floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, floods, shrink-swell.	Severe: excess salt, excess sodium, floods.
21---- Ijam	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: excess salt, wetness, too clayey.
22:*						
Ijam	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: excess salt, wetness, too clayey.
Urban land.						
23---- Kenney	Severe: cutbanks cave.	Slight----	Slight----	Slight----	Slight----	Moderate: droughty.
24, 25---- Lake Charles	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness, too clayey.
26:*						
Lake Charles	Severe: cutbanks cave, wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness, too clayey.
Urban land.						
27---- Leton	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, low strength.	Severe: wetness.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
28:*						
Leton	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, floods.	Severe: wetness, low strength.	Severe: wetness.
Aris	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: wetness.
29--- Morey	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Severe: low strength, wetness.	Severe: wetness.
30--- Mustang	Severe: cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: wetness, floods.
31--- Mustang	Severe: cutbanks cave, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, floods.	Severe: excess salt, wetness, floods.
32--- Narta	Severe: wetness.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: wetness, shrink-swell.	Severe: low strength, wetness, shrink-swell.	Severe: excess salt, excess sodium, wetness.
33, 34--- Norwood	Slight---	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.	Slight.
35:*						
Norwood	Slight---	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.	Slight.
Asa	Slight---	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength.	Slight.
36--- Pledger	Severe: wetness.	Severe: wetness, shrink-swell, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: wetness, too clayey.
37:*						
Pledger	Severe: wetness.	Severe: wetness, shrink-swell, floods.	Severe: wetness, floods, shrink-swell.	Severe: wetness, floods, shrink-swell.	Severe: low strength, shrink-swell, wetness.	Severe: wetness, too clayey.
Urban land.						
38--- Sumpf	Severe: too clayey, wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: wetness, low strength, floods.	Severe: wetness, floods, too clayey.
39--- Surfside	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness.	Severe: excess salt, wetness.
40--- Tatlum	Severe: floods.	Severe: floods.	Severe: floods.	Severe: floods.	Severe: low strength, floods.	Severe: excess salt.
41--- Tracosa	Severe: floods.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: floods, shrink-swell.	Severe: low strength, floods, shrink-swell.	Severe: excess salt, excess sodium, floods.

See footnote at end of table.

TABLE 11.--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets	Lawns and landscaping
42---------- Velasco	Severe: wetness.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: floods, wetness, shrink-swell.	Severe: low strength, wetness, floods.	Severe: excess salt, wetness, droughty.
43---------- Veston	Severe: wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: excess salt, wetness, droughty.
44---------- Veston	Severe: wetness, floods.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: floods, wetness.	Severe: low strength, wetness, floods.	Severe: excess salt, excess sodium, wetness.

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

TABLE 12.--SANITARY FACILITIES

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
1 Aris	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
2 Asa	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
3 Asa	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
4:* Asa	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods.	Moderate: floods.	Good.
Urban land.					
5.* Beaches					
6 Beaumont	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
7 Bernard	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
8:* Bernard	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Edna	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
9:* Bernard	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Urban land.					
10 Brazoria	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
11 Brazoria	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
12--Clemville	Severe: percs slowly.	Slight	Severe: too clayey.	Moderate: floods.	Poor: too clayey, hard to pack.
13--Edna	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
14--Edna	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
15:*					
Edna	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Aris	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
16--Follet	Severe: floods, percs slowly.	Severe: floods.	Severe: floods, excess sodium.	Severe: floods.	Poor: ponding, excess sodium, excess salt.
17--Francitas	Severe: ponding, percs slowly.	Slight	Severe: ponding, too clayey, excess salt.	Severe: ponding.	Poor: too clayey, hard to pack, ponding.
18--Galveston	Severe: floods, wetness, poor filter.	Severe: seepage, floods.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: seepage, too sandy.
19--Harris	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, hard to pack, wetness.
20:*					
Harris	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, hard to pack, wetness.
Tracosa	Severe: floods, percs slowly.	Severe: floods.	Severe: floods, too clayey, excess sodium.	Severe: floods.	Poor: too clayey, ponding, hard to pack.
21--Ijam	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
22:*					
Ijam	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Urban land.					

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
23--Kenney	Severe: poor filter.	Severe: seepage.	Severe: seepage.	Severe: seepage.	Poor: seepage.
24--Lake Charles	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
25--Lake Charles	Severe: wetness, percs slowly.	Moderate: slope.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
26:*					
Lake Charles	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
Urban land.					
27--Leton	Severe: wetness, floods, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.
28:*					
Leton	Severe: wetness, floods, percs slowly.	Severe: wetness.	Severe: wetness, floods.	Severe: wetness, floods.	Poor: wetness, too clayey.
Aris	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
29--Morey	Severe: wetness, percs slowly.	Severe: wetness.	Severe: wetness.	Severe: wetness.	Poor: wetness.
30, 31--Mustang	Severe: floods, wetness, poor filter.	Severe: seepage, floods, wetness.	Severe: floods, seepage, wetness.	Severe: floods, seepage, wetness.	Poor: seepage, too sandy, wetness.
32--Narta	Severe: wetness, percs slowly.	Slight	Severe: wetness, too clayey, excess sodium.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
33--Norwood	Moderate: floods, percs slowly.	Moderate: seepage.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
34--Norwood	Moderate: floods, percs slowly.	Moderate: seepage, slope.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
35:*					
Norwood	Moderate: floods, percs slowly.	Moderate: seepage, slope.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.
Asa	Moderate: floods, percs slowly.	Severe: floods.	Moderate: floods, too clayey.	Moderate: floods.	Fair: too clayey.

See footnote at end of table.

TABLE 12.--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
36---------- Pledger	Severe: percs slowly, wetness.	Slight----------	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
37:* Pledger----------	Severe: percs slowly, wetness.	Slight----------	Severe: too clayey, wetness.	Severe: wetness.	Poor: too clayey, wetness.
Urban land.					
38---------- Sumpf	Severe: floods, wetness, percs slowly.	Severe: floods.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, wetness.
39---------- Surfside	Severe: wetness, percs slowly.	Severe: floods, wetness.	Severe: wetness, too clayey.	Severe: wetness.	Poor: too clayey, hard to pack, wetness.
40---------- Tatlum	Severe----------	Severe: floods.	Severe: floods, excess sodium.	Severe: floods.	Poor: hard to pack, ponding, excess sodium.
41---------- Tracosa	Severe: floods, percs slowly.	Severe: floods.	Severe: floods, too clayey, excess sodium.	Severe: floods.	Poor: too clayey, ponding, hard to pack.
42---------- Velasco	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, too clayey.	Severe: floods, wetness.	Poor: too clayey, hard to pack, wetness.
43---------- Veston	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, excess salt.	Severe: floods, wetness.	Poor: hard to pack, wetness, excess salt.
44---------- Veston	Severe: floods, wetness, percs slowly.	Severe: floods, wetness.	Severe: floods, wetness, excess sodium.	Severe: floods, wetness.	Poor: hard to pack, wetness, excess salt.

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

TABLE 13.--CONSTRUCTION MATERIALS

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "good," "fair," and "poor." Absence of an entry indicates that the soil was not rated]

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
1---------- Aris	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
2---------- Asa	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
3---------- Asa	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
4:* Asa----------	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
Urban land.				
5.* Beaches				
6---------- Beaumont	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
7---------- Bernard	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
8:* Bernard----------	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Edna----------	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
9:* Bernard----------	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Urban land.				
10, 11---------- Brazoria	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey.
12---------- Clemville	Poor: low strength, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey, thin layer.
13, 14---------- Edna	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
15:*				
Edna	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness, too clayey.
Aris	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
16 Follet	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium, wetness.
17 Francitas	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
18 Galveston	Good	Probable	Improbable: too sandy.	Poor: too sandy.
19 Harris	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
20:*				
Harris	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
Tracosa	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
21 Ijam	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
22:*				
Ijam	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
Urban land.				
23 Kenney	Good	Probable	Improbable: too sandy.	Fair: too sandy.
24, 25 Lake Charles	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
26:*				
Lake Charles	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Urban land.				

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
27--Leton	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
28:*				
Leton	Poor: wetness, low strength.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
Aris	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
29--Morey	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: wetness.
30--Mustang	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, wetness.
31--Mustang	Poor: wetness.	Probable	Improbable: too sandy.	Poor: too sandy, excess salt, wetness.
32--Narta	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness, excess sodium.
33, 34--Norwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Good.
35:*				
Norwood	Poor: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
Asa	Fair: low strength.	Improbable: excess fines.	Improbable: excess fines.	Fair: too clayey.
36--Pledger	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
37:*				
Pledger	Poor: low strength, shrink-swell, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
Urban land.				
38--Sumpf	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, wetness.
39--Surfside	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.

See footnote at end of table.

TABLE 13.--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
40--- Tatlum	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, excess sodium, wetness.
41--- Tracosa	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, excess sodium.
42--- Velasco	Poor: low strength, wetness, shrink-swell.	Improbable: excess fines.	Improbable: excess fines.	Poor: too clayey, excess salt, wetness.
43--- Veston	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness.
44--- Veston	Poor: low strength, wetness.	Improbable: excess fines.	Improbable: excess fines.	Poor: excess salt, wetness, excess sodium.

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

TABLE 14.--WATER MANAGEMENT

[Some terms that describe restrictive soil features are defined in the Glossary. See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not evaluated]

Map symbol and soil name	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
1---------- Aris	Slight----------	Severe: wetness.	Severe: no water.	Percs slowly---	Wetness, percs slowly, erodes easily.	Wetness, erodes easily, percs slowly.
2, 3---------- Asa	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Erodes easily.
4:* Asa----------	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Erodes easily.
Urban land.						
5.* Beaches						
6---------- Beaumont	Slight----------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Wetness, slow intake, percs slowly.	Wetness, percs slowly.
7---------- Bernard	Slight----------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Wetness, percs slowly.	Wetness, percs slowly.
8:* Bernard----------	Slight----------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Wetness, percs slowly.	Wetness, percs slowly.
Edna----------	Slight----------	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.
9:* Bernard----------	Slight----------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Wetness, percs slowly.	Wetness, percs slowly.
Urban land.						
10, 11---------- Brazoria	Slight----------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Wetness, slow intake, percs slowly.	Wetness, percs slowly.
12---------- Clemville	Slight----------	Moderate: hard to pack.	Severe: no water.	Deep to water	Percs slowly, erodes easily.	Erodes easily, percs slowly.
13---------- Edna	Slight----------	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.
14---------- Edna	Moderate: slope.	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly, slope.	Wetness, percs slowly, slope.	Wetness, erodes easily, percs slowly.
15:* Edna----------	Slight----------	Severe: hard to pack, wetness.	Severe: no water.	Percs slowly---	Wetness, percs slowly.	Wetness, erodes easily, percs slowly.
Aris----------	Slight----------	Severe: wetness.	Severe: no water.	Percs slowly---	Wetness, percs slowly, erodes easily.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
16---- Follet	Slight	Severe: excess salt, excess sodium, ponding.	Severe: salty water.	Floods, percs slowly, excess sodium.	Floods, percs slowly, excess sodium.	Wetness, excess salt, excess sodium.
17---- Francitas	Slight	Severe: hard to pack, ponding, excess salt.	Severe: no water.	Ponding, percs slowly, excess salt.	Ponding, excess salt, slow intake.	Wetness, excess salt, percs slowly.
18---- Galveston	Severe: seepage.	Severe: seepage.	Severe: cutbanks cave.	Deep to water	Droughty, fast intake, slope.	Droughty.
19---- Harris	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, floods, excess salt.	Wetness, slow intake, excess salt.	Wetness, excess salt.
20:* Harris----	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, floods, excess salt.	Wetness, slow intake, excess salt.	Wetness, excess salt.
Tracosa----	Slight	Severe: hard to pack, excess sodium, excess salt.	Severe: salty water.	Percs slowly, excess sodium.	Floods, percs slowly, excess sodium.	Wetness, excess salt, excess sodium.
21---- Ijam	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, excess salt.	Wetness, slow intake, percs slowly.	Wetness, excess salt, percs slowly.
22:* Ijam----	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly, excess salt.	Wetness, slow intake, percs slowly.	Wetness, excess salt, percs slowly.
Urban land.						
23---- Kenney	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Not needed----	Droughty, fast intake.	Droughty.
24, 25---- Lake Charles	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Wetness, slow intake, percs slowly.	Wetness, percs slowly.
26:* Lake Charles----	Slight	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Wetness, slow intake, percs slowly.	Wetness, percs slowly.
Urban land.						
27---- Leton	Slight	Severe: wetness.	Severe: slow refill.	Floods, percs slowly.	Floods, wetness.	Wetness, erodes easily, percs slowly.
28:* Leton----	Slight	Severe: wetness.	Severe: slow refill.	Floods, percs slowly.	Floods, wetness.	Wetness, erodes easily, percs slowly.
Aris----	Slight	Severe: wetness.	Severe: no water.	Percs slowly---	Wetness, percs slowly, erodes easily.	Wetness, erodes easily, percs slowly.
29---- Morey	Slight	Severe: wetness.	Severe: slow refill.	Percs slowly---	Wetness, percs slowly, erodes easily.	Wetness, erodes easily, percs slowly.

See footnote at end of table.

TABLE 14.--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--			Features affecting--		
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Grassed waterways
30---------- Mustang	Severe: seepage.	Severe: seepage, wetness.	Severe: cutbanks cave.	Floods, cutbanks cave.	Wetness, fast intake.	Wetness.
31---------- Mustang	Severe: seepage.	Severe: seepage, wetness, excess salt.	Severe: salty water, cutbanks cave.	Floods, cutbanks cave, excess salt.	Wetness, fast intake, excess salt.	Wetness, excess salt.
32---------- Narta	Slight----------	Severe: wetness, excess sodium, excess salt.	Severe: no water.	Percs slowly, excess salt, excess sodium.	Wetness, excess sodium, percs slowly.	Wetness, excess salt, excess sodium.
33, 34---------- Norwood	Moderate: seepage.	Severe: piping.	Severe: no water.	Not needed-----	Erodes easily	Erodes easily.
35:*						
Norwood----------	Moderate: seepage, slope.	Severe: piping.	Severe: no water.	Not needed-----	Slope----------	Erodes easily.
Asa----------	Moderate: seepage.	Severe: piping.	Severe: no water.	Deep to water	Favorable------	Erodes easily.
36---------- Pledger	Slight----------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Slow intake, wetness, percs slowly.	Wetness, percs slowly.
37:*						
Pledger----------	Slight----------	Severe: hard to pack, wetness.	Severe: slow refill.	Percs slowly---	Slow intake, wetness, percs slowly.	Wetness, percs slowly.
Urban land.						
38---------- Sumpf	Slight----------	Severe: wetness.	Severe: slow refill.	Percs slowly, floods.	Wetness, slow intake, floods.	Wetness, percs slowly.
39---------- Surfside	Slight----------	Severe: hard to pack, wetness, excess salt.	Severe: slow refill, salty water.	Percs slowly, excess salt.	Wetness, slow intake.	Wetness, excess salt.
40---------- Tatlum	Slight----------	Severe: excess salt, excess sodium.	Severe: salty water.	Floods, percs slowly.	Floods, percs slowly, excess sodium.	Excess salt, excess sodium, wetness.
41---------- Tracosa	Slight----------	Severe: hard to pack, excess sodium, excess salt.	Severe: salty water.	Percs slowly, excess sodium.	Floods, percs slowly, excess sodium.	Wetness, excess salt, excess sodium.
42---------- Velasco	Slight----------	Severe: hard to pack, wetness, excess salt.	Severe: slow refill, salty water.	Percs slowly, floods, excess salt.	Wetness, slow intake.	Wetness, excess salt.
43---------- Veston	Moderate: seepage.	Severe: wetness, excess salt.	Severe: slow refill, salty water.	Percs slowly, floods, excess salt.	Wetness, percs slowly, excess salt.	Wetness, excess salt, erodes easily.
44---------- Veston	Moderate: seepage.	Severe: piping, wetness, excess sodium.	Severe: salty water.	Floods, excess salt, excess sodium.	Wetness, floods, excess sodium.	Wetness, excess salt, excess sodium.

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

TABLE 15.--ENGINEERING INDEX PROPERTIES

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

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
1---------- Aris	0-13	Fine sandy loam	ML, CL, SC, SM	A-4	0	98-100	95-100	95-100	40-60	<25	NP-9
	13-20	Sandy clay loam, clay loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	95-100	55-75	39-48	18-25
	20-50	Clay, clay loam, silty clay loam.	CL, CH	A-7	0	100	95-100	95-100	60-80	42-62	21-36
	50-60	Clay loam, silty clay loam.	CL, CH	A-7	0	100	95-100	95-100	60-80	41-60	20-35
2---------- Asa	0-12	Silt loam--------	CL, CL-ML	A-6, A-4	0	98-100	98-100	95-100	70-100	25-42	6-23
	12-51	Silty clay loam, silt loam, loam.	CL, CL-ML	A-6, A-4	0	98-100	98-100	90-100	70-100	25-46	6-27
	51-61	Very fine sandy loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	98-100	98-100	85-100	60-100	20-46	6-27
3---------- Asa	0-14	Silty clay loam	CL, CL-ML	A-6, A-4	0	98-100	98-100	95-100	70-100	25-42	6-27
	14-61	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0	98-100	98-100	90-100	70-100	25-46	6-27
4:*											
Asa----------	0-14	Silt loam--------	CL, CL-ML	A-6, A-4	0	98-100	98-100	95-100	70-100	25-42	6-23
	14-34	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0	98-100	98-100	90-100	70-100	25-46	6-27
	34-60	Very fine sandy loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	98-100	98-100	85-100	60-100	20-35	6-20
Urban land.											
5.* Beaches											
6---------- Beaumont	0-29	Clay----------	CH	A-7	0	100	85-100	65-75	60-70	55-65	35-45
	29-80	Clay, silty clay	CH	A-7	0	100	90-100	75-90	70-90	75-90	55-65
7---------- Bernard	0-13	Clay loam--------	CL	A-6, A-7	0	100	98-100	90-100	80-95	30-49	12-28
	13-65	Clay, silty clay, clay loam.	CL, CH	A-7	0	98-100	98-100	90-100	90-100	41-70	22-44
8:*											
Bernard----------	0-12	Clay loam--------	CL	A-6, A-7	0	100	98-100	90-100	80-95	30-49	12-28
	12-60	Clay, silty clay, clay loam.	CL, CH	A-7	0	98-100	98-100	90-100	90-100	41-70	22-44
Edna----------	0-9	Fine sandy loam	CL-ML, SM-SC, CL, SC	A-4, A-6	0	100	100	90-100	45-75	23-40	6-20
	9-48	Clay, clay loam	CH	A-7	0	100	98-100	90-100	60-80	50-72	28-46
	48-60	Clay, clay loam, sandy clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	80-100	55-80	30-60	13-35
9:*											
Bernard----------	0-5	Clay loam--------	CL	A-6, A-7	0	100	98-100	90-100	80-95	30-49	12-28
	5-60	Clay, silty clay, clay loam.	CL, CH	A-7	0	98-100	98-100	90-100	90-100	41-70	22-44
Urban land.											
10---------- Brazoria	0-65	Clay----------	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52
11---------- Brazoria	0-70	Clay----------	CH	A-7	0	98-100	98-100	95-100	95-100	60-80	35-52

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
12---------- Clemville	0-16	Silty clay loam	CL, CL-ML	A-6, A-4	0	98-100	98-100	95-100	70-95	25-45	6-25
	16-30	Silt loam, silty clay loam.	CL	A-6	0	98-100	98-100	95-100	70-95	30-40	10-20
	30-60	Silty clay, clay, silty clay loam.	CL, CH	A-7	0	98-100	98-100	95-100	85-100	41-70	22-50
13---------- Edna	0-8	Fine sandy loam	CL-ML, SM-SC, CL, SC	A-4, A-6	0	100	100	90-100	45-75	23-40	6-20
	8-48	Clay, clay loam	CH	A-7	0	100	98-100	90-100	60-80	50-72	28-46
	48-60	Clay, clay loam, sandy clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	80-100	55-80	30-60	13-35
14---------- Edna	0-4	Fine sandy loam	CL-ML, SM-SC, CL, SC	A-4, A-6	0	100	100	90-100	45-75	23-40	6-20
	4-45	Clay, clay loam	CH	A-7	0	100	98-100	90-100	60-80	50-72	28-46
	45-60	Clay, clay loam, sandy clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	80-100	55-80	30-60	13-35
15:*											
Edna----------	0-8	Fine sandy loam	CL-ML, SM-SC, CL, SC	A-4, A-6	0	100	100	90-100	45-75	23-40	6-20
	8-36	Clay, clay loam	CH	A-7	0	100	98-100	90-100	60-80	50-72	28-46
	36-60	Clay, clay loam, sandy clay loam.	CL, CH	A-7, A-6	0	98-100	98-100	80-100	55-80	30-60	13-35
Aris----------	0-23	Fine sandy loam, loam.	ML, CL, SC, SM	A-4	0	98-100	95-100	95-100	40-60	<25	NP-9
	23-33	Sandy clay loam, clay loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	95-100	55-75	39-48	18-25
	33-62	Clay, clay loam, silty clay loam.	CL, CH	A-7	0	100	95-100	95-100	60-80	42-20	21-36
16---------- Follet	0-4	Clay loam--------	SC, CL, CL-ML, SM-SC	A-4, A-6	0	100	100	70-100	40-85	20-40	5-20
	4-60	Stratified silty clay loam to loam.	CL	A-4, A-6, A-7-6	0	100	100	85-100	51-85	28-44	9-21
17---------- Francitas	0-18	Clay----------	CH	A-7-6	0	100	100	95-100	80-95	51-65	30-40
	18-36	Clay, silty clay	CH	A-7-6	0	98-100	95-100	95-100	80-95	60-90	40-65
	36-77	Clay, silty clay, silty clay loam.	CH	A-7-6	0	98-100	95-100	95-100	80-95	60-90	40-65
18---------- Galveston	0-60	Fine sand--------	SP-SM, SM, SP	A-3, A-2-4	0	100	95-100	65-90	2-20	<30	NP-3
	60-80	Fine sand, sand	SW-SM, SP-SM, SP	A-3	0	100	90-100	65-90	2-10	<30	NP-3
19---------- Harris	0-16	Clay----------	CH	A-7	0	98-100	85-95	70-95	70-95	65-80	40-55
	16-60	Clay, silty clay	CH	A-7	0	98-100	94-100	90-100	80-90	60-75	40-55
20:*											
Harris----------	0-15	Clay----------	CH	A-7	0	98-100	85-95	70-95	70-95	65-80	40-55
	15-60	Clay, silty clay	CH	A-7	0	98-100	94-100	90-100	80-90	60-75	40-55
Tracosa----------	0-5	Clay----------	CH, CL	A-7-6, A-6	0	100	100	90-100	80-95	39-66	18-39
	5-60	Clay loam, silty clay loam, clay.	CH, CL	A-7-6, A-6	0	100	100	90-100	80-95	39-66	18-39
21---------- Ijam	0-9	Clay----------	CH, CL	A-7	0	98-100	90-100	90-99	70-95	45-80	25-55
	9-60	Clay----------	CH	A-7	0	100	90-100	90-100	80-98	60-85	35-55

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number--				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
22:*											
Ijam	0-6	Clay	CH, CL	A-7	0	98-100	90-100	90-99	70-95	45-80	25-55
	6-60	Clay	CH	A-7	0	100	90-100	90-100	80-98	60-85	35-55
Urban land.											
23	0-70	Loamy fine sand	SM, SP-SM	A-2-4	0	100	99-100	75-100	10-30	<22	NP-3
Kenney	70-77	Fine sandy loam, sandy clay loam, clay loam.	SC, CL, CL-ML, SM-SC	A-4, A-6, A-2-4, A-2-6	0	100	95-100	80-100	30-55	25-40	7-20
24	0-13	Clay	CH	A-7	0	100	99-100	80-100	75-100	64-80	40-55
Lake Charles	13-64	Clay	CH	A-7	0	98-100	98-100	80-100	75-100	54-90	37-60
	64-80	Clay	CH	A-7	0	94-100	94-100	80-95	75-95	51-90	30-60
25	0-22	Clay	CH	A-7	0	100	99-100	80-100	75-100	64-80	40-55
Lake Charles	22-40	Clay	CH	A-7	0	98-100	98-100	80-100	75-100	54-90	37-60
	40-60	Clay	CH	A-7	0	94-100	94-100	80-95	75-95	51-90	30-60
26:*											
Lake Charles	0-18	Clay	CH	A-7	0	100	99-100	80-100	75-100	64-80	40-55
	18-60	Clay	CH	A-7	0	98-100	98-100	80-100	75-100	54-90	37-60
Urban land.											
27	0-23	Loam	CL, CL-ML, SM-SC, SC	A-4, A-6	0	100	98-100	95-100	45-98	21-30	5-12
Leton	23-62	Clay loam, silty clay loam, sandy clay loam.	CL	A-6, A-7-6	0	100	98-100	95-100	51-98	30-43	14-26
28:*											
Leton	0-21	Loam	CL, CL-ML, SM-SC, SC	A-4, A-6	0	100	98-100	95-100	45-98	21-30	5-12
	21-60	Clay loam, silty clay loam, sandy clay loam.	CL	A-6, A-7-6	0	100	98-100	95-100	51-98	30-43	14-26
Aris	0-20	Fine sandy loam, loam.	ML, CL, SC, SM	A-4	0	98-100	95-100	95-100	40-60	<25	NP-9
	20-31	Sandy clay loam, clay loam, silty clay loam.	CL	A-6, A-7	0	100	95-100	95-100	55-75	39-48	18-25
	31-48	Clay, clay loam, silty clay loam.	CL, CH	A-7	0	100	95-100	95-100	60-80	42-62	21-36
	48-60	Clay loam, silty clay loam.	CL, CH	A-7	0	100	95-100	95-100	60-80	41-60	20-35
29	0-11	Silt loam	CL, CL-ML	A-4, A-6	0	100	95-100	90-100	75-95	23-40	5-18
Morey	11-36	Silty clay loam, clay loam.	CL	A-6, A-7	0	100	95-100	90-100	85-95	34-50	14-30
	36-60	Silty clay loam, silty clay, clay.	CL, CH	A-6, A-7	0	98-100	95-100	90-100	85-95	35-60	15-36
30	0-4	Fine sand	SW-SM, SP-SM, SP	A-2-4, A-3	0-3	85-100	80-100	60-100	2-12	<25	NP-3
Mustang	4-72	Fine sand, sand	SW-SM, SP-SM, SP	A-2-4, A-3	0-3	85-100	80-100	60-100	2-12	<25	NP-3
31	0-8	Fine sand	SW-SM, SP-SM, SP	A-2-4, A-3	0-3	85-100	80-100	60-100	2-12	<25	NP-3
Mustang	8-60	Fine sand, sand	SW-SM, SP-SM, SP	A-2-4, A-3	0-3	85-100	80-100	60-100	2-12	<25	NP-3
32	0-7	Fine sandy loam	SC, CL, SM, ML	A-4, A-6	0	100	100	100	36-75	<30	NP-15
Narta	7-18	Silty clay, clay, clay loam.	CH, CL	A-7-6	0	98-100	95-100	90-100	60-80	48-60	35-45
	18-74	Clay loam, sandy clay, clay.	CH, CL	A-7-6	0	95-100	90-100	90-100	51-80	43-55	30-41

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
33---------- Norwood	0-13	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	51-90	20-35	4-15
	13-48	Silt loam, silty clay loam, loam.	CL	A-6, A-7, A-4	0	100	100	90-100	60-98	25-46	7-26
	48-64	Silt loam, very fine sandy loam, silty clay loam.	CL, ML, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-98	20-45	2-25
34---------- Norwood	0-26	Silt loam--------	CL, CL-ML	A-4, A-6	0	100	100	95-100	51-90	20-35	4-15
	26-40	Silt loam, silty clay loam, loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	60-98	25-46	7-26
	40-60	Silt loam, very fine sandy loam, silty clay loam.	CL, ML, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-98	20-45	2-25
35:*											
Norwood---------	0-18	Silty clay loam	CL, CH	A-6, A-7	0	100	100	95-100	57-98	30-55	6-35
	18-55	Silt loam, silty clay loam, loam.	CL, CL-ML	A-6, A-7, A-4	0	100	100	90-100	62-98	25-46	7-26
	55-63	Silt loam, very fine sandy loam, silty clay loam.	CL, ML, CL-ML	A-4, A-6, A-7	0	100	100	90-100	70-98	20-45	7-25
Asa----------	0-11	Silty clay loam	CL, CL-ML	A-6, A-4	0	98-100	98-100	95-100	70-100	25-42	6-23
	11-38	Silty clay loam, silt loam.	CL, CL-ML	A-6, A-4	0	98-100	98-100	90-100	70-100	25-40	6-27
	38-60	Very fine sandy loam, silty clay loam.	CL, CL-ML	A-4, A-6	0	98-100	98-100	85-100	60-100	20-35	6-20
36---------- Pledger	0-26	Clay----------	CH, CL	A-7-6	0	100	100	90-100	75-100	44-66	22-39
	26-50	Clay, clay loam, silty clay loam.	CH, CL	A-7-6	0	100	95-100	93-100	75-95	44-66	22-39
	50-64	Variable---------	---	---	0	---	---	---	---	---	---
37:*											
Pledger---------	0-26	Clay----------	CH, CL	A-7-6	0	100	100	90-100	75-100	44-66	22-39
	26-50	Clay, clay loam, silty clay loam.	CH, CL	A-7-6	0	100	95-100	93-100	75-95	44-66	22-39
	50-60	Variable---------	---	---	0	---	---	---	---	---	---
Urban land.											
38---------- Sumpf	0-60	Clay----------	CH	A-7	0	98-100	98-100	95-100	95-100	55-80	35-55
39---------- Surfside	0-14	Clay----------	CH	A-7	0	98-100	98-100	95-100	90-100	51-90	28-60
	14-72	Clay----------	CH	A-7	0	98-100	98-100	95-100	90-100	60-95	35-70
40---------- Tatlum	0-28	Clay loam--------	CL	A-6, A-7-6	0	100	100	90-100	70-95	33-46	12-23
	28-60	Stratified very fine sandy loam to clay.	CL, CH	A-6, A-7	0	100	100	90-100	51-98	30-55	11-30
41---------- Tracosa	0-5	Mucky clay-------	CH, CL	A-7-6, A-6	0	100	100	90-100	80-95	39-66	18-39
	5-60	Clay loam, silty clay loam, clay.	CH, CL	A-7-6, A-6	0	100	100	90-100	80-95	39-66	18-39
42---------- Velasco	0-30	Clay----------	CH	A-7	0	100	100	95-100	95-100	60-90	40-70
	30-65	Clay----------	CH	A-7	0	100	100	95-100	95-100	60-90	40-70
43---------- Veston	0-11	Silty clay loam	CL, CH	A-6, A-7-6	0	98-100	98-100	98-100	70-85	25-50	10-30
	11-26	Stratified silt loam to fine sandy loam.	CL-ML, CL	A-4, A-6	0	98-100	98-100	85-100	60-85	20-32	5-15
	26-60	Stratified silty clay loam to fine sandy loam.	CL, CH	A-6, A-7	0	98-100	98-100	90-100	80-95	28-55	13-35

See footnote at end of table.

TABLE 15.--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Fragments > 3 inches	Percentage passing sieve number--				Liquid limit	Plasticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
44----------	0-10	Silty clay loam--	CL, CL-ML	A-4	0	98-100	98-100	80-100	51-85	20-30	5-15
Veston	10-28	Stratified silt loam to fine sandy loam.	CL-ML, CL	A-4, A-6	0	98-100	98-100	85-100	60-85	20-30	5-15
	28-60	Stratified silty clay loam to fine sandy loam.	CL, CH	A-6, A-7-6	0	98-100	98-100	90-100	80-95	40-55	20-35

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

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

[The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated]

Map symbol and soil name	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				Pct
1----------	0-13	10-25	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low----------	0.37	5	<2
Aris	13-20	25-35	0.2-0.6	0.12-0.17	5.1-6.5	<2	Moderate-----	0.32		
	20-50	35-50	<0.06	0.12-0.18	5.1-7.3	<2	High---------	0.32		
	50-60	30-40	<0.06	0.12-0.18	5.1-7.3	<2	High---------	0.32		
2----------	0-12	18-35	0.6-2.0	0.17-0.22	6.6-8.4	<2	Low----------	0.28	5	1-3
Asa	12-51	18-35	0.6-2.0	0.17-0.22	7.9-8.4	<2	Low----------	0.43		
	51-61	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
3----------	0-14	18-35	0.6-2.0	0.17-0.22	6.6-8.4	<2	Low----------	0.28	5	1-3
Asa	14-61	18-35	0.6-2.0	0.17-0.22	7.9-8.4	<2	Low----------	0.43		
4:*										
Asa----------	0-14	18-35	0.6-2.0	0.17-0.22	6.6-8.4	<2	Low----------	0.28	5	1-3
	14-34	18-35	0.6-2.0	0.17-0.22	7.9-8.4	<2	Low----------	0.43		
	34-60	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
Urban land.										
5.*										
Beaches										
6----------	0-29	40-55	0.06-0.2	0.15-0.20	4.5-6.0	<2	High---------	0.32	5	1-4
Beaumont	29-80	45-60	<0.06	0.15-0.20	5.1-7.8	<2	High---------	0.32		
7----------	0-13	15-35	0.06-0.2	0.15-0.20	5.6-7.3	<2	Moderate-----	0.32	5	2-6
Bernard	13-65	35-60	<0.06	0.12-0.18	5.6-7.8	<2	High---------	0.32		
8:*										
Bernard---------	0-12	15-35	0.06-0.2	0.15-0.20	5.6-7.3	<2	Moderate-----	0.32	5	2-6
	12-60	35-60	<0.06	0.12-0.18	5.6-7.8	<2	High---------	0.32		
Edna----------	0-9	12-25	0.6-2.0	0.10-0.15	5.1-7.3	<2	Low----------	0.43	5	.5-3
	9-48	35-55	<0.06	0.15-0.20	5.6-7.3	<2	High---------	0.37		
	48-60	30-55	<0.06	0.15-0.20	6.6-8.4	<2	High---------	0.37		
9:*										
Bernard---------	0-5	15-35	0.06-0.2	0.15-0.20	5.6-7.3	<2	Moderate-----	0.32	5	2-6
	5-60	35-60	<0.06	0.12-0.18	5.6-7.8	<2	High---------	0.32		
Urban land.										
10----------	0-65	60-80	<0.06	0.14-0.19	7.4-8.4	<2	High---------	0.32	5	2-6
Brazoria										
11----------	0-70	60-80	<0.06	0.14-0.19	7.4-8.4	<2	High---------	0.32	5	2-6
Brazoria										
12----------	0-16	15-25	0.2-0.6	0.17-0.22	7.9-8.4	<2	Low----------	0.43	5	<1
Clemville	16-30	20-30	0.2-0.6	0.17-0.22	7.9-8.4	<2	Low----------	0.43		
	30-60	35-50	0.06-0.2	0.14-0.20	6.6-8.4	<2	High---------	0.37		
13----------	0-8	12-25	0.6-2.0	0.10-0.15	5.1-7.3	<2	Low----------	0.43	5	.5-3
Edna	8-48	35-55	<0.06	0.15-0.20	5.6-7.3	<2	High---------	0.37		
	48-60	30-55	<0.06	0.15-0.20	6.6-8.4	<2	High---------	0.37		
14----------	0-4	12-25	0.6-2.0	0.10-0.15	5.1-7.3	<2	Low----------	0.43	5	.5-3
Edna	4-45	35-55	<0.06	0.15-0.20	5.6-7.3	<2	High---------	0.37		
	45-60	30-55	<0.06	0.15-0.20	6.6-8.4	<2	High---------	0.37		
15:*										
Edna----------	0-8	12-25	0.6-2.0	0.10-0.15	5.1-7.3	<2	Low----------	0.43	5	.5-3
	8-36	35-55	<0.06	0.15-0.20	5.6-7.3	<2	High---------	0.37		
	36-60	30-55	<0.06	0.15-0.20	6.6-8.4	<2	High---------	0.37		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				Pct
15:*										
Aris	0-23	10-25	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low	0.37	5	<2
	23-33	25-35	0.2-0.6	0.12-0.17	5.1-6.5	<2	Moderate	0.32		
	33-60	35-50	<0.06	0.12-0.18	5.1-7.3	<2	High	0.32		
16	0-4	15-35	<0.06	0.01-0.03	6.6-8.4	>16	Moderate	0.43	5	---
Follet	4-60	18-35	<0.06	0.01-0.03	6.6-8.4	>16	Moderate	0.43		
17	0-18	35-50	<0.06	0.10-0.18	6.1-8.4	<4	High	0.32	5	<2
Francitas	18-36	40-60	<0.06	0.06-0.12	6.6-8.4	4-25	Very high	0.32		
	36-77	40-60	<0.06	0.06-0.12	7.9-8.4	8-25	Very high	0.32		
18	0-60	2-8	6.0-20	0.05-0.10	5.6-8.4	<4	Low	0.15	5	<.5
Galveston	60-80	2-8	6.0-20	0.05-0.10	5.6-8.4	<4	Low	0.15		
19	0-16	40-60	0.06-0.2	0.02-0.20	6.6-9.0	4-16	High	0.20	5	2-15
Harris	16-60	40-60	<0.06	0.01-0.10	6.6-9.0	4-16	High	0.32		
20:*										
Harris	0-15	40-60	0.06-0.2	0.02-0.20	6.6-9.0	4-16	High	0.20	5	2-15
	15-60	40-60	<0.06	0.01-0.10	6.6-9.0	4-16	High	0.32		
Tracosa	0-5	35-60	<0.06	0.01-0.03	6.6-8.4	>16	High	0.37	5	---
	5-60	35-60	<0.06	0.01-0.03	6.6-8.4	>16	High	0.37		
21	0-9	20-50	<0.06	0.10-0.12	6.6-9.0	4-16	High	0.32	5	---
Ijam	9-60	40-55	<0.06	0.10-0.12	6.6-9.0	4-16	High	0.32		
22:*										
Ijam	0-6	20-50	<0.06	0.10-0.12	6.6-9.0	4-16	High	0.32	5	---
	6-60	40-55	<0.06	0.10-0.12	6.6-9.0	4-16	High	0.32		
Urban land.										
23	0-70	2-12	6.0-20	0.06-0.10	5.1-6.5	<2	Low	0.17	5	<1
Kenney	70-77	15-35	2.0-6.0	0.11-0.15	5.1-6.5	<2	Low	0.24		
24	0-13	40-60	0.06-0.2	0.15-0.20	5.6-7.8	<2	High	0.32	5	2-6
Lake Charles	13-64	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
	64-80	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
25	0-22	40-60	0.06-0.2	0.15-0.20	5.6-7.8	<2	High	0.32	5	2-6
Lake Charles	22-40	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
	40-60	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
26:*										
Lake Charles	0-18	40-60	0.06-0.2	0.15-0.20	5.6-7.8	<2	High	0.32	5	2-6
	18-60	40-60	<0.06	0.15-0.20	6.6-8.4	<2	High	0.32		
Urban land.										
27	0-23	10-25	0.6-2.0	0.15-0.20	5.1-7.3	<2	Low	0.43	5	1-3
Leton	23-62	20-35	0.06-0.2	0.15-0.20	5.6-8.4	<2	Moderate	0.37		
28:*										
Leton	0-21	10-25	0.6-2.0	0.15-0.20	5.1-7.3	<2	Low	0.43	5	1-3
	21-60	20-35	0.06-0.2	0.15-0.20	5.6-8.4	<2	Moderate	0.37		
Aris	0-20	10-25	0.6-2.0	0.11-0.15	5.6-7.3	<2	Low	0.37	5	<2
	20-31	25-35	0.2-0.6	0.12-0.17	5.1-6.5	<2	Moderate	0.32		
	31-48	35-50	<0.06	0.12-0.18	5.1-7.3	<2	High	0.32		
	48-60	30-40	<0.06	0.12-0.18	5.1-7.3	<2	High	0.32		
29	0-11	15-30	0.6-2.0	0.16-0.24	5.1-7.3	<2	Low	0.37	5	1-4
Morey	11-36	25-35	0.06-0.2	0.18-0.22	5.6-7.8	<2	Moderate	0.37		
	36-60	30-45	0.06-0.2	0.18-0.22	6.1-8.4	<2	High	0.37		
30	0-4	2-8	6.0-20	0.01-0.07	6.6-8.4	<4	Low	0.15	5	<1
Mustang	4-72	2-8	6.0-20	0.01-0.06	6.6-8.4	<8	Low	0.15		

See footnote at end of table.

TABLE 16.--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay <2mm	Permeability	Available water capacity	Soil reaction	Salinity	Shrink-swell potential	Erosion factors		Organic matter
								K	T	
	In	Pct	In/hr	In/in	pH	Mmhos/cm				Pct
31----------	0-8	2-8	6.0-20	0.01-0.04	6.6-8.4	>4	Low----------	0.15	5	<1
Mustang	8-60	2-8	6.0-20	0.01-0.04	6.6-8.4	>4	Low----------	0.15		
32----------	0-7	10-25	0.6-2.0	0.05-0.11	6.6-8.4	2-16	Low----------	0.49	5	.5-2
Narta	7-18	35-45	<0.06	0.-0.02	7.4-9.0	>8	High---------	0.43		
	18-74	30-45	<0.06	0.-0.02	7.9-9.0	>8	High---------	0.43		
33----------	0-13	10-27	0.6-2.0	0.17-0.21	7.4-8.4	<2	Low----------	0.43	5	.5-2
Norwood	13-48	18-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
	48-64	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
34----------	0-26	10-27	0.6-2.0	0.17-0.21	7.4-8.4	<2	Low----------	0.43	5	.5-2
Norwood	26-40	18-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
	40-60	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
35:*										
Norwood---------	0-18	27-40	0.6-2.0	0.18-0.22	7.4-8.4	<2	Moderate-----	0.32	5	.5-2
	18-55	18-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
	55-63	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
Asa----------	0-11	18-35	0.6-2.0	0.17-0.22	6.6-8.4	<2	Low----------	0.28	5	1-3
	11-38	18-35	0.6-2.0	0.17-0.22	7.9-8.4	<2	Low----------	0.43		
	38-60	10-35	0.6-2.0	0.15-0.22	7.9-8.4	<2	Low----------	0.43		
36----------	0-26	40-60	0.06-0.2	0.12-0.22	6.1-8.4	<2	High---------	0.32	5	1-3
Pledger	26-50	35-60	<0.06	0.12-0.18	7.4-8.4	<2	High---------	0.32		
	50-64	---	---	---	---	---	----------	----		
37:*										
Pledger---------	0-26	40-60	0.06-0.2	0.12-0.22	6.1-8.4	<2	High---------	0.32	5	1-3
	26-50	35-60	<0.06	0.12-0.18	7.4-8.4	<2	High---------	0.32		
	50-60	---	---	---	---	---	----------	----		
Urban land.										
38----------	0-60	60-80	<0.06	0.14-0.19	7.4-8.4	<2	High---------	0.32	5	1-4
Sumpf										
39----------	0-14	35-70	<0.06	0.05-0.10	6.6-8.4	4-16	High---------	0.32	5	2-10
Surfside	14-72	60-80	<0.06	0.01-0.10	7.4-8.4	>16	High---------	0.32		
40----------	0-28	27-35	<0.06	0.01-0.03	6.6-8.4	>16	Moderate-----	0.43	5	---
Tatlum	28-60	18-35	<0.06	0.01-0.03	6.6-8.4	>16	Moderate-----	0.43		
41----------	0-5	35-60	<0.06	0.01-0.03	6.6-8.4	>16	High---------	0.37	5	---
Tracosa	5-60	35-60	<0.06	0.01-0.03	6.6-8.4	>16	High---------	0.37		
42----------	0-30	60-70	<0.06	0.06-0.12	6.6-9.0	>8	High---------	0.32	5	2-10
Velasco	30-65	60-70	<0.06	0.01-0.10	7.4-8.4	>16	High---------	0.32		
43----------	0-11	27-40	0.2-0.6	0.05-0.15	6.6-8.4	---	Moderate-----	0.49	5	<1
Veston	11-26	12-27	0.6-2.0	0.02-0.10	7.9-9.0	>8	Low----------	0.49		
	26-60	15-35	0.06-0.2	0.02-0.10	7.9-9.0	>8	Moderate-----	0.32		
44----------	0-10	15-27	0.6-2.0	0.02-0.10	6.6-8.4	>8	Low----------	0.49	5	<1
Veston	10-28	12-27	0.6-2.0	0.02-0.10	7.9-9.0	>8	Low----------	0.49		
	28-60	15-35	0.06-0.2	0.02-0.10	7.9-9.0	>8	Moderate-----	0.32		

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

TABLE 17.--SOIL AND WATER FEATURES

["Flooding" and "water table" and terms such as "rare," "brief," "apparent," and "perched," are explained in the text. The symbol > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated]

Map symbol and soil name	Hydrologic group	Flooding			High water table			Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total	Uncoated steel	Concrete
					Ft			In	In		
1----- Aris	D	None--------	---	---	0-2.0	Perched	Nov-Mar	---	---	High-----	Moderate.
2, 3----- Asa	B	None to rare	---	---	>6.0	---	---	---	---	High-----	Low.
4:*											
Asa-----	B	Rare--------	---	---	>6.0	---	---	---	---	High-----	Low.
Urban land.											
5.* Beaches											
6----- Beaumont	D	Rare--------	---	---	0-2.0	Apparent	Nov-Mar	---	---	High-----	Moderate.
7----- Bernard	D	None to rare	---	---	0-3.0	Apparent	Dec-Feb	---	---	High-----	Low.
8:*											
Bernard-----	D	None to rare	---	---	0-3.0	Apparent	Dec-Feb	---	---	High-----	Low.
Edna-----	D	None to rare	---	---	0-1.5	Perched	Dec-Mar	---	---	High-----	Low.
9:*											
Bernard-----	D	None to rare	---	---	0-3.0	Apparent	Dec-Feb	---	---	High-----	Low.
Urban land.											
10, 11----- Brazoria	D	Rare--------	---	---	1.0-3.0	Apparent	Dec-Feb	---	---	High-----	Low.
12----- Clemville	B	Rare--------	---	---	>6.0	---	---	---	---	High-----	Low.
13, 14----- Edna	D	None to rare	---	---	0-1.5	Perched	Dec-Mar	---	---	High-----	Low.
15:*											
Edna-----	D	None to rare	---	---	0-1.5	Perched	Dec-Mar	---	---	High-----	Low.
Aris-----	D	None to rare	---	---	0-2.0	Perched	Nov-Mar	---	---	High-----	Moderate.
16----- Follet	D	Frequent----	Very long	Jan-Dec	+1-0	Apparent	Jan-Dec	1-4	1-4	High-----	High.
17----- Francitas	D	Rare--------	---	---	0-2.0	Perched	Nov-May	---	---	High-----	Low.
18----- Galveston	A	Occasional	Very brief	Jun-Oct	3.0-6.0	Apparent	Jan-Dec	---	---	High-----	Low.
19----- Harris	D	Occasional	Long------	Sep-Jun	0-2.5	Apparent	Sep-Jun	---	---	High-----	High.
20:*											
Harris-----	D	Occasional	Long------	Sep-Jun	0-2.5	Apparent	Sep-Jun	---	---	High-----	High.
Tracosa-----	D	Frequent----	Very long	Jan-Dec	+1-0	Apparent	Jan-Dec	1-2	1-2	High-----	High.
21----- Ijam	D	Rare--------	---	---	0-3.0	Apparent	Sep-May	---	---	High-----	High.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Soil name and map symbol	Hydrologic group	Flooding			High water table			Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total	Uncoated steel	Concrete
					Ft			In	In		
22:*											
Ijam	D	Rare	---	---	0-3.0	Apparent	Sep-May	---	---	High	High.
Urban land.											
23--- Kenney	A	None	---	---	>6.0	---	---	---	---	Low	Moderate.
24, 25--- Lake Charles	D	None to rare	---	---	0-2.0	Apparent	Dec-Feb	---	---	High	Low.
26:*											
Lake Charles	D	None to rare	---	---	0-2.0	Apparent	Dec-Feb	---	---	High	Low.
Urban land.											
27--- Leton	D	Occasional	Very brief to very long.	Oct-May	0-1.5	Apparent	Oct-May	---	---	High	Moderate.
28:*											
Leton	D	Occasional	Very brief to very long.	Oct-May	0-1.5	Apparent	Oct-May	---	---	High	Moderate.
Aris	D	None to rare	---	---	0-2.0	Perched	Nov-Mar	---	---	High	Moderate.
29--- Morey	D	None to rare	---	---	0-2.0	Apparent	Dec-Feb	---	---	High	Low.
30--- Mustang	A/D	Frequent	Brief to long.	Aug-Nov	0-0.5	Apparent	Jan-Dec	---	---	High	Low.
31--- Mustang	A/D	Frequent	Brief to long.	Aug-Nov	0-0.5	Apparent	Jan-Dec	---	---	High	Moderate.
32--- Narta	D	None to rare	---	---	0-0.5	Perched	Sep-May	---	---	High	Moderate.
33, 34--- Norwood	B	Rare	---	---	>6.0	---	---	---	---	High	Low.
35:*											
Norwood	B	Rare	Very brief	Oct-Mar	>6.0	---	---	---	---	High	Low.
Asa	B	Rare	---	---	>6.0	---	---	---	---	High	Low.
36--- Pledger	D	Rare	---	---	0-2.5	Apparent	Dec-Feb	---	---	High	Low.
37:*											
Pledger	D	Rare	---	---	0-2.5	Apparent	Dec-Feb	---	---	High	Low.
Urban land.											
38--- Sumpf	D	Frequent	Very long	Sep-Jun	+1-2.0	Apparent	Jan-Dec	---	---	High	Low.
39--- Surfside	D	Rare	---	---	0-4.0	Apparent	Sep-Jun	---	---	High	Low.
40--- Tatlum	D	Frequent	Very long	Jan-Dec	+1-0	Apparent	Jan-Dec	1-4	1-4	High	High.
41--- Tracosa	D	Frequent	Very long	Jan-Dec	+1-0	Apparent	Jan-Dec	1-2	1-2	High	High.
42--- Velasco	D	Common	Long	Sep-Jun	0-2.5	Apparent	Sep-Jun	---	---	High	Low.

See footnote at end of table.

TABLE 17.--SOIL AND WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table			Subsidence		Risk of corrosion	
		Frequency	Duration	Months	Depth	Kind	Months	Initial	Total	Uncoated steel	Concrete
					Ft			In	In		
43, 44---------- Veston	D	Frequent----	Brief-----	Jun-Oct	0-2.0	Apparent	Jan-Dec	---	---	High-----	High.

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

TABLE 18.--ENGINEERING INDEX TEST DATA

[Dashes indicate data were not available]

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution								Liquid limit[1]	Plasticity index[1]	Particle density	Shrinkage		
			Percentage passing sieve--					Percentage smaller than--								
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
											Pct		G/cc	Pct	Pct	Pct
Asa silt loam:[2] (S76TX-039-019)																
A1------- 0 to 12	A-6 (23)	CL	100	100	100	100	97	88	34	29	40	23	2.68	16.0	11.3	1.8
B22------12 to 24	A-7-6(29)	CL	100	100	100	100	99	94	44	36	46	27	2.70	16.0	13.7	1.8
Brazoria clay:[3] (S76TX-039-005)																
A1------- 0 to 20	A-7-6(55)	CH	100	100	100	100	99	98	81	67	75	47	2.66	11.0	23.5	1.9
B21------20 to 35	A-7-6(55)	CH	100	100	100	100	99	97	87	73	74	47	2.74	10.0	24.2	2.0
B22------35 to 65	A-7-6(61)	CH	100	100	100	99	99	97	90	77	80	52	2.73	10.0	25.7	2.0
Clemville silty clay loam:[4] (S76TX-039-018)																
A1------- 0 to 14	A-6 (22)	CL	100	100	100	100	94	89	36	29	40	23	2.66	16.0	11.4	1.8
C--------14 to 44	A-6 (13)	CL	100	100	100	100	94	74	24	21	33	14	2.69	20.0	7.4	1.5
Bb-------54 to 70	A-7-6(47)	CH	100	100	100	100	98	94	73	62	64	42	2.73	12.0	21.2	2.0
Galveston fine sand:[5] (S76TX-039-013)																
C3-------33 to 60	A-3 (00)	SP	100	100	100	100	2	1	--	--	26	3	2.64	22.0	0.0	1.5
Leton loam:[6] (S76TX-039-020)																
A2------- 6 to 23	A-4 (05)	CL	100	100	100	100	79	63	18	16	27	9	2.64	19.0	4.5	1.7
B2tg-----29 to 50	A-6 (21)	CL	100	100	100	100	84	71	31	26	39	26	2.65	15.0	11.7	1.8
Mustang fine sand:[7] (S76TX-039-014)																
C1------- 4 to 25	A-3 (00)	SP	100	100	100	100	2	1	--	--	24	3	2.64	22.0	0.0	1.5
C3g------31 to 72	A-3 (00)	SP	100	100	100	100	3	1	--	--	25	3	2.65	22.0	0.0	1.5
Narta fine sandy loam:[8] (S76TX-039-015)																
A1------- 0 to 7	A-4 (05)	CL	100	100	100	100	71	56	18	14	29	9	2.65	19.0	4.7	1.7
B23t-----18 to 50	A-7-6(28)	CH	100	97	96	95	72	64	36	34	55	41	2.70	13.0	18.2	1.9
Norwood silt loam:[9] (S76TX-039-008)																
Ap------- 0 to 6	A-4 (01)	CL-ML	100	100	100	100	57	45	14	12	26	6	2.64	20.0	3.5	1.7
B2-------13 to 34	A-4 (02)	CL-ML	100	100	100	100	62	50	15	14	26	7	2.67	20.0	3.3	1.7
C1-------34 to 48	A-4 (04)	CL-ML	100	100	100	100	77	63	18	16	26	7	2.68	19.0	3.8	1.7

See footnotes at end of table.

TABLE 18.--ENGINEERING INDEX TEST DATA--Continued

Soil name, report number, horizon, and depth in inches	Classification		Grain size distribution								Liquid limit[1]	Plasticity index[1]	Particle density	Shrinkage		
			Percentage passing sieve--					Percentage smaller than--								
	AASHTO	Unified	3/8 inch	No. 4	No. 10	No. 40	No. 200	.05 mm	.005 mm	.002 mm				Limit	Linear	Ratio
											Pct		G/cc	Pct	Pct	Pct
Pledger clay:[10] (S76TX-039-009)																
A1------- 0 to 26	A-7-6(39)	CH	100	100	100	100	99	97	61	52	57	35	2.64	15.0	17.7	1.8
B21------26 to 38	A-7-6(35)	CH	100	99	95	93	92	90	56	45	54	36	2.70	14.0	17.8	1.9
C--------50 to 64	A-7-6(39)	CH	100	100	98	96	95	93	59	46	55	38	2.73	14.0	18.0	1.9
Surfside clay:[11] (S76TX-039-012)																
A11------ 0 to 10	A-7-5(70)	CH	100	100	100	100	98	95	77	67	90	60	2.61	12.0	26.3	1.9
A12g-----10 to 32	A-7-6(77)	CH	100	100	100	99	98	97	87	79	95	67	2.74	13.0	27.2	1.9
B2g------32 to 72	A-7-6(51)	CH	100	100	100	100	99	96	61	47	65	46	2.73	15.0	20.1	1.9
Velasco clay:[12] (S76TX-039-011)																
A1g------ 0 to 20	A-7-6(75)	CH	100	100	100	100	99	96	78	67	89	65	2.73	14.0	25.8	1.9
ACg------20 to 52	A-7-6(56)	CH	100	100	100	100	100	98	72	58	69	50	2.76	10.0	23.1	2.0
Veston silty clay loam:[13] (S76TX-039-017)																
A12g----- 3 to 18	A-4 (07)	CL	100	100	100	100	82	60	18	13	29	10	2.65	20.0	4.3	1.6
C1g------18 to 38	A-6 (10)	CL	100	100	100	99	84	65	22	19	31	14	2.65	18.0	6.7	1.7

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

[2]Asa silt loam:
3.2 miles southwest of Brazoria on Farm Road 521 and 300 feet north of road, in pastureland.

[3]Brazoria clay:
1.6 miles east of Brazos River bridge on Farm Road 1462 and 200 feet south of road.

[4]Clemville silty clay loam:
7 miles west of Farm Road 1462 from Texas 288, 4.7 miles north on county road, and 300 feet west of road.

[5]Galveston fine sand:
From Texas 332 and Farm Road 523, 2.75 miles southeast on Farm Road 332, 8.6 miles northeast, .05 mile southeast to beach, and 100 feet north, in front of dunes.

[6]Leton loam:
From Liverpool, 1.8 miles southeast on county road, 3.4 miles south on Canal Road, and 200 feet northwest, in pastureland.

[7]Mustang fine sand:
1.7 miles southeast on Farm Road 1495 from Texas 288, 1.3 miles south on Shell Road, left on beach 0.2 mile, and 270 feet from back of dunes.

[8]Narta fine sandy loam:
On Farm Road 2004 from Farm Road 2917, 2.3 miles northeast, 0.8 mile southeast on Shell Road, 0.2 mile southwest, 1.6 miles south, 2.1 miles southeast, and 120 feet from fence.

[9]Norwood silt loam:
0.9 mile east of Brazos River bridge on Farm Road 1462, 0.6 mile north on county road, and 300 feet east of road.

[10]Pledger clay:
3.1 miles southwest of Brazoria on Farm Road 521 and 200 feet north, in pastureland.

[11]Surfside clay:
2.1 miles northeast of Freeport on Texas 332, 0.3 mile southeast, and 300 feet south of road, in rangeland.

[12]Velasco clay:
3.1 miles south of Freeport on Farm Road 1495 and 40 feet east of road.

[13]Veston silty clay loam:
On Farm Road 2004 from Farm Road 2917, 1.4 miles southwest, 6 miles southeast, 0.6 mile west, and 100 feet northeast of turn, in road.

TABLE 19.--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Aris*	Fine, mixed, thermic Typic Glossaqualfs
Asa	Fine-silty, mixed, thermic Fluventic Haplustolls
Beaumont*	Fine, montmorillonitic, thermic Entic Pelluderts
Bernard	Fine, montmorillonitic, thermic Vertic Argiaquolls
Brazoria	Very-fine, mixed, thermic Typic Chromuderts
Clemville	Fine-silty, mixed (calcareous), thermic Typic Udifluvents
Edna	Fine, montmorillonitic, thermic Vertic Albaqualfs
Follet	Fine-silty, mixed, nonacid, hyperthermic Typic Haplaquents
Francitas	Fine, montmorillonitic, hyperthermic Typic Pelluderts
Galveston	Mixed, hyperthermic Typic Udipsamments
Harris	Fine, montmorillonitic, thermic Typic Haplaquolls
Ijam	Fine, montmorillonitic, nonacid, thermic Vertic Fluvaquents
Kenney	Loamy, siliceous, thermic Grossarenic Paleudalfs
Lake Charles**	Fine, montmorillonitic, thermic Typic Pelluderts
Leton	Fine-silty, mixed, thermic Typic Glossaqualfs
Morey	Fine-silty, mixed, thermic Typic Argiaquolls
Mustang	Mixed, hyperthermic Typic Psammaquents
Narta	Fine, montmorillonitic, hyperthermic Typic Natraqualfs
Norwood	Fine-silty, mixed (calcareous), thermic Typic Udifluvents
Pledger	Fine, mixed, thermic Vertic Hapludolls
Sumpf	Very-fine, mixed (calcareous), thermic Cumulic Haplaquolls
Surfside	Very-fine, mixed, hyperthermic Vertic Haplaquolls
Tatlum	Fine-silty, mixed, nonacid, hyperthermic Typic Hydraquents
Tracosa	Fine, montmorillonitic, nonacid, hyperthermic Typic Haplaquents
Velasco	Very-fine, mixed (calcareous), hyperthermic Cumulic Haplaquolls
Veston	Fine-silty, mixed, nonacid, hyperthermic Typic Fluvaquents

* The soil is a taxadjunct to the series. See text for a description of those characteristics of the soil that are outside the range of the series.

** Lake Charles Clay, 1 to 8 percent slopes, is a taxadjunct to the Lake Charles series. See text for a description of those characteristics of the soil that are outside the range of the series.

TABLE 20.--GEOLOGY OF BRAZORIA COUNTY, BY GENERAL SOIL MAP UNIT

Map unit	Land formation	Depositional environment
Most of Mustang-Veston---	Holocene deposits.	Beach and barrier island.
Harris-Veston----------	Holocene deposits.	Coastal marsh.
Surfside-Velasco---------	Holocene deposits.	Low, coastal fluviatile (mostly flood basin).
Pledger-Brazoria---------	Holocene deposits.	Flood basin.
Asa-Norwood----------	Holocene deposits.	Meander ridge.
Part of Edna-Aris-------- (near Hoskins Mound) and part of Mustang-Veston (on Rattlesnake Mound).	Pleistocene Beaumont Formation.	Ingleside barrier or strand plain.
Lake Charles and part of Francitas-Narta---------	Pleistocene Beaumont Formation.	Flood basin.
Bernard-Edna, most of Edna-Aris, and part of Francitas-Narta---------	Pleistocene Beaumont Formation.	Meander ridge.

☆U.S. GOVERNMENT PRINTING OFFICE : 1981—334-928/101

NRCS Accessibility Statement

This document is not accessible by screen-reader software. The Natural Resources Conservation Service (NRCS) is committed to making its information accessible to all of its customers and employees. If you are experiencing accessibility issues and need assistance, please contact our Helpdesk by phone at 1-800-457-3642 or by e-mail at ServiceDesk-FTC@ftc.usda.gov. For assistance with publications that include maps, graphs, or similar forms of information, you may also wish to contact our State or local office. You can locate the correct office and phone number at http://offices.sc.egov.usda.gov/locator/app.

The U.S. Department of Agriculture (USDA) prohibits discrimination in all its programs and activities on the basis of race, color, national origin, age, disability, and where applicable, sex, marital status, familial status, parental status, religion, sexual orientation, genetic information, political beliefs, reprisal, or because all or a part of an individual's income is derived from any public assistance program. (Not all prohibited bases apply to all programs.) Persons with disabilities who require alternative means for communication of program information (Braille, large print, audiotape, etc.) should contact USDA's TARGET Center at (202) 720-2600 (voice and TDD). To file a complaint of discrimination write to USDA, Director, Office of Civil Rights, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410 or call (800) 795-3272 (voice) or (202) 720-6382 (TDD). USDA is an equal opportunity provider and employer.