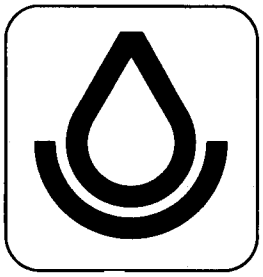
SOIL SURVEY

Fallon-Fernley Area, Nevada

Parts of Churchill, Lyon, Storey, and Washoe Counties



UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF NEVADA AGRICULTURAL EXPERIMENT STATION
and
UNITED STATES DEPARTMENT OF THE INTERIOR
Bureau of Indian Affairs
Issued January 1975

Major fieldwork for this soil survey was done in the period 1955–68. Soil names and descriptions were approved in 1971. Unless otherwise indicated, statements in the publication refer to conditions in the Area in 1968. This survey was made cooperatively by the Soil Conservation Service, the Nevada Agricultural Experiment Station, and the Bureau of Indian Affairs. It is part of the technical assistance furnished to the Lahontan, Stillwater, Dixie Valley, Fernley, and North Truckee Soil Conservation Districts.

Either enlarged or reduced copies of the soil map in this publication can be made by commercial photographers, or they can be purchased on individual order from the Cartographic Division, Soil Conservation Service, United States Department of Agriculture, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY contains information that can be applied in managing farms and ranches; in selecting sites for roads, ponds, buildings, and other structures; and in judging the suitability of tracts of land for farming, industry, and recreation.

Locating Soils

All the soils of Fallon-Fernley Area are shown on the detailed map at the back of this publication. This map consists of many sheets made from aerial photographs. Each sheet is numbered to correspond with a number on the Index to Map Sheets.

On each sheet of the detailed map, soil areas are outlined and are identified by symbols. All areas marked with the same symbol are the same kind of soil. The soil symbol is inside the area if there is enough room; otherwise, it is outside, and a pointer shows where the symbol belongs.

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the county in alphabetic order by map symbol and gives the capability classification of each. It also shows the page where each soil is described and the page for the woodland group and range site in which the soil has been placed.

Individual colored maps showing the relative suitability or degree of limitation of soils for many specific purposes can be developed by using the soil map and the information in the text. Translucent material can be used as an overlay over the soil map and colored to show soils that have the same limitation or suitability. For example, soils that have a slight limitation for a given use can be colored green, those with a moderate limitation can be colored yellow, and those with a severe limitation can be colored red.

Farmers and those who work with farmers can learn about use and management of the soils from soil descriptions and from the discussions of the capability units, the range sites, and the windbreak groups.

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Wildlife."

Ranchers and others can find, under "Range," groupings of the soils according to their suitability for range, and also the names of many of the plants that grow on each range site.

Engineers and builders can find, under "Engineering Uses of the Soils," tables that contain test data, estimates of soil properties, and information about soil features that affect engineering practices.

Scientists and others can read about how the soils formed and how they are classified in the section "Formation and Classification of Soils."

Newcomers in Fallon-Fernley Area may be especially interested in the section "General Soil Map," where broad patterns of soils are described. They may also be interested in the information about the area given at the beginning of the publication.

Contents

Issued January 1975

SOIL SURVEY OF FALLON-FERNLEY AREA, NEVADA PARTS OF CHURCHILL, LYON, STOREY, AND WASHOE COUNTIES

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FIELDWORK BY M. TOWNSEND, G. GARLICK, SOIL CONSERVATION SERVICE

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH UNIVERSITY OF NEVADA AGRICULTURAL EXPERIMENT STATION AND THE UNITED STATES DEPARTMENT OF THE INTERIOR, BUREAU OF INDIAN AFFAIRS

THE FALLON-FERNLEY AREA: PARTS OF CHURCHILL, LYON, STOREY, AND WASHOE COUNTIES (hereafter referred to as Fallon-Fernley Area) is in the west-central part of Nevada (fig. 1). It has an area of about 1,300 square miles, or 832,041 acres. Fallon is the county seat of Churchill County and the principal town in the Area. The survey area is bounded on the east by the Stillwater Range. The southern boundary passes through the White Thorne Mountains and meanders through the Lahontan Reservoir to a point about 4 miles south and 5 miles west of Fernley.

General Nature of the Area

This section is primarily for those who are not familiar with the survey area. It briefly discusses settlement and development, farming, industry, transportation, climate, water supply, and physiography and geology.

Settlement and Development

The original inhabitants of the Fallon-Fernley Area were Paiute Indians, who lived along the shorelines of Ancient Lake Lahontan. As the lake dried, they moved to areas along the banks of the Carson and Truckee Rivers and along the edge of Carson Lake and Carson Sink.

The first permanent settlements in the Area were on the Carson River and its south branch, at points where the overland trails crossed the stream. The main overland trail ran south from the present site of Lovelock to a point on the Carson River known as Leeteville. This area was known as the Forty-Mile Desert and was one of the most dreaded parts of the entire trail. Another branch of the overland trail, used largely by the Pony Express, crossed the southern part of the Area, and a station was located at St. Clair.

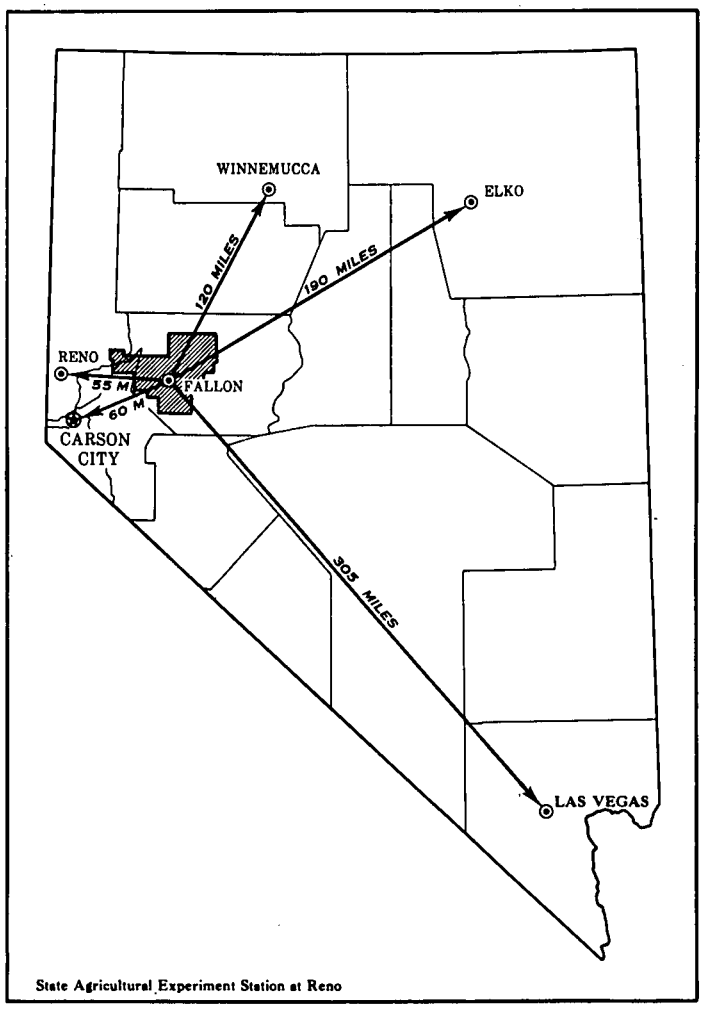

Figure 1.—Location of the Fallon-Fernley Area in Nevada.

Later settlers made their homes on bottom lands along the streams and on the lowlands surrounding Carson Lake. No marked development took place, however, until the construction of the irrigation system by the United States Reclamation Service, after which the population of the Area increased rapidly. Many came unprepared for the conditions that existed, and for a short time more persons were leaving than were coming in. Since that time there has been a steady growth in the permanent population of the Area.

Fallon is the largest town in the Area and in 1970 had a population of about 2,959. Because the survey area is made up of parts of several counties, population figures for the entire Area are difficult to obtain. The estimated population was 1,200 in 1910; 5,000 in 1920; 5,500 in 1930; 5,900 in 1940; 6,800 in 1950; 9,200 in 1960; and 11,500 in 1970.

Farming

Farming is the main enterprise in the Fallon-Fernley Area. There are about 9,000 mature beef cattle in the Area. Another 3,500 range outside the Area but spend some time in the Area. In addition to the mature cows, there are approximately 650 calves. About 30,000 head of cattle in the Area are finished for slaughter, and about 60,000 are feeder cattle. The feeder cattle are fed for a relatively short period for a small gain in weight, generally about 200 pounds.

About 4,200 producing dairy cattle are in the Area. About 3,100 of these are tested and are used to produce commercial Grade A milk. About 18,000 gallons of milk is produced daily from Grade A dairies.

In addition to the beef and dairy operations, there are a few apiarists in the Area. Many of the people in the Area have a horse or two. Almost all the people that live in the outlying areas have a few chickens for home use, and a few people have a few head of sheep or hogs.

About 62,000 acres is under irrigation in the Area. About 33,000 acres is used for alfalfa hay. The average is three cuttings, but some farmers manage to get four cuttings a year. About 7,000 acres is in small grain, 2,000 acres is in corn for silage, and 20,000 acres is in irrigated pasture. A few acres are used for speciality crops, including such melons as the "Heart of Gold," sweet corn, squash, tomatoes, and other garden vegetables.

Industry

Next to farming, the Naval Auxiliary Air Station, located a few miles south of Fallon, probably is the greatest contributor to the Area's economy. The gaming industry, which furnishes services and entertainment for tourists, contributes directly to the economy. Several wildlife areas, administered by the U.S. Bureau of Sport Fisheries and Wildlife and the Nevada Fish and Game Commission, are managed principally for waterfowl. These areas, together with several privately managed areas, offer excellent waterfowl shooting and fishing.

Transportation

Highway transportation within the Area is provided by U.S. Highways No. 50, 95, and 95 Alternate, Interstate Highway No. 80, and Nevada State Route No. 34.

U.S. Highway No. 50 passes through Carson City and Fallon, connecting these and other points west with Ely and points east. U.S. Highway No. 95 runs southward from Fallon to Las Vegas, and it joins Interstate Highway No. 80 at Lovelock to the north. U.S. Highway No. 95 Alternate connects Yerington with Fernley and Fallon. Interstate Highway No. 80, which passes through the northeastern corner of the survey area, passes through Reno and Elko. Nevada State Route No. 34 intersects Interstate Highway No. 80 at Wadsworth and passes through Gerlach to the north.

Most of the roads in the farming areas are paved and well maintained. Outside the farming areas, the roads are few and poor, although a few graded roads lead to mines and outlying ranches. During the dry periods of the year sand impedes travel, and after rains sticky mud on the clay flats impedes travel. Some of the Area is accessible only by 4-wheel-drive vehicles, by horse, or by foot.

A railroad that runs from Hazen Junction to the north, south, and west has a spur branch that runs to Fallon.

Air transportation in the Area is limited to small aircraft, except for that operated by the military. Fallon Naval Auxiliary Air Station has excellent aircraft facilities. Fallon Municipal Airport has a small, well-maintained airstrip, and a few, small, privately-owned airstrips are also in the Area.

Climate [1]

The climate of the Fallon-Fernley Area is affected by two main weather regimes that influence the flow of air to the State. The first, which is the major source, is from the Pacific Ocean. The Sierra Nevada Range to the west is an effective barrier to moisture in the air. As the air rises over the mountains from the west, much of the moisture is lost; consequently, only a small amount of moisture reaches the Fallon-Fernley Area. In northern Nevada, this "rain shadow" effect seems to be more pronounced. Precipitation averages slightly more than 5 inches annually.

When sunshine is abundant, evapotranspiration is high. The climate of the Area is characterized as an arid, continental type. Average May-October pan evaporation at Fallon is about 47 inches, but the amount of evaporation in areas not surrounded by irrigated fields is higher. Humidity is very low and ranges from 25 percent in summer to about 65 percent in winter. Humidity during the day is considerably lower than at night, particularly in the nonirrigated areas. Days are hot in summer and nights are cool, which is characteristic of this Area.

The second dominant weather regime affecting the climate of the Area is the flow of warm, moist air from the south. This is the main source of summer thunderstorms that occur 10 to 15 days a year. During thunderstorms as much as 1.12 inches of rain has fallen in 1 day. Hail is infrequent and occurs on less than 1 day a year. The hailstones generally are small and cause little damage.

[1] DR. CLARENCE M. SAKAMOTO, climatologist for Nevada, National Weather Service, U.S. Department of Commerce, prepared this section.

Snow falls each year, but is generally very light and melts within a few days; however, as much as 8.5 inches have fallen in a day.

Table 1 shows temperature and precipitation data for Fallon and Fernley. It indicates that nights generally are cooler in Fallon than in Fernley. Temperature difference between daily maximum and daily minimum ranges from 28°F. in winter to about 38° in summer.

Table 2 shows the probabilities of the last freezing temperature in spring and the first in fall for selected threshold temperatures of 16°, 20°, 24°, 28°, 32°. Because temperatures for this analysis were observed in a shelter 5 feet above the ground, it is possible that temperature at ground level might have been lower. The growing season is defined as the number of continuous days that have a minimum temperature of 24°, 28°, or 32° at 5 feet above ground level.

Table 3 shows the probabilities and associated growing season length at Fallon and Fernley, respectively. The average length is indicated by the 50 percent probability. The table indicates similarities between Fallon and Fernley, and the slightly cooler condition at Fallon is noted in the 2-day shorter season on the average at Fallon than at Fernley.

Windspeed averages less than 7 miles per hour, and the prevailing wind is from south to north in a clockwise direction. Strong surface winds, however, can occur from any direction. The strongest wind recorded in Fallon was less than 55 miles per hour.

Water Supply

Almost all of the water used for irrigation in the Fallon-Fernley Area is from the Newlands Reclamation Project. This project was among the first five of its kind and was a result of the Reclamation Act of 1902 (*8*).[2] Lahontan Reservoir, which can store 294,000 acre-feet of irrigation water for the project, was completed in June 1915. Small acreages are irrigated with water from the Carson and Truckee Rivers. The Truckee-Carson Irriga-

[2] Italic numbers in parentheses refer to Literature Cited, p. 110.

TABLE 1.—*Temperature and precipitation*

[Period of record, 1941–1970]

Month	Temperature				Precipitation			
	Average daily maximum	Average daily minimum	Two years in 10 will have about 4 days with—		Average total	One year in 10 will have—		Average depth of snow on days with snow cover
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—	
	°F.	°F.	°F.	°F.	Inches	Inches	Inches	Inches
FALLON								
January	45.7	17.4	62.0	2.1	0.42	0.03	0.94	2.1
February	52.1	22.7	64.4	9.5	.55	.05	1.27	1.7
March	58.0	26.3	72.2	15.1	.46	.04	1.08	1.4
April	66.3	33.2	80.0	23.3	.33	.03	.96	.4
May	74.3	41.3	88.0	33.2	.69	.10	1.52	.4
June	82.7	47.3	96.0	38.2	.48	.01	1.05	(1)
July	92.5	53.5	99.7	45.7	.26	.01	.49	.0
August	90.1	50.5	99.5	41.7	.39	.01	.61	.0
September	82.3	43.1	92.7	32.7	.36	.01	.71	.0
October	70.4	33.9	83.3	23.3	.43	.01	.93	.1
November	55.9	25.4	68.9	13.1	.44	.05	.85	.3
December	46.9	19.5	59.2	7.8	.44	.01	1.43	1.4
Year	68.1	34.5			5.25			7.4
FERNLEY								
January	45.7	19.7	57.8	3.6	.66	.03	1.51	2.6
February	51.8	24.1	63.0	11.0	.58	.04	1.28	1.0
March	57.7	27.4	72.8	15.9	.46	.01	.97	1.6
April	66.6	33.9	81.3	22.9	.35	.01	.84	(1)
May	76.2	42.2	86.8	30.6	.62	.01	1.46	(1)
June	84.6	49.1	99.5	39.3	.50	.01	1.24	(1)
July	94.6	56.7	101.8	47.6	.22	.01	.61	0
August	92.2	54.4	100.8	43.0	.33	.01	.83	0
September	83.0	45.1	94.1	33.9	.30	.01	.97	0
October	70.4	35.1	83.9	21.9	.33	.01	92	(1)
November	55.7	25.7	69.8	12.2	.48	.01	1.00	.6
December	46.2	20.9	58.1	7.8	.60	.03	1.41	1.9
Year	68.7	36.2			5.43			7.7

[1] Trace.

TABLE 2.—*Probabilities of last freezing temperatures in spring and first in fall*

FALLON

Probability	Dates for given probability and temperature				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	April 10	April 19	April 28	May 14	June 5
25 years in 100 later than	March 26	April 9	April 19	May 5	May 26
5 years in 10 later than	March 12	March 31	April 11	April 27	May 17
Fall:					
1 year in 10 earlier than	October 30	October 21	October 5	September 21	September 12
25 years in 100 earlier than	November 5	October 5	October 13	September 29	September 19
5 years in 10 earlier than	November 12	November 4	October 21	October 7	September 26

FERNLEY

Spring:					
1 year in 10 later than	April 18	May 3	May 15	June 1	June 10
25 years in 100 later than	April 2	April 19	May 3	May 19	May 30
5 years in 10 later than	March 16	April 5	April 21	May 6	May 18
Fall:					
1 year in 10 earlier than	October 29	October 22	September 30	September 20	September 13
25 years in 100 earlier than	November 7	October 29	October 9	September 28	September 20
5 years in 10 earlier than	November 15	November 6	October 17	October 6	September 28

TABLE 3.—*Length of growing season for selected minimum temperatures*

FALLON

Temperatures	Percent chance of longer than indicated length				
	10 percent	25 percent	50 percent	75 percent	90 percent
24° F. or lower	215	204	192	180	169
28° F. or lower	185	174	162	150	139
32° F. or lower	155	144	132	120	109

FERNLEY

24° F. or lower	211	197	182	167	153
28° F. or lower	186	171	155	139	124
32° F. or lower	162	148	134	120	106

tion District, organized in November 1918, took charge of operation and maintenance of the project January 1, 1927. The Newlands Reclamation Project now includes about 73,000 acres of water-right land, which lies within the survey area.

All irrigation water contains dissolved salts. The kind and amount of these salts determine the quality of the irrigation water. Some salts give irrigation water an excellent quality, but other salts are detrimental. Calcium and magnesium salts, in moderate amounts, improve the properties of irrigated soil. They give the soil good tilth, which permits water to penetrate easily. Sodium salts destroy these desirable properties, and as their concentration in the soil increases, they become toxic to some plants. Excessive amounts of carbonates and bicarbonates in irrigation waters can also be hazardous by causing precipitation of calcium and magnesium during the soil-drying process after irrigation. This increases the percentage of sodium ions in the soil solution and subsequently increases the sodium hazard.

The irrigation water of the Newland Reclamation Project is of good quality. The water has a medium salinity hazard and practically no sodium hazard. A moderate amount of leaching with this water should prevent any salt buildup in irrigated soils. Apparently, there is only a small change in the quality of irrigation water as it flows downstream, except where drainage waters are diverted into canals.

The salinity of the irrigation water increases slightly each year as the irrigation season progresses. It decreases as large volumes of low-salt spring runoff replenish the reservoir supply.

The drainage waters contain a higher concentration of salts and a higher percentage of sodium than the irrigation water. The drainage waters vary in quality from a medium salinity and low sodium hazard to a very high salinity and sodium hazard.

All the water used for domestic purposes comes from wells. The cities of Fallon and Fernley have central water systems, but the outlying areas are supplied by individual wells. The amount and kind of minerals in the water are highly variable in the Area. The water in the city of Fallon and the areas west and north of town is considered to be of good quality. The areas south and east of town have difficulty in obtaining water of good quality. The soluable salts content of the water in these areas generally is high. Some thought is being given to piping the water from near Fallon to the residents in the Stillwater Area. The people in outlying areas also are becoming

interested in water purifiers. The water in the Fernley Area generally is of good quality.

Physiography and Geology

The Fallon-Fernley Area is in the northwestern part of the Great Basin. It is essentially the southern part of a northeastward trending intermontane basin that borders the surrounding foothills and mountains.

Most of the Area is below an altitude of 4,000 feet. The highest large area of interior lowlands is an old delta that borders the area near Lahontan Dam, at an altitude of about 4,100 feet. The lowest parts of the Area are Carson Sink, a playa in the northern part of the Area at an altitude of about 3,860 to 3,880 feet; Carson Lake, a shallow lake in the southern part of the Area at an altitude of 3,908 feet; and the Stillwater Lakes, a chain of small lakes, ponds, and mashes that extend 20 miles southwestward from Carson Sink at an altitude of 3,870 to 3,880 feet.

The lowlands away from the flood plain of the Carson River consist of irregularly shaped sandhills, sand plains, and clay flats. The sandhills are mostly stabilized or active dunes. The clay flats are scattered, but they are numerous, and the largest are near Carson Sink.

Interrupting the lowlands south of Carson Sink are three low volcanic hills: Rattlesnake Hill, the Soda Lake uplift, and Upsal Hogback.

Along the eastern, southern, and western boundaries of the Area, parts of the piedmont slope and bordering mountains are included in the Area. The mountains have a considerable amount of relief and include parts of Stillwater Range, the Lahontan, Bunejug, Cocoon, White Throne, Desert, Dead Camel, and Hot Springs Mountains. The elevations of these mountains range from about 4,200 to 6,000 feet.

The Truckee River transects a small part of the Area near Fernley and terminates in Pyramid Lake. The Carson River enters the Area at Lahontan Reservoir and forms its flood plain through the complex of lowlands. At Lahontan Dam the flood plain is incised about 120 feet below the general land surface, but the river channel gradually becomes shallow downstream. About 5 miles west of Fallon, the trench is only a few feet deep, and the flood plain fans out over the area in an arc of 120°. The fan-shaped lower flood plain merges downstream with the almost level plains, former lake floors, that border Carson Lake, Carson Sink, and the Stillwater Lakes. Carson River, augmented by water diverted from the Truckee River to Lahontan Reservoir, is used for irrigation. Waste water from irrigation is channeled by drains and natural water courses to Carson Lake, the Stillwater Lakes, and Carson Sink (*5*).

The lowlands in the Area were periodically inundated by fluctuating deepwater lakes during the Pleistocene. Valley fill consists of great thicknesses of lake-laid materials interwedged with river alluvium and aeolian material deposited during interpluvial periods. In addition to the flood plains and sand dunes, prominent landforms on the lowlands are wave-built terraces, bars, embankments, and other shoreline deposits. Landforms shaped by the Pleistocene lakes are in evidence everywhere, but they are more prominent along the piedmont slopes bordering mountainous uplands. Throughout the Area, below the high water level of the Pleistocene lakes, a material identified as tufa (*9*) can be found. The tufa has been divided into three basic groups, but each group has many different types and formed at different periods of lake inundation. Lithoid tufa is basically calcium carbonate precipitated from shallow waters of Pleistocene Lake Lahontan. It is compact and stony in structure, is light yellowish gray in color, and weathers into forms of extreme ruggedness. Thinolite is by far the rarest form of tufa and is found only in the lowest parts of the Area, where it formed in deep lake waters. It occurs as interlaced crystals of calcium carbonate. Dendritic tufa commonly occurs along shorelines of former lakes. Its structure resembles arborescent forms and often is mushroom shaped.

Alluvium deposited by the Truckee and Carson Rivers, which have their source in the Sierra Nevada, washed from soils derived from mixed rock sources, but it has a strong granitic influence. Local alluvium washed from soils on uplands bordering the Area is derived mostly from volcanic rocks. Diatomaceous material and limestone occur in small areas in the western and northwestern parts of the Area.

Exposed volcanics on the uplands include olivine basalt, rhyolite, dacite, and andesite flow rocks. Volcanic tuffs of varying composition also occur extensively. Volcanic ash and pumice are exposed in the Soda Lake area and locally in the bordering mountains. Volcanic ash also has been identified as distinct strata in the surficial basin fill.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Fallon-Fernley Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose 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 that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in counties nearby and in places more distant. They classified and named the soils according to nationwide, uniform procedures. The *soil series* and the *soil phase* are the categories of soil classification most used in a local survey.

Soils that have profiles almost alike make up a soil series. Except for different texture in the surface layer, all the soils of one series have major horizons that are similar in thickness, arrangement, and other important characteristics. Each soil series is named for a town or other geographic feature near the place where a soil of that series was first observed and mapped. Bango and Juva, for example, are the names of two soil series. All the soils in the United States having the same series

name are essentially alike in those characteristics that affect their behavior in the undisturbed landscape.

Soils of one series can differ in texture of the surface layer and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Bango loamy sand is one of several phases within the Bango series.

After a guide for classifying and naming the soils had been worked out, the soil scientists drew the boundaries of the individual soils on aerial photographs. These photographs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this publication was prepared from aerial photographs.

The areas shown on a soil map are called mapping units. On most maps detailed enough to be useful in planning the management of farms and fields, a mapping unit is nearly equivalent to a soil phase. It is not exactly equivalent, because it is not practical to show on such a map all the small, scattered bits of soil of some kind that have been seen within an area that is dominantly of a recognized soil phase.

Some mapping units are made up of soils of different series, or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Fallon-Fernley Area: soil complexes and soil associations.

A soil complex consists of areas of two or more soils, so intricately mixed or so small in size that they cannot be shown separately on the soil map. Each area of a complex contains some of each of the two or more dominant soils, and the pattern and relative proportions are about the same in all areas. Generally, the name of a soil complex consists of the names of the dominant soils joined by a hyphen. Appian-Tipperary complex is an example.

A soil association is made up of adjacent soils that occur as areas large enough to be shown individually on the soil map but are shown as one unit because the time and effort of delineating them separately cannot be justified. There is a considerable degree of uniformity in pattern and relative extent of the dominant soils, but the soils may differ greatly one from another. The name of an association consists of the names of the dominant soils, joined by a hyphen. Bango-Stumble association is an example.

In most areas surveyed there are places where the soil material is so rocky, so shallow, so severely eroded, or so variable that it has not been classified by soil series. These places are shown on the soil map and are described in the survey, but they are called land types and are given descriptive names. Badland is a land type in this survey area.

While a soil survey is in progress, soil scientists take soil samples needed for laboratory measurements and for engineering tests. Laboratory data from the same kinds of soil in other places are also assembled. Data on yields of crops under defined practices are assembled from farm records and from field or plot experiments on the same kinds of soil. Yields under defined management are estimated for all the soils.

Soil scientists observe how soils behave when used as a growing place for native and cultivated plants, and as material for structures, foundations for structures, or covering for structures. They relate this behavior to properties of the soils. For example, they observe that filter fields for onsite disposal of sewage fail on a given kind of soil, and they relate this to the slow permeability of the soil or a high water table. They see that streets, road pavements, and foundations for houses are cracked on a named kind of soil and they relate this failure to the high shrink-swell potential of the soil material. Thus, they use observation and knowledge of soil properties, together with available research data to predict limitations or suitability of soils for present and potential uses.

After data have been collected and tested for the key, or benchmark, soils in a survey area, the soil scientists set up trial groups of soils. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others. They then adjust the groups according to the results of their studies and consultation. Thus, the groups that are finally evolved reflect up-to-date knowledge of the soils and their behavior under current methods of use and management.

General Soil Map

The general soil map at the back of this survey shows, in color, the soil associations in Fallon-Fernley Area. A soil association is a landscape that has a distinctive proportional pattern of soils. It normally consists of one or more major soils and at least one minor soil, and it is named for the major soils. The soils in one association may occur in another, but in a different pattern.

A map showing soil associations is useful to people who want a general idea of the soils in an area, who want to compare different parts of an area, or who want to know the location of large tracts that are suitable for a certain kind of land use. Such a map is a useful general guide in managing a watershed, a wooded tract, or a wildlife area, or in planning engineering works, recreational facilities, and community developments. It is not a suitable map for planning the management of a farm or field, or for selecting the exact location of a road, building, or similar structure, because the soils in any one association ordinarily differ in slope, depth, stoniness, drainage, and other characteristics that affect their management.

The soil associations in the Fallon-Fernley Area have been grouped into three general kinds of landscape for broad interpretative purposes. Each of the broad groups and the soil associations in each group are described in the following pages. The terms for texture used in the title for several of the associations apply to the texture of the surface layer. For example, in the title of association 2, the words "fine textured" refer to the texture of the surface layer.

Nearly Level Soils on Flood Plains and Low Lake Terraces

The associations in this group are mainly in the eastern half of the survey area, but there are a few areas in the

northwestern part. These associations make up about 47 percent of the survey area. The soils are excessively drained to poorly drained and have a coarse-textured to fine-textured surface layer. They are on flood plains, low stream terraces, and low lake terraces and in basins. They formed in alluvium weathered from mixed basic rocks. Elevation ranges from 3,800 to 4,200 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

Most of the farmland of this survey area is in this group. It is used to produce alfalfa, hay, pasture, and grain and other cultivated crops. The rest of the acreage is used for grazing and wildlife habitat.

1. Playas-Parran association

Nearly level playas and somewhat poorly drained, fine-textured soils; in basins and on low lake terraces

This association is mostly in the northeastern part of the survey area, but small scattered tracts occur throughout the Area. It occupies broad basins and low-lying lake terraces. The soils formed in fine-textured lacustrine material. Elevation ranges from 3,900 to 4,100 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

This association makes up about 25 percent of the survey area. It is about 75 percent Playas and 10 percent Parran soils. The remaining 15 percent is Tipperary, Churchill, Appian, and Carson soils and areas of Marsh and Badland.

The Playas are in basinlike areas without surface drainage outlets. They are very deep, intermittently ponded, and strongly alkaline to very strongly alkaline. They are commonly clayey but in places have thin strata of water-worked fine gravel or sand in the profile. The Playas are barren.

The Parran soils are very deep, somewhat poorly drained, strongly saline silty clay. They are prominently mottled in the substratum. They have a plant cover consisting of a very sparse stand of black greasewood, shadscale, suaeda, and iodine bush.

The soils of this association have limited use for recreation and as a resting area for migratory waterfowl. The sparse vegetation on the Parran soils is used for very limited grazing.

2. Lahontan association

Nearly level, somewhat poorly drained, fine-textured soils; on deltaic flood plains and in basins

This association is in the southern part of the survey area in the vicinity of Carson Lake. It occupies smooth, almost flat lake basins, terraces, and deltaic flood plains. The soils formed in clayey lacustrine material. Elevation ranges from 3,800 to 4,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

This association makes up about 2 percent of the survey area. It is about 80 percent Lahontan soils. The remaining 20 percent consists of inclusions of areas of Marsh and Pelic, Carson, and Parran soils.

Lahontan soils are very deep and are in basins and on deltaic flood plains. They are strongly alkaline and have a clay or silty clay texture throughout. They have a plant cover of black greasewood, saltbush, and saltgrass.

The soils of this association are used for grazing and for food and cover for wildlife. Irrigated tall wheatgrass pasture can be established on the soils of this association.

3. Carson-Stillwater association

Nearly level, somewhat poorly drained and poorly drained, fine textured and moderately fine textured soils; on flood plains

This association is in the eastern part of the survey area in a strip between Carson Sink and Carson Lake. It occupies smooth flood plains. The soils formed in alluvium of mixed origin. Elevation ranges from 3,800 to 4,200 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

This association makes up about 11 percent of the survey area. It is about 50 percent Carson soils and 30 percent Stillwater soils. The remaining 20 percent consists of Erber, Bunejug, Swope, Carcity, and Weishaupt soils. Ponds and sloughs connected by channels are in some areas.

The Carson soils are very deep and have a clay texture throughout. They have a native plant cover of black greasewood, suaeda, saltbush, and saltgrass.

Stillwater soils are very deep and have a texture of stratified clay loam and silty clay loam. They have a native plant cover of black greasewood, suaeda, saltbush, and saltgrass.

The soils of this association are used for crops and pasture where water is available for irrigation. They are used for range and wildlife habitat where irrigation water is not available and in areas where the salt and alkali content is so high that reclamation is not feasible. This association is used extensively for recreation. Ponds and sloughs in this association are used for fishing, and the soils and marsh areas are used for hunting waterfowl.

4. Dia-Sagouspe-East Fork association

Nearly level, somewhat poorly drained, coarse-textured to moderately fine textured soils; on flood plains and low stream terraces

This association is mainly in the central farming area surrounding the city of Fallon and in smaller areas near Fernley and along the Truckee River. It occupies low stream terraces and flood plains. The soils formed in alluvium derived from mixed rock. Elevation ranges from 3,800 to 4,800 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

This association makes up about 9 percent of the survey area. It is about 29 percent Dia soils, 13 percent Sagouspe soils, 9 percent East Fork soils, and 9 percent Fernley soils. The remaining 40 percent consists of Carcity, Dithod, Bunejug, Erber, Fallon, Pelic, Ragtown, Swope, and Swingler soils.

The Dia soils are very deep. They are silty clay loam or clay loam and are moderately deep over sand. They

have a native plant cover of big sagebrush in the salt- and alkali-free areas and black greasewood and saltgrass in the areas affected by salt and alkali.

Sagouspe soils are very deep and are on smooth stream terraces. They are dominantly loamy sand and have thin strata of sandy to silty clay loam. They have a plant cover of black greasewood, rabbitbrush, and saltgrass.

East Fork soils are very deep and are on smooth flood plains and low stream terraces. They have a clay loam or silty loam texture throughout. They have a plant cover of big sagebrush and meadow grass in the salt- and alkali-free areas and black greasewood and saltgrass in the salt and alkali affected areas.

The major soils in this association are among the most productive in the Area. Where the areas are cleared and leveled and irrigation water is available, alfalfa, small grains, corn, and other row crops are produced. Where irrigation water is lacking, these soils are used for grazing and wildlife habitat.

Nearly Level to Strongly Sloping Soils on Recent Terraces and High Terraces

The associations in this group are mainly in the western part of the survey area, but they also are in long, narrow areas in the southern and eastern parts. These associations make up about 41 percent of the survey area. The soils are moderately well drained to excessively drained and have a coarse-textured to fine-textured surface layer. They are on recent lake terraces and high terraces. They formed in lacustrine sediment and alluvium derived from mixed basic rocks.

Elevation ranges from 3,800 to 5,000 feet. The average annual precipitation is 4 to 6 inches, the average annual temperature is 51° to 55° F., and the frost-free season is about 130 days.

Small areas are irrigated and cultivated, but most areas in this group are used mainly for grazing and wildlife habitat.

5. Tipperary-Appian association

Nearly level to strongly sloping, excessively drained to well-drained, coarse textured and moderately coarse textured soils; on lake terraces and sand dunes

This association is on broad, low-lying lake terraces that have partly stabilized sand dunes. The largest area of this association is in the central part of the survey area. It consists of well-drained soils that formed in loamy alluvium over lacustrine sand and excessively drained soils that formed in aeolian material. Elevation ranges from 3,800 to 4,100 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is about 51° to 55° F., and the frost-free season is about 130 days.

This association makes up about 25 percent of the survey area. It is about 38 percent Tipperary soils and 28 percent Appian soils. The remaining 34 percent consists of Parran, Lahontan, Churchill, Soda Lake, Sagouspe, and Fernley soils, and Playas.

Tipperary soils are excessively drained, and they formed on partly stabilized sand dunes that are superimposed over Appian soils. They are nearly level to strongly sloping and are fine sand throughout. Tipperary soils have a plant cover of black greasewood, dalea, shadscale, and Indian ricegrass.

Appian soils are nearly level, very deep, and well drained. They formed in loamy alluvium over lacustrine sand derived from mixed rock. They are on smooth, low-lying lake terraces. Appian soils have a surface layer of sandy loam about 3 inches thick. They have a clay loam subsoil and are underlain by stratified sand and fine sand. In places Appian soils are underlain by slowly permeable, lacustrine clay at a depth below 40 inches. Appian soils have a plant cover of upland greasewood, shadscale, bud sagebrush, and black greasewood.

The soils in this association are used for grazing and for food and cover for wildlife.

6. Biddleman-Bango-Stumble association

Nearly level to strongly sloping, well-drained and somewhat excessively drained, moderately coarse textured and coarse textured soils; on high terraces and alluvial fans

This association is in narrow bands that separate the upland soils from the low terrace soils throughout the survey area. It occupies high terraces and alluvial fans. The soils formed in lacustrine sediment and alluvium of mixed origin. Elevation ranges from 4,000 to 5,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

This association makes up about 11 percent of the survey area. It is about 52 percent Biddleman soils, 20 percent Bango soils, and 15 percent Stumble soils. The remaining 13 percent consists of Tipperary, Mazuma, Patna, Juva, and Bluewing soils and of areas of Badland and Rock outcrop.

The Biddleman soils are nearly level to strongly sloping, deep to very deep, and well drained. They formed in a thin mantle of gravelly and cobbly loamy alluvium over old, very gravelly shorelines. They have a surface layer of very stony loamy sand, very stony sandy loam, and gravelly sandy loam and a subsoil of gravelly clay loam over stratified lacustrine sand and gravel. Biddleman soils have a plant cover of upland greasewood, shadscale, and bud sagebrush.

The Bango soils are nearly level to gently sloping, very deep, and well drained. They formed in lacustrine sediment. These soils are on smooth to slightly dissected high lake terraces. Slopes are slightly convex. These soils have a surface layer of sandy loam or loamy sand and a subsoil of loam over stratified lacustrine material. Bango soils have a plant cover of upland greasewood, shadscale, bud sagebrush, and Indian ricegrass.

The Stumble soils are nearly level to gently sloping, very deep, and somewhat excessively drained. They are on alluvial fans. Their texture generally is loamy sand throughout. They have a plant cover of Indian ricegrass, upland greasewood, dalea, horsebrush, and common winterfat.

The soils of this association are used mainly for grazing and for food and cover for wildlife. Bango and Stumble soils are suitable for irrigation if water is available. The substratum of the Biddleman soils is a source of gravel.

7. *Tipperary-Patna association*

Nearly level to gently rolling, excessively drained and somewhat excessively drained, coarse-textured soils; on high terraces

This association is in the northwest corner of the survey area and in a small area on Swingle Bench. It occupies alluvial terraces. The soils formed in sandy and loamy alluvium. Elevation ranges from 4,000 to 4,400 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

This association makes up about 4 percent of the survey area. It is about 70 percent Tipperary soils and 15 percent Patna soils. The remaining 15 percent consists of Appian, Bango, Biddleman, and Swingler soils and of Playas.

The Tipperary soils are nearly level to gently rolling, very deep, and excessively drained and are on high lake terraces. They are sand or fine sand throughout. They have a plant cover of Indian ricegrass, dalea, white sage, and horsebrush.

Patna soils are very deep, somewhat excessively drained soils that formed in lake reworked sandy deltaic deposits of mixed origin. These soils are on broad, slightly convex to smooth alluvial terraces. They have a surface layer of sand and loamy sand about 6 inches thick and a subsoil of sandy loam, stratified loamy sand, and sand. Patna soils have a plant cover of upland greasewood, dalea, spiny hopsage, littleleaf horsebrush, Indian ricegrass, and common winterfat.

The soils in this association are used mainly for livestock and for food and cover for wildlife. Small areas are irrigated and cultivated. In places Tipperary soils are a source of sand.

8. *Hooten-Huxley-Labou association*

Nearly level to strongly sloping, moderately well drained and well drained, coarse-textured to fine-textured soils; on recent lake terraces and volcanic cones

This association is in the north-central part of the survey area in the vicinity of Upsal Hogback. The soils are moderately well drained and well drained and formed in lacustrine sediment on recent lake terraces and volcanic cones. Elevation ranges from 3,800 to 4,400 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

This association makes up about 1 percent of the survey area. It is about 25 percent Hooten soils, 22 percent Huxley soils, 22 percent Labou soils, and 18 percent Gardella soils. The remaining 13 percent consists of Tipperary, Parran, and Bango soils and of areas of Rock outcrop.

Hooten soils are moderately well drained and nearly level to gently sloping. They are very shallow to silica-cemented hardpan. They are on smooth or slightly convex lake terraces bordering the outer margins of volcanic cones. They formed in finely stratified gravelly, sandy, and silty lacustrine sediment derived mainly from basalt and tuffs. Hooten soils are in a band between areas of Labou and Gardella soils. The subsoil is gravelly sand over gravelly sandy clay loam and is about 5 inches thick. Below this layer is a silica-cemented hardpan about 5 inches thick. The underlying material is dominantly stratified sand and gravel that has weak silica cementation. The plant cover consists of upland greasewood, shadscale, and some black greasewood.

Huxley soils are very deep and moderately well drained. They formed in lacustrine sediment of mixed origin. These nearly level soils are on smooth lake terraces. Huxley soils have a surface layer of gravelly clay loam about 2 inches thick and a subsoil of light clay and very gravelly light clay over stratified lacustrine fine sand and very fine sand. The plant cover consists of black greasewood and shadscale.

Labou soils are gently sloping to strongly sloping, shallow, and well drained. They are on uplands that have been truncated by water. They formed in lacustrine sediment of mixed origin. They are above the Hooten soils in the highest part of the association. They have a surface layer of gravelly loamy fine sand and fine sandy loam about 3 inches thick over clay and very gravelly sandy clay loam about 7 inches thick. The underlying material is extremely hard lithoid tufa. The plant cover consists of upland greasewood, bud sagebrush, and Indian ricegrass.

The soils of this association are used for limited grazing and for food and cover for wildlife.

Nearly Level to Steep Soils on Rolling Foothills and Mountains

The associations in this group are mainly in the western part of the survey area, but some small areas are in the southern and eastern parts. These associations make up about 12 percent of the survey area. The soils are well drained to somewhat excessively drained and have a moderately coarse textured to moderately fine textured surface layer. They are on rolling foothills and mountains. They formed mainly in residuum from diatomaceous earth, tuffs, and basalts.

Elevation ranges from 4,400 to 6,000 feet. The average annual precipitation is 4 to 7 inches, average annual air temperature is 50° to 54° F., and the frost-free season is 120 to 130 days.

The soils of these associations are not suitable for cultivated crops or irrigation. They are used for grazing, but about 50 percent of the acreage has very limited use.

9. *Pirouette-Osobb association*

Nearly level to moderately steep, well-drained, moderately fine textured to moderately coarse textured soils; on foothills

This association is in mountainous areas throughout the survey area. It occupies foothills. The soils formed in residuum from tuffs and basalts. Elevation ranges from 4,400 to 6,000 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 50° to 54° F., and the frost-free season is about 120 days.

This association makes up about 6 percent of the survey area. It is about 40 percent Pirouette soils and 20 percent Osobb soils. The remaining 40 percent consists of Bluewing, Celeton, and Biddleman soils and of areas of Rock outcrop.

Pirouette soils formed in residuum derived from tuffs and basalt. They are nearly level to moderately sloping. They are shallow and have well-developed erosion pavements. The surface layer is very fine sandy loam about 3 inches thick. The subsoil is cobbly clay loam about 7 inches thick. Below this layer is very cobbly sandy loam, about 9 inches thick, that is underlain by a thin indurated hardpan capping basalt bedrock. Pirouette soils have a plant cover of shadscale, upland greasewood, bud sagebrush, and cheatgrass.

Osobb soils are shallow and formed in mixed colluvium and residuum derived dominantly from soft tuffs. These strongly sloping to moderately steep soils are on convex, rolling foothills. They consist of fine sandy loam or very fine sandy loam that contains stones, cobblestones, and gravel. They are underlain by a thin indurated hardpan capping soft tuffs. The plant cover consists of shadscale, upland greasewood, bud sagebrush, and galleta grass.

The soils of this association are used for grazing and for food and cover for wildlife.

10. Celeton association

Moderately steep to steep, somewhat excessively drained, moderately coarse textured soils; on foothills and mountains

This association occupies foothills and mountains. The soils formed in residuum derived from diatomaceous earth. Elevation ranges from 4,400 to 5,200 feet. The average annual precipitation is 4 to 7 inches, the average annual air temperature is 50° to 54° F., and the frost-free season is about 120 to 130 days.

This association makes up about 5 percent of the survey area. It is about 70 percent Celeton soils. The remaining 30 percent consists of Pirouette and Osobb soils and of areas of Mine pits and Rock outcrop.

Celeton soils are very shallow. The surface layer is very gravelly sandy loam that is underlain by diatomaceous earth. The plant cover is mainly shadscale and other desert shrubs.

The soils in this association are not suitable for cultivated crops or irrigation. They have very limited use for grazing and food and cover for wildlife. The bedrock is a source of diatomite.

Descriptions of the Soils

This section describes the soil series and mapping units in the Fallon-Fernley Area. Each soil series is described in detail, and then, briefly, each mapping unit in that series. Unless it is specifically mentioned otherwise, it is to be assumed that what is stated about the soil series holds true for the mapping units in that series. Thus, to get full information about any one mapping unit, it is necessary to read both the description of the mapping unit and the description of the soil series to which it belongs.

An important part of the description of each soil series is the soil profile, that is, the sequence of layers from the surface downward to rock or other underlying material. Each series contains two descriptions of this profile. The first is brief and in terms familiar to the layman. The second is much more detailed and is for those who need to make thorough and precise studies of soils. The profile described in the series is representative for mapping units in that series. If the profile of a given mapping unit is different from the one described for the series, these differences are stated in describing the mapping unit, or they are differences that are apparent in the name of the mapping unit. Color terms are for dry soil unless otherwise stated.

As mentioned in the section "How This Survey Was Made," not all mapping units are members of a soil series. Alluvial land, for example, does not belong to a soil series, but nevertheless, is listed in alphabetic order along with the soil series.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the mapping unit on the detailed soil map. Listed at the end of each description of a mapping unit is the capability unit, range site, wildlife suitability group, and windbreak suitability group in which the mapping unit has been placed. The page for the description of each capability unit or other interpretative group can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The acreage and proportionate extent of each mapping unit are shown in table 4. Many of the terms used in describing soils can be found in the Glossary, and more detailed information about the terminology and methods of soil mapping can be obtained from the Soil Survey Manual (*11*).

Alluvial Land

Alluvial land (Ad) is in small and very small, narrow, nearly level areas that are frequently flooded. It consists of recently deposited, poorly drained sediment washed from soils derived from mixed rock and ranges widely in texture. It is very deep, stratified, and generally neutral in reaction. Because soil material is deposited or removed during each period of overflow, the texture of the surface layer changes frequently. At times the areas of Alluvial land are covered by water for long periods.

The vegetation consists mainly of sedges, rushes, willows, and cottonwoods. Rabbitbrush, black greasewood, and saltgrass grow in areas that have better drainage. From 70 to 95 percent of the surface is barren, depending upon the texture of the surface layer and depth of the water table.

Alluvial land is unsuitable for irrigation, because it is frequently flooded and drainage is not feasible. It is suited to native pasture. In most places this land type is a poor source of sand and gravel because it is highly stratified. In places that are suitable as a source of sand and gravel, drainage must be provided before the materials can be removed. Capability unit VIIw-241, nonirrigated; not placed in a range site or in windbreak or wildlife suitability groups.

Appian Series

The Appian series consists of very deep, well-drained soils that formed in loamy alluvium over lacustrine sand, both of which were derived from mixed rocks. These soils are on smooth, low-lying terraces and alluvial ter-

TABLE 4.—*Approximate acreage and proportionate extent of the soils*

Soil	Acres	Percent	Soil	Acres	Percent
Alluvial land	1, 560	0. 2	Juva sandy loam, 0 to 2 percent slopes	1, 699	. 2
Appian loamy fine sand	730	. 1	Juva sandy loam, 2 to 4 percent slopes	230	(1)
Appian sandy loam, wet	295	(1)	Juva silt loam, 2 to 4 percent slopes	320	(1)
Appian sandy loam, clay substratum	1, 937	. 2	Labou-Rock outcrop complex	2, 561	. 3
Appian fine sandy loam	1, 151	. 1	Lahontan clay, slightly saline	2, 395	. 3
Appian complex	3, 134	. 4	Lahontan clay, strongly saline	11, 572	1. 4
Appian-Tipperary complex	37, 604	4. 5	Marsh	21, 306	2. 5
Appian clay substratum-Tipperary complex	18, 219	2. 2	Mazuma-Bango association	5, 125	. 6
Appian-Playas association	20, 730	2. 5	Mine pits	1, 150	. 1
Badland	17, 458	2. 1	Parran silty clay	10, 797	1. 3
Bango loamy sand, 0 to 2 percent slopes	475	. 1	Parran-Tipperary complex	17, 077	2. 0
Bango loamy sand, 2 to 4 percent slopes	225	(1)	Patna sand	5, 414	. 7
Bango sandy loam, 2 to 4 percent slopes	3, 394	. 4	Pelic sand	861	. 1
Bango silt loam, 0 to 2 percent slopes	455	. 1	Pelic clay	1, 652	. 2
Bango-Stumble association	34, 240	4. 1	Pelic sand, clay substratum	3, 467	. 4
Biddleman very stony loamy sand, 2 to 4 percent slopes	1, 385	. 2	Pirouette-Bluewing association	9, 616	1. 2
Biddleman association	47, 655	5. 7	Pirouette-Osobb association	26, 900	3. 2
Bluewing gravelly loamy sand, 2 to 8 percent slopes	2, 117	. 3	Playas	157, 217	19. 0
Bunejug sandy loam	845	. 1	Ragtown sandy clay loam	665	. 1
Bunejug sandy loam, slightly saline	1, 750	. 2	Ragtown clay loam, slightly saline	1, 320	. 2
Bunejug sandy loam, strongly saline	2, 234	. 3	Ragtown clay loam, strongly saline	1, 769	. 2
Bunejug-Erber clay loams	7, 474	. 9	Sagouspe loamy sand	3, 452	. 4
Carcity clay	1, 083	. 1	Sagouspe loamy sand, saline	6, 547	. 8
Carcity clay, slightly saline	736	. 1	Soda Lake gravelly loamy sand, 0 to 2 percent slopes	543	. 1
Carcity clay, strongly saline	294	(1)	Soda Lake gravelly loamy sand, saline, 0 to 2 percent slopes	1, 817	. 2
Carson clay loam, strongly saline	9, 254	1. 1	Soda Lake gravelly loamy sand, 2 to 15 percent slopes	717	. 1
Carson clay	2, 186	. 3	Soda Lake sandy loam, 0 to 2 percent slopes	894	. 1
Carson clay, slightly saline	2, 945	. 4	Soda Lake sandy loam, saline, 0 to 2 percent slopes	728	. 1
Carson clay, strongly saline	2, 364	. 3	Soda Lake-Rock outcrop complex	410	(1)
Carson-Stillwater complex	16, 678	2. 0	Stillwater clay loam	830	. 1
Celeton very cobbly sandy loam, 8 to 30 percent slopes	29, 538	3. 6	Stillwater clay loam, slightly saline	1, 508	. 2
Churchill-Playas complex	7, 489	. 9	Stillwater clay loam, strongly saline	1, 388	. 2
Dia loam	6, 898	. 8	Stillwater clay loam, wet	893	. 1
Dia loam, slightly saline	7, 772	. 9	Stillwater clay	368	(1)
Dia loam, strongly saline	5, 346	. 6	Swingler sand	964	. 1
Dia loam, wet	421	. 1	Swingler sandy loam	1, 928	. 2
Dithod loam	889	. 1	Swingler clay loam	362	(1)
Dithod loam, slightly saline	907	. 1	Swingler clay loam, slightly saline	306	(1)
Dithod loam, strongly saline	468	. 1	Swingler clay loam, strongly saline	1, 238	. 1
Dune land-Playas complex	12, 598	1. 5	Swope sandy loam	352	(1)
East Fork clay loam	2, 549	. 3	Swope clay loam	451	. 1
East Fork clay loam, slightly saline	2, 659	. 3	Swope clay loam, slightly saline	857	. 1
East Fork clay loam, strongly saline	1, 754	. 2	Swope clay loam, strongly saline	484	. 1
Erber sand	1, 033	. 1	Tipperary sand, 0 to 2 percent slopes	3, 851	. 4
Erber loam	545	. 1	Tipperary sand, 2 to 8 percent slopes	19, 586	2. 3
Erber loam, strongly saline	660	. 1	Tipperary fine sand, 0 to 4 percent slopes	3, 357	. 4
Erber clay, slightly saline	752	. 1	Tipperary fine sand, 4 to 15 percent slopes	4, 194	. 5
Erber clay, strongly saline	1, 609	. 2	Tipperary-Appian complex	18, 651	2. 2
Fallon fine sandy loam	870	. 1	Tipperary-Appian clay substratum, complex	7, 805	. 9
Fallon fine sandy loam, slightly saline	1, 846	. 2	Tipperary-Lahontan complex	566	. 1
Fallon fine sandy loam, strongly saline	639	. 1	Tipperary-Parran complex	69, 005	8. 3
Fallon fine sandy loam, wet	260	(1)	Weishaupt clay loam	482	. 1
Fernley sand	4, 542	. 5	Weishaupt clay loam, slightly saline	500	. 1
Fernley loam	1, 939	. 2	Weishaupt clay loam, strongly saline	1, 036	. 1
Fernley clay	391	(1)	Water areas	46, 398	5. 6
Gardella gravelly silt loam	2, 254	. 3			
Hooten-Bango association	6, 650	. 8			
Huxley gravelly clay loam	2, 575	. 3	Total	832, 041	100. 0

[1] Less than 0.05 percent.

races. Slopes are 0 to 2 percent. Elevation ranges from 3,900 and 4,200 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F.; and the frost-free season is about 130 days.

In a representative profile the surface layer is gray sandy loam about 3 inches thick. The next layer is brown, friable, plastic clay loam about 8 inches thick. It is underlain by light brownish-gray, finely stratified sand, fine sand, and sandy loam about 10 inches thick. Beneath this is light brownish-gray, highly micaceous sand that is loose when dry and when moist. It extends to a depth of 60 inches.

Permeability is moderately slow in the surface layer and in the subsoil and very rapid in the substratum, except where slowly permeable clay is present. Runoff is slow, and the hazard of erosion is slight. Available water capacity is about 3.5 to 6.0 inches.

These soils are suited to crops if water is available and if they are reclaimed. They are used for crops and for grazing. The native vegetation is upland greasewood, shadscale, and bud sagebrush.

Representative profile of an Appian sandy loam, in an area of Appian-Tipperary complex in native vegetation, about 2,600 feet east and 500 feet north of the southwest corner of sec. 34, T. 19 N., R. 27 E., Mount Diablo base line and meridian:

A1—0 to 3 inches, gray (10YR 6/1) sandy loam, very dark grayish brown (10YR 3/2) moist; moderate, thick, platy structure; hard, friable, slightly sticky and plastic; common fine roots and few medium roots; many fine vesicular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

B2t—3 to 11 inches, brown (7.5YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; moderate, medium, columnar structure; very hard, friable, sticky and plastic; common fine roots and few medium roots; few very fine and common very fine and fine pores; many thin clay films on faces of peds and continuous thin clay film in pores; noneffervescent matrix but violently effervescent in common, fine and medium, prominent, white (10YR 8/1) lime filaments; very strongly alkaline; abrupt, smooth boundary.

IIC1—11 to 21 inches, light brownish-gray (10YR 6/2) finely stratified sand, fine sand, loamy sand, and sandy loam, dark grayish brown (10YR 4/2) moist; few, fine, prominent, strong-brown (7.5YR 5/6) mottles moist; massive; soft, very friable; few very fine roots; many very fine and fine interstitial pores; moderately alkaline; abrupt, wavy boundary.

IIC2—21 to 62 inches, light brownish-gray (10YR 6/2) highly micaceous sand, brown (10YR 4/3) moist; many, coarse, prominent, strong-brown (7.5YR 5/6) mottles and thin bands; single grain; loose when dry and moist; few very fine roots; many very fine and fine interstitial pores; moderately alkaline.

The solum ranges from 7 to 18 inches in thickness, but where these soils are leveled along with adjacent soils, the thickness is as much as 24 inches. The A1 horizon has a value of 6 or 7 when dry and 3 or 4 when moist. Its texture is clay loam, fine sandy loam, sandy loam, loamy fine sand, or fine sand. Structure ranges from weak to moderate, platy or subangular blocky, or the horizon is massive. Reaction ranges from neutral to moderately alkaline.

The B2t horizon has a hue of 10YR and 7.5YR, a value of 4 to 6 when dry and 4 or 5 when moist, and a chroma of 2 to 4. Structure is moderate or strong, fine, medium, or coarse, columnar or prismatic. Texture is dominantly clay loam but is sandy clay loam in places.

The IIC horizon has a hue of 2.5Y to 7.5YR and a value of 6 or 7 when dry and 4 or 5 when moist. Few to many, fine to coarse, faint to prominent, high-chroma mottles are present. The IIC horizon is dominantly sand, but in places it has strata of coarse sand, fine sand, loamy sand, loamy fine sand, fine sandy loam, or sandy loam of variable thickness and arrangement. Some strata are as much as 75 percent gravel. In places a IIIC horizon is at a depth of 40 to 60 inches, but the depth commonly is about 48 inches. This horizon has a texture of clay, silty clay, or heavy clay loam.

Appian loamy fine sand (Af).—This soil is on low lake terraces. It is nearly level and is in small irregularly shaped areas that commonly have one or more straight boundaries because of leveling. The profile of this soil is similar to that described as representative for the series, but this soil has been reclaimed and is not saline or alkali affected; also, the surface layer is loamy fine sand 8 to 10 inches thick because of leveling.

The drainage of this soil has been altered to somewhat poorly drained. A seasonal high water table is at a depth of 3 to 5 feet because of excessive canal leakage. Available water capacity is 5.0 to 6.0 inches.

Included with this soil in mapping are small areas of Sagouspe, Fallon, Appian, and Fernley soils.

This soil is used for irrigated pasture, alfalfa, and small grain. Capability unit IIw-22, irrigated; wildlife suitability group NV 27-3, irrigated; windbreak suitability group NV 27-3; not placed in a range site.

Appian sandy loam, wet (Am).—This soil is on smooth, high alluvial terraces. It is nearly level and is in small irregularly shaped areas in field corners, in homestead areas, and in other areas that are within the irrigation system but are not presently irrigated. The profile of this soil is similar to that described as representative for the series, but it is strongly affected by salt and alkali.

The drainage has been altered to somewhat poorly drained, and a seasonal high water table is at a depth of 3 to 5 feet because of excessive canal leakage. Available water capacity is 4.0 to 5.0 inches.

Included with this soil in mapping are small areas of Tipperary fine sand and Appian clay loam.

This soil is used for grazing and wildlife food and cover. It is unsuitable for irrigated crops unless it is leveled and reclaimed. It responds well to reclamation practices. The vegetation consists of black greasewood, saltbush, and saltgrass. Capability units IIIw-24, irrigated, and VIIw-241, nonirrigated; wildlife suitability groups NV 27-2, irrigated, and NV 27-9, nonirrigated; windbreak suitability group NV 27-4; not placed in a range site.

Appian sandy loam, clay substratum (An).—This soil is on smooth, low lake terraces of ancient Lake Lahontan. It is nearly level and is in small rectangularly shaped areas. The profile of this soil is similar to that described as representative for the series, but the surface layer and the subsoil are dominantly less than 12 inches thick, and clay is commonly at a depth of 40 to 60 inches. This soil has been leveled and reclaimed.

The drainage of this soil has been altered to somewhat poorly drained. Available water capacity is 3.5 to 4.0 inches.

Included with this soil in mapping are small areas of Fernley and Tipperary soils.

This soil is mainly used for irrigated pasture and crops. Many of the homesites and corral areas of ranches are located on this soil. Capability units IVw-22, irrigated, and VIIs-261, nonirrigated; wildlife suitability groups NV 27-2, irrigated, and NV 27-9, nonirrigated; windbreak suitability group NV 27-4; not placed in a range site.

Appian fine sandy loam (Ao).—This nearly level soil is in medium-sized, rectangularly shaped areas on smooth alluvial terraces. Straight boundaries are common because of leveling. The profile of this soil is similar to that described as representative for the series, but it has been reclaimed and is not saline or alkali affected. The surface layer is 7 to 10 inches thick because of leveling.

In places the water table rises within 3 feet of the surface during the irrigation season and recedes to a

depth of about 5 feet or more after the irrigation season. Because of irrigation, this soil is somewhat poorly drained. The available water capacity is 5.0 to 6.0 inches.

Included with this soil in mapping are small areas of other Appian soils and small areas of Tipperary and Fernley soils.

This soil is mainly used for irrigated crops. Capability unit IIw 1, irrigated; wildlife suitability group NV 27-3, irrigated; windbreak suitability group NV 27-3; not placed in a range site.

Appian complex (Ap).—This complex is on convex recent lake terraces. The soils are nearly level and are in small, narrow areas on the fringe of irrigated areas. This mapping unit is about 40 percent Appian fine sand, 40 percent Appian clay loam, and 20 percent included soils.

The Appian fine sand is in hummocky areas of wind-deposited fine sand. The profile of this soil is similar to that described as representative for the Appian series, but it has a surface layer of fine sand about 4 inches thick, the combined thickness of the surface layer and the subsoil is 7 to 10 inches, and clay is at a depth of 40 to 60 inches.

The Appian clay loam is in smooth, wind-swept areas. It has a profile that is similar to that described as representative for the Appian series, but the clay loam subsoil is exposed and the surface layer and subsoil combined is 7 to 12 inches thick; also, this soil is underlain by slowly permeable clay at a depth to 40 to 60 inches.

Both of these Appian soils are well drained and have an available water capacity of 3.5 to 4.0 inches. The vegetation is black greasewood and shadscale.

Included with this complex in mapping are small areas of Tipperary fine sand, 0 to 4 percent slopes, Parran silty clay, and Appian sandy loam.

The soils in this unit are used for limited grazing and wildlife habitat. They have a limited potential for irrigated crops if they are reclaimed and water supplies are available. Capability units IVw-22, irrigated, and VIIs-261, nonirrigated; wildlife suitability groups NV 27-2, irrigated, and NV 27-9, nonirrigated; range site NV 27-4 (Desert Alkali Flats); windbreak suitability group NV 27-4.

Appian-Tipperary complex (AR).—This complex consists of large and very large areas of nearly level to undulating Tipperary soils on partly stabilized, convex dunes in areas of smooth, nearly level Appian soils on lake terraces. It is about 40 percent Appian sandy loam; 40 percent Tipperary fine sand, 0 to 4 percent slopes; and 20 percent included soils.

The nearly level Appian soils are on low-lying lake terraces. They have the profile described as representative for the Appian series. They are well drained and have an available water capacity of 4.0 to 5.0 inches. The vegetation is sparse stands of shadscale, upland greasewood, and bud sagebrush.

The nearly level to undulating Tipperary soils have a fine sand texture and are on stabilized, low dunes. They have a profile similar to that described as representative for the Tipperary series. The vegetation is black greasewood, dalea, four-wing saltbush, shadscale, Indian ricegrass, and annuals.

Included with this complex in mapping are areas of Tipperary fine sand, 4 to 15 percent slopes, on rolling, stabilized dunes, mainly along the edges of the complex; areas of Appian clay loam adjacent to several isolated ponds and the Old River Reservoir; and randomly scattered, barren playas.

The soils in this complex are used mainly for grazing and wildlife habitat. They are suitable for crops if water supplies are available. Capability units IVw–22, irrigated, and VIIs–261, nonirrigated, and wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; Appian soils in range site NV 27–1 (Desert Lake Bars), and windbreak suitability group NV 27–4; Tipperary soils in range site NV 27–5 (Desert Dunes), and windbreak suitability group NV 27–5.

Appian clay substratum-Tipperary complex (AS).—This complex is in irregularly shaped, small and medium-sized areas on the fringe of irrigated areas and in large areas outside the present irrigation system. The areas are on low-lying terraces that are partly covered by sand dunes. The complex is about 20 percent Appian clay loam, clay substratum; 20 percent Appian fine sand, clay substratum; 40 percent Tipperary fine sand, 0 to 4 percent slopes; and 20 percent included soils.

The nearly level Appian soils are on low lake terraces. The Appian clay loam has a profile similar to that described as representative for the Appian series, but the clay loam subsoil is exposed; the combined thickness of the surface layer and the subsoil generally is 7 to 12 inches; and slowly permeable clay is at a depth of 40 to 60 inches. The Appian fine sand has a profile similar to that described as representative for the Appian series, but it has a surface layer of fine sand; combined thickness of the surface layer and subsoil generally is less than 12 inches; and slowly permeable clay is at a depth of 40 to 60 inches. The Appian soils are well drained and have an available water capacity of 3.5 to 4.0 inches. The vegetation is black greasewood, shadscale, and suaeda.

The nearly level to undulating Tipperary soils are on partly stabilized sand dunes. They have a profile similar to that described as representative for the Tipperary series. The vegetation is black greasewood, dalea, shadscale, and Indian ricegrass.

Included with this complex in mapping are areas of Tipperary fine sand, 4 to 15 percent slopes; Parran silty clay; and Playas.

The soils in this complex are used mainly for grazing and wildlife habitat. They have a very limited suitability for crops if they are reclaimed and water is available. Capability units IVw–22, irrigated, and VIIs–261, nonirrigated, and wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; Appian soils in range site NV 27–4 (Desert Alkali Flats), and windbreak suitability group NV 27–4; Tipperary soils in range site NV 27–5 (Desert Dunes), and windbreak suitability group NV 27–5.

Appian-Playas association (AT).—This association consists of nearly level soils in very large areas on smooth, low-lying terraces and in concave basins. It is about 40 percent Appian sandy loam, 40 percent Playas, and 20 percent included soils.

The nearly level Appian soils are in the slightly raised areas. They have a profile similar to that described as representative for the Appian series, but in places the surface layer is thinner or is absent in the transition to Playas. They are well drained and have an available water capacity of 4.0 to 5.0 inches. The vegetation is sparse stands of upland greasewood, shadscale, and bud sagebrush. The Playas are barren depressions scattered throughout the mapped areas.

Included with this complex in mapping are areas of Tipperary fine sand, 0 to 4 percent slopes; areas of Tipperary fine sand, 4 to 15 percent slopes, that are on randomly scattered, low and high, partly stabilized sand dunes; and areas of Parran silty slay, 0 to 2 percent slopes, adjacent to the Playas.

The soils in this association are used mainly for limited grazing and for wildlife habitat. If Appian soils are reclaimed, they are potentially suitable for crops where water supplies are available. Appian soils in capability units IIIw-24, irrigated, and VIIs-261, nonirrigated, wildlife suitability groups NV 27-2, irrigated, and NV 27-9, nonirrigated, range site NV 27-1 (Desert Lake Bars), and windbreak suitability group NV 27-4; Playas in capability unit VIIIw-207, nonirrigated, not placed in a wildlife suitability group, range site, or windbreak suitability group.

Badland

Badland (BA) is in large and very large bands on gently rolling to moderately steep shorelines of Ancient Lake Lahontan. Areas of this land type are throughout the Lahontan Basin. The areas of Badland consist of very strongly saline and alkali-affected lacustrine sediment. The areas have been severely eroded by gullying because of runoff received from surrounding uplands.

This land type is barren of vegetation and has no value except for recreation. It provides no food or cover for wildlife or grazing for livestock. Capability unit VIIIe-245, nonirrigated; not placed in a wildlife suitability group, range site, or windbreak suitability group.

Bango Series

The Bango series consists of very deep, well-drained soils that formed in stratified lacustrine sediment. These soils are on smooth to very slightly dissected high lake terraces. Slopes are slightly convex and range from 0 to 4 percent. Elevation ranges from 4,000 to 4,200 feet. The average annual precipitation is 4 to 6 inches, average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray sandy loam about 4 inches thick. The next layer is pale-brown, friable, slightly plastic loam about 4 inches thick. It is underlain by pale-brown, very friable, nonplastic fine sandy loam, about 8 inches thick, that generally contains cobblestones and gravel-size dendritic tufa in the upper part. The lower part is a stratified layer of light-gray, friable, slightly plastic very fine sandy loam and silt loam that extends to a depth of 60 inches.

Permeability is moderately slow. Runoff is slow, and the hazard of erosion is moderate. Available water capacity is about 8.0 to 9.5 inches.

These soils are suitable for alfalfa, pasture, and small grain if irrigation water is available. They are used mainly for grazing. Several small areas are used for irrigated crops. The native vegetation is upland greasewood, shadscale, and bud sagebrush and varying amounts of Indian ricegrass, annual forbs, and weeds.

Representative profile of Bango sandy loam, 2 to 4 percent slopes, in native vegetation, about 7 miles east of Fernley, 30 feet east of the power line, 500 feet north of Fernley Farm Road, SE¼SW¼sec. 19, T. 20 N., R. 26 E.:

A1—0 to 4 inches, light brownish-gray (2.5Y 6/2) sandy loam, dark grayish brown (2.5Y 4/2) moist; strong, coarse, platy structure; slightly hard, very friable; many fine roots; many fine vesicular pores; strongly effervescent; moderately alkaline; clear, smooth boundary.

B2t—4 to 8 inches, pale-brown (10YR 6/3) loam, brown (10YR 4/3) moist; weak, coarse, prismatic structure parting to moderate fine and medium subangular blocky; hard, friable, slightly sticky, and slightly plastic; many fine roots; common fine interstitial pores; few thin clayfilms on faces of peds and in pores; strongly effervescent, moderately alkaline; abrupt, irregular boundary.

C1—8 to 12 inches, pale-brown (10YR 6/3), cobbly, gravelly fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; many very fine roots; few fine tubular pores; 60 to 70 percent gravel- and cobblestone-size fragments of dendritic tufa; strongly effervescent; strongly alkaline; abrupt, irregular boundary.

C2—12 to 16 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, very friable; few very fine roots; few fine tubular pores; violently effervescent; strongly alkaline; abrupt, wavy boundary.

IIC3—16 to 30 inches, light-gray (2.5Y 7.2) very fine sandy loam, dark grayish brown (2.5Y 4/2) moist; massive; slightly hard, friable, slightly plastic; very few very fine roots; few fine tubular pores; violently effervescent; strongly alkaline; clear, smooth boundary.

IIC4—30 to 63 inches, light-gray (2.5Y 7/2) silt loam, grayish brown (2.5Y 5/2) moist; few, fine, prominent, yellowish-red (5YR 5/6) and dark reddish-brown (5YR 3/4) mottles moist; massive; slightly hard, friable, slightly sticky and slightly plastic; very few very fine roots; few fine tubular pores; common, fine and medium, irregularly shaped gypsum concretions; strongly effervescent; strongly alkaline.

The solum ranges from 6 to 10 inches in thickness. In places the A1 horizon is absent in cultivated areas because it has been mixed by plowing or has been stripped by leveling. This horizon has a hue of 2.5Y or 10YR and a value of 6 or 7 when dry and 4 or 5 when moist. Structure is moderate to strong and medium or coarse.

The B2t horizon has a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 2 or 3. It is loam to light clay loam or sandy clay loam that is 20 to 30 percent clay. Structure is weak to moderate, depending upon the content of clay.

The dendritic tufa in the C1 horizon is discontinuous and sporadic. In some areas it is cemented. The C2, IIC3, and IIC4 horizons are fine to coarsely stratified very fine sandy loam and silt loam. Relic mottles occur at a depth below 24 inches in places. Areas in native vegetation contain slight to moderate concentrations of salt below a depth of about 16 inches.

Bango loamy sand, 0 to 2 percent slopes (BdA).—This soil is in medium-sized areas that differ in shape and are on the toes of alluvial fans on high lake terraces. The

profile of this soil is similar to that described as representative for the series, but the combined thickness of the surface layer and the subsoil is 10 to 20 inches. Also, the surface layer is loamy sand 1 to 6 inches thick, and 10 to 15 percent of the surface is commonly covered by gravel. This soil lacks tufa fragments but commonly has strata of thin gravel.

Included with this soil in mapping are small areas of Biddleman, Juva, Patna, and, other Bango soils.

This soil is suitable for irrigated crops if water supplies are available. It is used mainly for grazing and for wildlife habitat. Most areas have a low density of native plant cover made up of upland greasewood, shalscale, and varying amounts of bud sagebrush, Indian ricegrass, and annuals. Capability units IIw–1, irrigated, and VIIs–261, nonirrigated; wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated; range site NV 27–1 (Desert Lake Bars); windbreak suitability group NV 27–6.

Bango loamy sand, 2 to 4 percent slopes (BdB).—This soil is in medium-sized narrow bands on toes of alluvial fans on high lake terraces. The profile of this soil is similar to that described as representative for the series, but the combined thickness of the surface layer and the subsoil is 10 to 20 inches. Also, the surface layer is loamy sand 1 to 6 inches thick, and the gravel content is about 10 percent. This soil lacks tufa fragments but commonly has thin strata of gravel.

Included with this soil in mapping are areas of Biddleman, Juva, Bluewing, and other Bango soils.

This soil is suitable for irrigated crops if water is available. It is used mainly for grazing and for wildlife habitat. Most areas have a low density of native plant cover made up of greasewood, shadscale, and varying amounts of bud sagebrush, Indian ricegrass, and annuals. Capability units IIe–1, irrigated, and VIIs–261, nonirrigated; wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated; range site NV 27–1 (Desert Lake Bars); windbreak suitability group NV 27–6.

Bango sandy loam, 2 to 4 percent slopes (BeB).—This soil is in medium-sized to large, long, narrow bands on high lake terraces above flood plains and low terraces. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Biddleman, Bluewing, Swingler, and other Bango soils. Also included are areas where gravel is scattered on the surface.

This soil is suitable for irrigated crops if water is available. It is used mainly for grazing and for wildlife habitat. Most areas have a low density of upland greasewood, shadscale, and bud sagebrush and varying amounts of Indian ricegrass, and annuals. Capability units IIe–1, irrigated, and VIIs–261, nonirrigated; wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated; range site NV 27–1 (Desert Lake Bars); windbreak suitability group NV 27–6.

Bango silt loam, 0 to 2 percent slopes (BhA).—This soil is in large fan-shaped areas on toes of alluvial fans on high lake terraces. The profile of this soil is similar to that described as representative for the series, but it has a silt loam surface layer and the combined thickness of the surface layer and the subsoil is 8 to 16 inches. It also has a very slowly permeable layer, 6 to 15 inches thick, between depths of 10 and 40 inches. This layer consists of compact silty lake sediment that can be mechanically destroyed.

Included with this soil in mapping are small areas of Juva, Swingler, and other Bango soils. Also included are small areas of soils that have a fine-textured substratum.

This soil is suitable for irrigated crops if water is available. It is used mainly for grazing and for wildlife habitat. In most areas the native cover of upland greasewood and shadscale has been removed and the soil is almost barren. Capability units IIIw–9, irrigated, and VIIs–261, nonirrigated; wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated; range site NV 27–1 (Desert Lake Bars); windbreak suitability group NV 27–6.

Bango-Stumble association (BK).—This association is in large and medium-sized areas bordering uplands and on high lake terraces that are being encroached upon by alluvial fans and aeolian sands. It is about 40 percent Bango sandy loam, 2 to 4 percent slopes; 40 percent Stumble loamy sand, 0 to 4 percent slopes; and 20 percent included soils.

The gently sloping Bango soils are on smooth lake terraces and have a sandy loam surface layer. They have a profile that is similar to that described as representative for the Bango series, but several inches of loamy sand overlies the surface layer in transitional areas adjacent to the Stumble soils. The native plant cover is upland greasewood, shadscale, bud sagebrush, Indian ricegrass, and annuals.

The nearly level to gently sloping Stumble soils are on alluvial fans that have encroached above and alongside areas of the Bango soils. They are very deep, somewhat excessively drained, and have the profile described as representative for the Stumble series. The vegetation is Indian ricegrass, upland greasewood, shadscale, fourwing saltbush, and annuals.

Included with this association in mapping are areas of Biddleman and Tipperary soils.

The major soils in this association are suitable for irrigated crops if water is available. They are used mainly for grazing and for wildlife habitat. Bango soils in capability units IIe–1, irrigated, and VIIs–261, nonirrigated, wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated, range site NV 27–1 (Desert Lake Bars), and windbreak suitability group NV 27–6; Stumble soils in capability units IIIs–22, irrigated, andVIIs–264, nonirrigated, wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated, range site NV 27–2 (Desert Sands), and windbreak suitability group NV 27–5.

Biddleman Series

The Biddleman series consists of very deep, well-drained soils that formed in thin mantles of gravelly and cobbly loamy alluvium over old gravelly shorelines. The materials are derived from mixed rock. Biddleman soils are on smooth lakeshore terraces. Slopes are 0 to 15 percent. Elevation ranges from 4,200 to 4,400 feet. The average annual precipitation is 4 to 6 inches, the average

annual air temperature is 51° to 55° F.; and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray gravelly sandy loam about 3 inches thick. The next layer is light brownish-gray heavy sandy loam about 2 inches thick and pale-brown, friable, plastic gravelly clay loam about 3 inches thick. It is underlain by light-gray, stratified, calcareous loamy sands, sands, and gravel that extend to a depth of more than 60 inches.

Permeability is moderately slow in the subsoil and very rapid in the substratum.

Runoff is slow to medium, and the erosion hazard is slight to moderate. Available water capacity is 2.0 to 3.5 inches.

These soils are used mainly for grazing, for wildlife habitat, and as a source of gravel. The native vegetation is upland greasewood, dalea, shadscale, and littleleaf horsebrush and varying amounts of annual forbs and weeds.

Representative profile of Biddleman gravelly sandy loam (0 to 8 percent slopes) in an areas of Biddleman association in native vegetation, about 660 feet northeast of the center of sec. 25, T. 20N., R. 25E.:

A1—0 to 3 inches, light brownish-gray (2.5Y 6/2) gravelly sandy loam, grayish brown (2.5Y 5/2) moist; moderate, medium and thick, platy structure; soft, very friable; very few very fine roots; many fine and medium vesicular pores; about 15 percent gravel; slightly effervescent; strongly alkaline; abrupt, smooth boundary.

B1t—3 to 5 inches, light brownish-gray (2.5Y 6/2), gravelly, heavy sandy loam, brown (10YR 4/3) moist; moderate, medium, prismatic structure; hard, friable, slightly sticky, and slightly plastic; many very fine and fine roots; many very fine and medium vesicular pores; about 20 percent gravel; common thin clay films on faces of peds and many thin clay films in pores; strongly effervescent; strongly alkaline; clear, wavy boundary.

Bt2—5 to 8 inches, pale-brown (10YR 6/3) gravelly clay loam, brown (10YR 4/3) moist; weak, medium, prismatic structure parting to weak, fine and medium, subangular blocky; hard, friable, sticky, and plastic; many very fine roots and few medium and coarse roots; few fine and medium tubular pores; about 30 percent gravel, common thin clay films on faces of peds and few moderately thick clay films bridging sand grains; strongly effervescent; moderately alkaline; clear, wavy boundary.

IICIca—8 to 17 inches, light-gray (10YR 7/2), stratified, very gravelly loamy coarse sand, sand, and gravel, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; common very fine and fine roots and few medium and coarse roots; many fine, medium, and coarse interstitial pores; about 70 percent rounded gravel; slightly effervescent but violently effervescent on lime coatings on undersides of gravel; strongly alkaline; gradual, wavy boundary.

IIC2—17 to 60 inches, light-gray (10YR 7/2) stratified sand and gravel, dark grayish brown (10YR 4/2) moist; single grain, loose; many fine, medium, and coarse interstitial pores; 80 to 90 percent gravel; slightly effervescent; strongly alkaline.

The solum ranges from 8 to 18 inches in thickness. In some areas about 95 percent of the surface is covered by an erosion pavement of rounded basalt pebbles coated with desert varnish on the upper surfaces. The A1 horizon is sandy loam or loamy sand that contains gravel, cobblestones, or stones. The A1 horizon has a hue of 2.5Y or 10YR and a value of 4 or 5 when moist. Structure is weak or moderate, fine or coarse, platy, or the horizon is massive.

The B2t horizon has a hue of 2.5Y or 10YR, a value of 4 or 5 when moist, and a chroma of 2 or 3. The B horizon is heavy sandy loam, sandy clay loam, or clay loam. After mixing, the clay content averages 20 to 30 percent and the content of coarse fragments is 20 to 35 percent. Structure is weak or moderate, medium or coarse, prismatic.

The gravel and cobblestone content of the C horizon ranges from 60 to 90 percent. Discontinuous, weakly to strongly cemented lithoid tufa occurs sporadically, generally below a depth of 36 inches, but in places as shallow as 24 inches.

Biddleman very stony loamy sand, 2 to 4 percent slopes (BlB).—This soil is in medium-sized and large, fan-shaped areas on alluvial fans on old lake shorelines. The profile of this soil is similar to that described as representative for the series, but the combined thickness of the surface layer and the subsoil generally is about 12 to 18 inches, stones cover 1 to 3 percent of the surface, and cobblestones cover as much as 12 percent. In addition, this soil lacks the erosion pavement typical of Biddleman soils. It also contains a thin strata of finer material within the lower strata of gravel.

Included with this soil in mapping are small areas of other Biddleman soils and Bluewing and Bango soils. Also included are small areas of soils that have slopes of 5 and 6 percent.

This soil has very limited suitability for irrigated crops if water is available. It is used for grazing and for wildlife habitat. Most areas have a low density of native plant cover of upland greasewood, shadscale, and bud sagebrush and varying amounts of Indian ricegrass, and annuals. Capability unit VIIs–283, nonirrigated; wildlife suitability group NV 27–6, nonirrigated; range site NV 27–1 (Desert Lake Bars); not placed in a windbreak suitability group.

Biddleman association (BM).—This association consists of nearly level to rolling soils in large and very large, broad bands that border the uplands on convex, high shoreline terraces. In some places terraces have been deeply dissected, resulting in a concave microrelief. This association is about 60 percent Biddleman gravelly sandy loam, 0 to 8 percent slopes, 20 percent Biddleman very stony sandy loam, 4 to 15 percent slopes, and 20 percent included soils and Rock outcrop.

Biddleman gravelly sandy loam, 0 to 8 percent slopes has the profile described as representative for the Biddleman series. Runoff is slow, and the hazard of erosion is slight. Biddleman very stony sandy loam has a profile similar to that described as representative for the Biddleman series, except for steeper slopes and the presence of stones. Surface runoff is medium, and the hazard of erosion is moderate. The vegetation on both soils is upland greasewood, shadscale, and bud sagebrush.

Included with this association in mapping are areas of Bluewing and Bango soils and Rock outcrop.

The soils in this association are not suitable for irrigation. They are used for limited grazing, for wildlife habitat, and as a source of gravel. Capability unit VIIs–283, nonirrigated, and range site NV 27–1 (Desert Lake Bars); Biddleman gravelly sandy loam in wildlife suitability group NV–27-9, nonirrigated; Biddleman very stony sandy loam in wildlife suitability group NV 27–6, nonirrigated; neither soil placed in a windbreak suitability group.

Bluewing Series

The Bluewing series consists of very deep, excessively drained soils that formed in alluvium derived from mixed rock. These soils are on plane or gently convex alluvial fans. Slopes are 2 to 8 percent. Elevation ranges from 3,800 to 4,500 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 52° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is grayish-brown gravelly loamy coarse sand about 2 inches thick. It is underlain by light brownish-gray and grayish-brown gravelly light coarse sandy loam or gravelly loamy coarse sand about 7 inches thick. Below this is stratified, grayish-brown and light-gray very gravelly and cobbly loamy sand that is very friable and nonplastic and extends to a depth of 60 inches.

Permeability is very rapid. Runoff is slow, and the hazard of erosion is moderate. Available water capacity is 2.0 to 3.0 inches.

These soils are used mainly for limited grazing. The vegetation is sparse and consists of shadscale, upland greasewood, bud sagebrush, and halogeton.

Representative profile of Bluewing gravelly loamy sand, 2 to 8 percent slopes, in native vegetation, about 3,800 feet south and 1,150 feet east of the northwest corner of sec. 23, T. 20 N., R. 25 E:

A1—0 to 2 inches, grayish-brown (2.5Y 5/2) gravelly loamy coarse sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose; few fine roots; many fine and medium interstitial pores; mildly alkaline; abrupt, smooth boundary.

C1—2 to 3 inches, light brownish-gray (2.5Y 6/2) gravelly light coarse sandy loam, dark grayish brown (2.5Y 4/2) moist; weak, medium, platy structure; soft, very friable; few fine roots; many fine and medium vesicular pores; slightly calcareous; moderately alkaline; abrupt, smooth boundary.

C2—3 to 9 inches, grayish-brown (2.5Y 5/2) gravelly loamy coarse sand, dark grayish brown (2.5Y 4/2) moist; massive; loose; many fine roots and few medium roots; many fine and medium interstitial pores; slightly calcareous; moderately alkaline; clear, smooth boundary.

C3—9 to 23 inches, grayish-brown (2.5Y 5/2) very gravelly loamy sand, dark grayish brown (2.5Y 4/2) moist; massive; very friable; many fine roots and few medium roots; many fine and medium interstitial pores; slightly calcareous matrix; lime coatings on underside of cobblestones and gravel; moderately alkaline; clear, wavy boundary.

C4ca—23 to 31 inches, light-gray (2.5Y 7/2) very gravelly and cobbly loamy sand, grayish brown (2.5Y 5/2) moist; massive; loose; many fine roots and few medium roots; many fine and medium interstitial pores; strongly calcareous matrix; gravel and cobblestones lime coated on undersides; strongly alkaline; clear, irregular boundary.

C5—31 to 60 inches, grayish-brown (2.5Y 5/2) very gravelly and cobbly loamy sand, dark grayish brown (2.5Y 4/2) moist; massive; loose; few fine and medium roots; many fine and medium interstitial pores; slightly calcareous; strongly alkaline.

The A horizon has a hue of 10YR or 2.5Y, value of 3 or 4 when moist, and chroma of 1 or 2.

The stratified C horizon has a hue of 10YR or 2.5Y, a value of 5 to 7 when dry and 4 or 5 when moist, and a chroma of 2 or 3. The content of gravel and cobblestones in any one horizon or stratum ranges from 20 to 95 percent, but it is more than 50 percent throughout most of the profile.

Bluewing gravelly loamy sand, 2 to 8 percent slopes (BnC).—This soil is in medium-sized and large, fan-shaped areas on alluvial fans.

Included with this soil in mapping are areas of Juva, Biddleman, Bango, and other Bluewing soils.

This soil is used for limited grazing, for wildlife habitat, and as a source for gravel and sand. Most areas have a low density of native plant cover of shalescale, upland greasewood, bud sagebrush, and holgeton. Capability unit VIIs–264, nonirrigated; wildlife suitability group NV 27–9, nonirrigated; range site NV 27–1 (Desert Lake Bars); not placed in a windbreak suitability group.

Bunejug Series

The Bunejug series consists of very deep, somewhat poorly drained soils that formed in sediment derived from mixed rock. These soils are on smooth flood plains. Slopes are 0 to 2 percent. Elevation ranges from 3,850 to 3,950 feet. The average annual precipitation is 4 to 6 inches, the average air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is dark-gray clay loam about 7 inches thick. Below this layer is gray, plastic silty clay loam about 10 inches thick. It is underlain by stratified, mottled, pale-brown, pale-olive, and light brownish-gray sandy clay loam, loamy very fine sand, and silt loam that extends to a depth of about 55 inches.

Permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is about 7.0 to 8.5 inches.

These soils are used for crops and pasture in areas where irrigation water is available and for limited grazing in areas where irrigation water is not available. They formed under lush grass vegetation and were poorly drained. Natural drainage improved as new channels formed, as water was diverted for irrigation, and as drainage ditches were constructed. The salt and alkali content increased, and black greasewood and saltgrass became the dominant vegetation.

Representative profile of Bunejug clay loam, strongly saline, in an area of Bunejug-Erber clay loams, in native vegetation about 1,320 feet south and 1,050 feet west of the northeast corner of sec. 19, T. 18 N., R. 30 E.:

A11sa—0 to 2 inches, dark-gray (10YR 4/1) clay loam, very dark brown (10YR 2/2) moist; moderate, fine and medium, subangular blocky structure; slightly hard, very friable sticky and plastic; many very fine interstitial and few tubular micropores; moderately alkaline; abrupt, smooth boundary.

A12sa—2 to 7 inches, dark-gray (10YR 4/1) clay loam, very dark brown (10YR 2/2) moist; moderate, very fine, granular structure, slightly hard, very friable, sticky and plastic; few microroots; many very fine interstitial pores; neutral; clear, wavy boundary.

A13—7 to 12 inches, gray (N 5/0) silty clay loam, black (10YR 2/1) moist; few, fine and very fine, prominent, strong-brown (7.5YR 5/6) mottles, moist; moderate, very fine, subangular blocky structure; slightly hard, very friable, sticky and plastic; few microroots and very fine roots; many fine interstitial pores and few very fine tubular pores; neutral; abrupt, irregular boundary.

AC—12 to 17 inches, gray (N 5/0) silty clay loam, brown (10YR 4/3), tongues (50 percent of mass) of black 10YR 2/1) moist; few, fine, prominent, dark-brown (10YR 3/3) mottles moist; moderate fine and very

fine, subangular blocky structure; hard, friable, sticky and plastic; few microroots; few very fine tubular pores; mildly alkaline; abrupt, irregular boundary.

IIC1—17 to 22 inches, pale-brown (10YR 6/3) stratified sandy clay loam and loamy fine sand, brown (10YR 4/3) moist; many, medium, prominent, gray (N 5/0) mottles and common, fine, distinct, dark yellowish-brown (10YR 4/4) mottles moist; weak, fine and very fine, subangular blocky structure; hard, friable, sticky and plastic; few microroots; many very fine interstitial pores; neutral; clear, wavy boundary.

IIIC2—22 to 31 inches, pale-olive (5Y 6/3) stratified very fine sandy loam and very fine loamy sand silt loam, olive (5Y 4/3) moist; common, medium, prominent, reddish-brown (5YR 4/4) and gray (N 6/0) mottles and many, large, distinct, pale-brown (10YR 6/3) mottles moist; massive; slightly hard, very friable, nonsticky and nonplastic; mildly alkaline; abrupt, wavy boundary.

IVC3—31 to 35 inches, pale-olive (5Y 6/3) loamy fine sand, olive (5Y 5/3) moist; common, fine, prominent, gray (10YR 5/1) and dark-brown (7.5YR 4/4) mottles moist; massive; soft, very friable; many very fine interstitial pores and few fine tubular pores; mildly alkaline; abrupt, wavy boundary.

VC4—35 to 47 inches, pale-olive (5Y 6/3) very fine sandy loam, olive (5Y 4/3) moist; common, fine, prominent, gray (10YR 6/1) and dark-brown (7.5YR 4/4) mottles moist; massive; hard, friable, slightly sticky and slightly plastic; common tubular micropores and very fine and fine tubular pores; strongly effervescent in spots; mildly alkaline; abrupt, smooth boundary.

VIC5—47 to 55 inches, light brownish-gray (2.5Y 6/2) heavy silt loam, dark grayish brown (2.5Y 4/2) moist; many, fine, prominent, dark-brown (7.5YR 4/4) mottles moist; massive; very hard, friable, slightly sticky and plastic; few tubular micropores; moderately alkaline.

The A horizon has a hue of 10YR to neutral, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 1 or 2. It is sandy loam, clay loam, or silty clay loam. Structure is moderate, subangular blocky or granular, or the horizon is massive. The horizon is never both massive and hard.

The C horizon has a hue of 10YR, 2.5YR, 5Y, or neutral, a value of 5 or 6 when dry, and a chroma of 2 or 3. The C horizon is highly mottled. It is finely stratified sandy loam, fine and very fine sandy loam, loamy fine and very fine sand, silt loam, and light silty clay loam. The structure is weak, or the horizon is massive.

Bunejug sandy loam (Bo).—This nearly level soil is in small, irregularly shaped areas on smooth flood plains and deltas. The profile of this soil is similar to that described as representative for the series, but it has a sandy loam surface layer about 10 inches thick; also, it has been reclaimed and is neither saline nor alkali. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of other Bunejug soils and Stillwater and Erber soils.

This soil is mostly used for irrigated pasture plants and crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–3, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Bunejug sandy loam, slightly saline (Br).—This nearly level soil is in small, irregularly shaped areas on smooth flood plains and deltas. The profile of this soil is similar to that described as representative for the series, but it is slightly saline-alkali affected, and has a sandy loam surface layer that is about 12 inches thick. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of other Bunejug soils and Erber soils.

This soil is mostly used for irrigated pasture plants and crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–3, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Bunejug sandy loam, strongly saline (Bs).—This nearly level soil is in small and medium irregularly shaped areas on flood plains and deltas. The profile for this soil is similar to that described as representative for the series, but it has a sandy loam surface layer. It is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Erber soils and poorly drained Bunejug soils. Also included are spots of low sandy hummocks or dunes that occur only around the base of shrubs and are 1 to 3 feet high in places.

This soil is suitable for irrigation if water is available and the soil is reclaimed. It is used for very limited grazing and for wildlife habitat. Most areas have a low-density plant cover of seepweed and black greasewood. Capability units IIw–1, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–3, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Bunejug-Erber clay loams (BT).—These nearly level soils are in medium-sized and large irregularly shaped areas on smooth flood plains. These soils are somewhat poorly drained, but they formed under poorly drained conditions. This mapping unit is about 40 percent Bunejug soils, 40 percent Erber soils, and 20 percent included soils.

Included with these soils in mapping are scattered areas of Erber clay loam, strongly saline; Swope clay loam, strongly saline; and poorly drained Bunejug soils.

The Bunejug soils have the profile described as representative for the Bunejug series. A seasonal high water table is at a depth of 3 to 5 feet. The vegetation is sparse stands of seepweed and black greasewood.

The Erber soils are intermingled with the Bunejug soils. They have a profile similar to that described is representative for the Erber series, but they have a clay loam surface layer. They are strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

These soils have limited suitability for crops if water is available and the soil reclaimed. They are used for very limited grazing and for wildlife habitat. Capability units IVw–24, irrigated, and VIIw–241, nonirrigated; and windbreak suitability group NV 27–4; Bunejug soils in wildlife suitability groups NV 27–3, irrigated, and NV 27–9, nonirrigated; Erber soils in wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; neither soil placed in a range site.

Carcity Series

The Carcity series consists of very deep, somewhat poorly drained soils on smooth, almost flat flood plains and deltas. Slopes are 0 to 2 percent. These soils formed in clayey alluvium superimposed over sandy alluvium, both of which were derived from mixed rock. Elevation ranges from 3,800 to 4,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air tem-

perature is 51° to 55° F.; and the frost-free season is about 130 days.

In a representative profile the surface layer is gray clay about 7 inches thick in the upper part. It is gray, grading to dark grayish-brown, clay about 21 inches thick in the lower part. The underlying material is brown sand that is loose or nonplastic. It extends to a depth of 60 inches.

Permeability is slow in the subsoil and very rapid in the substratum. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is about 5.5 to 8.0 inches.

Most areas are cleared, leveled, and irrigated. The dominant native vegetation is black greasewood, four-wing saltbush, and saltgrass. Before the damming of the Carson River and the diverting of water for irrigation, the dominant vegetation probably consisted of meadow grasses, and the soils were more poorly drained than at present.

Representative profile of Carcity clay, about 2,640 feet east and 100 feet south of the northwest corner of sec. 5, T. 17 N., R. 29 E.:

Ap—0 to 7 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, very sticky and very plastic; common very fine roots and few fine roots; neutral; abrupt, smooth boundary.

A11—7 to 14 inches, gray (10YR 5/1) clay, very dark grayish brown (2.5Y 3/2) moist; many, fine and medium, prominent, dark-brown (7.5YR 4/4) mottles and few, medium, distinct, very dark-gray (10YR 3/1) mottles moist; moderate, coarse, prismatic structure; very hard, firm, very sticky and very plastic; common very fine roots and few fine roots; common fine and very fine tubular pores; mildly alkaline; clear, wavy boundary.

A12—14 to 24 inches, gray (10YR 5/1) clay, variegated, black (10YR 2/1), very dark grayish brown (2.5Y 3/2) and dark grayish brown (2.5Y 4/2) moist; many, fine, prominent, dark-brown (7.5YR 4/4) mottles and common, fine and medium, dark grayish brown (2.5Y 4/2) moist; many, fine, prominent, white (10YR 8/1) moist; weak, coarse, prismatic structure parting to weak, medium and coarse, subangular blocky; very hard, firm, very sticky and very plastic; common microroots; few tubular micropores and common interstitial micropores; slightly effervescent in spots; moderately alkaline; abrupt, smooth boundary.

A13—24 to 28 inches, dark grayish-brown (10YR 4/2) clay, black (10YR 2/1) moist; many, fine, prominent, dark-brown (7.5YR 4/4) mottles and common, fine, prominent, white (10YR 8/1) mottles; weak, medium, subangular blocky structure; very hard, firm, very sticky and very plastic; few microroots; few tubular micropores; moderately alkaline; abrupt, wavy boundary.

IIC—28 to 60 inches, brown (7.5YR 5/4) sand, dark grayish brown (10YR 4/2) moist; few medium, prominent, black (10YR 2/1) mottles moist; single grain, few very fine roots; many fine and very fine interstitial pores; noneffervescent; strongly alkaline.

The A1 horizon has a hue of 10YR or 2.5Y, a value of 4 or 5 when dry and 2 or 3 when moist, and chroma of 1 or 2. It is dominantly clay but has strata of light clay, silty clay, or heavy silty clay loam in places. Structure is weak or moderate, fine to coarse, prismatic or subangular blocky, but the lower part of the horizon is massive in places. Consistence ranges from slightly hard to very hard. The horizon is never both massive and hard or very hard when dry.

The C horizon where present has a hue of 10YR or 2.5Y, a value of 5 or 6 dry, and a chroma of 1 or 2.

The IIC horizon has a hue of 10YR, 7.5YR, or 2.5Y, a value of 6 through 8 dry and 4 or 5 moist, and a chroma of 1 through 4. Reddish hue or high chroma mottles range from common to many and fine to very coarse. This horizon is dominantly sand or coarse sand but has strata of very coarse sand and fine gravel and very thin (1 inch thick) strata of fine sand in places. Any of these materials are likely to contain as much as 25 percent of ½-inch gravel. Depth to the IIC horizon ranges from 20 to 40 inches but averages between 26 and 30 inches.

Carcity clay (Cc).—This nearly level soil is on flood plains. It is in medium-sized rectangular areas that are dissected by sand channels in places. Because of leveling and reclamation, straight boundaries are not uncommon. This soil has the profile described as representative for the series. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are areas of Carson, Stillwater, and Weishaupt soils.

This soil is used for irrigated crops. Capability unit IIIw–13, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–1; not placed in a range site.

Carcity clay, slightly saline (Cc).—This nearly level soil is on smooth alluvial flood plains and deltas. It is in medium-sized, rectangular areas that are dissected by sand channels in places. Because of leveling and reclamation, straight boundaries are not uncommon. The profile of this soil is similar to that described as representative for the series, but it is slightly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Carson, Stillwater, and Weishaupt soils.

This soil is mostly used for irrigated crops. Capability gated; wildlife suitability group NV 27–4, irrigated, and NV 27–7, nonirrigated; windbreak suitability group NV 27–2; not placed in a range site.

Carcity clay, strongly saline (Cd).—This nearly level soil is on smooth alluvial flood plains and deltas. It is in small, irregularly shaped field corners and medium-sized, rectangular, abandoned fields. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Carson and Weishaupt soils.

This soil is mainly used for pasture. Reclamation is required before it can be used for irrigated crops. Capability units VIw–13, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–4, irrigated, and NV 27–7, nonirrigated; windbreak suitability group NV 27–2; not placed in a range site.

Carson Series

The Carson series consists of very deep soils that formed in sediment derived from mixed rock. These soils are on smooth flood plains and deltas. Slopes are 0 to 2 percent. Drainage has been altered in many areas by drainage ditches and diversion of water for irrigation, and the soils are now somewhat poorly drained. Elevation ranges between 3,800 and 4,000 feet. The average annual precipitation is 4 to 6 inches. The average air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is gray clay about 7 inches thick over gray clay that is very plas-

tic, is highly mottled, and extends to a depth of more than 60 inches.

Permeability is very slow. Runoff is very slow, and the hazard of erosion is slight. Available water capacity is about 8.5 to 10.0 inches.

Large areas of these soils are irrigated. The vegetation is mainly black greasewood and saltgrass.

Representative profile of Carson clay, slightly saline, in a cultivated area, 500 feet west and 100 feet north of the southeast corner of sec. 13 T. 19 E., R. 30 E.:

Ap—0 to 7 inches, gray (10YR 5/1) clay, very dark gray (10YR 3/1) moist; moderate, coarse, prismatic structure, parting to strong, coarse, subangular blocky; very hard, firm, very sticky and very plastic; many fine roots; many fine pores; slightly effervescent; strongly alkaline; clear, smooth boundary.

A1—7 to 17 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; common, fine, prominent, black (10YR 2/1) mottles moist and common, fine and large, prominent, white (10YR 8/1) mottles moist; weak, coarse, subangular blocky structure; hard, firm very sticky and very plastic; common fine roots, common fine pores; slightly effervescent; strongly alkaline; gradual, wavy boundary.

C1g—17 to 27 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; common, medium, prominent, dark reddish-brown (5YR 3/3) mottles moist; common, large, prominent, white (10YR 8/1) mottles moist; common, medium, prominent, black (10YR 2/1) mottles; weak, medium and fine, subangular blocky structure; hard, firm, very sticky and very plastic; common, fine and medium, dead roots; few very fine pores; noneffervescent; moderately alkaline; clear, wavy boundary.

C2g—27 to 34 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; many, medium, prominent, dark reddish-brown (5Y 3/3) mottles moist; common, fine and medium, prominent, white (10YR 8/1) moist; few, medium and large, prominent, black (10YR 2/1) mottles moist; weak, medium and coarse, subangular blocky structure; hard, firm, very sticky and very plastic, common, fine and medium, dead roots along cleavages; very few fine pores; moderately alkaline; clear, wavy boundary.

C3g—34 to 50 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; many, fine, prominent, brown (7.5YR 3/2) mottles moist; common, fine, prominent, black (10YR 2/1) mottles moist; weak, medium, subangular blocky structure; hard, firm, very sticky and very plastic; few, fine, dead roots; few very fine pores; many unoriented slickensides; moderately alkaline; clear, wavy boundary.

C4g—50 to 64 inches, gray (5Y 5/1) clay, olive gray (5Y 4/2) moist; many, medium and coarse, prominent, yellowish-brown (10YR 5/6) mottles moist, many, large, prominent, black (10YR 2/1) mottles moist; few, large, prominent, very pale brown (10YR 8/3) gypsum masses; weak, medium and coarse, subangular blocky structure; hard, firm, very sticky and very plastic; few, fine, dead roots; very few fine pores; moderately alkaline.

Reaction ranges from moderately alkaline to very strongly alkaline throughout. The profile ranges from saline and alkali free in the surface layer to strongly saline-alkali throughout.

The A horizon has a hue of 10YR through 5Y, a value of 4 or 5 dry and 2 or 3 moist, and a chroma of 1 or 0. It is clay, silty clay, and clay loam.

The C horizon has a hue of 2.5Y or 5Y, a value of 5 or 6 dry and 3 or 4 moist, a chroma of 1 or 2. Black mottles generally are present in all horizons except in the Ap horizon. They are few to many, fine to large, and distinct or prominent. The mottles have a hue of 7.5YR or 10YR, a value of 2 to 5, and a chroma of 1 to 6. Gypsum crystals and masses range from few to many and from fine to large, where present, but they can be absent from any one horizon.

Carson clay loam, strongly saline (CE).—This nearly level soil is in large bands on flood plains and low terraces. It has a hummocky microrelief caused by the wind-deposited sand around the base of the shrubs. The profile of this soil is similar to that described as representative for the series, but it has a clay loam surface layer that is about 10 to 15 inches thick, and it is strongly saline-alkali affected. This soil is somewhat poorly drained. It is partly drained by diversion of water for irrigation and by drain ditches. A seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of Bunejug and Stillwater soils and other Carson soils.

This soil is difficult to reclaim, but if it is reclaimed and water is available, it can be used for irrigated crops. It is used for limited grazing and food and cover for wildlife. The vegetation is black greasewood, seepweed, and saltbush. Capability units IVw–9, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–4, irrigated, and NV 27–7, nonirrigated; windbreak suitability group NV 27–2; not placed in a range site.

Carson clay (Cg).—This soil is in medium and large bands on smooth, flat, alluvial flood plains. The profile of this soil is similar to that described as representative for the series, but it has a saline-alkali free surface layer and the alkali content of the subsoil is slight. The subangular blocky structure is commonly more pronounced in the subsoil and in the substratum, which allows better water penetration. The soil is partly drained by diversion of water for irrigation and drain ditches and is somewhat poorly drained. A seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of Carcity, Stillwater, and Weishaupt soils and other Carson soils.

This soil is used for irrigated crops. Capability unit IVw–13, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–1; not placed in a range site.

Carson clay, slightly saline (Ch).—This nearly level soil is in medium and large bands on alluvial flood plains. It has the profile described as representative for the series. It is now somewhat poorly drained as a result of diversion of water for irrigation and construction of drainage ditches, and it is slightly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Carcity, Stillwater, and Weishaupt soils and other Carson soils.

These soils are mostly used for irrigated crops or pasture plants. Capability unit IVw–13, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–1; not placed in a range site.

Carson clay, strongly saline (Ck).—This soil is in small and medium-sized, irregularly shaped areas on smooth, almost flat flood plains. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected. The surface layer is very strongly alkaline, and the subsoil is strongly alkaline or very strongly alkaline. The soil has been partly drained because of diversion of water for irrigation and is somewhat poorly drained. The seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of other Carson soils, small areas of Stillwater and Weishaupt soils, and spots of low sandy hummocks or dunes.

This soil is difficult to reclaim, but if it is reclaimed and water is available, it can be used for irrigated crops. It is used for very limited grazing and for wildlife habitat. The vegetation is scattered black greasewood and occasional patches of saltgrass. Capability units VIw–13, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–4, irrigated, and NV 27–7, nonirrigated; windbreak suitability group NV 27–2; not placed in a range site.

Carson-Stillwater complex (CM).—This complex consists of nearly level soils that occur in large bands and small islands that are irregular in shape. The soils are on smooth flood plains and deltas. The islands are slightly raised and are surrounded by open bodies of water and areas of Marsh. The complex is about 40 percent Carson clay that is wet and strongly saline, 40 percent Stillwater clay loam, wet; and 20 percent included soils.

The Carson soils are on concave flood plains adjacent to and below the Stillwater soils. They have a profile similar to that described as representative for the Carson series, but they are strongly saline-alkali affected and a thin mat of roots is on the surface in places. These soils are poorly drained. A seasonal high water table is at a depth of 1½ to 3 feet. The vegetation is sparse stands of black greasewood, seepweed, saltwort, saltbush, iodinebush, and saltgrass.

The Stillwater soils are adjacent to and above the Carson soils. They have a profile that is similar to that described as representative for the Stillwater series, but they are strongly saline-alkali affected. They are poorly drained. The seasonal high water table is at a depth of about 1½ to 3 feet. The vegetation is sparse stands of black greasewood, seepweed, saltwort, saltbush, iodinebush, and saltgrass.

Included with this soil in mapping are areas of Marsh in low, concave, ponded areas below Carson soils. The vegetation in these areas is sedge and rush. Also included are areas of poorly drained and strongly saline Bunejug sandy loam, areas of Playas that are randomly scattered throughout areas of the Stillwater soils, and areas of a slightly saline-alkali Stillwater soil.

The soils in this complex are mainly used for wildlife habitat and for limited grazing. Because of the low-lying position of these soils, it is difficult to establish drainage and to reclaim them for irrigated crops. Both soils in capability unit VIIw–241, nonirrigated; wildlife suitability group NV 27–7, nonirrigated; not placed in a range site or in a windbreak suitability group.

Celeton Series

The Celeton series consists of shallow, somewhat excessively drained soils that formed in residuum derived from diatomaceous earth. These soils are on convex, rolling foothills. Slopes are 8 to 30 percent. Elevation ranges from 4,400 to 6,000 feet. The average annual precipitation is 4 to 7 inches, the average annual air temperature is 51° to 54° F., and the frost-free season is about 120 to 130 days.

In a representative profile the surface layer is light-gray very cobbly sandy loam about 3 inches thick. It is underlain by white, highly fractured diatomaceous earth about 8 inches thick. Below this is white, consolidated diatomaceous earth that extends to a depth below 60 inches.

Permeability is rapid. Runoff is slow to medium, and the hazard of erosion is moderate to high. Available water capacity is about 0.5 to 1.5 inches.

These soils are used for grazing and as a commercial source of diatomite. They have a very sparse cover consisting primarily of shadscale and ephedra.

Representative profile of Celeton very cobbly fine sandy loam, 8 to 30 percent slopes, about in the center of sec. 6, T. 19 N., R. 26 E.:

A1—0 to 3 inches, light-gray (10YR 7/2) very cobbly sandy loam, brown (10YR 5/3) moist; massive; soft, very friable; many fine and very fine roots and few medium roots; many fine interstitial pores; 65 percent of surface is covered with angular basalt gravel; horizon consists of about 70 percent platelets of diatomaceous earth as much as 1 inch in diameter; strongly effervescent; moderately alkaline; clear, wavy boundary.

C1—3 to 11 inches, white (10YR 8/1) very thin platelets of highly fractured diatomaceous earth, light gray (10YR 7/2) moist; loose; common fine roots; many fine interstitial pores; slightly effervescent; mildly alkaline; clear, wavy boundary.

C2—11 to 60 inches, white (N 8/0) consolidated diatomaceous earth; hard, very firm; very few very fine roots in vertical fracture planes in upper part; mildly alkaline; hardness is less than 3.

Depth to consolidated diatomaceous earth ranges from 8 to 18 inches. Reaction is mildly alkaline to moderately alkaline and decreases with depth. The A horizon has a value of 5 or 6 when moist and a chroma of 2 or 3. It is sandy loam to loam and contains coarse fragments ranging from 50 to 75 percent, by volume.

The C1 horizon is 80 to 100 percent fragments of diatomaceous earth. The C horizon has a hue of 10YR or neutral, a value of 7 or 8, and a chroma of 0 to 2.

Celeton very cobbly sandy loam, 8 to 30 percent slopes (CNE).—This soil is in large and very large areas on convex, rolling foothills. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Biddleman, Osobb, and Pirouette soils and a soil that is similar to Celeton soils but it is underlain by sandstone and white semiconsolidated clay. Also included are areas of Rock outcrop.

This soil is used for very limited grazing and for wildlife food and cover. It is a good commercial source of diatomite. Capability unit VIIs–283, nonirrigated; wildlife suitability group NV 27–6, nonirrigated; range site NV 27–3 (Desert Droughty Loam); not placed in a windbreak suitability group.

Churchill Series

The Churchill series consists of very deep, somewhat poorly drained soils that formed in loamy lacustrine sediment derived from mixed rock. These soils are on smooth, low, recent lake terraces of ancient Lake Lahontan. Slopes are 0 to 2 percent. Elevation ranges from 3,900 to 4,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is about 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light-gray gravelly sandy loam about 1 inch thick. The next layer is dark-brown, friable, slightly plastic clay loam about 3 inches thick and light olive-brown very cobbly silty clay loam about 5 inches thick. It is underlain by plastic silty clay that is light gray to light brownish gray and extends to a depth of 60 inches.

Permeability is very low. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 7.5 to 9.0 inches.

These soils are used for limited grazing and for wildlife habitat. They are not suitable for irrigated crops. The vegetation is a sparse cover of black greasewood, seepweed, and shadscale.

Representative profile of a Churchill gravelly sandy loam, in an area of Churchill-Playas complex in native vegetation, one-fourth mile west and one-fifth mile north of the southeastern corner of sec. 14, T. 19 N., R. 29 E., Mount Diablo base line and meridian:

A1—0 to 1 inch, light-gray (10YR 7/1) gravelly sandy loam, grayish brown (10YR 5/2) moist; weak, medium, platy structure; hard, friable, silghtly sticky and slightly plastic; very few fine roots; many fine, medium, and coarse vesicular pores: erosion pavement consisting of 40 percent gravel and cobblestone-size dendritic tufa fragments; violently effervescent; very strongly alkaline; abrupt, smooth boundary.

B2t—1 to 4 inches, dark-brown (10YR 4/3) clay loam, dark yellowish brown (10YR 4/4) moist; moderate, fine and medium, prismatic structure; hard, friable, sticky and plastic; very few fine roots; many fine and medium pores; violently effervescent; very strongly alkaline; abrupt, wavy boundary.

B3t—4 to 9 inches, light olive-brown (2.5Y 5/4) gravelly heavy silty clay loam, dark grayish brown (10YR 4/3) moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; very few fine roots; common fine and medium tubular pores; about 30 percent, by volume, consists of platelike cobblestones and gravel; few thin clay films on ped faces, in pores, and on coarse fragments; violently effervescent; strongly alkaline; clear, wavy boundary.

IIC1g—9 to 17 inches, light-gray (10YR 7/2) silty clay, olive gray (5Y 5/2) moist; moderate, fine, angular blocky structure; hard, friable, very sticky and very plastic; few fine roots; many fine and medium tubular pores; strongly effervescent; strongly alkaline; clear, irregular boundary.

IIC2g—17 to 24 inches, light brownish-gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; few, fine, prominent, black (10YR 2/1) stains; moderate, coarse, angular blocky structure; very hard, firm, sticky and plastic; very few fine roots; very few fine tubular pores; slightly effervescent; strongly alkaline; clear, irregular boundary.

IIC3g—24 to 38 inches, light brownish-gray (2.5Y 6/2) silty clay, grayish brown (2.5Y 5/2) moist; few, fine, prominent, black (N 2/0) stains; moderate, coarse, angular blocky structure; very hard, firm, very sticky and very plastic; some very fine sand lenses; few roots; very few tubular pores; slightly effervescent in spots, strongly alkaline; abrupt, smooth boundary.

IIC4g—38 to 60 inches, light-gray (2.5Y 7/2) silty clay, grayish brown (2.5Y 5/2) moist; few, fine, prominent, black (N 2/0) stains; common, fine prominent, yellowish-brown (10YR 5/4) horizontal sheets of highly micaceous sand; strong, very coarse, prismatic structure; very hard, firm, sticky and plastic; no roots; very few fine tubular pores; slightly effervescent in spots; strongly alkaline.

The solum ranges from 8 to 14 inches in thickness. The A1 horizon has a hue of 10YR or 2.5Y, a value of 5 to 7 when dry and 3 to 5 when moist, and a chroma of 1 or 2 when moist or dry.

The B2t horizon has common to many, thin to moderately thick clay films. There are fewer and thinner clay films where salt puffs are on the surface. The upper part of the B2t horizon tends to break into octagonal cracks. Windblown sand deposits are on its upper surfaces. This horizon ranges from heavy clay loam to light silty clay loam. A discontinuous tufa layer is present in places. The state of decomposition ranges from undecomposed, which is extremely hard and limiting, to almost complete decomposition.

The IICg horizon is dense lake-laid clay and silty clay.

Churchill-Playas complex (CP).—This complex is in large bands on low lake terraces and in small basins. It is about 40 percent Churchill gravelly sandy loam, 40 percent Playas, and 20 percent included soils.

The nearly level Churchill soils are on low lake terraces. They have the profile described as representative for the Churchill series. A seasonal high water table is at a depth of 3 to 5 feet. The vegetation is sparse stands of black greasewood, seepweed, and shadescale.

The Playas occur as small basins without outlets and are barren of vegetation.

Included with this soil in mapping are areas of Parran silty clay, Tipperary fine sand, 0 to 4 percent slopes, and Appian clay loam.

The soils in this complex are used for limited grazing and for wildlife habitat. Churchill soils in capability unit VIIw–241, nonirrigated, wildlife suitability group NV 27–8, nonirrigated, and range site NV 27–4 (Desert Alkali Flats); Playas not placed in a capability unit, wildlife suitability group, or range site; Churchill soils and Playas not placed in a windbreak suitability group.

Dia Series

The Dia series consists of very deep, nearly level soils on smooth flood plains and low stream terraces. These soils formed in loamy alluvium superimposed over sandy alluvium, both of which were derived from mixed rock. Slopes are less than 2 percent. Elevation ranges from 3,800 and 4,100 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is grayish-brown loam about 5 inches thick and grayish-brown light silty clay loam about 7 inches thick. It is underlain by light brownish-gray sandy loam, stratified with silt loam and silty clay loam, about 17 inches thick and pale-brown sand that extends to a depth of about 60 inches.

Permeabiilty is moderately slow in the upper part of these soils and very rapid in the substratum. Most of these soils are somewhat poorly drained, but the Dia loam, wet, is poorly drained. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 5.5 to 8.0 inches.

Most areas of these soils have been cleared and leveled and are irrigated. Alfalfa in rotation with small grain, corn, or legume-grass pasture are the main crops grown. The more saline-alkali affected areas are used for range. The vegetation is greasewood and saltgrass.

Representative profile of Dia loam, in a cultivated area, about 200 feet east and 1,400 feet north of the southwest corner of sec. 2, T. 18 N., R. 28 E., Mount Diablo base line and meridian:

Ap—0 to 5 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; moderate,

medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many microroots and very fine and fine roots; common fine and very fine pores; neutral; abrupt, smooth boundary.

A1—5 to 12 inches, grayish-brown (10YR 5/2) light silty clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many microroots and very fine roots and common fine roots; common fine and very fine pores; neutral; clear, smooth boundary.

C1—12 to 29 inches, light brownish-gray (10YR 6/2) sandy loam stratified with silt loam and silty clay loam, dark grayish brown (2.5Y 4/2) moist; common, medium, prominent, reddish-brown (5YR 4/4) mottles moist; massive; slightly hard, very friable, nonsticky and slightly plastic; common fine and very fine roots; common very fine pores; neutral; abrupt, smooth boundary.

IIC2—29 to 60 inches, pale-brown (10YR 6/3) sand, brown (10YR 5/3) moist; common, medium, prominent, dark-brown (7.5YR 4/4) mottles and few, fine, distinct, gray (10YR 6/1) mottles moist; single grain; loose; very few very fine roots; many very fine interstitial pores; neutral.

The A horizon has a value of 4 or 5 when dry and 2 or 3 when moist and a chroma of 2 or 3. It is loam to clay loam or light silty clay loam. Structure is subangular blocky or granular, or the horizon is massive. Consistence ranges from soft to hard. The A horizon is never both massive and hard.

The C horizon has a hue of 10YR or 2.5Y, a value of 5 or 6 when dry and 4 or 5 when moist, and a chroma of 2 or 3. Inherent mottles of reddish hue and high chroma are common in this horizon. The upper part is predominantly loam, but thin strata of sandy loam, silt loam, sandy clay loam, silty clay loam, or clay loam are in places. The IIC horizon has a hue of 10YR or 2.5Y, a value of 6 or 7 when dry and 4 or 5 when moist, and a chroma of 2 or 3. Fine to very large mottles that are reddish in hue or have high chroma occur throughout this horizon. Texture is dominantly very coarse sand, coarse sand, or sand that is as much as 25 percent ½-inch gravel. Strata of fine sand or fine gravel are common.

Dia loam (Da).—This nearly level soil occurs in very small, small, and medium-sized, irregularly shaped areas on flood plains and low terraces. It has the profile described as representative for the series. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Dithod, East Fork, and Fernley soils.

This soil is mostly used for irrigated crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–3, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Dia loam, slightly saline (Dc).—This nearly level soil is in very small, small, and medium-sized, irregularly shaped areas on smooth flood plains and low terraces The profile of this soil is similar to that described as representative for the series, but it is slightly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Dithod, East Fork, and Fernley soils.

This soil is mostly used for irrigated crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–3, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Dia loam, strongly saline (Dd).—This nearly level soil is in very small, small, and medium-sized, irregularly shaped areas on flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Dithod, East Fork, and Fernley soils.

This soil is suitable for irrigated crops if it is reclaimed and water is available. It is used mainly for grazing and for wildlife habitat. Most areas have a low density of plant cover of black greasewood, rabbitbrush, and saltgrass. Capability units IIw–2, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–3, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Dia loam, wet (De).—This nearly level soil is in very small and small, oval depressions on smooth to slightly concave, low flood plains. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected; also, the drainage has been altered to poorly drained. The high water table results from seepage of irrigation water from main canals, poor management, or inadequate drainage. A seasonal high water table is at a depth of 1½ to 3 feet.

Included with this soil in mapping are small areas of other Dia soils and of Dithod and Fernley soils.

This soil is suitable for irrigated crops if drainage is provided, the soil is reclaimed, and water is available. It is used for grazing and for wildlife habitat. The vegetation in most areas is black greasewood and saltgrass. Capability units IIw–2, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–3, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Dithod Series

The Dithod series consists of very deep, somewhat poorly drained soils that formed in loamy alluvium derived from mixed rock. These soils are on smooth flood plains and low terraces. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,100 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F.; and the frost-free season is about 130 days.

In a representative profile the surface layer is grayish-brown loam about 15 inches thick. It is underlain by light brownish-gray, stratified fine sandy loam and very fine sandy loam about 14 inches thick, light brownish-gray loam about 17 inches thick, and light brownish-gray loamy sand that extends to a depth of about 60 inches.

Permeability is moderate. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is 8.0 to 10.5 inches.

Most of the areas of these soils have been leveled and are used for irrigated crops. The dominant vegetation is black greasewood and saltgrass.

Representative profile of Dithod loam, in a cultivated area, about 1,000 feet east and 100 feet south of the northwest corner of sec. 3, T. 18 N., R. 28 E., Mount Diablo base line and meridian:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium roots and many coarse roots; common medium tubular pores; neutral; clear, smooth boundary.

A1—6 to 15 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common medium roots and many coarse roots; common medium tubular pores; neutral; abrupt, smooth boundary.

C1—15 to 29 inches, light brownish-gray (10YR 6/2) stratified fine sandy loam and very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; common medium roots and many coarse roots; common coarse pores; neutral; abrupt, smooth boundary.

C2—29 to 46 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine roots and common medium roots; common medium tubular pores; neutral; abrupt, smooth boundary.

IIC3—46 to 62 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; many, prominent, dark reddish-brown (5Y 3/3) mottles, dark brown (7.5YR 4/4) moist; massive; slightly hard, very friable; few fine roots; few fine tubular pores; neutral.

The A1 horizon has a hue of 10YR or 2.5Y and a chroma of 2 or 3. Mottles that have a chroma of 3 or 4 are present in places. Texture is loam, silt loam, or fine sandy loam. Structure ranges from weak to moderate, fine to medium, subangular blocky. Consistence ranges from soft to hard.

The C horizon has a hue of 10YR or 2.5Y and a chroma of 2 or 3. Mottles are present in places. In places the C horizon contains finely stratified material that ranges from loamy fine sand to clay loam but is dominantly loam. Structure is weak, fine or medium, subangular blocky, or the horizon is massive. Consistence ranges from soft to hard. Buried A horizons are common. Depth to the IIC horizon, if present, ranges from 42 to 60 inches. The IIC horizon ranges from a clay to coarse sand.

Dithod loam (Dh).—This nearly level soil is in small and very small, irregularly shaped areas on flood plains and low terraces. It has the profile described as representative for the series. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Dia soils and narrow stringers of Fernley soils.

This soil is used mostly for crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–1, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Dithod loam, slightly saline (Dk).—This soil is in small and very small, irregularly shaped areas on flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it is slightly saline-alkali affected. A seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of Dia, East Fork clay, and Fernley soils.

This soil is mostly used for irrigated crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–1, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Dithod loam, strongly saline (Dm).—This nearly level soil is in very small and small, irregularly shaped areas on smooth flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Dia, East Fork, and Fernley soils.

This soil is suitable for irrigated crops if it is reclaimed and water is available. It is used mainly for limited grazing and for wildlife habitat. Most areas have a low density of black greasewood and saltgrass. Capability units IIw–2, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated; windbreak suitability group NV 27–9; not placed in a range site.

Dune Land

Dune land-Playas complex (Dp).—This complex consists of about 40 percent Dune land, 40 percent Playas, and 20 percent included soils. In this survey area Dune land is mapped only in a complex with Playas. The Dune lands are unstabilized accumulations of loose sand, generally 20 to 30 feet high. The Playas are between the dunes in the windswept and barren basins.

Included with this complex in mapping are small areas of Tipperary fine sand, Parran silty clay, and Appian clay loam, clay substratum.

This complex generally is barren of vegetation and is of little value except for recreation. Capability unit VIIIs–264, nonirrigated; Dune land and Playas not placed in a wildlife suitability group, range site, or windbreak suitability group.

East Fork Series

The East Fork series consists of very deep, somewhat poorly drained soils that formed in loamy alluvium derived from mixed rock. These soils are along smooth flood plains and low terraces. Slopes are 0 to 2 percent. Elevation ranges from 3,900 to 4,100 feet. The average annual precipitation is 4 to 6 inches, average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is grayish-brown clay loam about 14 inches thick. It is underlain by grayish-brown, friable, plastic clay loam that extends to a depth of about 60 inches.

Permeability is moderately slow. Runoff is slow, and the hazard of erosion is none to slight. Available water capacity is 9.0 to 11.5 inches.

Most areas of these soils have been leveled and are used for irrigated crops.

Representative profile of East Fork clay loam, in a cultivated area, about 1,640 feet south and 370 feet east of the north quarter corner of sec. 30, T. 19 N., R. 29 E., Mount Diablo base line and meridian:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium to fine, subangular blocky structure and moderate, coarse, granular; slightly hard, friable, sticky and very plastic; many fine and medium roots; common fine pores, noneffervescent; neutral; clear, smooth boundary.

A1—6 to 14 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; moderate, medium and fine, granular structure; slightly hard, friable, sticky and plastic; common fine and medium roots; common fine and medium tubular pores and few coarse tubular pores; slightly effervescent in spots; neutral; clear, wavy boundary.

C1—14 to 27 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; few, fine,

faint, dark-brown (7.5YR 3/2) mottles moist and common fine, distinct, light-gray (10YR 7/2) mottles moist; weak, medium and fine, granular and subangular blocky structure; slightly hard, friable, sticky and plastic; common fine and medium roots; common fine and medium pores; slightly effervescent; moderately alkaline; clear, wavy boundary.

C2—27 to 60 inches, grayish-brown (10YR 5/2) clay loam, dark grayish brown (10YR 4/2) moist; many, medium, distinct, dark-brown (7.5YR 3/2) mottles moist; few, fine, distinct, black (10YR 2/1) stains moist; weak, fine, subangular blocky structure; slightly hard, friable, sticky and plastic; few fine roots, few fine tubular pores; noneffervescent; mildly alkaline.

The Ap horizon has a hue of 10YR or 2.5Y and a chroma of 2 to 3 when moist or dry. It is 5 to 14 inches in thickness in irrigated areas because of leveling. In places the profile contains finely stratified material that ranges from loamy fine sand to silty clay loam but is dominantly clay loam. The strata average 3 to 4 inches in thickness. Stratified clay or sand is below a depth of 30 inches in places. Mottles within a depth of 20 inches have a chroma of 2 to 4 and are few to common, fine to medium, distinct to prominent. Lime content in the C horizon is none to slight. Reaction, salinity, and alkalinity vary widely, depending upon the degree of reclamation.

East Fork clay loam (Ea).—This nearly level soil is in very small, small, and medium-sized, irregularly shaped areas on flood plains and low terraces. It has the profile described as representative for the series. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Dithod, Fernley, and Sagouspe soils.

This soil is used for irrigated crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–1, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

East Fork clay loam, slightly saline (Ec).—This nearly level soil is in small and medium-sized, irregularly shaped areas on flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it is slightly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Dia, Dithod, and Fernley soils.

This soil is used for irrigated crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–1, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

East Fork clay loam, strongly saline (Ed).—This nearly level soil is in small and medium-sized, irregularly shaped areas on smooth flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Dia, Dithod, and Fernley soils.

This soil is suitable for irrigated crops if it is reclaimed and water is available. It is used mainly for limited grazing and for wildlife habitat. Most areas have a low-density cover of black greasewood and saltgrass. Capability units IIw–2, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Erber Series

The Erber series consists of very deep, somewhat poorly drained soils that formed in sandy sediment derived from mixed rock. These soils are on smooth, almost flat flood plains and low terraces. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is grayish-brown loam about 5 inches thick over dark-gray silt loam about 8 inches thick. It is underlain by light brownish-gray, friable, slightly plastic silt loam about 3 inches thick and light-gray sand that extends to a depth of more than 50 inches.

Permeability is generally rapid, but where the underlying material is clay, it is very slowly permeable.

Runoff is slow, and the hazard of erosion is slight. Available water capacity is about 2.0 to 4.0 inches.

These soils are used for grazing and for limited irrigated pasture and cropland.

Representative profile of Erber loam, strongly saline, in native vegetation, about 314 feet south and 320 feet east of the northwest corner of sec. 6, T. 19 N., R. 31 E., Mount Diablo base line and meridian:

A11—0 to 5 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) moist; strong, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; very few fine roots; many very fine interstitial pores; many, very fine, prominent, white (10YR 8/1) salt streaks; slightly effervescent; strongly alkaline; abrupt, wavy boundary.

A12—5 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) moist; moderate, very fine, platy structure; slightly hard, friable, slightly sticky and slightly plastic; very few fine roots; very few fine tubular pores; many very fine prominent white (10YR 8/1) salt streaks; slightly effervescent; strongly alkaline; abrupt boundary.

A13—6 to 13 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many fine interstitial pores and few fine and medium tubular pores; many, very fine, prominent, white (10YR 8/2) gypsum crystals; slightly effervescent; moderately alkaline; abrupt, irregular boundary.

C1—13 to 16 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) moist; many, fine, prominent, yellowish-brown (10YR 5/6) mottles moist; very fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots and few very fine roots; very few medium interstitial pores; common, fine, distinct, white (10YR 8/2) gypsum crystals; slightly effervescent; strongly alkaline; abrupt boundary.

IIC2—16 to 50 inches, light-gray (10YR 7/1) sand, dark grayish brown (10YR 4/2) moist; many, prominent, yellowish-red (5YR 5/6) mottles moist; few, large prominent mottles, very dark grayish brown (10YR 3/2) moist; single grain; loose; few very fine and fine roots; many very fine pores; few shell fragments; moderately calcareous in spots; neutral.

The A1 and C horizons range from none to moderate in content of lime. The reaction in the entire profile ranges from neutral to strongly alkaline.

The A horizon has a hue of 10YR or 2.5Y, a value of 2 or 3 when moist and 4 or 5 when dry, and a chroma of 1 or 2 when moist or dry. It is sand, loam, silt loam, clay loam, or clay. A moderate amount of stratification is present

in some places. These strata range from sand to very fine sandy loam or silt loam.

The C horizon has a hue of 10YR or 2.5Y and a value of 3 or 4 moist. The mottles in this horizon are few to many, fine to large, and distinct to prominent. They range from 5YR to 10YR in hue, 3 to 5 in value, and 2 to 6 in chroma.

Erber sand (Ee).—This nearly level soil is in small and medium-sized bands on flood plains and deltas. The profile of this soil is similar to that described as representative for the series, but it has a sand surface layer and is underlain by very slowly permeable clay at a depth of 40 to 60 inches. It is strongly saline. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Pelic soils.

This soil has a limited suitability for irrigated crops if it is reclaimed and water is available. The drainage required in reclamation is difficult to establish because of the low-lying position of this soil. This soil is used for grazing and for wildlife habitat. The vegetation is mainly saltgrass. Capability units IVw–24, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Erber loam (Eg).—This nearly level soil is in small and medium-sized bands on smooth flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it has been reclaimed and is saline-alkali free in the upper part. The reaction ranges from neutral to moderately alkaline. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Bunejug and Fernley soils.

This soil is used for irrigated pasture plants and crops. Capability unit IVw–24, irrigated; wildlife suitability group NV 27–2, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Erber loam, strongly saline (Eh).—Ths nearly level soil is in medium-sized, rectangular areas on smooth flood plains. It has the profile described as representative for the series. It is strongly saline-alkali affected. A seasonal high water table is at a depth of about 3 to 5 feet

Included with this soil in mapping are small areas of Bunejug and Carson soils.

This soil has limited suitability for irrigated crops if it is reclaimed and water is available. The drainage required in reclamation is difficult to establish because of the low-lying position of this soil. This soil is used for limited grazing and for wildlife habitat. The vegetation is black greasewood and saltgrass. Capability units IVw–24, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Erber clay, slightly saline (Em).—This nearly level soil is in small and medium-sized, rectangular areas on flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but the surface layer is clay and the soil is slightly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Carcity, Fernley, and Swope soils.

This soil is used mainly for native and irrigated improved pasture, but some small areas are used for crops. Capability units IVw–24, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–3; not placed in a range site.

Erber clay, strongly saline (En).—This nearly level soil is in small and medium-sized, irregularly shaped areas on smooth deltas, flood plains, and low terraces. The profile of this soil is similar to that described as representative for the series, but the surface layer is clay. This soil is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Carcity and Swope soils.

This soil is used for irrigated and nonirrigated saltgrass pasture and for wildlife food and cover. Capability units IVw–24, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Fallon Series

The Fallon series consists of very deep, somewhat poorly drained alluvial soils that formed in loamy alluvium derived from mixed rock. These soils are on smooth, low stream terraces and flood plains. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,100 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray fine sandy loam about 14 inches thick. Below this is about 10 inches of light brownish-gray sandy loam that grades to heavy sandy loam and about 8 inches of loamy coarse sand. This is underlain by light-gray fine gravelly coarse sand about 16 inches thick and very plastic clay that extends to a depth of more than 55 inches.

Permeability generally is moderately rapid throughout, but it ranges from moderately slow to very slow, depending on the texture of the underlying material. Runoff is very slow, and the hazard of erosion is slight. Available water capacity is 5.5 to 8.5 inches.

Most areas of these soils are used for irrigated crops. The vegetation is greasewood, rabbitbrush, and saltgrass.

Representative profile of Fallon fine sandy loam, in a cultivated area, about 2,400 feet east and 800 feet south of the northwest corner of sec. 6, T. 18 N., R, 29 E., Mount Diablo base line and meridian:

A1—0 to 14 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; many and common fine roots; many very fine and fine interstitial pores; abrupt, smooth boundary.

C1—14 to 18 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; few fine, prominent, strong-brown (7.5YR 5/6) mottles moist and common, fine, prominent, dark-brown (7.5YR 3/2) mottles moist; massive; slightly hard, very friable; common very fine roots and few fine roots; many very fine interstitial and common fine and very fine tubular pores; mildly alkaline; clear, wavy boundary.

C2—18 to 24 inches, light brownish-gray (10YR 6/2) heavy sandy loam, dark grayish brown (10YR 4/2) moist; common, fine, faint, light-gray (10YR 7/2) lime streaks moist; many, fine, prominent, dark reddish-brown (5YR 3/2) mottles moist and few, fine, prominent, strong-brown (7.5YR 5/6) mottles moist; massive; hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine tubular pores and few fine tubular pores, many very fine interstitial pores; very few very thin clay films in pores and bridges; slightly calcareous matrix, strongly calcareous in spots; mildly alkaline; abrupt, wavy boundary.

IIC3—24 to 32 inches, light brownish-gray (10YR 6/2) loamy coarse sand, dark grayish brown (10YR 4/2) moist; many, large, prominent, dark reddish-brown (5YR 3/2) mottles moist and few, fine, prominent, strong-brown (7.5YR 5/6) mottles moist; massive; slightly hard, very friable; few very fine roots; many very fine and fine interstitial pores; mildly alkaline; gradual, wavy boundary.

IIC4—32 to 48 inches, light-gray (10YR 7/2) fine gravelly coarse sand, grayish brown (10YR 5/2) moist; single grain; loose; few very fine roots; many very fine and fine interstitial pores; mildly alkaline; gradual, wavy boundary.

IIC5—48 to 55 inches, light-gray (10YR 7/2) clay, few, fine, faint, light-gray (2.5Y 7/2) lime streaks, grayish brown (2.5Y 5/2) moist; massive; very hard, firm, very sticky and very plastic; no roots; few very fine tubular pores; very strongly calcareous; strongly alkaline.

The A horizon has a hue of 2.5Y or 10YR, a value of 5 or 6 when dry and 3 or 4 when moist, and a chroma of 2 or 3 when moist or dry. It is sandy loam, fine sandy loam, very fine sandy loam, or loam.

In places the profile contains strata or silty clay loam to coarse sand 3 to 6 inches thick. Below a depth of 40 inches, stratified material ranging from clay to coarse sand are present in some places. Mottles within a depth of 20 inches have a hue of 5YR, 7.5YR, or 10YR and a chroma of 2 to 6. They are few to many, fine to large, and faint to prominent. The content of lime ranges from slight to moderate.

Fallon fine sandy loam (Fa).—This nearly level soil is in small and very small, rectangular areas on smooth, low stream terraces and flood plains. The areas are dissected by sand channels in places. This soil has the profile described as representative for the series. Permeability is very slow because of the underlying lake-laid clay. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Dia, Fernley, and Sagouspe soils.

This soil is mostly used for irrigated crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–3, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Fallon fine sandy loam, slightly saline (Fc).—This nearly level soil is in very small, small, and medium-sized, irregularly shaped areas on smooth flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it is slightly saline-alkali affected. Permeability is very slow because of the underlying lake-laid clay.

Included with this soil in mapping are small areas of Appian, Fernley, and Sagouspe soils.

Most of this soil is used for irrigated cropland or irrigated pasture. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–3, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Fallon fine sandy loam, strongly saline (Fd).—This nearly level soil is on smooth flood plains and low terraces. The profile of this soil is very similar to that described as representative for the series, but it is strongly saline-alkali affected. Permeability is moderately slow because of the underlying silty lake-laid material.

Included with this soil in mapping are small areas of Appian and Sagouspe soils and narrow stringers of strongly saline-alkali affected Fernley soils.

This soil is suitable for irrigated crops if it is reclaimed and water is available. It is used mainly for limited grazing and for wildlife habitat. Capability units IIw–1, irrigated and VIIw–241, nonirrigated; wildlife suitability groups NV 27–3, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Fallon fine sandy loam, wet (Fe).—This nearly level soil is in small and very small, oval areas on smooth to concave flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected and the drainage has been altered to poorly drained. A high water table is the result of seepage from irrigation canals, poor irrigation water management, and a lack of a drainage outlet. Permeability is moderately slow because of the underlying silty lake-laid material. A seasonal high water table is at a depth of 1½ to 3 feet.

Included with this soil in mapping are small areas of Appian, Pelic, and Sagouspe soils.

This soil is used for grazing and for wildlife habitat. It is suitable for irrigated crops if it is reclaimed, but its low-lying position makes it very difficult to establish the drainage necessary for reclamation. The vegetation is mostly black greasewood and saltgrass. Capability units IIw–1, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–3, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Fernley Series

The Fernley series consists of nearly level somewhat poorly drained soils that formed in sandy alluvium derived from mixed rock. These soils are in narrow stringers, which are recent river channels on smooth flood plains and alluvial terraces. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,300 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the soil is grayish-brown sand that extends to a depth of about 60 inches.

Permeability is very rapid. Runoff is very slow, and the hazard of erosion is slight. Available water capacity is 3.0 to 4.0 inches.

Most areas of these soils are used for irrigated crops. These soils formed under a sparse stand of rabbitbrush, saltgrass, sedges, rushs, bluegrass, black greasewood, and annual weeds.

Representative profile of Fernley sand, in a cultivated area, about 100 feet west and 50 feet north of the south quarter corner of sec. 12, T. 20 N., R. 24 E., Mount Diablo base line and meridian:

Ap—0 to 7 inches, grayish-brown (2.5Y 5/2) sand, dark grayish brown (2.5Y 4/2) moist; single grain; loose; few coarse roots and many fine and medium roots; many

fine and medium pores; moderately alkaline; clear, smooth boundary.

C1—7 to 23 inches, grayish-brown (2.5Y 5/2) sand, dark grayish brown (2.5Y 4/2) moist; massive; soft, very friable; few fine and medium roots; many fine and medium interstitial pores; moderately alkaline; clear, smooth boundary.

C2—23 to 60 inches, grayish-brown (2.5Y 5/2) sand, dark grayish brown (2.5Y 4/2) moist; few, coarse, prominent, dark-brown (7.5YR 3/2) mottles moist; single grain; loose; few fine roots; many fine and medium interstitial pores; moderately alkaline.

The A horizon is sand, loam, or clay, but all the materials except the sand are present as a result of leveling and covering with materials from adjacent soils. The A horizon and the C horizon have a hue of 10YR or 2.5Y, a value of 5, 6, or 7 when dry and 4 or 5 when moist, and a chroma of 2 or 3 when moist or dry. The C horizon is dominantly medium sand, but it contains thin strata of sandy loam or loamy sand in places. The dark-brown mottles in the substratum are few to common, medium to coarse, distinct to prominent, and the dark-colored concretions are few to common, medium to coarse, distinct to prominent. Strata of finer textured material are below a depth of 48 inches in places. Reaction is mildly to strongly alkaline throughout.

Fernley sand (Fn).—This soil is in narrow stringers or sand channels on flood plains and terraces. It has the profile described as representative for the series. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Appian, Fallon, and Sagouspe soils and small areas of other Fernley soils that have a surface layer of loamy sand and sandy loam.

This soil is mostly used for irrigated crops or pasture. Capability unit IVw–24, irrigated; wildlife suitability group NV 27–2, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Fernley loam (Fo).—This soil is in stringer channels on smooth flood plains and terraces. The profile of this soil is similar to that described as representative for the series, but it has a loam surface layer about 6 to 12 inches thick. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Appian, Dithod, Fallon, and East Fork soils that generally are on islands. Also included are small areas of Fernley soils that have a surface layer of sandy loam, fine sandy loam, and clay loam.

This soil is mostly used for irrigated crops. Capability unit IVw–24, irrigated; wildlife suitability group NV 27–2, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Fernley clay (Fr).—This soil is in narrow stringer channels on smooth, flood plains and terraces. The profile of this soil is similar to that described as representative for the series, but it has a clay surface layer about 6 to 10 inches thick. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Carcity and Erber soils.

This soil is mostly used for irrigated crops or pasture. Capability unit IVw–24, irrigated; wildlife suitability group NV 27–2, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Gardella Series

The Gardella series consists of moderately well drained soils that are shallow to a silica-cemented hardpan. These soils formed in mixed sediment. The sediment contains appreciable amounts of volcanic sand, silt, and tuff interbedded with lacustrine sand and clay. These soils are on the smooth outer margins of recent volcanic cones and lake terraces. Slopes are 0 to 2 percent. Elevation ranges from 3,900 to 4,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray gravelly silt loam about 3 inches thick. Below this layer is about 7 inches of grayish-brown stratified coarse sand and coarse sandy loam that contains very thin (one-half inch thick) strata of fine sand and very fine sandy loam that are weakly silica cemented. This is underlain by a grayish-brown, strongly cemented hardpan consisting of silica-cemented strata as much as 1 inch thick; weakly silica cemented and noncemented very fine sand, sand, and fine sandy loam about 14 inches thick; and grayish-brown, very plastic silty clay that extends to a depth of 60 inches.

Permeability is very slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is about 1.0 inch.

These soils are mainly used for limited grazing and for wildlife habitat. The native vegetation is black greasewood and shadscale.

Representative profile of Gardella gravelly silt loam, in native cover, about at the center of sec. 30, T. 21N., R. 29 E., Mount Diablo base line and meridian:

A1sa—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly silt loam, dark grayish brown (10YR 4/2) moist; massive; hard, very friable, slightly sticky; few coarse roots; many very fine vesicular pores; strongly salt affected; effervescent; strongly alkaline; abrupt, smooth boundary.

C1si—3 to 10 inches, grayish-brown (2.5Y 5/2) stratified coarse sand and coarse sandy loam, very dark grayish brown (10YR 3/2) moist; very thin (one-half inch thick) strata of fine sand and very fine sandy loam that are weakly silica cemented; moderate, very thin, platy structure; slightly hard and very hard, very friable and firm; no roots; many very fine interstitial pores; few, 1 millimeter thick, discontinuous laminae; effervescent; strongly alkaline; abrupt, smooth boundary.

C2sim—10 to 24 inches, grayish-brown (2.5Y 5/2) strongly cemented hardpan consisting of silica-cemented strata as much as 1 inch thick and weakly silica-cemented and noncemented very fine sand, sand, and fine sandy loam, very dark grayish-brown (2.5Y 3/2) moist; massive and moderate, thin and medium platy structure; very hard and hard, very firm and very friable; no roots; many very fine interstitial pores; very thin (2 millimeters) discontinuous laminae on surface of plates; effervescent; strongly alkaline; abrupt, slightly wavy boundary.

IIC3—24 to 60 inches, grayish-brown (2.5Y 5/2) silty clay, grayish brown (2.5Y 5/2) moist; common, fine and medium, distinct, dark yellowish-brown (10YR 3/4) iron stains moist; moderate, medium, prismatic structure; very hard, very firm, very sticky and very plastic; many, very fine, very pale brown ostracod shells; no roots; few very fine tubular pores; strongly effervescent; strongly alkaline.

A pavement of scoriaceous pebbles ⅛ to ¼ inch thick is on the surface. The profile is finely stratified coarse sand to silt loam, and any one stratum is likely to be as much as 50 percent fine scoriaceous gravel and volcanic ash. When the strata are mixed, the average texture is loamy sand that contains less than 35 percent gravel. These soils are calcareous

throughout and are salt affected. Reaction is strongly alkaline to very strongly alkaline throughout. Depth to the hardpan ranges from 7 to 12 inches.

The A1 and Csi horizons have a hue of 10YR or 2.5Y, and a value of 5 or 6 when dry and 3 or 4 when moist. The darker value is inherited from the scoriaceous parent material and does not reflect the organic-matter content, which is less than 0.5 percent. The A1 horizon is typically massive, but in places structure is weak, thin or medium, platy. Consistence is hard or slightly hard. The Csim horizon consists of stratified, strongly cemented lenses that contain sand and loam. The cemented lenses are as much as 1½ inches in thickness but are dominantly ¼ to ½ inch thick. Discontinuous laminae on the upper and lower surfaces of the lenses are as much as 2 millimeters in thickness. Consistence is very hard or extremely hard and very firm in the laminae and is loose to hard and loose to friable in the uncemented parts. The IIC horizon is dense lacustrine clay.

Gardella gravelly silt loam (GA).—This nearly level soil is in very large bands in depressions on lake terraces bordering recent volcanic cones. Penetration of most plant roots is limited to about 1 foot by the hardpan.

Included with this soil in mapping are small areas of Hooten, Parran, and Tipperary soils and a soil similar to Gardella soils that has sand below the hardpan. Also included are areas of Playas.

This soil is not suitable for irrigation, because it is shallow to hardpan. It is used for very limited grazing and for wildlife habitat. The vegetation is very sparse stands of black greasewood and shadscale. Capability unit VIIs-283, nonirrigated; wildlife suitability group NV 27-8, nonirrigated; range site NV 27-4 (Desert Alkali Flats); not placed in a windbreak suitability group.

Hooten Series

The Hooten series consists of level to gently sloping, moderately well drained soils that are very shallow to a silica-cemented hardpan. These soils are on smooth or slightly convex lake terraces bordering the outer margins of volcanic cones. They formed in finely stratified gravelly sandy and silty lacustrine sediment derived mainly from basalt and tuff. Slopes are 0 to 4 percent. Elevation ranges from 3,900 to 4,200 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray very gravelly basalt sand about one-half inch thick. The next layer is pale-brown and light-gray plastic gravelly clay loam and very gravelly sandy clay loam about 4½ inches thick. It is underlain by a light-gray, platy, silica-cemented hardpan about 5 inches thick and stratified light-gray, dark-gray, and grayish-brown silt loam, and sandy loam that has some weak silica cementation and extends to a depth of 60 inches.

Permeability is moderately slow above the hardpan and very slow in the hardpan.

Runoff is medium, and the hazard of erosion is moderate. Available water capacity is about 0.5 to 1 inch.

These soils have a sparse cover of upland greasewood, shadscale, and some black greasewood. They are used mainly for limited grazing.

Representative profile of Hooten very gravelly sand, in an area of Hooten-Bango association, in native vegetation about 2,100 feet east and 120 feet south of the northwest corner of sec. 36, T. 21 N., R. 28 E., Mount Diablo base line and meridian:

A1—0 to ½ inch, light brownish-gray (10YR 6/2) very gravelly sand, very dark gray (10YR 3/2) moist; single grain; loose, no roots; many very fine interstitial pores; effervescent; strongly alkaline; abrupt, smooth boundary.

IIB21—½ to 2 inches, pale-brown (10YR 6/3) fine gravelly clay loam, brown (10YR 5/3) moist; moderate, coarse, prismatic structure; slightly hard, friable, sticky and plastic; common fine and medium roots; common fine interstitial pores and many fine tubular pores; few thin clay bridges; violently effervescent; few, fine, faint, light-gray (10YR 7/2) lime segregations; strongly alkaline; abrupt, smooth boundary.

IIIB22—2 to 5 inches, light-gray (10YR 7/2) very gravelly sandy clay loam, brown (10YR 5/3) moist; weak, coarse, prismatic structure; very hard, friable, sticky and plastic; few clay bridges; common fine and medium roots; many very fine and fine interstitial pores; violently effervescent; few, medium, faint, white (10YR 8/2) lime segregations; strongly alkaline; abrupt, smooth boundary.

IVC1sim—5 to 10 inches, light-gray (10YR 7/2), strongly silica-cemented, finely stratified coarse sandy loam, silt loam, and fine sand that has very thin (1/64 to 1/16 inch thick), discontinuous, white (10YR 8/2) and very pale brown (10YR 7/3) laminae that are mostly horizontally oriented, brown (10YR 5/3) and light brownish gray (10YR 6/2) moist; strong, medium, platy structure; laminae are extremely hard and very firm, and the matrix material is hard, friable, nonsticky and nonplastic; common very fine roots matted on the laminae surfaces; common very fine interstitial pores; laminae are violently effervescent and matrix is strongly effervescent; very strongly alkaline; abrupt, smooth boundary.

VC2—10 to 15 inches, light-gray (2.5Y 7/2) silt loam, dark grayish brown (2.5Y 4/2) moist; weak, thin and medium, platy structure; soft, friable, nonsticky and nonplastic; few very fine roots; common very fine and fine interstitial pores; noneffervescent; very strongly alkaline; abrupt, smooth boundary.

VIC3si—15 to 44 inches, dark-gray (10YR 4/1) stratified basalt sand, very gravelly coarse sand, and gravel, some of which is lenticular and discontinuous, black (10YR 2/1) moist; massive; loose, nonsticky and nonplastic; no roots; many fine and very fine interstitial pores; contains occasional 1/64-inch thick discontinuous, weakly silica-cemented lenses that are hard, and brittle; common and many, fine to coarse faint-brown mottles (10YR 5/3) and few, coarse, distinct, strong-brown mottles (7.5YR 5/3) and stains, which sometimes occur as bands; noneffervescent; very strongly alkaline; abrupt, smooth boundary.

VIIC4si—44 to 60 inches, grayish-brown (2.5Y 5/2), weakly silica-cemented, finely stratified fine sandy loam, silt loam, and sandy loam, very dark grayish brown (2.5Y 3/2) moist; massive; hard, brittle, nonsticky and nonplastic; no roots; common very fine interstitial pores; few silica bridges between sand grains; strongly effervescent; very strongly alkaline.

About 70 percent of the surface is covered by subangular basalt gravel ⅛ to ¼ inch in diameter.

The A1 horizon has a value of 4 to 6 when dry and 2 or 3 when moist and a chroma of 2 or 3. It is single grained or massive. Reaction ranges from pH 8.8 to 9.2.

The B21 and B22 horizons have a hue of 10YR or 7.5YR a value of 5 to 7 dry and 4 or 5 moist, and a chroma of 2 or 3. The reaction is strongly alkaline to very strongly alkaline, and the texture is gravelly and very gravelly clay loam, sandy clay loam, or heavy loam. Structure in the B21 horizon is weak or moderate, coarse, prismatic. The gravel content of strata in the B2 horizon ranges from 30 to 60 percent, and when the strata are mixed, the content of gravel averages about 35 to 50 percent. The average gravel size is less than one-half inch.

Exchangeable sodium, ranging from 20 to 50 percent, occurs in the B2 horizon and in the C horizon in places. Concentrations of soluble salts range from slight to strong in the B2 horizon and in the C horizon in places.

The depth of the C1sim horizon ranges from about 5 to 11 inches. The C1sim horizon ranges from noneffervescent to strongly effervescent.

The C horizon varies considerably in color, depending on texture and color of the stratified parent materials. The C horizon is coarse sand to silt loam of variable thickness and sequence. Any one stratum of the C horizon is likely to be as much as 80 percent gravel, by volume. In places the C1sim horizon contains many, very thin, discontinuous, silica-cemented veins, and silica-lined pores and bridging are also in places. The part of the C horizon underlying the C1sim horizon is weakly silica-cemented in places.

Hooten-Bango association (HB).—This soil association is in very large, oval areas on lake terraces between and adjacent to low volcanic cones. It is about 50 percent Hooten very gravelly sand, 0 to 4 percent slopes; 20 percent Bango sandy loam, 2 to 4 percent slopes; 20 percent Tipperary fine sand, 0 to 4 percent slopes; and 10 percent included soils.

The nearly level to gently sloping Hooten soils are on lake terraces bordering low volcanic cones and have basalt gravel on the surface. They have the profile described as representative for the Hooten series. Rooting depth of plants is limited to about 1 foot by the hardpan. The vegetation is sparse stands of upland greasewood, shadscale, and some black greasewood.

The gently sloping Bango soils are on smooth lake terraces that intervene between areas of Hooten soils. They have a profile that is essentially the same as that described as representative for the Bango series. Rooting depth of plants is limited to about 1 to 2½ feet by the scant precipitation. The vegetation is mainly upland greasewood, shadscale, some Indian ricegrass, and annuals.

The nearly level to gently sloping Tipperary soils are in low dune and hummocky areas on terraces and scarps. They have a profile similar to that described as representative for the Tipperary series but are fine sand throughout. Rooting depth of most plants is within 2 feet; however, plants such as black greasewood extend roots to a depth of 10 feet to extract moisture. The vegetation is black greasewood, dalea, four-wing saltbush, shadscale, Indian ricegrass, and numerous annuals.

Included with this association in mapping are areas of Biddleman, Gardella, Huxley, and Labou soils.

The soils in this association are used mainly for grazing and for wildlife habitat. Bango and Tipperary soils are suitable for crops if irrigation water is available. Hooten soils are not suitable for irrigated crops. Hooten soils in capability unit VIIs–283, nonirrigated, wildlife suitability group NV 27–8, nonirrgated, range site NV 27–4 (Desert Alkali Flats); Bango soils in capability units IIe–1, irrigated, and VIIs–261, nonirrigated, wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated, range site NV 27–1 (Desert Lake Bars), and windbreak suitability group NV 27–5; Tipperary soils in capability unit IVs–22, irrigated, and VIIs–264, nonirrigated, wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated, range site NV 27–5 (Desert Dunes), and windbreak suitability group NV 27–5.

Huxley Series

The Huxley series consists of very deep, moderately well drained soils that formed in lacustrine sediment derived from mixed rock. These soils are on smooth, low terraces of ancient Lake Lahontan. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 3,950 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is very pale brown gravelly clay loam about 1 inch thick. The next layer is pale-brown very plastic light clay about 2 inches thick and pale-brown very gravelly light clay about 2 inches thick. It is underlain by light-gray very gravelly clay loam about 4 inches thick and light brownish-gray stratified fine sand and very fine sand that extends to a depth of 60 inches.

Permeability is slow in the subsoil and rapid in the substratum. Runoff is slow, and the hazard of erosion is slight. Available water capacity is about 4.5 to 5.5 inches.

These soils have a very sparse cover of black greasewood and shadscale. They are used mainly for limited grazing and for wildlife habitat.

Representative profile of Huxley gravelly clay loam in native vegetation, about 1,320 feet northeast of the southwest corner of sec. 7, T. 21, N., R. 29 E., Mount Diablo base line and meridian:

A1—0 to 1 inch, very pale brown (10YR 7/3) gravelly clay loam, dark brown (10YR 4/3) moist; massive; hard, friable, very sticky and very plastic; few very fine tubular pores and many very fine vesicular pores; surface has an erosion pavement of basin interior lithoid tufa fragments ranging from ½ to 3 inches in diameter; strongly effervescent; very strongly alkaline; abrupt, wavy boundary.

B21t—1 to 3 inches, pale-brown (10YR 6/3) light clay, dark yellowish brown (10YR 4/4) moist; moderate, very fine and fine, subangular blocky structure; hard, friable, very sticky and very plastic; many very fine interstitial pores; strongly effervescent; very strongly alkaline; abrupt, wavy boundary.

B22t—3 to 5 inches, pale-brown (10YR 6/3) very gravelly light clay, brown (10YR 4/3) moist; moderate, very fine, subangular blocky structure; hard, friable, very sticky and very plastic; many very fine interstitial pores; the gravel consists of weathered tufa; strongly effervescent; very strongly alkaline; clear, irregular boundary.

IIC1ca—5 to 9 inches, light-gray (2.5Y 7/2) very gravelly clay loam, grayish brown (2.5Y 5/2) moist; massive; slightly hard, very friable, very sticky and very plastic; many very fine interstitial pores; the gravel consists of weathered tufa; violently effervescent; very strongly alkaline; abrupt, smooth boundary.

IIIC2—9 to 12 inches, light brownish-gray (2.5Y 6/2) fine sand, dark grayish brown (2.5Y 4/2) moist; many, large and medium, prominent, dark-brown (7.5Y 3/2) mottles moist; massive; slightly hard, very friable; strongly effervescent; very strongly alkaline; abrupt, wavy boundary.

IIIC3—12 to 60 inches, light brownish-gray (2.5Y 6/2) stratified fine sand and very fine sand, dark grayish brown (2.5Y 4/2) moist, common, large and medium, prominent, dark-brown (7.5YR 3/2) mottles moist; massive; slightly hard, very friable; many very fine interstitial pores; noneffervescent; very strongly alkaline.

The solum ranges from 3 to 10 inches in thickness. In places a discontinuous tufa layer is just below the solum. Where highly weathered, the tufa occurs as gravel or cobblestones. The A horizon has a value of 6 or 7 when dry and

4 or 5 when moist and a chroma of 2 or 3. A thin erosion pavement is on the surface in places.

The B2t horizon has a value of 5 to 7 when dry and 4 or 5 when moist and a chroma of 3 or 4. The texture ranges from a heavy clay loam to light clay.

The IIC1ca horizon is absent in places. Depth to sand is 8 to 15 inches. Mottles are present in places. The IIIC horizon ranges from very fine sand to coarse sand and has thin strata of loamy sand that is modified by gravel in some places.

Huxley gravelly clay loam (HU).—This nearly level soil is in very large bands on smooth, low lake terraces.

Included with this soil in mapping are small areas of Gardella, Hooten, and Tipperary soils.

This soil is used mainly for grazing and for wildlife habitat. The sparse vegetation is black greasewood and shadscale. Capability unit VIIs-261, nonirrigated; wildlife suitability group NV 27-9, nonirrigated; range site NV 27-4 (Desert Alkali Flats); not placed in a windbreak suitability group.

Juva Series

The Juva series consists of very deep, well-drained soils that formed in sandy alluvium derived from mixed rock. These soils are on convex alluvial fans. Slopes are 0 to 4 percent. Elevation ranges from 4,100 to 4,300 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray sandy loam about 1 inch thick and light-gray loam about 5 inches thick. It is underlain by brown, light brownish-gray, grayish-brown, and light-gray stratified sandy loam, loamy sand, very coarse sand, very gravelly coarse sand, very fine sandy loam, loam, fine gravelly sand, fine sand, and sandy loam that extends to a depth of about 65 inches.

Permeability is moderately rapid. Runoff is slow, and the hazard of erosion is slight to moderate. The available water capacity is about 5.5 to 8.5 inches.

These soils are used for irrigated crops where water is available and for grazing and for wildlife habitat where water is not available. The vegetation is upland greasewood, bud sagebrush, and Indian ricegrass.

Representative profile of Juva sandy loam, 0 to 2 percent slopes, in native vegetation, about 250 feet south and 100 feet east of the northwest corner of sec. 24, T. 20 N., R. 24 E., Mount Diablo base line and meridian:

A11—0 to 1 inch, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, medium, platy structure; soft, very friable, nonsticky and nonplastic; very few fine roots; many fine interstitial and tubular pores; slightly effervescent; strongly alkaline; abrupt, smooth boundary.

A12—1 to 6 inches, light-gray (10YR 7/2) loam, brown (10YR 5/3) moist; weak, coarse, prismatic structure parting to moderate, medium, platy; hard, friable, slightly sticky and silghtly plastic; few fine roots; many medium vesicular and tubular pores; violently effervescent; strongly alkaline; abrupt, smooth boundary.

C1—6 to 13 inches, brown (10YR 5/3) light sandy loam, dark grayish brown (10YR 4/2) moist; weak, coarse, prismatic structure parting to moderate, medium, subangular blocky; slightly hard, very friable, nonsticky and nonplastic; many fine roots; many fine and medium tubular pores; contains 2 to 3 percent lime-coated gravel; moderately alkaline; clear, smooth boundary.

C2—13 to 25 inches, light brownish-gray (10YR 6/2) light sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; many fine roots; many fine and medium tubular pores; 1 to 2 percent gravel; strongly effervescent; strongly alkaline; clear, wavy, boundary.

C3—25 to 34 inches, coarsely stratified grayish-brown (10YR 5/2) loamy sand, very coarse sand, very gravelly coarse sand, very dark grayish brown (10YR 3/2) moist; thin lenses of light-gray (10YR 7/2) very fine sandy loam, brown (10YR 5/3) moist; single grain; loose and slightly hard; many fine roots; many fine tubular pores; the very gravelly coarse sand lenses are about 50 to 60 percent gravel ⅛ to 1 inch in diameter; effervescent; strongly alkaline; abrupt, wavy boundary.

C4—34 to 38 inches, light-gray (10YR 7/2) loam, wark grayish brown (10YR 4/2) moist; strong, medium, platy structure; hard, friable, nonsticky and nonplastic; few fine roots along cleavage planes; few fine pores; violently effervescent; strongly alkaline; abrupt, wavy boundary.

C5—38 to 65 inches, light-gray (10YR 7/2) thinly stratified, fine gravelly sand, fine sand, sandy loam, and very fine sandy loam; massive; slightly hard, friable, nonsticky and nonplastic; very few fine roots; very few pores; effervescent; strongly alkaline.

The profile ranges from slightly calcareous to strongly calcareous. A small amount of lime-coated gravel occurs throughout the profile in places. The reaction of the entire profile is moderately alkaline to strongly alkaline. A thin desert pavement is present on the surface in places.

The A horizon has a hue of 10YR or 2.5Y, a value of 3 or 4 moist and 5 to 7 dry, and a chroma of 2 or 3. It is sandy loam or silt loam. The profile is highly stratified and ranges from coarse sand to sandy clay loam. Discontinuous finely stratified material, 2 to 3 inches thick, that ranges from gravelly sand to silt loam is present in the C horizon in places. The amount of gravel and cobblestones in the soil ranges between 5 and 20 percent.

Juva sandy loam, 0 to 2 percent slopes (JuA).—This nearly level soil is in small and medium-sized bands on alluvial fans. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Bluewing and Swingler soils.

This soil is used for crops where water is available and for range, wildlife habitat, or urban developments where water is not available. Capability units IIe-1, irrigated, and VIIs-261, nonirrigated; wildlife suitability groups NV 27-2, irrigated, and NV 27-9, nonirrigated; range site NV 27-1 (Desert Lake Bars); windbreak suitability group NV 27-6.

Juva sandy loam, 2 to 4 percent slopes (JuB).—This gently sloping soil is in medium-sized bands and on convex alluvial fans.

Included with this soil in mapping are small areas of Bluewing soils.

This soil is used mostly for crops where water is available for irrigation and for range or wildlife habitat where water is not available. Capability units IIe-1, irrigated, and VIIs-261, nonirrigated; wildlife suitability groups NV 27-2, irrigated, and NV 27-9, nonirrigated; range site NV 27-1 (Desert Lake Bars); windbreak suitability group NV 27-6.

Juva silt loam, 2 to 4 percent slopes (JvB).—This gently sloping soil is in medium-sized, fan-shaped areas on alluvial fans and in drainageways. The profile of this soil is similar to that described as representative for the series, but the surface layer is silt loam 3 to 8 inches thick. The

hazard of erosion is moderate. The soil is subject to flooding during heavy rains, but the flooding can be controlled.

Included with this soil in mapping are small areas of nearly level Bango and Bluewing soils.

This soil is suitable for irrigated crops if water is available and flooding is controlled. It is used mainly for grazing and for wildlife habitat. Most areas have a low density of native cover of upland greasewood and shadscale and varying amounts of bud sagebrush, Indian ricegrass, and annuals. Capability units IIe–1, irrigated, and VIIs–261, nonirrigated; wildlife suitability groups NV 27–3, irrigated, and NV 27–9, nonirrigated; range site NV 27–1 (Desert Lake Bars); windbreak suitability group NV 27–6.

Labou Series

The Labou series consists of shallow, gently sloping to strongly sloping, well-drained soils on uplands that have been truncated by water. These soils formed in calcareous lacustrine sediment of mixed origin. Slopes are 2 to 15 percent. Elevation ranges from 4,100 to 4,400 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray gravelly loamy fine sand about 1 inch thick. The subsurface layer is light-gray, friable, nonplastic fine sandy loam about 2 inches thick. Below this is brown, friable, very plastic clay about 4 inches thick and pale-brown very gravelly sandy clay loam. Extremely hard lithoid tufa is at a depth of about 11 inches.

Permeability is slow. Runoff is medium, and the hazard of erosion is moderate. Available water capacity is about 1.0 to 1.5 inches.

These soils are used mainly for limited grazing and for wildlife habitat. The vegetation is Bailey greasewood, bud sagebrush, and Indian ricegrass.

Representative profile of Labou gravelly loamy fine sand, 2 to 15 percent slopes, in an area of Labou-Rock outcrop complex, in native vegetation, about 2,000 feet west and 1,200 feet south of the northeast corner of sec. 35, T. 21 N., R. 28 E., Mount Diablo base line and meridian:

A1—0 to 1 inch, brownish-gray (10YR 6/2) gravelly loamy fine sand, dark brown (10YR 3/3) moist; massive; soft, very friable, nonsticky and nonplastic; no roots; many very fine interstitial pores and few very fine tubular pores; moderately alkaline; abrupt, smooth boundary.

A2—1 to 3 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 4/3) moist; massive; slightly hard, friable, nonsticky and nonplastic; common very fine roots and few fine and medium roots; many very fine and fine vesicular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

B2t—3 to 7 inches, brown (10YR 5/3) clay, brown (10YR 5/3) moist; moderate, medium and coarse, columnar structure; very hard, friable, very sticky and very plastic; common very fine roots and few medium roots; common very fine tubular pores and few fine tubular pores; common, thin and moderately thick, yellowish-brown (10YR 5/4) clay films on the faces of peds and in pores; common, thin, variegated brown (10YR 5/3) and light-gray (10YR 7/2) film on horizontal faces of peds; strongly effervescent; many, medium and large, distinct lime mottles, very strongly alkaline; abrupt, wavy boundary.

B3t—7 to 11 inches, pale-brown (10YR 6/3) very gravelly sandy clay loam, brown (10YR 5/3) moist; weak, fine and medium, subangular blocky structure; slightly hard, very friable, sticky and plastic; common very fine and fine roots; many very fine interstitial pores and few very fine tubular pores; common thin clay films in pores and very few thin clay films on faces of peds; strongly effervescent; strongly alkaline; clear, wavy boundary.

R—11 to 18 inches, extremely hard lithoid tufa.

The A1 horizon has a value of 3 or 4 when moist and a chroma of 2 or 3. It is gravelly loamy fine sand or gravelly loamy sand. The consistence ranges from soft to loose. The A2 horizon has a value of 4 or 5 when moist, and a chroma of 2 or 3. It ranges from fine sandy loam to loamy fine sand. Structure is weak subangular blocky or the horizon is massive. Consistence is soft or slightly hard. Reaction ranges from moderately alkaline to very strongly alkaline.

The B2t horizon has a value of 5 or 6 dry and 4 or 5 when moist. Its structure is columnar in the upper part and prismatic or subangular blocky structure in the lower part. The consistence ranges from slightly hard to very hard. Reaction ranges from strongly alkaline to very strongly alkaline. The horizon contains more than 15 percent exchangeable sodium in all parts. The B horizon contains 35 to 60 percent coarse fragments and ranges from sandy clay loam to clay.

The R horizon consists of lithoid tufa and calcium carbonate cemented sinter gravel.

Labou-Rock outcrop complex (LR).—This complex consists of gently sloping to strongly sloping soils in medium-sized and large, narrow areas on uplands that have been truncated by water. It is about 60 percent Labou gravelly loamy fine sand, 2 to 15 percent slopes, 25 percent Rock outcrop, and 15 percent included soils.

The gently sloping to strongly sloping Labou soils are on side slopes and in swales. They have the profile that is described as representative for the Labou series. Rooting depth of native plants is limited to about 8 to 14 inches by the tufa. The vegetation is sparse stands of Bailey greasewood, shadscale, bud sagebrush, and Indian ricegrass. The Rock outcrop is on points and on the top of ridges.

Included with this complex in mapping are areas of Hooten and Biddleman soils.

The soils in this complex are used mainly for limited grazing and for wildlife habitat. Capability unit VIIs-283, nonirrigated; Labou soils in wildlife suitability group NV 27–6, nonirrigated, and range site NV 27–1 (Desert Lake Bars), not placed in a windbreak suitability group; Rock outcrop not placed in a capability unit, wildlife suitability group, range site, or windbreak suitability group.

Lahontan Series

The Lahontan series consists of very deep, nearly level, somewhat poorly drained soils that formed in clayey alluvium derived from mixed rock. These soils are of major extent in slightly concave lake basins. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 3,970 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray clay about 10 inches thick. It is underlain by light brownish-gray, very plastic clay that extends to a depth of more than 60 inches.

Permeability is very slow. Runoff is very slow or ponded, and the hazard of erosion is none to slight. Available water capacity is about 7.5 to 9.0 inches.

These soils are used for grazing and for food and cover for wildlife. The native vegetation is black greasewood, saltbush, and saltgrass. If irrigated, the soils are suited to all wheatgrass pasture.

Representative profile of Lahontan clay, slightly saline, in a pasture of tall wheatgrass, about 150 feet west and 30 feet north of the southeast corner of sec. 19, T. 17 N., R. 30 E., Mount Diablo base line and meridian:

Ap—0 to 10 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; weak, coarse, subangular blocky structure; hard, firm, very sticky and very plastic; many fine roots; common fine tubular pores; few worm casts; strongly effervescent; strongly alkaline; clear, wavy boundary.

C1—10 to 21 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; few, coarse, distinct, black (10YR 2/1) mottles moist; weak, medium and fine, platy structure parting to moderate, medium and fine, subangular blocky; hard, firm, very sticky and very plastic; common fine roots; few fine tubular pores; effervescent; few fine, medium and coarse, distinct lime segregations, light gray (2.5Y 7/2) moist; strongly alkaline; clear, wavy boundary.

C2—21 to 33 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; few, coarse, distinct, dark-brown (7.5YR 3/2) mottles moist; strong, coarse, angular blocky structure; hard, firm, very sticky and very plastic; few fine roots; very few fine tubular pores; strongly effervescent; strongly alkaline; clear, smooth boundary.

C3—33 to 51 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5Y 4/2) moist; few, medium, distinct, strong-brown (7.5YR 5/6) mottles, moist, on faces of peds; moderate, very coarse, angular blocky structure; hard, firm, very sticky and very plastic; few fine roots; very few fine tubular pores; strongly effervescent; strongly alkaline; clear, smooth boundary.

C4—51 to 63 inches, light brownish-gray (2.5Y 6/2) clay, dark grayish brown (2.5 Y 4/2) moist; common, very fine, distinct, dark-brown (7.5YR 4/4) mottles moist; massive; very hard, very firm, very sticky and very plastic; few fine roots; no pores; effervescent matrix, but strongly effervescent in spots; strongly alkaline.

Texture ranges from clay to silty clay throughout the profile. In places few or common, fine to coarse lime segregations occur in any horizon. Reaction ranges from very strongly alkaline to moderately alkaline throughout, but it generally decreases or remains constant with depth.

The A horizon has a hue of 2.5Y or 10YR, a value of 6 or 7 when dry and 4 or 5 when moist, and a chroma of 1 or 2. Structure ranges from weak or moderate, medium or coarse, subangular or angular blocky, thin to thick platy, or the horizon is massive. In places the upper 1 or 2 inches is moderately vesicular or strongly vesicular.

The C horizon has a hue of 10YR, 2.5Y, or 5Y, and a value of 6 or 7 dry and 4 or 5 moist. Mottles occur in any or all horizons below a depth of 20 inches and range from few to many, very fine to coarse. They have a hue of 10YR, 7.5YR, or 5YR and a chroma of 2 through 6. The C horizon is either massive or it ranges from weak to strong, medium or coarse, angular blocky or platy.

Lahontan clay, slightly saline (Ls).—This soil is in large bands in lake basins. It has the profile described as representative for the series. It is slightly to moderately saline-alkali affected. The rooting depth of black greasewood is about 5 feet, which is maximum for native plants. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Parran soils and areas of poorly drained soils.

Small areas of this soil are used for irrigated salt- and alkali-tolerant pasture plants, but this soil is mostly used for grazing and for wildlife habitat. The vegetation is saltgrass and black greasewood. Capability units VIw-13, irrigated, and VIIw-241, nonirrigated; wildlife suitability groups NV 27–5, irrigated, and NV 27–7, nonirrigated; windbreak suitability group NV 27–2; not placed in a range site.

Lahontan clay, strongly saline (Lt).—This soil is in very large, horseshoe-shaped areas and in large, irregular areas in concave lake basins. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Parran soils and areas of Lahontan soils that have a thin covering of sand, especially in areas around the base of shrubs.

This soil is suitable for improved pasture of salt- and alkali-tolerant plants, but it is very difficult to reclaim because the very slowly permeable clay is extremely difficult to leach. The low-lying position of the soil makes adequate drainage difficult. The vegetation is mostly black greasewood and saltgrass. Capability units VIw–13, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–5, irrigated and NV 27–7, nonirrigated; range site NV 27–4 (Desert Alkali Flats); windbreak suitability group NV 27–2.

Marsh

Marsh (Ma) consists of concave, nearly level valley bottoms, oxbow lake bottoms, and slough channels that contain large areas of open water and of salt water-affected marsh plants, predominantly rushes and sedges. Subaerial sediment consists of peat deposits, averaging 1 to 2 feet in thickness, overlying materials that range from sand to clay.

Natural drainage is very poor. Internal drainage is very slow and water ponds.

The dense stand of marsh plants and open areas of water provide habitat especially suited to migratory waterfowl, muskrats, and such warm-water species of fish as bass and catfish. Marsh is suitable for only limited grazing, but the areas are suitable for recreational activities, especially duck and geese hunting, fishing, and trapping. Capability unit VIIIw–241, nonirrigated; not placed in a wildlife suitability group, range site, or windbreak suitability group.

Mazuma Series

The Mazuma series consists of very deep, well-drained soils that formed in alluvium derived from mixed rock. These soils are on smooth, broad alluvial fans. Slopes are 0 to 2 percent. Elevation ranges from 4,000 to 4,500 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is pale-brown silt loam about 5 inches thick and gravelly loamy

sand about 1 inch thick. It is underlain by pale-brown loam and light clay loam, about 8 inches thick, and pale-brown stratified silt loam, very fine sandy loam, and loam that extends to a depth of about 60 inches.

Permeability is moderately rapid. Runoff is slow, and the hazard of erosion is slight. Available water capacity is about 8.0 to 10.0 inches.

These soils are suitable for crops if they are reclaimed and irrigation water is available. They are used for grazing. The vegetation is black greasewood and seepweed.

Representative profile of Mazuma silt loam, in an area of Mazuma-Bango association in native cover, about 14 miles northeast of Stillwater, Nevada, about 100 feet east of the U.S. Coast and Geodetic Survey Marker number C-389:

A11—0 to 5 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) moist; weak, coarse, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine and fine roots; common fine tubular pores; noneffervescent; moderately alkaline; clear, smooth boundary.

A12—5 to 6 inches, pale-brown (10YR 6/3) gravelly loamy sand, grayish brown (10YR 5/2) moist; single grain; slightly hard, friable; many fine and very fine roots; many fine interstitial pores; slightly effervescent; strongly alkaline; abrupt, smooth boundary.

IIC1—6 to 8 inches, pale-brown (10YR 6/3) light clay loam, grayish brown (10YR 5/2) moist; weak, medium, prismatic structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; many fine and medium vesicular pores; strongly effervescent; strongly alkaline; clear, smooth boundary.

IIC2—8 to 14 inches, pale-brown (10YR 6/3) loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; slightly effervescent; many fine, prominent, white (10YR 8/1) salt mottles, strongly alkaline; clear, smooth boundary.

IIIC3—14 to 33 inches, pale-brown (10YR 6/3) stratified silt loam and very fine sandy loam, grayish brown (10YR 5/2) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common fine vesicular pores; slightly effervescent in spots; moderately alkaline; clear, smooth boundary.

IVC4—33 to 43 inches, pale-brown (10YR 6/3) loam, brown (10YR 5/3) moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; strongly effervescent; moderately alkaline; clear, smooth boundary.

VC5—43 to 60 inches, pale-brown (10YR 6/3) silt loam. brown (10YR 5/3) moist; massive, slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; strongly effervescent; moderately alkaline.

The A horizon generally is 4 to 8 inches in thickness, but it is absent in places. It has a hue of 10YR or 2.5Y, a value of 6 or 7 when dry and 4 or 5 when moist, and a chroma of 2 or 3 dry or moist.

The C horizon has a hue of 10YR or 2.5Y, a value of 4 or 5 when moist, and a chroma of 2 or 3. It is highly stratified sandy loam to light clay loam.

Salt crystals or mottles are present in places, and the lime content varies from stratum to stratum. Lacustrine clay occurs below a depth of 40 inches. The average texture of the profile is less than 15 percent clay.

Mazuma-Bango association (MB).—This association consists of nearly level to gently sloping soils in very large bands on smooth to gently convex, dissected alluvial fans and terraces. It is about 60 percent Mazuma silt loam; 20 percent Bango sandy loam, 2 to 4 percent slopes; and 20 percent included soils.

The nearly level Mazuma soils are on alluvial fans. They have the profile described as representative for the Mazuma series. Mazuma soils are below the Bango soils and are influenced by loessal deposits in places. Roots of such plants as black greasewood can penetrate as deep as 10 feet to extract moisture. The vegetation is black greasewood and seepweed.

The gently sloping Bango soils are on smooth, recent lake terraces above the Mazuma soils. They have a profile that is essentially the same as that described as representative for the Bango series.

Included with this complex in mapping are areas of Biddleman and Stumble soils.

The soils in this association are suitable for irrigated crops if water is available. They are used mainly for grazing. Mazuma soils in capability units IIw–1, irrigated, and VIIs–261, nonirrigated, wildlife suitability groups NV 27–3, irrigated, and NV 27–9, nonirrigated, and range site NV 27–4 (Desert Alkali Flats); Bango soils in capability units IIe–1, irrigated, and VIIs–261, nonirrigated, wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated, and range site NV 27–1 (Desert Lake Bars); both soils in windbreak suitability group NV 27–6.

Mine Pits

Mine pits (MD) are in very large, strongly sloping to steep areas. They consist of open excavations from which limestone is being removed and of other areas where the soil has been scraped off for preliminary investigation before mining. The areas are so badly broken up that the soils cannot be classified. Small areas where the soil is not completely removed have a sparse cover of upland greasewood and shadscale.

Included with this land type in mapping are small areas of Biddleman and Celeton soils and areas of Rock outcrop.

The areas of Mine pits are used mainly as a source of limestone for a cement plant in Fernley. They have limited use for watershed. Capability unit VIIIs–283, nonirrigated; not placed in a wildlife suitability group, range site, or windbreak suitability group.

Osobb Series

The Osobb series consists of shallow, strong sloping to moderately steep, well-drained soils that formed in mixed colluvium and residuum derived dominantly from soft tuffs. These soils are on convex, rolling foothills. Slopes are 8 to 30 percent. Elevation ranges from 4,400 to 6,000 feet. The average annual precipitation is about 6 inches, the average annual air temperature is 50° to 54° F., and the frost-free season is about 120 to 130 days.

In a representative profile the surface layer is light brownish-gray, very stony. very fine sandy loam about 1 inch thick and light brownish-gray gravelly fine sandy loam about 3 inches thick. Below this is pale-brown very fine sandy loam and very cobbly fine sandy loam that extends to a depth of 17 inches, and is underlain

by a thin hardpan about 1 inch thick. Very pale-brown, soft tuff is at a depth of about 18 inches.

Permeability is moderately rapid. Runoff is medium to rapid, and the hazard of erosion is moderate to high. Available water capacity is about 1.5 to 2.0 inches.

These soils are used for limited grazing and for wildlife habitat. The vegetation is shadscale, upland greasewood, bud sagebrush, and gelleta grass.

Representative profile of Osobb very stony very fine sandy loam, 8 to 30 percent slopes, in an area of Pirouette-Osobb association, in native cover, about 750 feet north of the east quarter corner of sec. 15, T. 16 N., R. 29 E., Mount Diablo base line and meridian:

A11—0 to 1 inch, light brownish-gray (10YR 6/2) very stony very fine sandy loam, dark grayish brown (10YR 4/2) moist; massive; soft, very friable, nonsticky and nonplastic; common few very fine roots; many very fine interstitial pores; slightly effervescent; about 2.5 percent covered by stones, about 50 percent covered by cobblestones; moderately alkaline; abrupt, smooth boundary.

A12—1 to 4 inches, light brownish-gray (10YR 6/2) gravelly fine sandy loam, dark grayish brown (10YR 4/2) moist; moderate, medium, subangular blocky; slightly hard, very friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; many very fine and fine tubular pores and few medium tubular pores; slightly effervescent; moderately alkaline; clear, smooth boundary.

C1ca—4 to 11 inches, pale-brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/2) moist; massive; soft, very friable, slightly sticky and slightly plastic; common very fine roots and few fine roots; many very fine and fine pores and few medium pores; strongly effervescent; moderately alkaline; clear, wavy boundary.

C2ca—11 to 17 inches, pale-brown (10YR 6/3) very cobbly fine sandy loam, dark brown (10YR 4/3) moist; massive; soft, very friable, nonsticky and nonplastic; few very fine and fine roots and common microroots; many very fine and fine interstitial pores; violently effervescent; very strongly alkaline; abrupt, wavy boundary.

C3sicam—17 to 18 inches, very pale brown (10YR 7/3) indurated hardpan, pale brown (10YR 6/3) moist; massive; extremely hard, extremely firm, violently effervescent; very strongly alkaline; abrupt, wavy boundary.

C4—18 to 20 inches, very pale brown (10YR 7/3) soft tuff, pale brown (10YR 6/3) moist; massive; extremely hard, extremely firm; violently effervescent; very strongly alkaline.

Stones on the surface range from 1 to 3 percent, cobblestones from 30 to 50 percent, and gravel from 15 to 30 percent. Reaction ranges from moderately alkaline in the A1 horizon to very strongly alkaline in the C2ca horizon, and it generally increases with depth.

The A1 horizon has a value of 6 or 7 when dry and 3 to 5 when moist and a chroma of 2 or 3. It is either massive or moderate, medium or fine, granular or subangular blocky.

The Cca horizon has a value of 6 or 7 when dry and 4 or 5 when moist and a chroma of 2 or 3. It is either massive or has weak, medium, subangular blocky structure. Cobblestones in the Cca horizon range from 50 to 80 percent. They are strongly coated with laminated lime and silica. Texture is dominantly very fine sandy loam but is sandy loam or fine sandy loam that contains less than 18 percent clay in places. Depth to bedrock ranges between 10 to 20 inches.

In this Area Osobb soils are mapped only in an association with Pirouette soils.

Parran Series

The Parran series consists of very deep, nearly level, somewhat poorly drained soils that formed in clayey alluvium derived from mixed rock. These soils are on concave, low lake terraces and in basins. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,100 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray, salty silty clay about 5 inches thick. It is underlain by light-gray, salty silty clay about 13 inches thick and silty clay that extends to a depth of 60 inches.

Permeability is very slow. Runoff is very slow to ponded, and the hazard of erosion is none to slight. Available water capacity is about 7.5 to 9.0 inches.

These soils are used for limited grazing. The native vegetation is black greasewood, seepweed, shadscale, and iodine bush.

Representative profile of Parran silty clay, in native cover, about 100 feet south and west of the northeast corner of sec. 1, T. 19 N., R. 26 E., Mount Diablo base line and meridian:

A1sa—0 to 5 inches, light brownish-gray (2.5Y 6/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak, fine, granular structure; hard, friable, very sticky and very plastic; few fine roots; many fine interstitial pores; many, fine, distinct, white (2.5Y 8/2) salt crystals; thin salt crush on surface; very strongly alkaline; clear, smooth boundary.

C1sa—5 to 18 inches, light-gray (5Y 7/2) silty clay, dark grayish brown (2.5Y 4/2) moist; weak, fine and medium, subangular, blocky structure; hard, firm, very sticky and very plastic; common fine and medium roots; many fine and medium tubular pores; many, fine, distinct, white (2.5Y 8/2) salt and gypsum crystals; strongly effervescent; strongly alkaline; abrupt, smooth boundary.

C2—18 to 60 inches, light-gray (5Y 7/1) silty clay, olive gray (5Y 5/2) moist; many, large, prominent, dark reddish-brown (5YR 3/2) stains, moist, on face of peds; strong, coarse, angular blocky structure parting to weak, thick, platy; extremely hard, very firm, very sticky and very plastic; few fine roots along vertical cleavage; very few fine tubular pores; strongly alkaline.

The entire profile has a hue of 2.5Y or 5Y, a value of 4 or 5 when moist and 6 or 7 when dry, and a chroma of 1 or 2. The texture is clay or silty clay.

The Asa and Csa horizons range from 12 to 22 inches in thickness, contain from 2 to 5 percent salts more soluble in cold water than gypsum, and occur within a depth of 24 inches. Small to moderate amounts of gypsum are commonly present in some horizons in most areas.

The A horizon is dominantly granular but is weak or moderate, fine or medium, subangular blocky in places.

The C horizon has weak to strong, fine to coarse, angular, subangular blocky, or platy structure. The structure is commonly more strongly expressed below the Csa horizon.

Thin, discontinuous tufa deposits occur below a depth of 12 inches in places. Depth to mottles range from 20 to 30 inches. Mottles range from common to many, fine to coarse, and distinct to prominent. Common to many ostracods are below a depth of 18 inches in places.

Parran silty clay (PA).—This soil occurs in medium-sized and large, irregular areas on concave low terraces and in basins. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Tipperary and Appian soils and small areas of Badland and Playas.

This soil is used mainly for limited grazing. Most areas have a very low density plant cover of black greasewood,

seepweed, shadscale, and iodine bush. Capability unit VIIw–241, nonirrigated; wildlife suitability group NV 27–7, nonirrigated; range site NV 27–4 (Desert Alkali Flats); not placed in a windbreak suitability group.

Parran-Tipperary complex (PC).—This complex consists of soils on concave, low lake terraces, in basins, and on stabilized, convex, isolated hummocks scattered throughout the mapped areas. It is about 60 percent Parran silty clay; 20 percent Tipperary fine sand, 0 to 4 percent slopes; and 20 percent included land types.

The nearly level Parran soils are on concave, low lake terraces. They have a profile that is essentially the same as that described as representative for the Parran series. The vegetation is black greasewood and seepweed.

The level to undulating Tipperary soils are on stabilized dunes in areas of Parran soils. They have a profile similar to that described as representative for the Tipperary series but they are fine sand throughout. The vegetation is black greasewood, dalea, horsebrush, and Indian ricegrass.

Included with this complex in mapping are areas of Playas and Badland.

The soils in this complex are used mainly for grazing and for wildlife habitat. Capability unit VIIw–241, nonirrigated; Parran soils in wildlife suitability group NV 27–7, nonirrigated, and range site NV 27–4 (Desert Alkali Flats); Tipperary soils in wildlife suitability group NV 27–9, nonirrigated, and range site NV 27–5 (Desert Dunes); neither soil placed in a windbreak suitability group.

Patna Series

The Patna series consists of very deep, nearly level, somewhat excessively drained soils that formed in reworked sandy deltaic deposits derived from mixed rock. These soils are on slightly convex to broad, smooth alluvial terraces. Slopes are 0 to 2 percent. Elevation ranges from 4,000 to 4,350 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray sand and loamy sand about 6 inches thick. The next layer is light yellowish-brown and pale-brown sandy loam and light sandy loam about 18 inches thick and pale-brown loamy sand about 12 inches thick. It is underlain by light brownish-gray loamy sand and light-gray and pale-brown sand that extends to a depth of about 58 inches.

Permeability is moderately rapid in the upper part of the profile and rapid in the lower part. Runoff is very slow, and the hazard of soil blowing is moderate. Available water capacity is about 4.0 to 5.0 inches.

These soils are suitable for crops if water is available. They are used mainly for grazing. The native vegetation is upland greasewood, dalea, spiny hopsage, littleleaf horsebrush, Indian ricegrass, and common winterfat.

Representative profile of Patna sand, in native vegetation, about 920 feet west of the southeast corner of sec. 29, T. 21 N., R. 24 E., Mount Diablo base line and meridian:

A11—0 to 2 inches, light brownish-gray (10YR 6/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; few very fine and fine roots; many very fine and fine interstitial pores; neutral; abrupt, wavy boundary.

A12—2 to 6 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish-brown (10YR 4/2) moist; a few light-gray (10YR 7/1) areas 2 to 3 millimeters in diameter; massive; soft, very friable; common very fine and fine roots; many very fine and fine interstitial pores; very thin coatings on sand grains; neutral; abrupt, wavy boundary.

B21t—6 to 11 inches, lamellated light yellowish-brown (10YR 6/4) sandy loam and pale-brown (10YR 6/3) light sandy loam, brown (10YR 4/3) moist; massive; lamellae are very hard, very friable, slightly sticky and slightly plastic; hard, very friable, nonsticky and nonplastic; many very fine roots and common fine roots; many very fine and fine interstitial pores; lamellae have continuous thin and moderately thick clay films on sand grains, and common bridges; matrix has many thin clay films on sand grains; mildly alkaline; abrupt, wavy boundary.

B22t—11 to 18 inches, pale-brown (10YR 6/3) sandy loam, dark grayish brown (10YR 4/2) moist; few thin lamellae that are 1 chroma higher; massive; hard, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; many thin clay films on sand grains and few bridges; mildly alkaline; abrupt, wavy boundary.

B31t—18 to 24 inches, pale-brown (10YR 6/3) light sandy loam, dark grayish brown (10YR 4/2) moist; a few lamellae 1 millimeter thick; massive; soft, very friable, nonsticky and nonplastic; common very fine and fine roots; many very fine and fine interstitial pores; few very thin clay films on sand grains; mildly alkaline; abrupt, wavy boundary.

B32—24 to 31 inches, pale-brown (10YR 6/3) loamy sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; common very fine roots and few fine roots; many very fine and fine interstitial pores; sand grains are slightly stained; mildly alkaline; clear, smooth boundary.

B33—31 to 36 inches, pale-brown (10YR 6/3) loamy sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; common very fine and fine roots; many very fine and fine interstitial pores; sand grains are slightly stained; mildly alkaline; clear, smooth boundary.

C1ca—36 to 43 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; sand grains are very slightly stained; few roots; many very fine and fine interstitial pores; slightly effervescent in about 10 percent of the matrix; mildly alkaline; clear, wavy boundary.

C2ca—43 to 48 inches, light-gray (10YR 7/2) sand, dark grayish brown (10YR 4/2) moist; single grain; loose; few roots in upper part; many very fine and fine interstitial pores; slightly effervescent in about 10 percent of the matrix; moderately alkaline; clear, wavy boundary.

IIC3a—48 to 58 inches, pale-brown (10YR 6/3) sand, brown (10YR 4/3) moist; single grain; loose; many very fine and fine interstitial pores; very slightly effervescent; moderately alkaline.

Reaction increases with depth and is neutral to mildly alkaline in the solum and mildly alkaline to moderately alkaline in the C horizon.

The A horizon has a value of 6 or 7 when dry and a chroma of 1 or 2.

The B2t horizon has a value of 5 or 6 when dry and 4 or 5 when moist and a chroma of 3 or 4. It ranges from 8 to 18 inches in thickness. The B21t and B22t horizons are generally light sandy loam, but they range to loamy sand and sand that has 1 to 10 continuous heavy sandy loam or sandy clay loam lamellae that range from 1 centimeter to about 2 inches in thickness. The aggregate thickness of the lamellae

ranges from 1 to 10 inches. Lamellae generally are one chroma higher than the matrix when dry.

The C horizon has a value of 4 to 7 when dry and 3 to 5 when moist and a chroma of 2 or 3. It is a loamy sand, fine sand, sand, or coarse sand. Silty lake sediment is below a depth of 42 inches in places.

Patna sand (PD).—This soil is in large irregularly shaped areas on alluvial terraces.

Included with this soil in mapping are small areas of Tipperary, Swingler, and Bango soils and Playas. Also included are small areas of a soil that is similar to this Patna soil but is underlain by very gravelly material at a depth of about 20 inches.

This soil is suitable for irrigated crops if water is available. It is used mainly for grazing and for wildlife habitat. Most areas have a sparse cover of upland greasewood, dalea, spiny hopsage, littleleaf horsebrush, fourwing saltbush, rabbitbrush, Indian ricegrass, needle-and-thread, and common winterfat. Capability units IIIs–22, irrigated, and VIIs–264, nonirrigated; wildlife suitability group NV 27–2, irrigated, and NV 27–9, nonirrigated; range site NV 27–2 (Desert Sands); windbreak suitability group NV 27–5.

Pelic Series

The Pelic series consists of very deep, nearly level, very poorly drained soils that formed in sandy alluvium derived from mixed rock. These soils are on concave to flat flood plains, deltas, and oxbows and in abandoned slough channels. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,100 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light-gray sand about 12 inches thick. It is underlain by light brownish-gray loamy fine sand and sandy loam about 10 inches thick and light olive-gray, stratified sand and coarse sand that extends to a depth of 60 inches and has a thin stratum of silty clay.

Permeability generally is rapid but ranges to very slow where lake-laid clay or silty clay are present. Runoff is ponded, and the hazard of erosion is none to slight. Available water capacity is 3.0 to 4.0 inches.

These soils are used for grazing and for food and cover for wildlife. The native vegetation is saltgrass, wiregrass, bluejoint reedgrass, and sedge.

Representative profile of Pelic sand, in native vegetation, about 1,300 feet east and 1,300 feet south of the northwest corner of sec. 2, T. 17 N., R. 29 E., Mount Diablo base line and meridian:

A1—0 to 12 inches, light-gray (10YR 7/2) sand, light brownish gray (2.5Y 6/2) moist; few, large, prominent, dark reddish-brown (5YR 3/3) mottles moist; single grain; loose; many fine roots and many medium rhizomes; many very fine and fine interstitial pores; the upper one-eighth inch consists of a white (N 8/0) slightly hard salt crust; slightly effervescent; moderately alkaline; clear, wavy boundary.

C1g—12 to 16 inches, light brownish-gray (2.5Y 6/2) loamy fine sand, dark gray (10YR 4/1) moist; few, large, prominent, dark reddish-brown (5YR 3/3) mottles and stains moist; massive; slightly hard, very friable; common very fine roots and common medium rhizomes; common very fine and fine tubular pores; slightly effervescent; moderately alkaline; abrupt, wavy boundary.

IIC2g—16 to 22 inches, light brownish-gray (2.5Y 6/2) sandy loam, dark gray (10Y 4/1) moist; few, large, prominent, dark redish-brown (5YR 3/3) mottles and stains moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common very fine and fine roots; common very fine and fine tubular pores; slightly effervescent; moderately alkaline; abrupt, broken boundary.

IIIC3g—22 to 38 inches, light olive-gray (5Y 6/2) sand, dark gray (10YR 4/1) moist; few, large, prominent, dark reddish-brown (5Y 3/3) mottles and stains moist; single grain; loose; few very fine and fine roots; many very fine and fine interstitial pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

IVC4g—38 to 42 inches, light-olive gray (5Y 6/2) silty clay, very dark gray (5Y 3/1) moist; few, fine and medium, prominent, dark reddish-brown (5YR 3/3) mottles moist; massive; very hard, firm, very sticky and very plastic; few very fine and fine roots; many very fine and fine tubular pores; noneffervescent; moderately alkaline; abrupt, smooth boundary.

VC5g—42 to 60 inches, light olive-gray (5Y 6/2) stratified sand and coarse sand, gray (10YR 5/1) moist; single grain; loose; few fine roots; many very fine and fine interstitial pores; noneffervescent; moderately alkaline.

The A1 horizon has a hue of 10YR through 5Y, a value of 6 or 7 when dry and 5 or 6 when moist, and a chroma of 1 or 2. Mottles that have reddish hue or high chroma range from few to many and from very fine to coarse. Texture ranges from sand to clay, depending on position with respect to active river channels. The horizon is either single grain or massive, or it ranges from weak or moderate, very thin to medium, platy in structure. It is salt affected.

The upper part of the C horizon has a moist hue of 2.5Y or 10YR and ranges to 5B or is neutral, depending on depth. The hue fades rapidly on exposure to air. Value is 4 to 6 when dry and 2 to 4 when moist, and chroma is 0 or 1 when moist and 0 to 2 when dry. Mottles or stains are present throughout the C horizon. They are reddish, yellowish, bluish, or greenish in hue and are high or low in chroma. The horizon is stratified but is dominantly sand or coarse sand. Thin strata of sandy loam to clay, ½ to 6 inches thick, are present in places. Thick, continuous, dense clay strata are below a depth of 40 inches in places. An odor of methane can be detected in the lower part of the Cg horizon. One or more buried A horizons are present in places.

Pelic sand (Pe).—This soil is in small, narrow stringer channels or sloughs and in very small, oval areas on flood plains and deltas. It has the profile described as representative for the series. Permeability is very slow because of stratified clayey material. A seasonal high water table is at a depth of 0 to 3 feet.

Included with this soil in mapping are small areas of Erber soils; Pelic sand, clay substratum; and Marsh.

This soil is used for grazing and for wildlife habitat. Its low position makes it extremely difficult to drain. Most areas have a plant cover of saltgrass, wiregrass, and bluejoint reedgrass. Capability unit VIIw–241, nonirrigated; wildlife suitability group NV 27–5, nonirrigated; not placed in a range site or windbreak suitability group.

Pelic clay (Pf).—This soil is on small isolated oxbows, in abandoned slough channels, in medium-sized areas on deltas, and on concave to flat flood plains. The profile of this soil is similar to that described as representative for the series, but it has a clay surface layer that is 4 to 10 inches thick. Permeability is rapid. A seasonal high water table is at a depth of 0 to 3 feet.

Included with this soil in mapping are small areas of Erber soils; Pelic sand, clay substratum; and Marsh.

This soil is used for grazing and for wildlife food and cover. Because the soil is in a low position, drainage is extremely difficult to establish. The vegetation is mostly saltgrass, wiregrass, bluejoint reedgrass, and sedge. Capability unit VIIw-241, nonirrigated; wildlife suitability group NV 27-5, nonirrigated; not placed in a range site or a windbreak suitability group.

Pelic sand, clay substratum (Ph).—This soil is in very small, small, and medium-sized, irrigularly shaped areas on flat to concave deltas. The profile of this soil is similar to that described as representative for the series, except that it is underlain by lake-laid clay at a depth of 40 to 60 inches. The underlying layer is very slowly permeable. A seasonal high water table is at a depth of 0 to 3 feet.

Included with this soil in mapping are small areas of Erber soils, Pelic sand, and Pelic clay.

This soil is used for grazing and for wildlife food and cover. Artificial drainage is difficult because oulets are not available. The vegetation is mainly saltgrass, wiregrass, and bluejoint reedgrass. Capability unit VIIw-241, nonirrigated; wildlife suitability group NV 27-5, nonirrigated; not placed in a range site or windbreak suitability group.

Pirouette Series

The Pirouette series consists of shallow, well-drained soils that formed in residuum derived from tuff and basalt. Slopes are 0 to 8 percent. Elevation ranges from 4,500 to 6,000 feet. The average annual precipitation is 5 to 7 inches, the average annual air temperature is 51° to 54° F., and the frost-free season is about 120 days.

In a representative profile the surface layer is light-gray, very stony, very fine sandy loam about 3 inches thick. The next layer is brown and light-brown, friable, plastic cobbly heavy clay loam about 7 inches thick. It is underlain by light-brown very cobbly, slightly plastic sandy loam about 9 inches thick and a thin, very pale brown and white hardpan. Basalt is at a depth of about 20 inches.

Permeability is moderately slow. Runoff is rapid, and the hazard of erosion is moderate. Available water capacity is 2.0 to 3.0 inches.

The soil is used for limited grazing and for wildlife habitat. The vegetation is shadscale, upland greasewood, and bud sagebrush.

Representative profile of Pirouette very stony very fine sandy loam, 0 to 8 percent slopes, in an area of Pirouette-Osobb association, in native vegetation, near a line between sec. 15 and sec. 16, at the southern edge of Carson Lake, about 0.1 mile north of the east quarter corner of sec. 15, T. 16 N., R. 19 E., Mount Diablo base line and meridian:

A1—0 to 3 inches, light-gray (10YR 7/2) very stony very fine sandy loam, grayish brown (10YR 5/2) moist; moderate, fine, platy structure; slightly hard, friable, slightly sticky and plastic; many fine roots; many fine vesicular pores and few medium vesicular pores; 2 percent stones and 40 percent cobblestones and gravel; slightly effervescent; strongly alkaline; abrupt, smooth boundary.

B2t—3 to 7 inches, brown (7.5YR 5/4) cobbly heavy clay loam, brown (7.5YR 4/4) moist; moderate, medium, common fine roots; many fine interstitial pores and tubular pores; many thin clay films on faces of peds and in pores; 40 percent cobblestones and gravel; moderately alkaline; clear, wavy boundary.

B3t—7 to 10 inches, light-brown (7.5YR 6/4) cobbly clay loam, dry and moist; weak, medium, prismatic structure; slightly hard, friable, sticky and plastic; common fine roots; many fine interstitial pores and tubular pores; few thin clay films on faces of peds; common thin clay film in pores and as bridges; 40 percent cobblestones and gravel; moderately alkaline; clear, wavy boundary.

C1sica—10 to 19 inches, light-brown (7.5YR 6/4) very cobbly sandy loam, pink (7.5YR 7/4) moist; weak, coarse, subangular blocky structure; nonsticky and slightly plastic; few fine roots; many fine interstitial pores; few fine and medium silica-lime concretions; 60 percent coarse fragments coated with silica and lime; strongly effervescent; strongly alkaline; abrupt, wavy boundary.

C2sicam—19 to 20 inches, very pale brown (10YR 7/3) and white (10YR 8/2) indurated hardpan, pale brown (10YR 6/3) moist; extremely hard, extremely firm, strongly effervescent; strongly alkaline; abrupt, wavy boundary.

R—20 inches, olivine basalt bedrock.

An erosion pavement of dark-brown, varnished, flaggy blocks and pebbles of basalt cover 90 percent of the surface. The entire profile is 35 to 50 percent coarse fragments.

The A1 horizon has a value of 6 or 7 when dry. The B2t horizon has a hue of 7.5YR or 5YR, a value of 5 or 6 when dry, and a chroma of 3 or 4. It is 27 to 35 percent clay, by weight, and has moderate to strong, prismatic or subangular blocky structure. The B3t horizon contains a few lime concretions in places, but it is only limy where the C horizon is absent. Clay films are thin to moderately thick and few to common. Reaction ranges from moderately alkaline to very strongly alkaline. Depth to bedrock is 11 to 20 inches.

Pirouette-Bluewing association (PM).—This association consists of gently sloping to strongly sloping soils in very large, oval areas on hills and in drainageways. It is about 30 percent Pirouette stony clay loam, 5 to 15 percent slopes; 30 percent Bluewing gravelly loamy sand, 2 to 8 percent slopes; 20 percent Rock outcrop; and as much as 20 percent included soils.

The moderately sloping to strongly sloping Pirouette soils are on the sides and the top of broad ridges. They have a profile similar to that described as representative for the Pirouette series, but the surface layer is clay loam about 2 inches thick. The vegetation is shadscale, upland greasewood, and bud sagebrush.

The gently sloping to moderately sloping Bluewing soils are in swales and drainageways. They have a profile that is essentially the same as that described for the Bluewing series. The vegetation is shadscale, upland greasewood, bud sagebrush, and halogeton.

Areas of Rock outcrop occur on peaks and ridgetops and are barren of vegetation.

Included with this association in mapping are narrow bands of Biddleman soils that are above the Bluewing soils.

The soils in this association are used for grazing and for wildlife habitat. Pirouette soils in capability unit VIIs-283, nonirrigated, wildlife suitability group NV 27-6, nonirrigated, and range site NV 27-6 (Desert Shallow Loam); Bluewing soils in capability unit VIIs-264, nonirrigated, wildlife suitability group NV 27-9, nonirrigated, and range site NV 27-1 (Desert Lake Bars); neither soil placed in a windbreak suitability group.

Pirouette-Osobb association (PO).—This association consists of nearly level to moderately steep soils in large

and very large areas on rolling uplands. It is about 40 percent Pirouette very stony very fine sandy loam, 0 to 8 percent slopes; 40 percent Osobb very stony very fine sandy loam, 8 to 30 percent slopes; 10 percent Rock outcrop; and 10 percent included soils.

The nearly level to moderately sloping Pirouette soils are on the high ridges. They have the profile described as representative for the Pirouette series. The vegetation is shadscale, upland greasewood, and bud sagebrush.

The strongly sloping to moderately steep Osobb soils occur below the Pirouette soils. They have the profile described as representative for the Osobb series. The vegetation is shadscale, Bailey greasewood, and bud sagebrush.

Areas of Rock outcrop occur on peaks and ridgetops and are barren of vegetation.

Included with this association in mapping are areas of Biddleman and Celeton soils.

The soils in this association are used for grazing and for wildlife habitat. Capability unit VIIs–283, nonirrigated, wildlife suitability group NV 27–6, nonirrigated, and range site NV 27–6 (Desert Shallow Loam); neither soil placed in a windbreak suitability group.

Playas

Playas (PY) occur in small and medium-sized, irregularly shaped areas and in a very large oval area in Carson Sink. They consist of nearly level basins of intermittent lakes that do not have surface outlets. They are mostly of clayey material that ranges from sand to clay and are strongly alkaline to very strongly alkaline.

Natural drainage is very poor. Internal drainage is very slow, and water ponds. At intervals, strongly saline and alkaline water from surrounding areas accumulates on the surface and very slowly evaporates or percolates, frequently leaving salt crusts and salt deposits.

This land type generally is barren of vegetation and has little value except for recreation and wildlife habitat. Many areas of Playas are used as race tracks and as resting places for migratory wildlife, especially waterfowl. Capability unit VIIIw–207, nonirrigated; not placed in a wildlife suitability group, range site, or windbreak suitability group.

Ragtown Series

The Ragtown series consists of very deep, moderately well drained soils that formed in loamy alluvium derived from mixed rock. These soils are on lake terraces. Slopes are 0 to 2 percent. Elevation ranges from 3,900 to 4,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray light sandy clay loam about 10 inches thick. It is underlain by light brownish-gray clay loam, light-gray heavy silty clay loam and silty clay, and light-gray and light brownish-gray, finely stratified silty clay and fine sand that extends to a depth of more than 60 inches.

Permeability is slow. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 9.0 to 11.0 inches.

Most areas of these soils are cleared, leveled, and irrigated. The vegetation is black greasewood.

Representative profile of Ragtown sandy clay loam, in a cultivated area, about 500 feet east and 350 feet south of the northwest corner of sec. 32, T. 19 N., R. 29 E., Mount Diablo base line and meridian:

Ap—0 to 10 inches, light brownish-gray (10YR 5.5/2) light sandy clay loam, very dark grayish brown (10YR 4/2) moist; weak, fine, subangular blocky structure; hard, friable, sticky; many very fine and fine roots and common medium roots; many very fine and fine tubular pores; slightly effervescent; moderately alkaline; clear, smooth boundary.

C1—10 to 23 inches, light brownish-gray (10YR 6/2) clay loam, dark grayish brown (2.5Y 4/2) moist; weak, medium and fine, subangular blocky structure; hard, friable, sticky and plastic; many very fine and fine roots, and common medium roots; many very fine and fine tubular pores; slightly effervescent; strongly alkaline; clear, smooth boundary.

C2ca—23 to 42 inches, light-gray (10YR 7/2) heavy silty clay loam, grayish brown (10YR 5/2) moist; common, medium, distinct, dark-brown (7.5YR 3/2) mottles, moist; weak, thin and medium, platy structure; hard, friable, sticky and plastic; common very fine and fine roots; common fine tubular pores; common fine soft masses of lime; strongly effervescent; strongly alkaline; clear, smooth boundary.

C3—42 to 55 inches, light-gray (10YR 7/2) silty clay, grayish brown (2.5Y 5/2) moist; common, medium, distinct, dark-brown (7.5YR 3/2) mottles, moist; weak, thin and medium, platy structure; hard, friable, sticky and plastic; few fine roots; few fine tubular pores; slightly effervescent; strongly alkaline; abrupt, smooth boundary.

C4—55 to 64 inches, light-gray (10YR 7/2) and light brownish-gray (10YR 6/2) finely stratified silty clay and fine sand, grayish brown (2.5Y 5/2) moist; many, coarse, prominent, dark reddish-brown (5YR 3/3) mottles, moist; massive; hard, firm, slightly sticky, and slightly plastic; few fine roots; few fine tubular pores; slightly effervescent; strongly alkaline.

The entire profile has a hue of 10YR or 2.5Y and a chroma of 2 or 3. The A horizon in cultivated areas has a value of 3 or 4 moist.

The C horizon has a value of 6 or 7 when dry and 4 or 5 when moist. It is dominantly massive or has weak, platy structure that appears to be caused by deposition rather than soil formation. It has a weak, subangular blocky structure in the upper part in some cultivated and irrigated areas. The C horizon is commonly stratified clay loam or sandy clay loam that is 25 to 35 percent clay in the upper part, and clay, silty clay, or silty clay loam that is 35 to 55 percent clay in the lower part. The depth to fine-textured lacustrine material ranges from 16 to 30 inches. The average clay content between depths of 10 and 40 inches ranges from 35 to 45 percent. The content of lime varies. The Cca horizon is absent in some places. Effervescence is slight or strong. Reaction ranges from moderately alkaline to very strongly alkaline. Relict mottles considered to be associated with ancient Lake Lahontan generally are present in the fine-textured lake sediment.

Ragtown sandy clay loam (Ra).—This soil is in very small, small, and medium-sized, irregularly shaped areas. Some boundaries are straight because of reclamation. This soil is on alluvial lake terraces. It has the profile described as representative for the series. A seasonal high water table generally is at a depth of about 3 to 5 feet. Excessive irrigation creates a perched water table above the lacustrine sediment.

Included with this soil in mapping are small areas of Ragtown clay loam, slightly saline, and East Fork and Fernley soils.

This soil is used for irrigated crops. Capability unit IIw–8, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Ragtown clay loam, slightly saline (Rc).—This soil is in very small, small and medium-sized, rectangular areas on smooth alluvial lake terraces. The profile of this soil is similar to that described as representative for the series, but it is slightly saline-alkali affected and has a surface layer of clay loam about 10 inches thick. A seasonal high water table is at a depth of about 3 to 5 feet. Excessive irrigation creates a perched water table above the lacustrine sediment.

Included with this soil in mapping are small areas of East Fork and Fernley soils.

This soil is used for irrigated pasture plants, grain, and row crops. Capability unit IIIw–9, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Ragtown clay loam, strongly saline (Rg).—This soil is in small and medium-sized, irregularly shaped areas around the edges of irrigated areas on smooth alluvial lake terraces. The profile of this soil is similar to that described for the series, but it is strongly saline-alkali affected and has a surface layer of clay loam about 8 inches thick. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of East Fork and Fernley soils.

This soil is suitable for irrigated crops if water is available and the soil is reclaimed. It is used for grazing and for wildlife habitat. The dominant vegetation is black greasewood. Capability units IIIw–9, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–4, irrigated, and NV 27–7, nonirrigated; range site NV 27–4 (Desert Alkali Flats); windbreak suitability group NV 27–4.

Rock Outcrop

Rock outcrop consists of nearly level to extremely steep rock cliffs, bare rock mountain peaks, and small areas that have less than 4 inches of soil over rock. The outcrop consists of various types of igneous and sedimentary rocks, including basalt, rhyolite, sandstone, obsidian, dacite, tuff, breccias, latite, andesite, and limestone.

Rock outcrop supports little vegetation and is important mainly for recreation and wildlife. Many forms of wildlife, especially the chukar partridge, use areas of Rock outcrop as nesting places. Picnickers and rock hounds use the areas for recreational purposes.

This land type is mapped only in associations or complexes with Soda Lake, Pirouette, Osobb, and Bluewing soils.

Sagouspe Series

The Sagouspe series consists of very deep, nearly level, somewhat poorly drained soils that formed in sandy alluvium. These soils are on smooth, low terraces. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,100 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray loamy sand about 6 inches thick. It is underlain by light brownish-gray, very friable loamy sand and loamy fine sand about 23 inches thick. Below this layer, in sequence from the top, is light-gray, friable, slightly plastic silt loam about 5 inches thick; light-gray loose, nonplastic, stratified sand and coarse sand about 9 inches thick; and brownish-gray, very friable stratified silt loam, fine sandy loam, fine sand, and silty clay loam that extends to a depth of about 58 inches.

Permeability is rapid in the upper part of the profile and moderate in the lower part because of stratification. Runoff is slow, and the hazard of erosion is slight. Available water capacity is about 5.0 to 7.5 inches.

Most areas of these soils are cultivated and irrigated and are used for alfalfa, corn, small grain, and pasture. The native vegetation is black greasewood, rabbitbrush, and saltgrass.

Representative profile of Sagouspe loamy sand, in a cultivated area, about 1,780 feet east and 660 feet south of the northwest corner of sec. 6, T. 18 N., R. 29 E., Mount Diablo base line and meridian:

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; medium, prominent, very dark gray (10YR 3/1) stains moist; massive; soft, friable; common very fine roots, few fine roots, and a very few coarse roots; many fine and very fine pores; mildly alkaline; clear, smooth boundary.

C1—6 to 21 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) moist; few fine, prominent, strong-brown (7.5YR 5/6) mottles moist; massive; soft, very friable; common very fine and medium roots; many very fine and fine pores; slightly effervescent; moderately alkaline; clear, smooth boundary.

C2ca—21 to 29 inches, light brownish-gray (10YR 6/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; common, fine, prominent, dark reddish-brown (5YR 3/2) and dark-brown (7.5YR 4/4) mottles moist; massive; slightly hard, very friable; common very fine and fine roots; many very fine and fine pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

IIC3ca—29 to 34 inches, light-gray (10YR 7/2) heavy silt loam, dark grayish brown (10YR 4/2) moist; many, fine, prominent, dark-brown (7.5YR 4/4) mottles moist; common, fine, prominent, dark reddish-brown (5YR 3/2) mottles moist; and few, friable, slightly sticky and slightly plastic; common very fine, fine, and few medium roots; many very fine pores; strongly effervescent; strongly alkaline; abrupt, smooth boundary.

IIIC4—34 to 43 inches, light-gray (10YR 7/2) stratified sand and coarse sand, brown (10YR 4/3) moist; common, large, prominent, yellowish-brown (10YR 5/6) mottles moist; single grain; loose; common very fine and fine roots and few medium roots; many very fine pores; moderately alkaline; abrupt, smooth boundary.

IVC5ca—43 to 58 inches, light brownish-gray (10YR 6/2) stratified silt loam, fine sandy loam, loamy fine sand, and silty clay loam, dark grayish brown (10YR 4/2) moist; few, large, prominent, very dark gray (10YR 3/1) mottles moist, many, medium, prominent, reddish-brown (2.5YR 4/4) mottles moist, and few, fine, prominent, strong-brown (7.5YR 5/8) mottles moist; massive; slightly hard, very friable, slightly sticky and slightly plastic; very strongly effervescent; strongly alkaline.

The entire profile has a hue of 10YR or 2.5Y, a value of 4 or 5 when moist and 5 to 7 when dry, and a chroma of 2 or 3. It is dominantly stratified loamy sand and sand but contains thin strata of finer textured material. The average texture

is loamy sand or loamy fine sand. The substratum is dominantly loamy sand, sandy loam, or loam but also includes strata of silt loam, silty clay loam, and clay. Depth to mottles, which are largely relict, ranges from 6 to 40 inches. The lime varies in content and ranges from noneffervescent to slightly effervescent in the coarser textured material and from slightly effervescent to very strongly effervescent in the medium-textured and fine-textured material. Segregated lime in the form of soft masses and concretions occurs at a depth below 20 inches in places and generally is associated with the finer textured strata. Reaction is dominantly mildly alkaline to strongly alkaline throughout but ranges to neutral in the Ap horizon.

Sagouspe loamy sand (Sa).—This soil is in small and medium-sized, rectangular areas on smooth alluvial terraces. This soil has the profile described as representative for the series. A seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of Sagouspe loamy sand, saline, and Fernley, Fallon, and Appian soils.

This soil is used for irrigated crops. Capability unit IIw–22, irrigated; wildlife suitability group NV 27–3, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Sagouspe loamy sand, saline (Sb).—This soil is on smooth alluvial terraces. It is in medium-sized irrigated areas and in medium-sized and large areas that are adjacent to irrigated areas. The profile of this soil is similar to that described as representative for the series, but it is slightly to moderately saline-alkali affected. A seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of Sagouspe loamy sand and Fernley, Fallon, and Appian soils.

This soil is used for all irrigated crops and for range. Capability units IIw–22, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–3, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Soda Lake Series

The Soda Lake series consists of very deep, nearly level to strongly sloping, somewhat excessively drained soils that formed in sandy sediment. These soils are on and adjacent to convex, recent volcanic cones. Slopes are 0 to 15 percent. Elevation ranges from 4,000 to 4,200 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light brownish-gray gravelly loamy sand about 2 inches thick. The next layer is light brownish-gray, very friable gravelly loamy sand about 7 inches thick. It is underlain by light brownish-gray, very friable, stratified loamy fine sand, gravelly sand, fine sand, and loamy very fine sand about 10 inches thick; light-gray and grayish-brown very friable loamy very fine sand about 31 inches thick; and grayish-brown gravelly sand that extends to a depth of about 60 inches.

Permeability is rapid. Runoff is slow to very slow, and the hazard of erosion is slight to moderate. Available water capacity is about 4.0 to 5.5 inches.

These soils are suitable for alfalfa, grain, and pasture plants if irrigation water is available. The vegetation is upland greasewood, shadscale, and bud sagebrush.

Representative profile of Soda Lake gravelly loamy sand, 0 to 2 percent slopes, in native vegetation, 1,700 feet east and 800 feet north of the southwest corner of sec. 5, T. 19 N., R. 28 E., Mount Diablo base line and meridian:

A1—0 to 2 inches, light brownish-gray (10YR 6/2) gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable; few very fine roots; common very fine interstitial pores and few very fine tubular pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

B2—2 to 9 inches, light brownish-gray (10YR 6/2) gravelly loamy sand, very dark grayish brown (10YR 3/2) moist; weak, very coarse, prismatic structure; soft, very friable; common very fine and fine roots; many fine and very fine interstitial pores and common very fine tubular pores; effervescent; moderately alkaline; abrupt, smooth boundary.

C1—9 to 14 inches, light brownish-gray (10YR 6/2) finely stratified loamy fine sand and gravelly sand, very dark grayish brown (10YR 3/2) moist; very dark gray and gray (10YR 3/1 and 5/1) basalt scoria; single grain; loose; common fine interstitial pores; violently effervescent; common, medium and coarse, distinct, white (10YR 8/1) soft lime segregations and crusts around gravel; strongly alkaline; abrupt, smooth boundary.

C2ca—14 to 19 inches, light brownish-gray (10YR 6/2) finely stratified fine sand and loamy very fine sand, very dark grayish brown (10YR 3/2) moist; massive; soft, very friable; common very fine and fine roots; many very fine and fine interstitial pores and few fine tubular pores; violently effervescent; strongly alkaline; abrupt, smooth boundary.

C3—19 to 24 inches, light-gray (10YR 7/2) loamy very fine sand, dark grayish brown (10YR 4/2) moist; massive; soft, very friable; few very fine and fine roots; many fine and very fine interstitial pores; strongly effervescent; moderately alkaline; abrupt, smooth boundary.

C4—24 to 50 inches, grayish-brown (10YR 5/2) loamy fine sand, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable; few very fine roots; many very fine and fine interstitial pores; strongly effervescent; very strongly alkaline; abrupt, smooth boundary.

C5—50 to 60 inches, grayish-brown (10YR 5/2) gravelly sand, dark grayish brown (10YR 4/2) moist; single grain; loose; few very fine roots; many very fine and fine interstitial pores; many fine scoriaceous gravel; noneffervescent; very strongly alkaline.

The A1 horizon has a value of 6 or 7 when dry and 3 or 4 when moist and a chroma of 2 or 3. It generally is massive or single grain, but structure is weak, medium or coarse, platy in places.

The B2 horizon has a value of 5 or 6 when dry and 3 or 4 when moist and a chroma of 2 or 3. The darker values, both dry and moist, are a result of the presence of dark-colored basalt fragments of sand size. The B2 horizon is either gravelly coarse sandy loam or gravelly loamy sand that is as much as 20 percent fine basalt gravel.

The C horizon has a hue of 10YR or 2.5Y, a value of 5 to 7 when dry and 3 or 4 when moist, and a chroma of 2 or 3. In places the Cca horizon has weakly cemented areas that range from 1 to 3 inches in diameter.

The stratified material in the upper 40 inches is dominantly loamy fine sand, but sand, fine sand, loamy very fine sand, coarse sandy loam, and sandy loam are included. Any of this stratified material, including loamy fine sand, contains up to 40 percent fine or very fine gravel in places. These strata consist of scoriaceous basalt or lapilli. In places any stratum below a depth of 24 inches is as much as 20 percent spheroidally shaped concretions that are ¼ to ¾ inch in diameter. These concretions are slightly hard to very hard when dry and slightly brittle or brittle when wet. Their outer surface generally is coated by few or common, fine or medium lime segregations.

Soda Lake gravelly loamy sand, 0 to 2 percent slopes (ScA).—This soil is in a large, horseshoe-shaped areas adjacent to a recent volcanic cone. It has the profile described as representative for the series.

Included with this soil in mapping are small areas of Tipperary soils and other Soda Lake soils.

This soil is suitable for irrigated crops if water is available. It is used mainly for grazing and for wildlife habitat. Most areas have a low density of plant cover of upland greasewood, shadscale, and bud sagebrush. Capability units IIIs–22, irrigated, and VIIs–264, nonirrigated; wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; range site NV 27–1 (Desert Lake Bars); windbreak suitability group NV 27–6.

Soda Lake gravelly loamy sand, saline, 0 to 2 percent slopes (SdA).—This soil is in medium-sized and large bands on a smooth outer margin of a volcanic cone. The profile of this soil is similar to that described as representative for the series, but the drainage has been altered to moderately well drained by seepage from irrigation canals. A seasonal high water table is at a depth of about 5 to 6 feet. This soil is slightly saline-alkali affected.

Included with this soil in mapping are small areas of Tipperary soils and other Soda Lake soils.

This soil is used for limited grazing and for wildlife habitat. The dominant vegetation is black greasewood. Capability units IIIs–22, irrigated, and VIIs–264, nonirrigated; wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; range site NV 27–4 (Desert Alkali Flats); windbreak suitability group NV 27–4.

Soda Lake gravelly loamy sand, 2 to 15 percent slopes (SeD).—This soil is in large, horseshoe-shaped areas on a convex, recent volcanic cone.

Included with this soil in mapping are small areas of Tipperary soils and other Soda Lake soils.

This soil is used for grazing and for wildlife habitat. Most areas have a low density of upland greasewood, shadscale, and bud sagebrush. Capability unit VIIs–264, nonirrigated; wildlife suitability group NV 27–9, nonirrigated; range site NV 27–1 (Desert Lake Bars); not placed in a windbreak suitability group.

Soda Lake sandy loam, 0 to 2 percent slopes (SfA).—This soil is in medium-sized, irregularly shaped areas on smooth outer margins of a volcanic cone. The profile of this soil is similar to that described as representative for the series, but the surface layer is sandy loam about 16 inches thick. The drainage has been altered by seepage from irrigation canals, and the soil is now somewhat poorly drained. A seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of Tipperary soils and other Soda Lake soils.

Most of this soil is used for irrigated crops. Capability unit IIIw–24, irrigated; wildlife suitability group NV 27–2, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Soda Lake sandy loam, saline, 0 to 2 percent slopes (SgA).—This soil is in medium-sized bands on the lower part of the smooth outer margin of a volcanic cone. The profile of this soil is similar to that described as representative for the series, but the surface layer is sandy loam about 16 inches thick. The drainage has been altered by seepage from the irrigation canal system that traverses the area. This soil is now somewhat poorly drained and strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Pelic soils and Soda Lake sandy loam, 0 to 2 percent slopes.

This soil is suitable for irrigation if water is available and the soil is reclaimed. It is used for limited grazing and for wildlife habitat. The vegetation is black greasewood and saltgrass. Capability units IIIw–24, irrigated, and VIIw–241, nonirrigated; wildlife suitabiilty groups NV 27–2, irrigated, and NV 27–9, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Soda Lake-Rock outcrop complex (SH).—This complex consists of gently sloping to strongly sloping soils in large, circular areas on recent volcanic cones. It is about 60 percent Soda Lake gravelly loamy sand, 2 to 15 percent slopes; 30 percent Rock outcrop; and 10 percent included soils.

The gently sloping to strongly sloping Soda Lake soils are on the sides of the volcanic cones. They have a profile that is essentially the same as that described as representative for the series. They are somewhat excessively drained. The vegetation is shadscale, upland greasewood, and bud sagebrush.

The strongly sloping Rock outcrop is on the peak of volcanic cones.

Included with these soils in mapping are areas of Soda Lake gravelly loamy sand, 0 to 2 percent slopes; Tipperary fine sand, 0 to 4 percent slopes; and Appian clay loam.

This complex is used mainly for recreation and for wildlife habitat. Soda Lake soils in capability unit VIIs–264, nonirrigated; in wildlife suitability group NV 27–9, nonirrigated, and range site NV 27–1 (Desert Lake Bars), not placed in a windbreak suitability group; Rock outcrop in capability unit VIIIs–283, nonirrigated; not placed in a wildlife suitability group, range site, or windbreak suitability group.

Stillwater Series

The Stillwater series consists of very deep, nearly level soils that formed in alluvium. These soils are on slightly concave flood plains and terraces. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,200 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is gray and grayish-brown clay loam and silty clay loam about 15 inches thick. It is underlain by gray and light brownish-gray, plastic silty clay loam and silty clay that extend to a depth of about 60 inches.

Permeability is moderately slow or slow. Runoff is slow, and the hazard of erosion is none to slight. Available water capacity is about 8.5 to 11.5 inches.

Most areas of these soils have been leveled and are irrigated. They are used for alfalfa, small grain, and grass-legume pasture. The vegetation is black greasewood, saltgrass, and four-wing saltbush.

Representative profile of Stillwater clay loam, in a cul-

tivated area, about 125 feet north and 1,067 feet east of the west quarter corner of sec. 4, T. 19 N., R. 31 E., Mount Diablo base line and meridian:

Ap—0 to 5 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; weak, coarse, subangular blocky structure; hard, friable, sticky, and plastic; many very fine roots and few medium roots; many fine pores; noneffervescent; moderately alkaline; abrupt, smooth boundary.

A11—5 to 8 inches, grayish-brown (2.5Y 5/2) silty clay loam, very dark grayish brown (2.5Y 3/2) moist; massive; hard, firm, sticky and plastic; common very fine and fine roots; common very fine pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

A12—8 to 15 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate, fine and medium, subangular blocky structure; slightly hard, friable, sticky and plastic; many very fine roots and common fine and medium roots; few very fine and fine pores; strongly effervescent; strongly alkaline; gradual, smooth boundary.

C1—15 to 24 inches, gray (10YR 5/1) silty clay, very dark gray (10YR 3/1) moist; massive; slightly hard, friable, sticky and plastic; many very fine roots, common fine roots, and few coarse roots; common very fine pores; many fine mollusk shells; strongly effervescent; moderately alkaline; gradual, smooth boundary.

C2—24 to 31 inches, gray (5Y 6/1) silty clay loam, very dark gray (N 3/0) moist; massive; hard, friable, sticky and plastic; many very fine roots and few fine roots; common very fine pores; very strongly effervescent; strongly alkaline; clear, smooth boundary.

C3—31 to 35 inches, light brownish-gray (2.5Y 6/2) silty clay, very dark grayish-brown (2.5Y 3/2) moist; many, medium, prominent, brown (10YR 4/3) mottles, moist; common, very fine, prominent, dark-brown (7.5YR 4/4) mottles, moist, and few, large, distinct, very pale brown (10YR 7/3) mottles, moist; massive; hard, friable, very sticky and very plastic; many very fine roots and few fine roots; common very fine pores; very strongly effervescent; strongly alkaline; clear, smooth boundary.

C4—35 to 60 inches, gray (5Y 6/1) silty clay, very dark grayish brown (2.5Y 3/2) moist; common, fine, distinct, dark-brown (7.5YR 3/2) mottles, moist; few, medium, prominent, black (10YR 2/1) mottles, moist, and few, medium and large, prominent, light brownish-gray (2.5Y 6/2) mottles; moist; massive; hard, friable, sticky and very plastic; many very fine roots; common very fine tubular pores; violently effervescent; strongly alkaline.

The A1 horizon has a hue of 10YR or 2.5Y, a value of 2 or 3 when moist and 4 or 5 when dry, and a chroma of 1 or 2 when moist or dry. It is clay loam or clay.

The C horizon is slightly stratified in some places. These strata are 3 to 4 inches thick and range from sand to clay. The mottles in the horizon are common to many, faint to prominent, and have a hue of 5YR to 10YR, a value of 3 to 5, and a chroma of 2 to 6. The matrix has a hue of 2.5Y or 5Y, a value of 3 or 4, and a chroma of 1 or 2. The C horizon ranges from slightly calcareous to very strongly calcareous.

Stillwater clay loam (Sk).—This soil is in small and medium-sized, rectangular areas on smooth deltas and flood plains. It has the profile described as representative for the series. The drainage has been altered, and the soil is now somewhat poorly drained. A seasonal high water table is at a depth of 3 to 5 feet. Permeability is slow.

Included with this soil in mapping are small areas of Carson and Erber soils.

This soil is used for crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Stillwater clay loam, slightly saline (Sm).—This soil is in small and medium-sized, rectangular areas on smooth flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it is slightly saline-alkali affected. The drainage has been altered, and the soil is now somewhat poorly drained. A seasonal high water table is at a depth of 3 to 5 feet. Permeability is slow.

Included with this soil in mapping are small areas of Bunejug soils.

This soil is used for irrigated pasture plants, grain, and row crops. Capability unit IIw–2, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Stillwater clay loam, strongly saline (Sn).—This soil is in small and medium-sized, irregularly shaped areas on flood plains and low terraces. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected. The drainage has been altered to somewhat poorly drained. A seasonal high water table is at a depth of 3 to 5 feet. Permeability is slow.

Included with this soil in mapping are small areas of Weishaupt and Swope soils and other Stillwater soils.

This soil is suitable for irrigated crops if water is available and the soil is reclaimed. It is used for limited grazing and for wildlife habitat. Most areas have a low density of black greasewood and saltgrass. Capability units IIw–2, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–4, irrigated, and NV 27–7, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Stillwater clay loam, wet (So).—This soil is on slightly concave flood plains, low terraces, and deltas. The profile of this soil is similar to that described as representative for the series, but it is saline-alkali affected. This soil is poorly drained. A seasonal high water table is at a depth of 1½ to 3 feet. Permeability is moderately slow.

Included with this soil in mapping are small areas of Stillwater clay loam, strongly saline, and Swope soils.

This soil is used for grazing and for wildlife food and cover. The vegetation is mainly saltgrass. Capability units IVw–9, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–4, irrigated, and NV 27–7, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Stillwater clay (Sp).—This soil is in small and medium-sized, irregularly shaped areas on smooth alluvial flood plains. The profile of this soil is similar to that described as representative for the series, but it has a surface layer of clay and has strata of silt loam, silty clay loam, and very fine sandy loam below a depth of 30 inches. The drainage has been altered to somewhat poorly drained. A seasonal high water table is at a depth of 3 to 5 feet. Permeability is slow.

Included with this soil in mapping are small areas of Carson soils and Stillwater clay loam, slightly saline.

This soil is used for irrigated crops. Capability unit IIIw–13, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–1; not placed in a range site.

Stumble Series

The Stumble series consists of very deep, nearly level to gently sloping, somewhat exeessively drained soils that formed in sandy alluvium. These soils are on slightly convex alluvial fans. Slopes are 0 to 4 percent. Elevation ranges from 4,200 to 5,400 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the uppermost layer is light brownish-gray loamy sand about 6 inches thick. Below this layer is light brownish-gray very friable loamy sand about 23 inches thick and gravelly loamy sand that extends to a depth of about 60 inches.

Permeability is rapid. Runoff is very slow, and the hazard of erosion is moderate. Available water capacity is about 4.0 to 5.0 inches.

These soils are used for grazing and for wildlife habitat. They are suitable for irrigated crops if water is available. The vegetation is Indian ricegrass, dalea, and horsebrush and some ephedra, upland greasewood, and saltbush.

Representative profile of Stumble loamy sand, 0 to 4 percent slopes, in an area of Bango-Stumble association in native vegetation, about 1,300 feet north and 1,350 feet east of the southwest corner of sec. 12, T. 18 N., R. 31 E., Mount Diablo base line and meridian:

C1—0 to 6 inches, light brownish-gray (10YR 6/2) loamy sand, dark gray (10YR 4/1) moist; single grain; loose; common fine and medium roots; many fine interstitial pores; noneffervescent; moderately alkaline; clear, smooth boundary.

C2ca—6 to 29 inches, light brownish-gray (10YR 6/2) loamy sand, dark brown (10YR 4/3) moist; massive; soft, very friable; common fine and medium roots; few fine pores; strongly effervescent; moderately alkaline; gradual, wavy boundary.

C3—29 to 60 inches, light brownish-gray (10YR 6/2) gravelly loamy sand, dark brown (10YR 4/3) moist; massive; soft, very friable, few fine roots; few fine pores; slightly effervescent; moderately alkaline.

The chroma is 2 or 3 when dry and 1 to 3 when moist throughout the profile. Depth to noncalcareous sediment ranges from 6 to 15 inches. The profile ranges from loamy sand to loamy fine sand, but it is gravelly in places. Reaction is mildly alkaline to moderately alkaline.

In this county Stumble soils are mapped only in an association with the Bango soils.

Swingler Series

The Swingler series consists of very deep, nearly level to gently sloping, moderately well drained soils that formed in silty lacustrine sediment. These soils are on slightly concave to slightly convex terraces. Slopes are 0 to 4 percent. Elevation ranges from 3,900 to 4,200 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

A representative profile has a layer of light brownish-gray sandy loam about 19 inches thick over light-gray silt loam which extends to a depth of about 60 inches.

Permeability is moderately slow. Runoff is slow, and the hazard of erosion is none to slight. Available water capacity is about 6.0 to 8.0 inches.

Most areas of these soils have been cleared and leveled and are irrigated. They are used for alfalfa, small grain, and legume-grass pasture. The native vegetation is black greasewood, bud sagebrush, and shadscale.

Representative profile of Swingler sandy loam, in a cultivated area, about 1,300 feet west and 20 feet north of the east quarter corner of sec. 20, T. 20 N., R. 25 E., Mount Diablo base line and meridian:

Ap—0 to 6 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and medium roots; many fine and medium tubular pores; slightly effervescent; mildly alkaline; clear, smooth boundary.

C1—6 to 19 inches, light brownish-gray (10YR 6/2) sandy loam, dark grayish brown (10YR 4/2) moist; massive; slightly hard, very friable, nonsticky and nonplastic; many fine and medium roots; many fine and medium tubular pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

IIC2—19 to 29 inches, light-gray (2.5Y 7/2) silt loam, dark grayish brown (2.5Y 4/2) moist; many, coarse and medium, prominent, yellowish-red (5YR 4/6) mottles moist; strong, medium and fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine roots; common fine tubular pores; slightly effervescent; moderately alkaline; clear, smooth boundary.

IIC3—29 to 60 inches, light-gray (10YR 7/2) silt loam, olive gray (5Y 5/2) moist; many, coarse, prominent, yellowish-red (5YR 4/6) mottles moist; strong, coarse, angular and subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few fine roots; few fine tubular pores; mildly alkaline.

The Ap and C1 horizons have a hue of 10YR or 2.5Y, a value of 4 or 5 when moist and 6 or 7 when dry, and a chroma of 2 or 3. The Ap horizon is sand, sandy loam, or clay loam.

The IIC2 horizon has a hue of 2.5Y or 5Y, a value of 4 or 5 when moist and 6 or 7 when dry, and a chroma of 1 or 2. Mottles in the IIC2 and IIC3 horizons are common to many, medium to coarse, distinct to prominent and are 5YR or 7.5YR in hue, 4 or 5 in value, and 4 to 6 in chroma when moist or dry.

The highly stratified profile is silt loam, fine sandy loam and very fine sandy loam, and light silty clay loam. Strata that range from fine sand to silty clay are below a depth of 40 inches in places.

Swingler sand (Sr).—This soil is in small, medium-sized, and large, irregularly shaped areas on lower edges of convex alluvial terraces. The profile of this soil is similar to that described as representative for the series, but it has a surface layer of sand that is about 10 inches thick. A seasonal high water table is at a depth of about 5 to 6 feet.

Included with this soil in mapping are small areas of Patna soils.

This soil is used mostly for range and for wildlife habitat. It is used for irrigated crops where water is available. The dominant vegetation is black greasewood and shadscale. Capability units IIIw–9, irrigated, and VIIs–264, nonirrigated; wildlife suitability group NV 27–2, irrigated, and NV 27–9, nonirrigated; range site NV 27–4 (Desert Alkali Flats); windbreak suitability group NV 27–4.

Swingler sandy loam (Ss).—This soil is in small and medium-sized, rectangular areas on terraces and alluvial fans. This soil has the profile described as representative for the series. Depth to dense silty lacustrine sediment is 2 to 4 feet. The seasonal high water table is at a depth of about 5 to 6 feet, but excessive irrigation creates a water table above the lacustrine sediment.

Included with this soil in mapping are small areas of Juva soils and other Swingler soils.

This soil is used for irrigated crops. Capability unit IIw–8, irrigated; wildlife suitability group NV 27–1, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Swingler clay loam (St).—This soil is in small and medium-sized, rectangular areas on slightly convex terraces. The profile of this soil is similar to that described for the series, but it has a surface layer of clay loam that is about 12 inches thick. Depth to dense silty lacustrine sediment is 2 to 4 feet. A seasonal high water table is at a depth of about 5 to 6 feet, but excessive irrigation creates a temporary water table above this depth.

Included with this soil in mapping are small areas of other Swingler soils.

This soil is used for irrigated crops. Capability unit IIw–8, irrigated; wildlife suitability group NV 27–1, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Swingler clay loam, slightly saline (Su).—This soil is in small and medium-sized, rectangular areas on slightly convex recent terraces. The profile of this soil is similar to that described as representative for the series, but it has a surface layer of clay loam that is about 12 inches thick, and it is slightly saline-alkali affected. The drainage has been altered. The water table fluctuates between depths of 3 and 5 feet, mainly because of seepage from the Truckee Canal.

Included with this soil in mapping are small areas of other Swingler soils.

This soil is used for irrigated crops that can tolerate slight amounts of salt and alkali. It is also used for limited grazing. Capability unit IIIw–9, irrigated; wildlife suitability group NV 27–1, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Swingler clay loam, strongly saline (Sv).—This soil is in small and medium-sized, irregularly shaped areas on terraces. The profile of this soil is similar to that described as representative for the series, but it has a surface layer of clay loam about 12 inches thick, and it is strongly saline-alkali affected. The drainage has been altered. A water table fluctuates between depths of 3 and 5 feet, mainly because of seepage from the Truckee Canal.

Included with this soil in mapping are small areas of Swingler clay loam, slightly saline; Swingler sandy loam; and Swingler clay loam.

This soil is used for limited grazing. It is suitable for irrigated crops if water is available. The vegetation is mainly black greasewood. Capability units IVw–9, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Swope Series

The Swope series consists of very deep, nearly level, somewhat poorly drained soils that formed in loamy alluvium over sandy alluvium on flood plains. These soils formed under poorly drained conditions, but the diversion of water has altered the drainage. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is gray clay loam about 7 inches thick over gray, firm, sticky, and plastic silty clay loam about 13 inches thick. It is underlain by light brownish-gray firm, sticky and plastic silty clay loam about 7 inches thick and light brownish-gray, stratified sand and coarse sand that extend to a depth of 60 inches.

Permeability is moderately slow in the upper part of the profile and rapid to very rapid in the substratum. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is about 6.0 to 8.5 inches.

Most areas of these soils have been cleared and leveled and are irrigated. They are used for alfalfa, small grain, and legume-grass pastures. The vegetation is greasewood and saltgrass.

Representative profile of Swope clay loam, in a cultivated area, about the center of sec. 7, T. 17 N., R. 29 E., Mount Diablo base line and meridian:

Ap—0 to 7 inches, gray (10YR 5/1) clay loam, dark gray (10YR 3/1) moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; many fine and very fine roots and common medium and coarse roots; common fine tubular pores and common very fine interstitial pores; noneffervescent; moderately alkaline; clear, smooth boundary.

A11—7 to 15 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine tubular and interstitial pores; slightly effervescent; moderately alkaline; clear, smooth boundary.

A12—15 to 20 inches, gray (10YR 5/1) silty clay loam, very dark gray (10YR 3/1) moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; common fine and very fine tubular and interstitial pores; slightly effervescent; moderately alkaline; clear, smooth boundary.

C1—20 to 27 inches, light brownish-gray (2.5Y 6/2) silty clay loam, dark grayish brown (2.5Y 4/2) moist; common, medium, prominent, dark-brown (7.5Y 4/4) mottles moist; massive; hard, firm, sticky and plastic; few very fine roots; few very fine tubular pores; slightly effervescent; moderately alkaline; abrupt, smooth boundary.

IIC2—27 to 60 inches, light brownish-gray (10YR 6/2) stratified sand and coarse sand, dark grayish brown (10YR 4/2) moist; common, medium, prominent, dark-brown (7.5YR 4/4) mottles, moist; single grain; loose; very few very fine roots; many fine interstitial pores; mildly alkaline.

The A1 horizon has a hue of 10YR or 2.5Y, a value of 4 or 5 when dry and 2 or 3 when moist, and a chroma of 1 or 2. Structure ranges from weak or moderate, fine to coarse, subangular blocky.

The C1 horizon has a hue of 10YR or 2.5Y, a value of 3 or 4 when moist, and a chroma of 1 or 2. The upper part of the profile is dominantly silty clay loam or clay loam, but thin strata of finer or coarser textured material are common.

The IIC horizon has a hue of 10YR, 2.5Y, or 5Y, a value of 6 to 8 when dry and 4 or 5 when moist, and a chroma of 1 or 2. Mottles that have reddish or yellowish hue or high or low chroma are common to many and fine to very coarse. The IIC horizon is dominantly sand or coarse sand but has strata of very coarse sand or fine gravel in places. Any of these materials can contain as much as 25 percent gravel that is one-half inch in diameter.

Swope sandy loam (Sw).—This soil is in very small and small, irregulary shaped areas on smooth flood plains,

low terraces, and deltas. The profile of this soil is similar to that described as representative for the series, but it has a surface layer of sandy loam 4 to 10 inches thick and is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Stillwater, Carson, and Erber soils and other Swope soils.

This soil is used mainly for grazing and for wildlife habitat. It is suitable for irrigated crops if water is available and the soil is reclaimed. Most areas have a low density of plant cover of black greasewood, saltgrass, and annual weeds. Capability units IIw–2, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated; windbreak suitability group NV 27–4; not placed in a range site.

Swope clay loam (Sx).—This soil is in small and medium-sized, rectangular areas on smooth flood plains and terraces that are dissected in places by sand channels. It has the profile described as representative for the series. A seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of Bunejug, Erber, Fernley, Carson, and Stillwater soils.

This soil is used for irrigated crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–1, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Swope clay loam, slightly saline (Sy).—This soil is in small and medium-sized, rectangular areas on smooth flood plains, deltas, and terraces. It is dissected by sand channels in places. The profile of this soil is similar to that described as representative for the series, but it is slightly saline-alkali affected. A seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of Fernley and Carson soils and other Swope soils.

This soil is used for irrigated crops. Capability unit IIw–1, irrigated; wildlife suitability group NV 27–1, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Swope clay loam, strongly saline (Sz).—This soil is in very small and small, irregularly shaped areas on smooth flood plains, low terraces, and deltas. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Stillwater, Carson, and Erber soils and other Swope soils.

This soil is suitable for irrigated crops if water is available and the soil is reclaimed. It is used for grazing and for wildlife habitat. Most areas have a low density of plant cover of black greasewood, saltgrass, and annual weeds. Capability units IIw–2, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–1, irrigated, and NV 27–8, nonirrigated; windbreak suitability group 27–4; not placed in a range site.

Tipperary Series

The Tipperary series consists of nearly level to gently rolling and rolling, very deep, excessively drained soils that formed in sandy alluvium and aeolian deposits derived from mixed rocks. These soils are on smooth, high terraces and partly stabilized sand dunes. Slopes are 0 to 15 percent. Elevation ranges from 3,800 to 5,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is light-gray and light brownish-gray sand about 7 inches thick. It is underlain by light brownish-gray and light-gray fine sand that extends to a depth of about 60 inches.

Permeability is very rapid. Runoff is very slow, and the hazard of erosion is high. Available water capacity is 3.0 to 4.5 inches.

These soils have limited suitability for irrigated crops, even if water is available. They are used mainly for livestock grazing and wildlife habitat. Some small areas are used for irrigated crops. Other small areas are used as a source of sand. The vegetation dominantly is Indian ricegrass, dalea, winterfat, and horsebrush.

Representative profile of Tipperary sand, 0 to 2 percent slopes, in native vegetation, about 420 feet north and 210 feet west of the southeast corner of sec. 18, T. 19 N., R. 27 E., Mount Diablo base line and meridian:

A11—0 to 2 inches, light-gray (10YR 7/2) sand, grayish brown (10YR 5/2) moist; single grain; loose; common very fine and fine roots; many very fine and fine interstitial pores; mildly alkaline; abrupt, wavy boundary.

A12—2 to 7 inches, light brownish-gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft; common very fine and fine roots; many very fine and fine interstitial pores; moderately alkaline; gradual, smooth boundary.

C1—7 to 16 inches, light brownish-gray (10YR 6/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft; few very fine and fine roots; many very fine and fine interstitial pores; slightly effervescent; moderately alkaline; clear, smooth boundary.

C2ca—16 to 28 inches, light-gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft; few very fine and fine roots; many very fine and fine interstitial pores; slightly effervescent; moderately alkaline; clear, smooth boundary.

C3ca—28 to 40 inches, light-gray (10YR 7/2) fine sand, grayish brown (10YR 5/2) moist; massive; soft; few very fine and fine roots and few medium and coarse roots; many very fine and fine interstitial pores; strongly effervescent; strongly alkaline; clear, smooth boundary.

C4ca—40 to 48 inches, light-gray (10YR 7/1) fine sand, gray (10YR 6/1) moist; single grain; loose; few very fine and fine roots and very few medium and coarse roots; many very fine and fine interstitial pores; slightly effervescent; strongly alkaline; clear, smooth boundary.

IIC5—48 to 62 inches, light-gray (10YR 7/1) fine sand, gray (10YR 6/1) moist; single grain; loose; many very fine and fine interstitial pores; few, coarse, relict mottles; slightly effervescent; strongly alkaline.

The entire profile has a hue of 10YR or 2.5Y, a value of 6 or 7 when dry and 4 or 5 when moist, and a chroma of 2 or 3. It is sand or fine sand and is single grain or massive. Reaction ranges from mildly alkaline to strongly alkaline, and alkalinity increases with depth. Silty lake sediment is between depths of 40 inches and 10 feet in some places.

Tipperary sand, 0 to 2 percent slopes (TnA).—This soil is on terraces of ancient Lake Lahontan. It is in small irrigated areas and medium-sized and large, irregularly shaped, nonirrigated areas. This soil has the profile described as representative for the series.

Included with this soil in mapping are small areas of Bango and Swingler soils.

This soil has limited suitability for irrigated crops if water is available. Most of the soil is used for grazing and for wildlife habitat. The vegetation is Indian ricegrass, dalea, winterfat, and horsebrush. Capability units IVs–22, irrigated, and VIIs–264, nonirrigated; wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; range site NV 27–2 (Desert Sands); windbreak suitability group NV 27–5.

Tipperary sand, 2 to 8 percent slopes (TnC).—This undulating to gently rolling soil is in irregularly shaped, medium-sized, large, and very large areas. It is on convex to concave sandy alluvial terraces that overlie silty lacustrine sediment of ancient Lake Lahontan.

Included with this soil in mapping are small areas of Patna and Swingler soils and other Tipperary soils.

This soil has limited suitability for irrigated crops if water is available. Most of this soil is used for grazing and for wildlife habitat. Some small areas are used for irrigated crops. Capability units IVs–22, irrigated, and VIIs–264, nonirrigated; wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; range site NV 27–2 (Desert Sands); windbreak suitability group NV 27–5.

Tipperary fine sand, 0 to 4 percent slopes (TPB).—This nearly level to undulating soil is in very small and small irrigated areas and medium-sized and large nonirrigated areas. It is on partly stabilized sand dunes on flood plains and terraces. This soil has a profile similar to the one described as representative for the series, but it is fine sand throughout.

Included with this soil in mapping are areas of Appian soils, other Tipperary soils, and Playas.

Most areas of this soil are used for range and for wildlife habitat. Because this soil has very rapid permeability and low available water capacity, its suitability for leveling and irrigation is limited. The vegetation consists of black greasewood, dalea, shadscale, and Indian ricegrass. Capability units IVs–22, irrigated, and VIIs–264, nonirrigated; wildlife suitability groups NV 27–2, irrigated, and NV 27–9, nonirrigated; range site NV 27–5 (Desert Dunes); windbreak suitability group NV 27–5.

Tipperary fine sand, 4 to 15 percent slopes (TPD).—This undulating to rolling soil is in very small and small, long and narrow irrigated areas and in large and very large nonirrigated areas. It is on convex, partly stabilized dunes. The profile of this soil is similar to that described as representative for the Tipperary series, except that it is fine sand throughout.

Included with this soil in mapping are areas of Parren, Appian, and Lahontan soils and other Tipperary soils.

Most of this soil is used for grazing and for wildlife habitat. The vegetation consists of black greasewood, dalea, shadscale, and Indian ricegrass. Capability unit VIIs–264, nonirrigated; wildlife suitability group NV 27–9, nonirrigated; range site NV 27–5 (Desert Dunes).

Tipperary-Appian complex (TR).—This complex is in large and very large bands. It is about 40 percent Tipperary fine sand, 4 to 15 percent slopes; 20 percent Tipperary fine sand, 0 to 4 percent slopes; 20 percent Appian sandy loam; and 20 percent included soils.

The Tipperary soils are nearly level to undulating and gently rolling to rolling. They are on stabilized, convex dunes surrounded by areas of Appian soils. These Tipperary soils have a profile similar to the one described as representative for the series, but they are fine sand throughout. The vegetation is black greasewood, horsebrush, dalea, and Indian ricegrass.

The nearly level, low-lying Appian soils are on low lake terraces. The vegetation is shadscale, bud sagebrush, and upland greasewood. These soils have a profile similar to that described as representative of the Appian series.

Included with this complex in mapping are small areas of Parran and Appian soils and of Playas.

The soils in this complex are used for limited grazing and for wildlife habitat. Capability unit VIIs–264, nonirrigated, and wildlife suitability group NV 27–9, nonirrigated; Tipperary soils in range site NV 27–5 (Desert Dunes); Appian soils in range site NV 27–1 (Desert Lake Bars).

Tipperary-Appian clay substratum, complex (TS).—This complex is in large and very large bands. It is about 40 percent Tipperary fine sand, 4 to 15 percent slopes; 20 percent Appian clay loam, clay substratum; 20 percent Appian fine sand, clay substratum; and 20 percent included soils.

The Tipperary soils are gently rolling to rolling and are on stabilized, convex dunes surrounded by areas of Appian soils. They have a profile similar to the one described as representative for the Tipperary series, but they are fine sand throughout. The vegetation is black greasewood, dalea, horsebrush, and Indian ricegrass.

The Appian soils are nearly level and are on convex lake terraces. Appian fine sand is in areas of wind-deposited material, and Appian clay loam is in wind-swept areas. The profile of Appian fine sand is similar to that described as representative for the Appian series, but it has a fine sand surface layer ½ inch to 4 inches thick and is underlain by dense clay at depths between 40 and 60 inches. The profile of Appian clay loam is similar to that described as representative for the Appian series, but it has a clay loam surface layer 2 to 6 inches thick and is underlain by dense clay between depths of 40 and 60 inches. A seasonal high water table is at a depth of about 5 feet. The vegetation is black greasewood, shadscale, and seepweed.

Included with this complex in mapping are scattered stabilized dunes and hummocks of Tipperary fine sand, 0 to 4 percent slopes, and scattered, depressional areas of Parran silty clay and Playas.

The soils in this complex are used for limited grazing and for wildlife habitat. Both soils in capability unit VIIs–264, nonirrigated, and wildlife suitability group NV 27–9, nonirrigated; Tipperary soils in range site NV 27–5 (Desert Dunes); Appian soils in range site NV 27–4 (Desert Alkali Flats).

Tipperary-Lahontan complex (TU).—This complex consists of nearly level and gently rolling to rolling soils. It is in medium and large bands on partly stabilized sand dunes on lake terraces and in basins. It is about 40 percent Tipperary fine sand, 4 to 15 percent slopes; 40 percent Lahontan clay, strongly saline; and 20 percent included soils.

The Tipperary soils are gently rolling to rolling and are on partly stabilized, convex dunes. They have a profile similar to the one described as representative for the

Tipperary series, but they are fine sand throughout. The dominant vegetation is black greasewood and shadscale.

The nearly level Lahontan soils are on low-lying lake terraces. They have a profile similar to the one described as representative for the Lahontan series, but they are strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet. The dominant vegetation is black greasewood.

Included with this complex in mapping are areas of Tipperary fine sand, 0 to 4 percent slopes; Parran silty clay; and Lahontan clay, slightly saline.

The soils in this complex are used mainly for grazing and for wildlife habitat. Capability unit VIIs–264, nonirrigated; Tipperary soils in wildlife suitability group NV 27–9, nonirrigated, and range site NV 27–5 (Desert Dunes); Lahontan soils in wildlife suitability group NV 27–7, nonirrigated, and NV 27–5, irrigated; range site NV 27–4 (Desert Alkali Flats).

Tipperary-Parran complex (TV).—This complex consists of nearly level to gently rolling and rolling soils. It is in large and very large bands on stabilized, convex dunes; on low-lying, concave and convex terraces; and in basins. It is about 40 percent Tipperary fine sand, 4 to 15 percent slopes; 20 percent Parran silty clay; 20 percent Appian fine sand; and 20 percent included soils.

The Tipperary soils are gently rolling to rolling and are on stabilized, convex dunes in areas of Parran and Appian soils. They have a profile similar to the one described as representative for the Tipperary series, but they are fine sand throughout. The vegetation is black greasewood, horsebrush, and dalea.

The nearly level Parran soils are on concave, low lake terraces and in basins adjacent to the Appian soils. They can be recognized by a salt crust on the surface and the fine texture. A seasonal high water table is at a depth of 3 to 5 feet. The dominant vegetation is black greasewood. These soils have a profile similar to that described as representative of the Parran series.

The nearly level Appian soils are on convex, low-lying lake terraces. The Appian soils have a profile similar to the one described as representative for the Appian series, but they have a surface layer of fine sand about ½ inch to 4 inches thick and are underlain by dense clay at a depth between 40 and 60 inches. A seasonal high water table is at a depth of about 5 feet. The vegetation is black greasewood, shadscale, and seepweed.

Included with this complex in mapping are randomly scattered, small areas of Appian sandy loam; Tipperary fine sand, 0 to 4 percent slopes; and Playas.

The soils in this complex are used for limited grazing and for wildlife habitat. Capability unit VIIs–264, nonirrigated; Tipperary soils in wildlife suitability group NV 27–9, nonirrigated, and range site NV 27–5 (Desert Dunes); Parran soils in wildlife suitability group NV 27–7, nonirrigated, and range site NV 27–4 (Desert Alkali Flats); Appian soils in wildlife suitability group NV 27–9, nonirrigated, and range site NV 27–4 (Desert Alkali Flats).

Weishaupt Series

The Weishaupt series consists of very deep, nearly level, somewhat poorly drained soils that formed in clayey sediment. These soils are on smooth flood plains and low terraces. Slopes are 0 to 2 percent. Elevation ranges from 3,800 to 4,000 feet. The average annual precipitation is 4 to 6 inches, the average annual air temperature is 51° to 55° F., and the frost-free season is about 130 days.

In a representative profile the surface layer is gray clay loam about 11 inches thick. Below this layer is grayish-brown, friable, very stick and very plastic clay loam about 4 inches thick and friable, sticky and very plastic sandy clay loam about 8 inches thick. The next layer is gray, firm, very sticky and very plastic clay that extends to a depth of about 56 inches.

Permeability is very slow. Runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is about 9.0 to 10.5 inches.

These soils are suitable for alfalfa, pasture plants, and small grain if irrigation water is available. The vegetation is black greasewood and saltgrass.

Representative profile of Weishaupt clay loam, slightly saline, in a cultivated area, about 1,400 feet west and 1,300 feet south of the east quarter corner of sec. 6, T. 19 N., R. 31 N., Mount Diablo base line and meridian:

Ap—0 to 5 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; weak, medium and fine, granular structure; hard, friable, very sticky and very plastic; many very fine, fine, and medium roots; many fine and very fine tubular pores; effervescent; moderately alkaline; abrupt, wavy boundary.

A11—5 to 11 inches, gray (10YR 5/1) clay loam, very dark gray (10YR 3/1) moist; moderate, medium and fine, granular structure; hard, friable, very sticky and very plastic; many very fine, fine and medium roots; many fine and very fine tubular pores; few worm casts; effervescent; strongly alkaline; clear, smooth boundary.

A12—11 to 15 inches, grayish-brown (10YR 5/2) clay loam, very dark grayish brown (10YR 3/2) moist; few pockets of fine sandy loam, dark gray (2.5Y 4/1) moist; few, coarse, distinct, black (10YR 2/1) stains moist; weak, medium and fine, granular structure; slightly hard, friable, very sticky and very plastic; many very fine and fine roots; many fine and very fine tubular pores; common worm casts; strongly effervescent; few, medium, distinct, light-gray (2.5Y 7/2) lime segregations; strongly alkaline; abrupt, wavy boundary.

A13—15 to 23 inches, grayish-brown (2.5Y 5/2) sandy clay loam, very dark grayish brown (2.5Y 3/2) moist; weak, medium and fine, granular structure; slightly hard, friable, sticky and very plastic; many very fine and fine roots; many fine tubular pores; strongly effervescent; few, fine, distinct, white (10YR 8/2) lime segregations; moderately alkaline; clear, wavy boundary.

IIA11bg—23 to 31 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; many, fine, distinct, dark-brown (7.5YR 3/2) mottles moist; moderate, coarse, angular and subangular blocky structure; hard, firm, very sticky and very plastic; common very fine roots; very few fine tubular pores; many, medium, prominent, white (10YR 8/1) salt and gypsum segregations along root channels and on surfaces of peds; noneffervescent; moderately alkaline; clear, wavy boundary.

IIA12bg—31 to 39 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; many, fine, prominent, dark reddish-brown (5YR 3/3) mottles moist; moderate, fine, subangular blocky structure; hard, firm, very sticky and very plastic; few very fine roots; very few very fine tubular pores; few, medium, prominent, white (10YR 8/2) salt and gypsum segregations; moderately alkaline; clear, wavy boundary.

IICg—39 to 56 inches, gray (5Y 5/1) clay, very dark gray (5Y 3/1) moist; many, coarse, distinct stains on surface of peds, very dark grayish-brown (10YR 3/2)

moist; many, medium, prominent, dark reddish-brown (5YR 3/3) mottles, moist; moderate, medium, and fine subangular blocky structure; hard, firm, very sticky, very plastic; very few fine tubular pores; few, medium, prominent, white (10YR 8/2) gypsum and salt segregations; noneffervescent; moderately alkaline.

The A horizon has a hue of 10YR, 2.5Y, or 5Y, a value of 3 to 5 when dry and 2 or 3 when moist, and a chroma of 0 to 2. The yellower hue occurs only in the lower part of the horizon. The upper part of the profile is dominantly clay loam, silty clay loam, or sandy clay loam that has a high content of very fine sand. The average content of clay is 25 to 35 percent. Structure is weak or moderate; coarse, medium, or fine, granular; subangular blocky, angular blocky, or prismatic. A distinct salt and exchangeable sodium bulge occurs immediately above or at the top of the clay in most cultivated areas. The content of salt and exchangeable sodium is highest at the surface in uncultivated areas. Depth to clay ranges from 16 to 34 inches.

The IIAb and IIC horizons have a hue of 2.5Y or 5Y, or are neutral, a value of 4 or 5 when dry, and a chroma of 0 to 2. These horizons are dominantly clay, but they contain some silty clay in places.

Weishaupt clay loam (Wc).—This soil is in very small, small, and medium-sized, irregularly shaped areas on smooth flood plains and terraces. The profile of this soil is similar to that described as representative for the series, but it is salt and alkali free in the surface layer. A seasonal high water table is at a depth of about 3 to 5 feet.

Included with this soil in mapping are small areas of Carson soils and other Weishaupt soils.

This soil is used for irrigated crops. Capability unit IIIw–9, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Weishaupt clay loam, slightly saline (We).—This soil is in very small, small, and medium-sized, irregularly shaped areas on smooth flood plains and terraces. It has the profile described as representative for the series. It is slightly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Carson soils and other Weishaupt soils.

This soil is used for crops. Capability unit IIIw–9, irrigated; wildlife suitability group NV 27–4, irrigated; windbreak suitability group NV 27–3; not placed in a range site.

Weishaupt clay loam, strongly saline (Wh).—This soil is in small areas in field corners and in medum-sized and large, irregularly shaped areas on smooth flood plains and terraces. The profile of this soil is similar to that described as representative for the series, but it is strongly saline-alkali affected. A seasonal high water table is at a depth of 3 to 5 feet.

Included with this soil in mapping are small areas of Carson and Stillwater soils and other Weishaupt soils.

This soil is suitable for irrigated crops if water is available and the soil is reclaimed. It is used for grazing and for wildlife habitat. Most areas have a low-density plant cover of black greasewood, saltgrass, and annual weeds. Capability units VIw–13, irrigated, and VIIw–241, nonirrigated; wildlife suitability groups NV 27–4, irrigated, and NV 27–7, nonirrigated; windbreak suitability group NV 27–2; not placed in a range site.

Use and Management of the Soils

This section first discusses the use and management of the soils for crops. Next, it describes the system of capability classification and the management of the soils by capability units. Then, it discusses the use and management of the soils for range, wildlife, and windbreaks. Finally, it describes the use of the soils for engineering works. Placement of soils in interpretive groups can be found by referring to the "Guide to Mapping Units" at the back of the survey.

Use of the Soils for Crops

The aim of good land use is to produce the greatest amount of the most needed crops, while protecting and improving the soil. To achieve this aim, the land must be protected according to its needs and used within its capabilities. This can be done by using plants that are well suited to the soil, applying soil management practices that protect the soil, and keeping the soil in good physical condition.

In the following paragraphs the principal soil management practices needed in the survey area are generally described. Although the soils in the survey area differ in management needs, certain practices apply to all the soils that are cultivated.

Conservation cropping systems.—A conservation cropping system is the growing of crops in combination with needed cultural and management measures. If soil-improving crops and practices more than offset the soil-depleting crops and deteriorating practices, then it is a good conservation cropping system.

Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes, the return of crop residue to the soil, proper tillage, adequate fertilization, weed and pest-control measures, and other good management practices.

Several cropping systems are used in the survey area. A typical one is alfalfa grown for about 6 to 8 years, followed by small grain or field corn for 2 years, and then back to alfalfa with a protective nurse crop of oats. The crop residue of the small grain or field corn is returned to the soil, and tillage is reduced to only operations that are necessary.

Crop residue management.—Crop residue management is the use of plant residue left in cultivated fields and is needed on all soils in the survey area. It is done by incorporating the residue into the soil or leaving it on the surface during that part of the year when erosion is likely to occur. Plant residue adds organic matter. A major benefit of organic matter in the soil is its influence on the development and stabilization of good soil structure and its relationship to the general physical environment of the soil, which influences crop growth. Organic matter functions mainly as it decomposes. The application of nitrogen fertilizer to the soil aids in this process.

It is particularly important that organic matter be continuously returned to the soil. The easiest and most common way to add organic matter to the soil is to return plant residue produced by a crop. Unless sufficient crop residue is reurned to the soil, the physical condition of the soil declines, soil compaction starts, and slower water infiltration and poorer aeration result.

Erosion control.—Erosion control prevents the excessive wearing away of the land surface by wind, running water, and other geological agents.. The protection of the surface layer is important, because it contains most of the organic matter and generally is more fertile than the subsoil. Erosion can be controlled by using cover crops to protect the surface during windy or stormy periods of the year; by leveling in spring and then seeding right away; by leveling to the proper grade and applying water at the proper rate. In this survey area, soil blowing is a particular concern on such sandy soils as those in the Tipperary, Sagouspe, and Soda Lake series.

Addition of plant nutrients.—Most of the irrigated soils used for crops in this survey area respond well to liquid or solid fertilizer. The specific fertilizer needed depends on the kind of crop grown and the nutrient level in the soil. Applying a combination fertilizer that contains nitrogen and phosphate increases production of small grain and aids in establishing alfalfa. Thereafter, alfalfa benefits from phosphate applied every 2 years for the life of the stand, except where the soil contains enough available phosphorous. Truck crops need a combination fertilizer in two applications, the first applied at planting time and the second applied as topdressing before thinning or before the second irrigation.

Barnyard manure adds some nitrogen, phosphate, and potassium to the soil and promotes good tilth. If barnyard manure is available, it can be used with good results before planting corn or small grain.

Irrigation water management.—Irrigation water management concerns regulation of applications of irrigation water at rates and amounts that will insure high crop production and minimum soil and water losses. It is needed in all irrigated areas. Good irrigation means applying water according to the crop needs and at rates and in amounts consistent with the characteristics of the soil.

Efficient delivery of water to farms is the first step in supplying the moisture needed by growing crops. A good distribution system is one that has enough capacity to meet the needs of the crops irrigated, that is so located and controlled that seepage losses are negligible, and that carries the required flow safely.

Next, the water must be delivered from the distribution system to the individual fields. An efficient system for transporting water on a farm or a ranch is so designed and constructed that it carries the required flow without excessive seepage and without causing erosion. Control structures are needed to facilitate the handling of water.

The design of an irrigation system is governed by the method of irrigation to be used, the amount of land leveling needed, and the expected efficiency in applying water. In this survey area two methods of irrigation are commonly used: border and furrow. Border irrigation, the most commonly used method, consists of applying water to strips of varying width that are separated by low dikes or border ridges. It is suitable on fields in close-growing crops. It can be effectively used on all soils that can be leveled and have a basic water-intake rate of not more than 3 inches per hour. Furrow irrigation consists of applying water down-slope in small trenches, 2 to 12 inches deep. The length and the spacing of furrows depend on soil texture and the kind of crop. Furrow irrigation is suitable on fields in row crops. It can be used on all soils except those that have a high intake rate and poor lateral movement of water.

If the water is to be applied efficiently, a farmer needs to know the capacity of the soil to hold water that plants can use, the rate that water enters and moves through the soil, and the amount of water required by the crop. Most crops should be irrigated when 40 to 50 percent of the available moisture has been depleted from the top half of the root zone of the plant. Forty-eight hours after irrigation, a soil check can be made to determine whether the desired moisture was added.

Drainage.—One of the major concerns in the Fallon-Fernley Area is drainage. A fluctuating high water table is present in all soils in the survey area that are irrigated or are within the irrigated area, except where drainage has been established. Probably the major factor contributing to the high water table is the seepage and lateral movement of water from the network of major canals that transect the area. This and some excessive irrigation cause the water table to rise during the irrigation periods.

In soils that are inadequately drained, soluble salts and alkali accumulate and retard or prevent the growth of crops. Also, soils that are inadequately drained have poor soil aeration, which reduces growth of plants and increases susceptibility of plants to diseases.

Even soils that are moderately well drained to well drained must have drainage established if they are to be reclaimed and irrigated. The reclamation process requires large amounts of water to leach the salts from the root zone and drains to dispose of drainage water.

Drainage outlets have been established on the major part of the land in the Area. The different patterns of soils are very important in establishing drainage. The Fernley, Pelic, and other soils in sandy channels that meander through the survey area, as well as sand strata in other soils, act as aquifers for the lateral movement of water. Drains can be designed to intercept this water.

Managing saline-alkali soils.—Like most soils in arid and subarid regions, the soils in the Fallon-Fernley Area contain at least small quantities of soluble salts and alkali. Because rainfall is low and evaporation is high, percolating rainfall is insufficient to leach salts out of the root zone. In some soils the salts and alkali are highly concentrated and limit or prevent the growth of crops. In addition, many low-lying areas receive salty water from runoff or seepage. Surface evaporation of such water generally results in a further increase of soluble salts on or in the soils. In some areas that have a high water table, water may rise in the soil by capillary action and carry dissolved salts with it. Soluble salts are readily dissolved in water and can move to any part of the soil profile.

A soil that contains excessive amounts of soluble salts but not alkali is called a saline soil. One that contains excessive absorbed sodium is called an alkali soil. A soil that contains both excess soluble salts and alkali is described as saline-alkali (*12*).

Saline-alkali phases of several of the soils have been mapped. The mapping unit name does not give the degree to which these soils are affected, nor does it indicate it contains both salt and alkali, but this information is given in the mapping unit description. In the Fallon-Fernley

Area, three saline and alkali classes are used as soil phases. These classes are:

1. Soils free of excess salts and alkali contain less than 0.15 percent salts, the conductivity of the saturation extract is less than 4 millimhos per centimeter at 25° C., and the content of exchangeable sodium is less than 15 percent.

2. Slightly saline-alkali soils contain 0.15 to 0.35 percent salts, or the conductivity of the saturation extract is 4 to 8 milimhos per centimeter at 25° C. The content of exchangeable sodium is 15 to 20 percent for moderately coarse, medium, moderately fine, and fine textured soils.

3. Strongly saline-alkali soils contain more than 0.65 percent salts, or the conductivity of the saturation extract is greater than 15 millimhos per centimeter at 25° C. The content of exchangeable sodium is greater than 25 percent for moderately coarse, medium, moderately fine, and fine textured soils.

Although a distinct gap occurs between the second class and the third, an intermediate or moderate class is not needed in this survey area, because a very small percentage of the samples analyzed was moderately saline-alkali.

Some soils mapped as slightly saline-alkali are free of excess salts and alkali in the uppermost 4 or 5 inches, but they contain slight or moderate concentrations just below the plow layer. Several soils mapped as strongly saline-alkali are only slightly affected in the plow layer.

Soils differ in the kinds of salt they contain and in the practices needed for improvement. For this reason, each soil requires individual treatment; however, some general guidelines can be given that should be helpful.

A good supply of irrigation water and adequate drainage must be provided to reclaim any soil in this area. Two methods of applying water are commonly used. One method is to level the areas to flat basins and then pond the water within these basins. The other method requires that the areas be leveled to a uniform grade and then flooded between the border dikes. If drainage is adequate and large amounts of water are used, either method is effective in leaching the soluble salts out of the root zone. If the soils contain an excessive amount of absorbed sodium, the process is more difficult. In addition to draining and leaching, other practices are needed for the improvement of alkali soils.

Chemical amendments used for replacing sodium are gypsum and its various forms, including gypsite, anhydrite, and selenite as well as elemental sulfur, sulfuric acid, iron sulfate, and aluminum sulfate. Any of these amendments can be successfully used, though some are faster to react than others. Cost and availability generally determine the choice. The amount of amendment needed for improving a soil is determined by laboratory analyses of soil samples that indicate the amount of sodium that must be replaced if the soil is to be improved.

Because the amount of soluble salts and alkali can differ within short distances, the sampling shows only the average concentrations in a field. If some alkali spots remain after the first treatment, they can be corrected the following year. An estimate of the amount of amendments needed should not be based on an analysis of the most strongly alkali spots, because the estimate would be two to five times greater than the amount actually needed.

If an amendment other than gypsum or sulfur is desired for use, the relative amount needed can be determined from the following:

Amendment	*Tons equivalent to 1 ton of sulfur*
Sulfur	1.00
Sulfuric acid	3.06
Gypsum ($CaSO_4 \cdot 2H_2O$)	5.38
Iron Sulfate ($FeSO_4 \cdot 7H_2O$)	8.69
Aluminum sulfate ($Al_2SO_4 \cdot 318H_2O$)	6.94

Iron sulfate and aluminum sulfate act quickly, but high cost prohibits their general use.

For efficiency in replacing sodium, most of the soluble salts should be leached before applying chemical amendments. If the soluble salts are removed, more calcium is available for replacing absorbed sodium. For soil improvement, however, the efficient removal of sodium by leaching before amendments are applied may be more than offset by the decrease in soil permeability than generally accompanies the leaching of salts from saline-alkali soils. The resulting permeability, therefore, determines whether amendments should be applied before or after soluble salts are removed. In this survey area, it is advisable to remove part of the salts through leaching and then apply the amendment.

Chemical amendments normally are broadcast and incorporated into the soil by light disking. Sulfur should be thoroughly mixed with the soil to insure rapid oxidation to the sulfate form. Some amendments can be added to the irrigation water. However, gypsum dissolves so slowly that the amount that can be applied in irrigation water is less than the amount needed by the soil.

Except where sulfur is used, saline-alkali soils should be leached immediately after the amendment is applied. Leaching dissolves the amendment and carries it downward, and it also removes the soluble salts that form as the absorbed sodium is replaced by calcium.

Where sulfur is applied, sufficient time should be allowed before leaching so that the sulfur is oxidized and reacts with the lime to form gypsum. The soil must be kept moist, however, because water is needed for the oxidation of sulfur. Consequently, the most favorable season for applying sulfur is fall rather than spring.

An alternative to reclamation through use of large quantities of gypsum is the seeding of salt- and alkali-tolerant grasses. Among the grasses well suited are tall wheatgrass, western wheatgrass, and alta fescue (Gores fescue). These grasses can grow in relatively strong concentrations of both soluble salts and alkali.

In using grass to improve an area, the greatest difficulty is getting a satisfactory stand. High concentrations of salts delay germination and limit the absorption of water. In addition, seeds may not germinate after the first irrigation, or even after the second or third. Seeds that fail to germinate eventually rot.

The second stage in establishing grass is the growth of seedlings upward through the soil. If a saline-alkali soil dries out, it tends to bake and to crust. When the surface is severely crusted, seedlings cannot break through and they die.

Frequent light irrigations can be used to reduce the salt accumulation around the seeds and to prevent crusting. The soil may need irrigating every 3 to 5 days until

the crop has grown to a height of 3 to 5 inches. Applying a small amount of gypsum or sulfur, generally 2 to 4 tons per acre, helps to prevent crusting and allows seedlings to emerge.

Proper pasture management.—Proper pasture management is grazing pasture at a rate that will maintain grasses and legumes of high quality. This objective can be accomplished by adjusting the stocking rates or season of use to favor maximum growth and survival.

A common method of pasture management is to use several pastures with a rotation system that allows adequate regrowth in each. Care should be taken to keep the livestock off the pastures when they are wet. If livestock are allowed to graze when the pastures are wet, the soil is compacted, the intake rate is decreased, and the structure is destroyed. The pastures should have proper irrigation water management, and drainage should be provided. Increased yields can be obtained by applying commercial fertilizers and barnyard manure if it is available. Weeds generally can be controlled by mowing. Droppings of manure can be spread with a drag each spring.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are so used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to horticultural crops or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substitute for interpretations designed to show suitability and limitations of groups of soils for range, for trees, or for engineering.

In the capability system, the kinds of soils are grouped at three levels: the capability class, subclass, and unit. These groups are discussed 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, defined as follows:

Class I soils have few limitations that restrict their use. (None in the Fallon-Fernley Area)

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

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

Class IV soils have very severe limitations that reduce the choice of plants, 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 largely to pasture, range, woodland, or wildlife. (None in the Fallon-Fernley Area.)

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

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife.

Class VIII soils and landforms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife, water supply, or to esthetic purposes.

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 but not in the Fallon-Fernley Area, shows that the chief limitation is climate that is too cold to too dry.

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife, or recreation.

Capability Units are soil groups within the subclasses. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe–1 or IIIw–9. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass.

Management by capability units

The capability classification of the soils in this survey area is based on the assumption that—

1. The production of cultivated crops is not feasible without irrigation.
2. An adequate quantity of high-quality water is available for the soils placed in irrigated classes.
3. The drainage can feasibly be altered to the drainage class given in each capability unit description. For example, Dia loam, wet, is now poorly drained, but it is included with somewhat poorly drained soils in capability unit IIw–2 because it is assumed the drainage can feasibly be improved. In other cases the drainage class may become less favorable with irrigation. It is assumed the presently well-drained Appian soils will develop a

water table caused by excessive water losses in ditches, and they are classified as IVw–24.

4. The salt and alkali content can feasibly be reduced to the level described in the individual capability unit description.
5. Protection against overflow can feasibly be developed for the soils placed in an irrigated capability unit.
6. Stone removal is not feasible unless specifically stated otherwise in the capability unit description.

Most of the soils in the Fallon-Fernley Area have been placed in both an irrigated capability unit and a dryland capability unit. A soil that has not been placed in an irrigated capability unit is not considered suitable for irrigation. If a soil has not been placed in a dryland capability unit, it is because all areas of that soil are irrigated.

Soil complexes have been placed in a single capability unit. The description of the capability unit will not fit each component soil of the complex individually. Therefore, it is very important that the description of the mapping unit for each complex, as well as the capability unit description, be referred to for management decisions.

If a high level of production is to be sustained, all irrigated land must be used according to a conservation cropping system. The actual practices applied in a conservation cropping system are determined by the requirements specified in the capability unit description, the preference of the individual farmer or rancher, and the resources available to the farmer or rancher.

In the following pages each of the capability units in the Fallon-Fernley Area is described, and suggestions for the use and management of the soils in each unit are given. The units are not numbered consecutively, because not all the units in the statewide system are represented in the Area. The names of the soil series represented are mentioned in the description of each unit, but this does not mean that all the soils in a given series are in the unit. The capability classification of each soil is given in the "Guide to Mapping Units."

CAPABILITY UNIT IIe–1, IRRIGATED

This unit consists of very deep, well-drained soils in the Bango and Juva series. These soils have a sandy loam, silt loam, or loamy sand surface layer and a sandy loam or loam subsoil. The substratum is highly stratified very coarse sand to light clay loam. Some of the strata are gravelly. Slopes generally are 2 to 4 percent, but some of the Juva soils have slopes of 0 to 2 percent. Permeability is moderately slow to moderately rapid. Surface runoff is slow, and the hazard of erosion is slight to moderate. Available water capacity is about 5.5 to 9.5 inches. Effective rooting depth is greater than 60 inches. In places the Juva soils are occasionally flooded, but flooding can be controlled. Otherwise, use and management of the Juva soils are similar to those of other soils in this unit.

The soils in this unit are used for irrigated crops, grazing, or wildlife habitat. They are suited to alfalfa, small grain, field corn, irrigated pasture plants, and row crops adapted to the climate of the Area.

Erosion control practices and irrigation water management are needed to maintain sustained production of crops.

Virgin soils that are to be used for irrigated crops require leaching to remove salts. In places gypsum or other soil amendments are also required during and after reclamation to reduce the high content of sodium.

CAPABILITY UNIT IIw–1, IRRIGATED

This unit consists of very deep soils in the Appian, Bango, Bunejug, Dia, Dithod, East Fork, Fallon, Mazuma, Stillwater, and Swope series. These soils have a surface layer, subsurface layer, and subsoil ranging from sandy loam to clay loam. The lower part of the substratum in some places includes layers of sand and clay. Slopes are 0 to 2 percent. Permeability is moderately rapid to slow, runoff is slow, and the hazard of erosion is none to moderate. Available water capacity is 5.5 to 11.5 inches. A fluctuating high water table at depths between about 3 and 5 feet is present during the irrigation period.

The soils in this unit are used for irrigated crops, grazing, and wildlife habitat. Suitable irrigated crops are alfalfa, small grain, irrigated pasture plants, and row crops adapted to the climate of the Area. Keeping the soils drained, reducing the content of toxic salt, and managing irrigation water are essential practices for maintaining sustained production of crops.

The seasonal high water table is a limitation to the use of the soils in this unit. Salinity is a slight limitation to the use of some of the irrigated soils.

Virgin soils that are to be used for irrigated crops require leaching to remove salts. In places gypsum or other soil amendments are needed during and after reclamation to reduce the high content of sodium.

CAPABILITY UNIT IIw–2, IRRIGATED

This unit consists of very deep, somewhat poorly drained soils in the Dia, Dithod, East Fork, Stillwater, and Swope series. These soils have a surface layer of sandy loam to clay loam, a subsoil of sandy loam to silty clay loam, and substrata that range from sand to silty clay. Slopes are 0 to 2 percent. Permeability is moderately rapid to slow, runoff is slow, and the hazard of erosion is none to slight. Available water capacity is about 5.5 to 11.5 inches. A fluctuating high water table occurs between depths of 3 and 5 feet. Dia loam, wet, is a poorly drained soil that can be used and managed similarly to the other soils after drainage.

A small acreage of the soils in this unit is used for irrigated crops, but most of the acreage is used for grazing and for wildlife habitat. Suitable irrigated crops are alfalfa, small grain, field corn, pasture plants, and row crops adapted to the climate of the area.

Keeping the soils drained, reducing the content of toxic salt, and managing irrigation water are essential practices for maintaining sustained production of crops.

Wetness is a limitation to the use of the soils in this unit. Salinity is a slight limitation to the use of some of the irrigated soils.

Virgin soils that are to be used for irrigated crops require leaching to remove salts. In places gypsum or other soil amendments are needed during and after reclamation to reduce the high content of sodium.

CAPABILITY UNIT IIw–8, IRRIGATED

This unit consists of very deep, moderately well drained soils in the Ragtown and Swingler series. These soils have

a surface layer of sandy loam to silty clay loam, a subsurface layer of sandy loam to clay loam, and a substratum of dense silt loam to silty clay substratum. In places thin strata of coarser material are in the substratum. Slopes are 0 to 2 percent. Permeability is moderately slow to very slow, runoff is slow, and the hazard of erosion is none to slight. Available water capacity is 6.0 to 11.0 inches. A seasonal high water table is at a depth of about 5 feet, but in places a temporary perched water table is above the lacustrine material following irrigation.

Most of the soils in this unit are used for irrigated crops. Suitable irrigated crops are alfalfa, small grain, field corn, pasture plants, and sugar beets.

Managing irrigation water and keeping the soils drained are essential practices for maintaining sustained production of crops.

Wetness, slow permeability, and poor aeration in the substratum are limitations to the use of the soils in this unit.

CAPABILITY UNIT IIw-22, IRRIGATED

This unit consists of very deep, somewhat poorly drained soils in the Appian and Sagouspe series. These soils have a surface layer of loamy sand or loamy fine sand, a subsoil of loamy sand and clay loam, and stratified substrata that range from coarse sand to silty clay loam. Slopes are 0 to 2 percent. Permeability is moderately slow, runoff is slow, and the hazard of erosion is slight to moderate. Available water capacity is about 5 to 7 inches, and the seasonal high water table is at a depth of 3 to 5 feet.

Most areas of the soils in this unit are used for irrigated crops, but some areas are used for grazing and for wildlife habitat. Suitable irrigated crops are alfalfa, small grain, field corn, pasture plants, and row crops adapted to the climate of the Area.

Keeping the soils drained and managing water are essential practices for maintaining sustained production of crops.

Wetness, moderately low available water capacity, and coarse texture of the surface layer are limitations to the use of the soils in this unit.

Virgin soils that are to be used for irrigated crops require leaching to remove salts. In places gypsum or other soil amendments are needed during reclamation to reduce the content of sodium.

CAPABILITY UNIT IIIw-9, IRRIGATED

This unit consists of very deep, moderately well drained to somewhat poorly drained soils in the Bango, Ragtown, Swingler, and Weishaupt series. These soils generally have a surface layer of silt loam and clay loam, a subsoil of sandy loam to silty clay loam, and a substratum of silt loam to clay, but the Swingler soil has a surface layer of sand. Slopes are 0 to 2 percent. Permeability in the upper part of the subsoil is moderately rapid to moderately slow, and in the substratum it is moderately slow to very slow. Runoff is slow to very slow, and the hazard of erosion is none to slight. Available water capacity is 6.0 to 11.0 inches. A seasonal high water table is at a depth of about 3 to 5 feet, and a temporary perched water table occurs above the lacustrine material following irrigation.

Some of the soils in this unit are used for irrigated crops and others are used for grazing and for wildlife habitat. Suitable crops are sugar beets, alfalfa, small grain, and corn.

Keeping the soils drained, managing irrigation water, and reducing and controlling the content of toxic salt are essential practices for maintaining sustained production of crops. Chiseling or subsoiling benefits the soils in this unit, especially the Bango soils.

Wetness, a slowly permeable layer or substratum, and salt concentrations in the subsoil and substratum are limitations to the use of the soils in this unit.

CAPABILITY UNIT IIIw-13, IRRIGATED

This unit consists of very deep, somewhat poorly drained soils in the Carcity and Stillwater series. These soils have a surface layer of clay. The subsurface layer and substratum range from sand to clay. Slopes are 0 to 2 percent. Permeability is slow above the substratum and moderately slow to very rapid in the substratum. Runoff is slow to very slow, and the hazard of erosion is none to slight. Available water capacity is 5.5 to 10.0 inches, and a seasonal high water table is at a depth of 3 to 5 feet.

The soils in this unit are used for irrigated crops. Suitable crops are alfalfa, small grain, field corn, pasture plants, and sugar beets.

Wetness is a limitation to the use of the soils in this unit. Salinity is a slight limitation to use of some of the soils.

Keeping the soils drained, reducing the content of toxic salt, and managing irrigation water are essential practices for maintaining sustained production of irrigated crops. Slow permeability makes drainage difficult, and excess salts cannot be entirely removed from the lower part of the soil. When these soils are wet, equipment should not be used and livestock should not be grazed.

Virgin soils that are to be used for irrigated crops require leaching to remove salts from the upper part of the soil. In places gypsum or other soil amendments are needed during and after reclamation to reduce the high content of sodium.

CAPABILITY UNIT IIIw-24, IRRIGATED

This unit consists of very deep, somewhat poorly drained soils in the Appian and Soda Lake series. These soils have a surface layer of sandy loam. The soils in this unit have a subsoil of clay loam or gravelly loamy sand and a substratum of stratified sand, fine sand, loamy fine sand, loamy very fine sand and sandy loam. In places some strata are gravelly. Slopes are 0 to 2 percent. Permeability is moderately slow to rapid in the surface layer and subsoil and rapid to very rapid in the substratum. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 3.5 to 6.0 inches, and the seasonal high water table is at a depth of 3 to 5 feet.

Most areas of the soils in this unit are used for grazing and for wildlife habitat. They also are suitable for alfalfa, small grain, field corn, pasture plants, and row crops adapted to the climate of the Area.

Keeping the soils drained, reducing the content of toxic salt, and managing irrigation water are essential practices for maintaining sustained production of crops.

Wetness and low available water capacity are limitations to the use of the soils in this unit.

Virgin soils that are to be used for irrigated crops require leaching to remove salts. In places gypsum or other soil amendments are needed during and after reclamation to reduce the high content of sodium.

CAPABILITY UNIT IIIs-22, IRRIGATED

This unit consists of very deep, somewhat excessively drained to moderately well drained soils in the Patna, Soda Lake, and Stumble series. These soils have a surface layer of sand and gravelly loamy sand. The subsurface layer and the subsoil range from sand to sandy loam, and the substratum generally is loamy sand or sand that is gravelly in places. Slopes are 0 to 4 percent. Permeability is moderately rapid to rapid, runoff is slow to very slow, and the hazard of erosion is slight to moderate. Available water capacity is 3.5 to 5.5 inches.

The soils in this unit are used for grazing and for wildlife habitat. They are suitable for alfalfa, small grain, field corn, and row crops adapted to the Area.

Managing irriagtion water and controlling erosion are essential practices for maintaining sustained production of crops. Some shaping and smoothing is necessary in places if methods of irrigation other than sprinkler are used.

Low available water capacity and the coarse texture of the surface layer are limitations to the use of the soils in this unit.

CAPABILITY UNIT IVw-9, IRRIGATED

This unit consists of very deep, somewhat poorly drained and poorly drained soils in the Carson, Stillwater, and Swingler series. These soils have a surface layer of clay loam. The subsurface layer and substratum are silt loam to clay. Slopes are 0 to 2 percent. Permeability is moderately slow to very slow, runoff is very slow to slow, and the hazard of erosion is none to slight. Available water capacity is about 8.5 to 11 inches, and a seasonal high water table is at a depth of about 3 to 5 feet.

The soils in this unit are used for irrigated crops and pasture plants and for grazing and wildlife habitat. They are suited to small grain, sugar beets, and pasture plants. Alfalfa also is grown, but wetness, poor aeration, and salt accumulations in the subsurface layer limit production and shorten the life of the stand.

Keeping the soil drained, reducing the content of toxic salt, and managing irrigation water are essential practices for maintaining sustained production of crops. Permeability makes drainage difficult, and salts cannot be entirely removed from the lower part of these soils.

Wetness, moderately slow to very slow permeability, and salt concentrations in the subsurface layer are limitations to the use of the soils in this unit.

Virgin soils that are to be used for irrigated crops require leaching to remove salts from the upper part of the soil profile. In places gypsum or other soil amendments are needed during and after reclamation to reduce the high content of sodium.

CAPABILITY UNIT IVw-13, IRRIGATED

This unit consists of very deep, somewhat poorly drained soils in the Carson series. All of these soils have a surface layer and subsurface layer of clay. The substratum of Carson soils is clay. Slopes are 0 to 2 percent. Permeability is slow to very slow, runoff is very slow, and the hazard of erosion is none to slight. Available water capacity is about 5.5 to 10 inches, and a seasonal high water table is at a depth of 3 to 5 feet.

The soils in this unit are used for irrigated crops, grazing, and wildlife habitat. They are suited to small grain, sugar beets, and pasture plants. Alfalfa also is grown, but wetness, poor aeration, salt accumulations in the subsurface layer, and restricted rooting depth limit production and shorten the life of the stand.

The clay texture, very slow permeability, wetness, and salt concentrations in the subsurface layer are limitations to the use of soils in this unit.

Keeping the soils drained, reducing the content of toxic salt, and managing irrigation water are essential practices for maintaining sustained production of crops. The use of organic residue is also helpful. When these soils are wet, equipment should not be used and livestock should not be grazed. Slow permeability makes drainage difficult, and salts cannot be entirely removed from the lower part of these soils.

Virgin soils that are to be used for irrigated crops require leaching to remove salts from the upper part of the soils. In places gypsum or other soil amendments are needed during and after reclamation to reduce the high content of sodium.

CAPABILITY UNIT IVw-22, IRRIGATED

This unit consists of very deep, well drained and somewhat poorly drained soils in the Appian series. These soils have a surface layer of fine sand to clay loam. The subsoil is clay loam and generally is thin. The substratum is sand, but in places it is clay below a depth of 40 inches. Slopes are 0 to 2 percent. Permeability is moderately slow in the surface layer and subsoil and very rapid in the substratum, except where slowly permeable clay occurs in the substrata. Runoff is slow, and the hazard of erosion is slight. Available water capacity is 3.5 to 5.0 inches, and a seasonal high water table is at a depth of 3 feet to more than 5 feet. The water table can be expected to rise in the presently nonirrigated soils when they are irrigated, because of ditch seepage.

The soils in this unit are used for crops, grazing, and wildlife habitat. They are marginally suitable for alfalfa, small grain, and pasture plants.

Managing irrigation water and keeping the soils drained are essential practices for maintaining sustained production of crops.

The seasonal high water table, low available water capacity, and sandy surface layer are limitations to the use of the soils in this unit.

Virgin soils that are to be used for irrigated crops require leaching of salts. In places gypsum or other soil amendments are needed during and after reclamation to reduce the high content of sodium. In places gypsum is needed to control the water table and to remove salts and sodium from the soil.

CAPABILITY UNIT IVw-24, IRRIGATED

This unit consists of very deep, somewhat poorly drained soils in the Bunejug, Erber, and Fernley series. These soils have a surface layer of sand, loam, clay loam, or clay. They are generally underlain by sand, but in places Erber soils are underlain by clay at depth of 40

to 60 inches. Slopes are 0 to 2 percent. Permeability is rapid and very rapid, but is very slow in the unconformable clay. Runoff is slow or very slow, and the hazard of erosion is slight. Available water capacity is 2.0 to 4.0 inches, and a seasonal high water table is at a depth of about 3 to 5 feet.

The soils in this unit are used for range, wildlife habitat, irrigated pasture plants, and some irrigated crops. They are marginal for alfalfa, small grain, and irrigated pasture plants.

Managing irrigation water and keeping the soils drained are essential practices for maintaining sustained production of crops. In many places these soils are in narrow irregular areas that dissect areas of finer textured soils that have a higher available water capacity than these soils. Management in these areas is difficult.

Virgin soils that are to be used for irrigated crops require leaching to remove salts. In places gypsum or other soil amendments are needed during and after reclamation to reduce the high content of sodium.

CAPABILITY UNIT IVs-22, IRRIGATED

This unit consists of very deep, excessively drained soils in the Tipperary series. These soils are sand or fine sand throughout. Slopes are 0 to 8 percent. Permeability is rapid to very rapid, runoff is slow to very slow, and the hazard of erosion is high. Available water capacity is about 3.0 to 4.0 inches.

The soils in this unit are used mainly for grazing and wildlife habitat, but small areas are used for crops. These soils are marginal for such irrigated crops as alfalfa, small grain, and field corn.

Managing irrigation water and controlling erosion are essential practices for sustained production of crops. Sprinklers are the most efficient method of irrigation, but border irrigation with short runs is well suited to the flatter areas.

Low available water capacity and the coarse texture of the surface layer are limitations to the use of the soils in this unit.

CAPABILITY UNIT VIw-13, IRRIGATED

This unit consists of very deep, somewhat poorly drained soils in the Lahontan, Carcity, Carson, and Weishaupt series. All these soils except the Weishaupt soils have a surface layer and subsurface layer of clay. Weishaupt soils have a surface layer and subsurface layer of clay loam. All the soils in this unit have a substratum of sand or clay. Slopes are 0 to 2 percent. Permeability is very slow, runoff is very slow or ponded, and the hazard of erosion is none to slight. Available water capacity is about 5.5 to 10.5 inches. A seasonal high water table is at a depth of 3 to 5 feet.

The soils in this unit are used for pasture, range, and wildlife habitat. If seeded to salt- and alkali-tolerant plants, they are suitable for irrigated improved pasture.

Keeping the soils drained, reducing the content of toxic salt, and managing irrigation water are essential practices for establishing and maintaining improved pasture. Very slow permeability and the low-lying position of these soils make drainage difficult, and in places salts are entirely removed from the soils.

Clay texture, very slow permeability, poor aeration, wetness, and salt concentrations are limitations to the use of the soils in this unit.

Virgin soils that are to be used for improved pasture require leaching of salts from the surface layer. In places gypsum or other soil amendments are required during and after reclamation to reduce the high content of exchangeable sodium. In places drainage is required to remove excess water and salts.

CAPABILITY UNIT VIIw-241, NONIRRIGATED

This unit consists of somewhat poorly drained soils and very poorly drained soils in the Appian, Bunejug, Carcity, Carson, Churchill, Dia, Dithod, East Fork, Erber, Fallon, Lahontan, Parran, Pelic, Ragtown, Sagouspe, Soda Lake, Stillwater, Swingler, Swope, Tipperary, and Weishaupt series and Alluvial land. The profile of these soils is variable, and the surface layer ranges from sand to clay. Slopes are 0 to 2 percent. Precipitation is 4 to 6 inches. Permeability to very rapid to very slow, runoff is ponded to slow, and the hazard of erosion is none to slight. Available water capacity is about 3.0 to 11.0 inches, and a seasonal water table is at a depth of 0 to 5 feet. Alluvial land is subject to frequent flooding.

The soils in this unit are suitable for limited grazing and for wildlife habitat.

The seasonal high water table, the salinity and alkalinity of the soils, the lack of irrigation water, and the low annual precipitation are limitations to the use of the soils in this unit.

CAPABILITY UNIT VIIs-261, NONIRRIGATED

This unit consists of very deep, moderately well drained to well drained soils in the Appian, Bango, Huxley, Juva, and Mazuma series. These soils have a surface layer that is dominantly sandy loam to clay loam and is gravelly in places. Slopes are 0 to 4 percent. Precipitation is 4 to 6 inches. Permeability is rapid to very slow, runoff is slow to medium, and the hazard of erosion is none to moderate. Available water capacity is about 3.5 to 9.5 inches. A water table is below a depth of 5 feet. Effective rooting depth ranges from 6 inches to more than 60 inches. In places Juva soils are subject to occasional flooding.

The soils in this unit are suitable for limited grazing and for wildlife habitat.

CAPABILITY UNIT VIIs-264, NONIRRIGATED

This unit consists of soils in the Appian, Bluewing, Lahontan, Patna, Parran, Soda Lake, Stumble, Swingler, and Tipperary series. Some of the Soda Lake and Swingler soils are moderately well drained, but most of the other soils in this unit are somewhat excessively drained to excessively drained. The soils in this unit generally have a surface layer of sand, fine sand, or loamy sand that is gravelly in some places. Where Lahontan and Parran soils occur with Tipperary soils, however, the surface layer is clay or silty clay, and the soils are somewhat poorly drained. Precipitation is 4 to 6 inches. Permeability is moderately slow to very rapid, runoff is slow to very slow, and the hazard of erosion is moderate to high. Available water capacity is about 3.5 to 5.5 inches.

Most areas of the soils in this unit are used for limited

grazing and wildlife habitat, but some are used as a source of sand and gravel.

Range improvement practices are not feasible, because of the arid climate and the sandy surface layer.

Low available water capacity, sandy texture of the surface layer, and a low average annual precipitation are limitations to the use of the soils in this unit.

CAPABILITY UNIT VIIs-283, NONIRRIGATED

This unit consists of very shallow, shallow, and very deep, somewhat excessively drained and well drained soils in the Biddleman, Celeton, Gardella, Hooten, Labou, Osobb, and Pirouette series. These soils are on uplands. The soils have a surface layer of gravelly to very stony sand to clay loam. The shallower soils are underlain by a hardpan or bedrock, and the deeper soils are underlain by stratified gravel and sand at a shallow depth. Slopes are 0 to 30 percent. Precipitation is 4 to 7 inches. Permeability is rapid to very slow, runoff is slow to rapid, and the hazard of erosion is none to high. Available water capacity is about 0.5 to 4.0 inches.

Most areas of the soils in this unit are used for limited grazing and for wildlife habitat. Some are used as a source of gravel or as a source of diatomaceous earth.

Range improvement practices are not feasible, because of the arid climate.

Very low available water capacity, coarse fragments on the surface, and low annual precipitation are limitations to the use of the soils in this unit.

CAPABILITY UNIT VIIIe-245, NONIRRIGATED

This unit consists only of Badland. This land type consists of severely eroded lacustrine sediment on which silt and clay has been deposited by runoff. It is on gently rolling to moderately steep shorelines of ancient Lake Lahontan. This land type is strongly saline-alkali affected.

Badland is suitable neither for cultivated crops nor for grazing. It provides no food or cover for wildlife. It has little potential for the production of plants.

CAPABILITY UNIT VIIIw-207, NONIRRIGATED

This unit consists only of Playas in nearly level basins. The surface layer generally is clay but ranges to sand in places. Playas are very strongly alkaline and often are ponded. They receive water from the surrounding areas and are subject to flooding and to forming shallow lakes. They are barren and have little potential for plant production.

This unit is not suited to cultivated crops or grazing. It has limited value for recreation and wildlife habitat.

CAPABILITY UNIT VIIIw-241, NONIRRIGATED

This unit consists only of nearly level areas of Marsh on valley and oxbow bottoms and in abandoned slough channels that have large areas of open water. The soils vary in texture and thickness. Deposits of peat are in some places. The areas are subject to flooding. Drainage is not feasible.

This unit is not suitable for cultivated crops or grazing, but the large areas of open water afford habitat for migratory waterfowl. The vegetation is dense stands of marsh plants.

CAPABILITY UNIT VIIIs-264, NONIRRIGATED

This unit consists of areas of Dune land and Playas. The dunes are unstabilized accumulations of loose sand, generally 20 to 30 feet high. They are excessively drained, are very droughty, and are subject to soil blowing. The Playas are very strongly alkaline, poorly drained, and often ponded.

Dune land is suitable neither for cultivated crops nor for grazing. It provides no food or cover for wildlife. It has little potential for the production of plants but may have some potential recreational use.

CAPABILITY UNIT VIIIs-283, NONIRRIGATED

This unit consists of areas of Mine pits and Rock outcrop that are nearly level to extremely steep, bare cliffs, ledges, and mountain peaks that have no vegetation, and open pits where limestone is being mined.

These land types are not suited to cultivated crops or grazing. They are used for wildlife habitat, recreation, watershed, esthetic purposes, and a source of limestone.

Estimated Yields

Table 5 lists average yields per acre of alfalfa, corn for silage, sugar beets, wheat, and barley that can be expected on selected irrigated soils in the Fallon-Fernley Area under an improved level of management.

The estimates were prepared cooperatively by the Soil Conservation Service, the Nevada Agricultural Experiment Station, the Nevada Extension Service, and selected farmers and ranchers.

Several important limitations should be kept in mind when using table 5. First, the yield figures are estimates, or predictions, but they are considered reliable enough to be of value. Second, the estimates are for average yields that can be expected over a period of years. Yields may be higher or lower than the average in any particular year. Third, there are variations in yield among areas of the same soil. Fourth, past management of a soil affects its immediate response to new management. Fifth, new crop varieties and improved farming practices are likely to increase future yields. Sixth, the availability of competent management and labor on the farm has an influence on yields.

Farmers who obtain the yields given in table 5 follow the practices recommended in their conservation plan, which includes practices suggested for each capability unit and the soil management practices suggested in this subsection. Briefly this involves—

1. Using a conservation cropping system.
2. Managing crop residue.
3. Controlling erosion.
4. Adding plant nutrients.
5. Controlling insects and weeds.
6. Managing irrigation water and drainage.
7. Managing pasture and hayland.
8. Managing saline-alkali affected soils.

Range [3]

A major part of the Fallon-Fernley Area is rangeland or playas that completely surround the irrigated part of

[3] J. BOYD PRICE, range conservationist, Soil Conservation Service, assisted in preparing this subsection.

TABLE 5.—*Estimated average yields per acre of principal crops on selected irrigated soils*

[These yields can be obtained under an improved level of management. Absence of a yield figure indicates that the crop is not suited to the soil or that it is not commonly grown]

Soil name	Alfalfa	Corn for silage	Sugar beets	Winter wheat [1]	Winter barley [2]	Spring barley
	Tons	*Tons*	*Tons*	*Tons*	*Tons*	*Tons*
Appian loamy fine sand	4.7	17	----------	1.8	2.3	1.5
Appian fine sandy loam	5.0	20	----------	2.2	2.7	1.8
Bunejug sandy loam	5.2	20	----------	2.2	2.7	1.8
Carcity clay	4.8	17	20	2.1	2.2	1.5
Carcity clay, slightly saline	4.7	15	20	1.9	2.0	1.2
Carson clay	4.6	17	20	1.8	1.9	1.3
Carson clay, slightly saline	4.5	15	20	1.5	1.7	1.0
Dia loam	5.8	23	20	2.6	3.2	2.4
Dia loam, slightly saline	5.7	20	20	2.4	3.0	2.0
Dithod loam	5.9	25	22	3.0	3.5	2.5
Dithod loam, slightly saline	5.7	22	22	2.6	3.0	2.0
East Fork clay loam	6.0	25	25	3.0	3.5	2.5
East Fork clay loam, slightly saline	5.8	23	25	2.6	3.0	2.0
Fallon fine sandy loam	5.0	20	15	2.6	3.0	2.3
Fallon fine sandy loam, slightly saline	4.9	17	15	2.2	2.5	1.8
Ragtown sandy clay loam	5.7	25	23	2.3	2.9	2.0
Ragtown clay loam, slightly saline	5.3	20	23	2.0	2.0	1.3
Sagouspe loamy sand	4.7	15	----------	2.2	2.3	1.5
Stillwater clay loam	6.0	20	25	2.9	3.2	2.5
Stillwater clay loam, slightly saline	5.7	17	25	2.0	2.5	2.0
Swingler sandy loam	5.5	19	----------	2.4	3.0	2.0
Swingler clay loam	5.5	19	----------	2.4	3.0	2.0
Swope clay loam	5.4	19	22	2.5	2.9	2.2
Swope clay loam, slightly saline	5.2	17	22	2.3	2.5	1.7
Weishaupt clay loam	5.3	18	22	2.5	2.9	1.8
Weishaupt clay loam, slightly saline	5.0	15	22	2.2	2.0	1.3

[1] Gains variety.
[2] Luther variety.

the valley. The native vegetation is sparse and generally is of very poor quality. Most of the Area receives less than 6 inches of precipitation annually, mainly late in fall and early in spring. During years of below-normal precipitation, little usable forage is produced and in places grazing by cattle and horses is reduced sharply or is curtailed completely. During years of normal or above-average precipitation, it is generally not feasible to take advantage of the increase in production of the short-lived, lush green feed through proper stocking of the range. Because of the low amount of precipitation received annually, seeding of the areas is not feasible.

Most of the soils used for range have a coarse-textured surface layer. The main hazard is soil blowing, but some water erosion occurs during high-intensity storms. Trampling by livestock or the use of mechanical devices has caused considerable disturbance to both soils and vegetation, as evidenced by gullies, desert pavement, and dunes.

The rangeland is primarily public, but in the northern part of the Area large acreages are in State and national wildlife refuge and management areas. Grazing provided on these lands is regulated by the appropriate land management agency. Forage management plans involving use of both public and private lands are designed to facilitate year-round movement of livestock.

The economic benefits that can be derived from the use of a particular area may be small, but the use of the areas may be a significant part of the operator's total livestock management plan.

Range rehabilitation measures are primarily associated with grazing management practices and nonuse.

Range sites and condition classes

Range sites are distinctive kinds of rangeland that have a different potential for producing plants. Range sites are the product of all the environmental factors, including soil, temperature, rainfall, and elevation.

Range condition of a particular range site is the present state of the vegetation of that site in relation to the climax or potential plant community.

A range operator who knows the important range sites on his land and the condition of each can determine if his range is producing the best possible usable forage plants. He can determine if the range condition is improving or deteriorating and then decide upon the best management plan to suit his needs.

The adverse climate of the area is not suitable for range seeding. A grazing system specifically designed for the ranch operation and compatible with the physiology of the important forage plants is frequently the most effective and economical range improvement measure. Livestock water development to facilitate good distribution of water to grazing animals is especially important. Brush control is practical in some areas.

Descriptions of the range sites

The soils of the Fallon-Fernley Area have been grouped into six range sites according to the kinds and amounts of potential vegetation. Excluded from the range site

groupings are (1) soils used mainly for irrigated crops and pasture, (2) small range areas that are intermingled and managed along with irrigated soils, (3) soils having a great variability in drainage, salinity, alkalinity, and plant cover caused by the influence of waste waters from adjacent irrigated lands, (4) soils and land types not suitable for grazing, and (5) very frequently flooded flood plains that have been mapped as Alluvial land.

The names of the soil series represented in the survey area are mentioned in the description of each range site, but this does not mean that all the soils in a given series are in the site. The soils in each range site can be identified by referring to the "Guide to Mapping Units" at the back of this survey. Detailed information for each of these soils is given in the section titled "Descriptions of the Soils."

RANGE SITE NV 27-1 (DESERT LAKE BARS)

This site consists of soils of the Appian, Bango, Biddleman, Bluewing, Juva, Labou, and Soda Lake series. These soils are on lacustrine terraces, alluvial fans, and rolling uplands. Elevation ranges from 3,800 to 4,400 feet. Average annual precipitation is 4 to 5 inches. Most of the precipitation that falls is infiltrated and is available for plant use. Precipitation wets the soil to a depth of about 12 to 30 inches, which corresponds approximately to the rooting depth of major plant species. Total available water capacity for this rooting depth is about 2.5 to 3.0 inches.

The soils in this site typically are excessively drained to well drained and have slopes of 2 to 15 percent. They have a surface layer of moderately alkaline sandy loam, loamy sand, or gravelly loamy sand and a subsoil of moderately alkaline to strongly alkaline clay to gravelly loamy sand. The substratum is stratified loam to very gravelly sand. The deeper parts of the subsoil and the substratum are generally saline. Labou soils included in the site have a cemented tufa layer at a depth of about 12 to 20 inches.

The potential plant community is greasewood and an understory of shadscale and Indian ricegrass. The approximate composition of plants, by weight, is 30 to 55 percent upland greasewood, 20 to 30 percent shadscale, 5 to 10 percent four-wing saltbush; 1 to 5 percent bud sagebrush; 1 to 5 percent ephedra; 1 ti 5 percent dalea; 0 to 5 percent Cooper wolfberry; 5 to 20 percent Indian ricegrass; 2 to 5 percent perennial forbs; and 0 to 10 percent annuals. Upland greasewood, dalea, and Cooper wolfberry are not generally used by cattle. Many of the forbs and annuals have limited use.

Total annual production of air-dry herbage ranges from 200 pounds per acre in favorable years to 50 pounds per acre in unfavorable years. Under prolonged heavy grazing by cattle, Indian ricegrass and four-wing saltbush decrease in the stand and are replaced by low-choice shrubs and annuals.

RANGE SITE NV 27-2 (DESERT SANDS)

This site consists of nearly level to gently sloping soils of the Stumble, Tipperary, and Patna series. These soils are on alluvial fans and terraces. Elevation ranges from 4,000 to 5,400 feet. Average annual precipitation is 4 to 6 inches. Most of the precipitation that falls on these soils is infiltrated and is available for plant use. Precipitation wets the soil to a depth of about 24 to 36 inches, which corresponds approximately to the rooting depth of major plant species. Total available water capacity for this rooting depth is about 2.0 to 2.5 inches.

The soils in this site typically are somewhat excessively drained to excessively drained. They have moderately rapid to very rapid permeability and are salt and alkali free. They have a surface layer of sand to loamy sand about 3 to 6 inches thick and a subsoil of sand to sandy loam about 10 to 18 inches thick. The substratum is sand or loamy sand and is gravelly in places.

The potential plant community is dominantly shrubs and a strong understory of Indian ricegrass. The approximate composition of plants, by weight, is 50 to 60 percent Indian ricegrass; 0 to 10 percent desert needlegrass; 20 to 30 percent upland greasewood; 10 to 15 percent four-wing saltbush; 0 to 5 percent littleleaf horsebush; 0 to 3 percent dalea; 0 to 5 percent ephedra; 5 to 10 percent spiny hopsage; 5 to 10 percent winterfat; 1 to 2 percent globemallow; 1 to 2 percent evening primrose; 1 to 5 percent other perennials; and 0 to 10 percent annuals. Upland greasewood, littleleaf horsebush, and dalea are not generally used by cattle. Many of the forbs and annuals have limited use.

This site produces about 600 pounds of air-dry herbage per acre in favorable years and about 250 pounds in less favorable years. Annuals often contribute a considerable amount of forage in favorable years.

Under prolonged heavy grazing of the site, Indian ricegrass and four-wing saltbush decrease and are replaced by such low-choice shrubs as horsebrush and greasewood.

RANGE SITE NV 27-3 (DESERT DROUGHTY LOAM)

This site consists only of Celeton very cobbly sandy loam, 8 to 30 percent slopes. This soil is on uplands. Elevation ranges from 4,400 to 6,000 feet. The average annual precipitation is 5 to 7 inches. Rooting depth of plants is shallow to very shallow. Total available water capacity for this rooting depth is about 1.0 to 2.0 inches.

The soil in this site typically is well drained to somewhat excessively drained and is nonsaline. It is shallow to very shallow to softly consolidated diatomaceous earth. It has a surface layer of very cobbly sandy loam or gravelly loam.

The potential plant community dominantly is shadscale and a strong understory of Indian ricegrass and sand dropseed. The approximate composition of plants, by weight, is 50 to 60 percent shadscale; 5 to 10 percent bud sagebrush; 0 to 10 percent upland greasewood; 5 to 10 percent Indian ricegrass; 5 to 10 percent sand dropseed; 0 to 10 percent desert needlegrass; 10 to 15 percent ephedra; 0 to 10 percent other perennial forbs; and 5 to 10 percent annuals. Upland greasewood is not generally used by cattle. Many of the forbs and annuals have limited use.

This site produces about 200 pounds of air-dry herbage per acre in favorable years and about 50 pounds in less favorable years. Annuals often contribute a considerable amount of forage in favorable years.

Under prolonged heavy grazing of the site, Indian ricegrass, sand dropseed, and desert needlegrass decrease

in the stand and are replaced by such low-choice shrubs as upland greasewood.

RANGE SITE NV 27-4 (DESERT ALKALI FLATS)

This site consists of nearly level to gently sloping soils of the Appian, Churchill, Gardella, Hooten, Huxley, Lahontan, Mazuma, Parran, Ragtown, Soda Lake, and Swingler series. These soils are on low lake terraces and alluvial fans and in basins. Elevation ranges from 3,800 to 4,500 feet. Average annual precipitation is between 4 to 6 inches. Such plants are black greasewood, seepweed, and quailbush obtain most of their water from the capillary zone. Roots from these plants penetrate to a considerable depth to obtain moisture. The total available water capacity is about 18 to 21 inches. Shadscale, forbs, and annuals root in upper horizons of the soils, and are dependent mainly upon the scanty precipitation.

The soils in this site typically are somewhat poorly drained to moderately well drained and strongly saline-alkali affected. A seasonal high water table fluctuates within a depth of about 5 to 10 feet, but in some soils it is at a depth of about 3 feet. These soils are highly variable. The surface layer and the subsurface layer range from sand to clay. Most of the soils are deep and some have a highly stratified subsurface layer. The Hooten and Gardella soils have a silica-cemented hardpan at a very shallow depth.

The potential plant community is dominantly black greasewood. The approximate composition of plants, by weight, is 40 to 65 percent black greasewood; 0 to 10 percent fourwing saltbush; 0 to 5 percent Cooper wolfberry; 5 to 20 percent seepweed; 15 to 25 percent shadscale; 2 to 10 percent quailbush; 2 to 5 percent perennial forbs; and 2 to 10 percent annuals. Black greasewood, Cooper wolfberry, and seepweed are not generally used by cattle. Many of the forbs and annuals have limited use.

This site produces about 150 pounds of air-dry herbage per acre in favorable years and about 75 pounds in less favorable years.

If this site is heavily grazed, forage plants become hedged and lose vigor, and the amount of black greasewood increases.

RANGE SITE NV 27-5 (DESERT DUNES)

This site consists only of nearly level to rolling soils of the Tipperary series. These soils are on partly stabilized sand dunes. Elevation ranges from 3,800 to 5,000 feet. Average annual precipitation is 4 to 6 inches. Most of the precipitation that falls on these soils infiltrates and is available for plant use. Precipitation wets the soil to a depth of about 40 inches, which corresponds approximately to the rooting depth of most of the plants. Total available water capacity for this rooting is about 2.5 to 3.0 inches. In places roots of black greasewood penetrate into underlying material to extract soil moisture.

The soils in this site typically are excessively drained and very rapidly permeable. They are not affected by salt and alkali. The entire profile consists of fine sand. Soil blowing is a hazard if the ground cover is depleted.

The potential plant community is dominantly large shrubs such as four-wing saltbush and black greasewood and an understory of Indian ricegrass. The approximate composition of plants, by weight, is 10 to 20 percent black greasewood; 0 to 5 percent hairy horsebrush; 0 to 2 percent shadscale; 2 to 5 percent dalea; 2 to 5 percent spiny hopsage; 20 to 50 percent Indian ricegrass; 5 to 15 percent four-wing saltbush; 2 to 5 percent perennial forbs; and 0 to 10 percent annuals. Black greasewood, hairy horsebrush, and dalea are not generally used by cattle. Many of the forbs and annuals have limited use.

This site produces about 300 pounds of air-dry herbage per acre in favorable years and about 150 pounds in less favorable years.

Under prolonged heavy grazing of the site, or if it is disturbed, Indian ricegrass and four-wing saltbush decrease and are replaced by greasewood and horsebrush.

RANGE SITE NV 27-6 (DESERT SHALLOW LOAM)

This site consists of nearly level to moderately steep soils of the Osobb and Pirouette series. These soils are on uplands. Elevation ranges from 4,400 to 6,000 feet. Average annual precipitation is 5 to 7 inches. Most of the precipitation that falls on this soil infiltrates and is available for plant use, but part of it is lost as surface runoff. Precipitation wets the soil to a depth of about 15 to 20 inches, which corresponds approximately to the rooting depth of major plant species. Total available water capacity for this rooting depth is about 2.0 to 2.5 inches.

The soils in this site typically are well drained. They are underlain by hardpan-capped tuff and basalt bedrock at a depth of 15 to 20 inches. They have a surface layer of very fine sandy loam or clay loam and a subsoil of fine or very fine sandy loam or clay loam. The surface layer and subsoil contain gravel, cobblestones, and stones.

The potential plant community is dominantly shrubs and an understory of Indian ricegrass and galleta grass. The approximately composition of plants, by weight, is 30 to 40 percent upland greasewood; 10 to 30 percent shadscale; 5 to 10 percent littleleaf horsebrush; 2 to 4 percent wolfberry; 0 to 2 percent pricklypear; 0 to 5 percent ephedra; 2 to 3 percent bud sagebrush; 5 to 10 percent spiny hopsage; 10 to 15 percent galletagrass; 5 to 10 percent Indian ricegrass; 0 to 1 percent fluffgrass; 1 to 3 percent globemallow; 2 to 5 percent other perennial forbs; and 0 to 5 percent other annuals. Upland greasewood, littleleaf horsebrush, wolfberry; pricklypear, and fluffgrass are not generally used by cattle. Many of the forbs and annuals have little use.

This site produces about 450 pounds of air-dry herbage per acre in favorable years and about 200 pounds in less favorable years. Annuals often contribute a considerable amount of forage in good years.

Under prolonged heavy grazing of the site, Indian ricegrass and galleta grass decrease and are replaced by upland greasewood and littleleaf horsebrush.

Wildlife

The kind and number of wildlife species that live in a particular area are determined by the suitability of the environment as habitat. Suitability of the habitat is related to the use of the soils, the kind of plant cover, and the topography. In addition, such soil features as drainage and those that affect suitability of the soils for water

impoundments are important considerations in planning the development of habitat for waterfowl and pond fish.

Sustained use of the Fallon-Fernley Area for wildlife depends upon a well-planned management program. The suitability of the soils as a habitat for desirable kinds of wildlife can be determined through knowledge of the soils. This knowledge can serve as a basis for planning the development and maintenance of areas suitable for wildlife habitat.

Important wildlife species in the Area are duck, geese, pheasant, California quail, mourning dove, chukar partridge, and such furbearers as cottontail rabbit, muskrat, and mink. A few mule deer can also be found in the dense patches of willows that grow along the Carson River. Rainbow trout and German brown trout inhabit the upper reaches of the Carson River below Lahontan Reservoir. Smallmouth bass, channel catfish, and carp can be found in the warmer water of the many perennial lakes, ponds, sloughs, and drainage ditches in the Area, mainly north of Stillwater.

Duck and geese are mainly in the northwestern, northeastern, and southern parts of the Area, where the soils are more poorly drained and lakes and ponds are available. They are also in other areas scattered throughout the valley. Most of the muskrat and mink also populate these areas. The Stillwater National Wildlife Refuge is northeast of Stillwater and adds materially to the concentration of ducks and geese during their migration from the north.

Pheasant, quail, dove, and cottontail rabbit generally live throughout the irrigated cropland areas, but they also inhabit some of the desert shrub areas on the low terraces and flood plains outside the irrigated areas in the valley. Chuckar partridge live only on the peripheral high terraces and, fans in the mountain areas that border the valley.

Wildlife suitability groups

The soils in the Fallon-Fernley Area have been placed in nine wildlife suitability groups. In the wildlife suitability groups are soils that have similar potential for wildlife habitat. The suitability of an irrigated soil for wildlife habitat differs from that of the soil if it is not irrigated. Therefore, some of the soils in the survey area are placed in one wildlife suitability group if they are irrigated and in another group if nonirrigated. The names of the soil series represented in each group are mentioned in the description of the group, but this does not mean that all the soils in a given series are in the group. The soils in each wildlife suitability group can be determined by referring to the "Guide to Mapping Units."

WILDLIFE SUITABILITY GROUP NV 27-1

This group consists of deep, somewhat poorly drained and moderately well drained soils of the Bango, Dithod, East Fork, Swingler, and Swope series. These soils are on flood plains and terraces. Slopes range from 0 to 4 percent. The surface layer ranges from loamy sand to silty clay loam. The Swope soil has unconformable stratified sand below a depth of 20 inches.

Permeability is moderate or moderately slow. Runoff is slow or very slow, and the hazard of erosion is none to moderate. The available water capacity is 5 to 11 inches, and a seasonal high water table is at a depth of 3 to 5 feet.

The soils in this group are irrigated and have few if any limitations for the production of grains, grasses, or legumes. They provide excellent habitat for pheasant, quail, and dove. These soils have slight limitations for the development of shallow-water impoundments, and they provide good habitat for duck, geese, muskrat, and mink.

WILDLIFE SUITABILITY GROUP NV 27-2

This group consists of very deep, poorly drained to excessively drained soils of the Appian, Erber, Fernley, Juva, Patna, Soda Lake, Stumble, Swingler, and Tipperary series. These soils are on flood plains, alluvial fans, and terraces. Slopes range from 0 to 8 percent. The surface layer ranges from sand to clay but is dominantly sand or sandy loam. The subsoil ranges from sand to sandy loam, and the substratum is sand, stratified gravelly sand, fine sand, or sandy loam.

Permeability is very rapid to slow. Runoff is slow or very slow, and the hazard of erosion is slight to severe. The available water capacity is 2.0 to 8.0 inches, and a seasonal high water table generally is at a depth of 3 to 5 feet.

The soils in this group are irrigated and have moderate limitations for production of grains, grasses, and legumes. They provide good habitat for pheasant, quail, and dove. These soils have severe limitations for the development of shallow-water impoundments, and they provide poor habitat for duck, geese, muskrat, and mink.

WILDLIFE SUITABILITY GROUP NV 27-3

This group consists of very deep, somewhat poorly drained soils of the Appian, Bunejug, Dia, Fallon, Juva, Mazuma, and Sagouspe series. These soils are on flood plains, alluvial fans, and low terraces. Slopes range from 0 to 4 percent. The surface layer ranges from loamy fine sand to clay loam. The subsoil ranges from loamy sand to clay loam, and the substratum is dominantly sand to silt loam but is stratified sandy clay loam and finely stratified sands in places.

Permeability is moderately slow to moderately rapid. Runoff is slow or very slow, and the hazard of erosion is none to moderate. The available water capacity is 3.5 to 10.0 inches, and a seasonal high water table generally is at a depth of 3 to 5 feet, but it is at a depth of more than 5 feet in the Mazuma and Juva soils.

The soils in this group are irrigated and have few if any limitations for the production of grains, grasses, and legumes. They provide excellent habitat for pheasant, quail and dove. These soils have severe limitations for the development of shallow-water impoundments, and they provide poor habitat for duck, geese, muskrat, and mink.

WILDLIFE SUITABILITY GROUP NV 27-4

This group consists of very deep, moderately well drained to poorly drained soils of the Carcity, Carson, Ragtown, Stillwater, and Weishaupt series. These soils are on flood plains, deltas, and low terraces. Slopes range

from 0 to 2 percent. The surface layer is dominantly clay, clay loam, or sandy clay loam. The subsoil is clay, silty clay, or clay loam, and the substratum is dominantly clay or silty clay but is stratified sand in places.

Permeability is slow or very slow. Runoff is slow or very slow, and the hazard of erosion is none to slight. The available water capacity is 5.5 to 11.5 inches. A seasonal high water table generally is at a depth of 3 to 5 feet, but it is slightly deeper in some soils.

The soils in this group are irrigated and have slight to moderate limitations for the production of grains, grasses, and legumes. They provide excellent habitat for pheasant, quail, and dove. These soils have no or only slight limitations for the development of shallow-water impoundments, and they provide good habitat for duck, geese, muskrat, and mink.

WILDLIFE SUITABILITY GROUP NV 27-5

This group consists of very deep, somewhat poorly drained and poorly drained soils of the Lahontan and Pelic series. These soils are in basins and old, low-lying river channels and on flood plains. Slopes range from 0 to 2 percent. The surface layer is clay or sand. The subsoil is clay or loamy fine sand, and the substratum is clay, sandy loam, or sand.

Permeability is very slow, slow, or rapid. Runoff is ponded or very slow, and the hazard of erosion is none to slight. The available water capacity is 3.0 to 9.0 inches, and a seasonal high water table is at a depth of 1 to 4 feet. The soils are strongly saline-alkali affected.

The soils in this group are irrigated, but they are poorly suited to the production of grains, grasses, and legumes. They provide poor habitat for pheasant, quail, and dove. These soils have slight limitations for the development of shallow-water impoundments, and they provide fair habitat for duck, geese, muskrat, and mink.

WILDLIFE SUITABILITY GROUP NV 27-6

This group consists of shallow to very deep, somewhat excessively drained and well drained soils of the Biddleman, Celeton, Labou, Osobb, and Pirouette series. These soils are on high shoreline terraces, foothills, and mountains. Slopes range from 0 to 50 percent. The surface layer is dominantly very stony, very cobbly, or rocky sand, loamy sand, or sandy loam, but it is loam or clay loam in places. The subsoil is clay, clay loam, or cobbly clay loam and some very cobbly fine sandy loam or fragmented diatomaceous earth. The substratum is stratified sand and gravel, consolidated diatomaceous earth, lithoid tufa, and basalt bedrock.

Permeability is very slow to rapid. Runoff is slow to rapid, and the hazard of erosion is moderate to severe. The available water capacity ranges from 1.0 to 3.5 inches.

The soils in this group are not irrigated. They are in native vegetation that is used for limited grazing. They have severe limitations for the production of food and cover for most wildlife in the area. They provide fair to good habitat for chuckar partridge. These soils have severe limitations for the development of shallow-water impoundments, and they provide very poor habitat for duck, geese, muskrat, and mink.

WILDLIFE SUITABILITY GROUP NV 27-7

This group consists of very deep, moderately well drained to poorly drained soils of the Carcity, Carson, Lahontan, Parran, Ragtown, Stillwater, and Weishaupt series. These are on flood plains, deltas, and low terraces. Slopes range from 0 to 2 percent. The surface layer is clay, clay loam, or silty clay. The subsoil is clay or silty clay, and the substratum is clay or silty clay and stratified silty clay and fine sand or sand.

Permeability is very slow to moderately slow. Runoff is slow, very slow, or ponded. The hazard of erosion is none or slight. The available water capacity ranges from 5 to 11.5 inches. A seasonal high water table generally is at a depth of 3 to 5 feet, but it is deeper in some soils. The soils are strongly saline-alkali affected.

The soils in this group are not irrigated. They have severe limitations for the production of grains, grasses, or legumes. They provide very poor habitat for pheasant, quail, and dove, but small isolated areas in or adjacent to the irrigated cropland provide cover. These soils have slight or no limitations for the development of shallow-water impoundments, and they provide good habitat for duck, geese, muskrat, and mink.

WILDLIFE SUITABILITY GROUP NV 27-8

This group consists of very deep to shallow, well-drained to poorly drained soils of the Bango, Churchill, Dithod, East Fork, Gardella, Hooten, Swingler, and Swope series. These soils are on flood plains, low-lying stream-cut terraces, lake terraces, outer margins of volcanic cones, and toe slopes of alluvial fans. Slopes range from 0 to 4 percent. The surface layer is dominantly gravelly sand, loamy sand, and sandy loam, but it is loam, gravelly silt loam, or clay loam in places. The subsoil is mainly stratified coarse sand and sandy loams, but it is loam or gravelly clay loam in places. The substratum is stratified sand and coarse sand, loamy sand, silt loam, and silty clay. The Hooten soils have silica-cemented horizons.

Permeability is moderate to very slow. Runoff is moderate to very slow, and the hazard of erosion is none to moderate. The available water capacity is 0.5 to 11.5 inches and a seasonal high water table generally is at a depth of 3 to 5 feet, but it is deeper in some soils.

The soils in this group are not irrigated and have severe limitations for the production of grains, grasses, and legumes. They provide very poor habitat for pheasant, quail, and dove, but small isolated areas in or adjacent to irrigated cropland provide cover. These soils have moderate limitations for the development of shallow-water impoundments, and they provide fair habitat for duck, geese, muskrat, and mink.

WILDLIFE SUITABILITY GROUP NV 27-9

This group consists of very deep, excessively drained to poorly drained soils of the Appian, Biddleman, Bluewing, Bunejug, Dia, Erber, Fallon, Huxley, Juva, Mazuma, Patna, Sarouspe, Soda Lake, Stumble, Swingler, and Tipperary series. These soils are on alluvial fans and terraces. Slopes range from 0 to 15 percent.

The surface layer is dominantly sand, loamy sand, or sandy loam, but it is loam, clay loam, or clay in places. The subsoil is dominantly sand, loamy sand, gravelly

loamy sand, and sandy loam, but it is silt loam, silty clay loam, silty clay, and gravelly clay in places. The substratum is dominantly sand, loamy sand, and sandy loam, but it is stratified sandy clay loam or silt loam in places.

Permeability is very slow to very rapid. Runoff is very slow to medium, and the hazard of erosion is generally none to moderate, but it is severe on the Tipperary soils. The available water capacity is 1.5 to 10 inches, and a seasonal high water table is generally at a depth of more than 5 feet, but it is at a depth of 3 to 5 feet in some soils.

The soils in this group are not irrigated and have severe limitations for the production of grains, grasses, and legumes. They provide poor habitat for pheasant, quail, and dove, but small isolated areas in or adjacent to irrigated cropland provide cover. These soils have severe limitations for the development of shallow-water impoundments, and they provide poor habitat for duck, geese, muskrat, and mink.

Windbreaks

Only a few planned windbreaks are in the Fallon-Fernley Area. As the need to conserve the soil and water increases, however, the need for planned windbreaks becomes more important.

Windbreaks are planted to protect soil, crops, livestock, and homes or farm buildings. In summer they protect gardens, orchards, and field crops from drying winds and reduce soil blowing. In winter they control snow drifting, protect livestock, and help to reduce fuel consumption in the home. Windbreaks also provide food and cover for wildlife, particularly songbirds and game birds. They enhance the beauty of the landscape (*2*).

Windbreaks for farmsteads, fields, or livestock shelter should be planned carefully. Selection of specific trees and shrubs and proper spacing and proper placement of the windbreaks are important considerations when planning a windbreak system. A single windbreak or a windbreak system is an important part of a complete soil and water conservation plan (*14*).

In the Fallon-Fernley Area irrigation is required to establish windbreaks.

Windbreak suitability groups

A windbreak suitability group is a grouping of soils that have a similar potential and require similar management to produce trees and shrubs for windbreaks. The soils in the survey area have been placed in six windbreak suitability groups. In table 6 these groups are rated according to their suitability for some adapted species of trees and shrubs.

Engineering Uses of the Soils

This section is useful to those who need information about soils used as structural material or as foundation upon which structures are built. Among those who can benefit from this section are planning commissioners, town and city managers, land developers, engineers, contractors, and farmers.

Among properties of soils highly important in engineering are permeability, strength, compaction characteristics, soil drainage condition, shrink-swell potential, grain size, plasticity, and soil reaction. Also important are depth to the water table, depth to bedrock, and soil slope. These properties, in various degrees and combinations, affect construction and maintenance of roads, airports, pipelines, foundations for small buildings, irrigation systems, ponds and small dams, and systems for disposal of sewage and refuse.

Information in this section of the soil survey can be helpful to those who—

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, highways, pipelines, and underground cables.
3. Seek sources of gravel, sand, or clay.
4. Plan farm drainage systems, irrigation systems, ponds, terraces, and other structures for controlling water and conserving soil.
5. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of predicting performance of structures on the same or similar kinds of soil in other locations.
6. Predict the trafficability of soils for cross-country movement of vehicles and construction equipment.
7. Develop preliminary estimates pertinent to construction in a particular area.

Most of the information in this section is presented in tables 7, 8, and 9, which show, respectively, several estimated soil properties significant to engineering; interpretations for various engineering uses; and results of engineering laboratory tests on soil samples.

This information, along with the soil map and other parts of this publication, can be used to make interpretations in addition to those given in tables 7 and 8, and it also can be used to make other useful maps.

This information, however, does not eliminate need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than those shown in the tables. Also, inspection of sites, especially the small ones, is needed because many delineated areas of a given soil mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

Some of the terms used in this soil survey have special meaning to soil scientists that is not known to all engineers. The Glossary defines many of these terms commonly used in soil science.

Engineering classification system

The two systems most commonly used in classifying samples of soils for engineering are the Unified system, used by the SCS engineers, Department of Defense, and others, and the AASHO system, adopted by the American Association of State Highway Officials.

TABLE 6.—*Ratings of windbreak suitability groups*

Windbreak suitability group	Green ash	Black locust	Honey locust	Poplar
NV 27–1. Clayey soils that have a seasonal high water table; none to slightly affected by salt and alkali.	Good	Poor	Good	Good
NV 27–2. Clayey soils that have a seasonal high water table; strongly affected by salt and alkali.	Poor	Poor	Poor	Poor
NV 27–3. Loamy and sandy soils that have a seasonal high water table; none to slightly affected by salt and alkali.	Good	Poor	Good	Good
NV 27–4. Loamy and sandy soils that have a seasonal high water table; strongly affected by salt and alkali.	Fair	Poor	Fair	Fair
NV 27–5. Loamy and sandy soils that do not have a seasonal high water table; not affected by salt and alkali.	Good	Good	Good	Good
NV 27–6. Loamy and sandy soils that do not have a seasonal high water table; slightly to moderately affected by salt and alkali.	Fair	Poor	Fair	Fair

TABLE 7.—*Estimated soil properties*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils
tions for referring to other series that appear in the first column of

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Hardpan or bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*In*				*Pct*
Alluvial land: Ad Very frequently flooded; variable, stratified, recently deposited material. Onsite investigation required.	>5	0–3					
*Appian:							
Af, Ao	>5	3–5	0–10	Loamy fine sand	SM	A–2 or A–4	0
			10–20	Clay loam	CL	A–6	0
			20–60	Stratified sand, loamy sand, loamy fine sand, and sandy loam.	SP–SM or SM	A–2	0
An, Ap, AS For properties of Tipperary part in AS, see Tipperary series. Water table at a depth of more than 5 feet in Ap and AS.	>5	3–5	0–4	Sandy loam	SM	A–2 or A–6	0
			4–14	Clay loam	CL–MC	A–6 or A–4	0
			14–48	Stratified sand, fine sand, and gravelly coarse sand.	SP–SM or SM	A–1 or A–2	0
			48–60	Silty clay	CH	A–7	0
Am, AR, AT For properties of Tipperary part in AR and Playas in AT, see Tipperary series and Playas. Water table at a depth of more than 5 feet in AR and AT	>5	3–5	0–3	Sandy loam	SC	A–2 or A–6	0
			3–11	Clay loam	CL	A–6	0
			11–62	Stratified sand, loamy sand, and sandy loam.	SP–SM or SM	A–2	0

See footnotes at end of table.

for producing some adapted trees and shrubs

Golden willow	Utah juniper	Russian-olive	Bladder seens	Buffalo-berry	Sand cherry	European sagebrush	Four-wing saltbush	Tamarisk
Fair	Good	Good	Fair	Good	Fair	Fair	Fair	Good.
Poor	Fair	Good	Poor	Good	Poor	Poor	Fair	Good.
Good	Good	Good	Fair	Good	Fair	Fair	Fair	Good.
Fair	Good	Good	Poor	Good	Poor	Poor	Fair	Good.
Good	Good	Good	Good	Good	Good	Good	Good	Good.
Fair	Good	Good	Poor	Good	Fair	Fair	Good	Good.

significant to engineering

in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instruc-this table. The sign < means less than; the sign > means more than]

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-action potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
						In per hr	*In per inch of soil*	*pH*	*Mmhos per cm at 25°C*		
100	100	60–80	20–40	20–30	----	2. 0–6. 3	0. 10–0. 13	7. 0–8. 0	<2	Low	Low.
100	100	80–90	70–80	30–40	15–25	0. 2–0. 6	0. 17–0. 18	7. 0–8. 0	<2	Moderate	Low.
[1] 100	[1] 80–90	[1] 50–60	[1] 10–20	[1] 10–20	([1])	>20. 0	0. 05–0. 08	7. 5–8. 0	2–4	Low	Low.
95–100	95–100	60–70	30–40	20–30	----	2. 0–6. 0	0. 10–0. 13	7. 0–8. 2	<2	Moderate	Moderate.
100	100	80–90	70–80	30–40	15–25	0. 2–0. 6	0. 17–0. 18	7. 5–8. 6	2–8	Moderate	Low.
95–100	85–100	40–70	5–20	10–20	----	6. 0–20. 0	0. 03–0. 06	7. 5–8. 5	4–8	Low	Low.
100	100	95–100	85–100	55–65	30–50	0. 06–0. 2	0. 13–0. 15	8. 0–8. 6	4–16	High	Low.
95–100	95–100	60–70	30–40	30–40	15–20	0. 6–2. 0	0. 10–0. 13	8. 4–8. 5	4–8	Moderate	Low.
100	100	80–90	70–80	30–40	15–25	0. 2–0. 6	0. 17–0. 18	9. 0–9. 4	8–16	Moderate	Low.
100	80–90	50–60	10–20	10–20	----	>20. 0	0. 05–0. 08	8. 3–8. 5	4–16	Low	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Hardpan or bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*In*				*Pct*
Badland: BA Variable, eroded, lacustrine deposits along shoreline. Onsite investigation required.	>5	>5					
*Bango:							
BdA, BdB	>5	>5	0–30	Stratified loamy sand, sandy loam, and sandy clay loam.	SC	A–6	0
			30–43	Very fine sandy loam	ML	A–5	0
			43–60	Loamy sand	SM	A–2	0
BeB, BK For properties of Stumble part in BK; see Stumble series.	>5	>5	0–8	Sandy loam and loam	SM	A–2 or A–4	0
			8–12	Very cobbly and gravelly sandy loam.	SM	A–2	35–60
			12–63	Stratified fine sandy loam, very fine sandy loam, and silt loam.	SM or ML	A–4	0
BhA	>5	>5	0–25	Silt loam and clay loam	ML or CL	A–4 or A–6	0
			25–33	Silt loam	ML	A–4 or A–5	0
			33–60	Stratified loamy very fine sand, fine sand, and sand.	SM	A–2	0
Biddleman: BLB, BM	>5	>5	0–5	Gravelly sandy loam and very stony sandy loam.	SM	A–2 or A–1	5–30
			5–8	Gravelly clay loam	GC or CL	A–6	5–15
			8–60	Very gravelly loamy sand, sand, and gravel.	GP–GM or GP	A–1	0–15
Bluewing: BnC	>5	>5	0–9	Gravelly loamy sand	SM	A–1	0–5
			9–60	Very gravelly and cobbly loamy sand.	GP–GM	A–1	10–20
*Bunejug:							
Bo, Br Salinity of Bo at a depth of 0 to 10 inches is less than 2.	>5	3–5	0–10	Sandy loam	SC–SM or SC	A–2 or A–6	0
			10–60	Stratified loamy fine sand, silt loam and very fine sandy loam.	ML	A–4	0
Bs	>5	3–5	0–12	Sandy loam	SC–SM or SC	A–2 or A–6	0
			12–60	Stratified loamy fine sand, silt loam, and very fine sandy loam.	ML	A–4	0
BT For properties of Erber part, see Erber series.	>5	3–5	0–17	Clay loam or silty clay loam.	CL	A–6 or A–7	0
			17–60	Stratified loamy fine sand, silt loam, very fine sandy loam, and sandy clay loam.	ML	A–4	0
Carcity:							
Ca, Cc Salinity of Ca at a depth of 0 to 28 inches is less than 2.	>5	3–5	0–28	Clay	CH	A–7	0
			28–60	Sand	SP–SM or SM	A–3	0
Cd	>5	3–5	0–32	Clay	CH	A–7	0
			32–60	Stratified sand and loamy fine sand.	SM	A–2 or A–4	0

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-action potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
						In per hr	*In per inch of soil*	*pH*	*Mmhos per cm at 25°C*		
95–100	95–100	70–80	35–50	25–35	10–20	0. 2–0. 6	0. 15–0. 17	7. 5–8. 5	4–8	Moderate	Low.
100	100	85–95	50–65	40–50	5–10	0. 6–2. 0	0. 15–0. 17	8. 0–8. 5	4–8	Low	Low.
100	100	50–75	15–30	15–25		6. 0–20. 0	0. 08–0. 10	7. 5–8. 0	2–4	Low	Low.
80–90	70–80	60–70	30–40	30–40		0. 2–0. 6	0. 13–0. 15	8. 3–8. 6	4–8	Low or moderate.	Low.
60–80	50–70	35–60	20–30	20–30		0. 6–2. 0	0. 15–0. 17	8. 3–8. 6	8–16	Low	Low.
90–100	85–100	85–95	45–70	30–40	5–10	0. 2–0. 6	0. 15–0. 17	8. 5–8. 7	8–16	Low	Low.
95–100	95–100	85–100	65–85	30–40	5–25	0. 2–0. 6	0. 17–0. 18	8. 0–8. 6	2–8	Moderate	Low.
100	100	95–100	85–95	35–45	5–10	<0. 06	0. 02–0. 05	8. 0–8. 5	4–8	Low	Low.
100	100	65–95	25–35	15–25		6. 0–20. 0	0. 08–0. 10	8. 0–8. 5	2–4	Low	Low.
70–85	70–80	40–55	20–30	25–35	5–10	0. 6–2. 0	0. 08–0. 10	8. 5–8. 7	<2	Low	Low.
70–85	65–75	60–75	45–55	30–40	15–25	0. 2–0. 6	0. 13–0. 15	8. 3–8. 7	4–8	Moderate	Low.
20–40	15–30	10–20	0–10	5–15		>20. 0	0. 03–0. 05	8. 4–8. 8	4–8	Low	Low.
70–85	65–80	30–45	10–25	10–20		6. 0–20. 0	0. 07–0. 08	7. 6–8. 4	<2	Low	Low.
30–50	20–40	15–30	5–10	10–20		>20. 0	0. 03–0. 05	8. 4–8. 8	4–8	Low	Low.
100	100	60–70	30–40	20–30	5–15	2. 0–6. 0	0. 10–0. 13	6. 8–7. 5	<8	Low	Low.
100	100	70–90	50–70	30–40	0–10	0. 6–2. 0	0. 13–0. 15	7. 5–8. 0	4–8	Low	Low.
100	100	60–70	30–40	20–30	5–15	2. 0–6. 0	0. 10–0. 13	6. 8–7. 5	>16	Low	Low.
100	100	70–90	50–70	30–40	0–10	0. 6–2. 0	0. 13–0. 15	7. 5–8. 2	>16	Low	Low.
100	100	90–100	70–80	30–45	20–30	0. 2–0. 6	0. 18–0. 19	8. 0–8. 4	>16	Moderate	Low.
100	100	70–90	50–70	30–40	0–10	0. 6–2. 0	0. 13–0. 15	7. 0–8. 2	>16	Low	Low.
100	100	90–100	75–90	55–65	40–50	0. 06–0. 2	0. 15–0. 17	7. 5–8. 3	<8	High	Low.
100	95–100	50–70	5–15	10–20		>20. 0	0. 05–0. 06	8. 0–8. 5	2–8	Low	Low.
100	100	90–100	75–90	55–65	40–50	0. 06–0. 2	0. 15–0. 17	8. 4–8. 6	>16	High	Low.
90–100	60–100	35–70	15–40	20–30		6. 0–20. 0	0. 06–0. 07	8. 0–8. 5	>16	Low	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Hardpan or bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*In*				*Pct*
*Carson:							
CE	>5	3–5	0–15	Clay loam	CL or CH	A–7 or A–6	0
			15–60	Clay	CH	A–7	0
Cg, Ch	>5	3–5	0–15	Clay	CH	A–7	0
			15–60	Clay	CH	A–7	0
Ck, CM	>5	3–5	0–60	Clay	CH	A–7	0
For properties of Stillwater part in CM, see Stillwater series. Seasonal high water table at a depth of 1.5 to 3 feet in CM.							
Celeton: CNE	0.5–1	>5	0–11	Very cobbly sandy loam	GP–GM or GM	A–1	30–50
			11–60	Consolidated diatomaceous earth.			
*Churchill: CP	>5	3–5	0–9	Clay loam and gravelly silty clay loam.[2]	CL or CH	A–6 or A–7	10–40
For Playas part, see Playas.			9–60	Silty clay	CH	A–7	0
Dia:							
Da, Dc	>5	3–5	0–29	Stratified loam, silt loam, silty clay loam, and sandy loam.	CL	A–6 or A–7	0
Salinity of Da at depth of 0 to 60 inches is less than 2.			29–60	Sand	SP–SM or SM	A–3 or A–2	0
Dd, De	>5	3–5	0–29	Stratified loam and silty clay loam.	CL	A–6 or A–7	0
Seasonal high water table at a depth of 1.5 to 3 feet in De.			29–60	Sand	SP–SM or SM	A–2	0
Dithod:							
Dh, Dk	>5	3–5	0–46	Loam, stratified fine sandy loam, and very fine sandy loam.	CL	A–6	0
Salinity of Dh is less than 2.			46–62	Loamy sand	SM	A–2	0
Dm	>5	3–5	0–46	Loam, stratified fine sandy loam, and very fine sandy loam.	CL	A–6	0
			46–62	Loamy sand	SM	A–2	0
*Dune land: Dp	>5	>5	0–60	Sand or fine sand	SP–SM or SM	A–2 or A–3	0
For Playas part, see Playas.							
East Fork:							
Ea, Ec	>5	>5	0–60	Clay loam	CL	A–6	0
Salinity of Ea at depth of 0 to 60 inches is less than 2.							
Ed	>5	3–5	0–40	Clay loam	CL	A–6	0
			40–60	Loamy fine sand	SM	A–2	0

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-action potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
						In per hr	*In per inch of soil*	*pH*	*Mmhos per cm at 25°C*		
100	100	95–100	90–100	35–55	20–30	0. 06–0. 2	0. 18–0. 19	8. 5–9. 6	>16	High	Low.
100	100	95–100	90–100	50–75	25–50	<0. 06	0. 15–0. 17	8. 5–9. 6	>16	High	Low.
100	100	95–100	90–100	60–75	40–50	<0. 06	0. 15–0. 17	8. 0–8. 9	2–8	High	Low.
100	100	95–100	90–100	60–75	40–50	<0. 06	0. 15–0. 17	8. 0–8. 5	4–16	High	Low.
100	100	95–100	90–100	60–75	40–50	<0. 06	0. 15–0. 17	8. 5–9. 6	>16	High	Moderate.
25–40	20–45	20–40	5–20	25–35		6. 0–20. 0	0. 10–0. 13	7. 6–8. 4	<2	Low	Low.
75–85	70–80	60–70	50–60	35–55	20–30	0. 06–0. 2	0. 17–0. 18	8. 5–9. 6	>16	Moderate	Low.
100	95–100	90–100	80–95	50–60	35–45	<0. 06	0. 13–0. 15	8. 5–9. 6	>16	High	Low.
100	100	85–95	60–75	30–45	15–30	0. 2–0. 6	0. 16–0. 18	6. 5–7. 2	<8	Moderate	High.
100	95–100	50–70	5–15	10–20		>20. 0	0. 05–0. 06	6. 5–7. 2	<4	Low	Low.
100	100	85–95	60–75	30–45	15–30	0. 6–2. 0	0. 15–0. 17	7. 0–8. 5	>16	Moderate	Low.
100	95–100	50–70	5–15	10–20		>20. 0	0. 05–0. 06	7. 0–7. 5	8–16	Low	Low.
100	100	85–95	60–75	30–40	10–20	0. 6–2. 0	0. 15–0. 17	6. 5–7. 5	4–8	Moderate	Low.
100	100	80–90	15–30	20–30		>20. 0	0. 08–0. 10	6. 8–7. 5	4–8	Low	Low.
100	100	85–95	60–75	30–40	10–30	0. 6–2. 0	0. 15–0. 17	6. 5–7. 5	>16	Moderate	Low.
100	100	80–90	15–30	20–30		>20. 0	0. 08–0. 10	6. 8–7. 5	>16	Low	Low.
100	100	50–75	5–15	10–20		>20. 0	0. 06–0. 07	7. 0–8. 4	<2	Low	Low.
100	100	90–100	70–80	30–40	15–25	0. 2–0. 6	0. 18–0. 19	7. 0–8. 0	<8	Moderate	Low.
100	100	90–100	70–80	30–40	15–25	0. 2–0. 6	0. 18–0. 19	8. 0–8. 6	>16	Moderate	Low.
100	100	70–80	20–35	10–20		6. 0–20. 0	0. 10–0. 13	8. 2–8. 6	>16	Low	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Hardpan or bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*In*				*Pct*
Erber:							
Ee	>5	3–5	0–40	Sand	SP–SM or SM	A–2 or A–3	0
			40–60	Clay	CH	A–7	0
Eg	>5	3–5	0–14	Loam	ML or CL	A–6	0
			14–60	Sand	SP–SM or SM	A–2 or A–3	0
Eh	>5	3–5	0–16	Loam and silt loam	ML or CL	A–6	0
			16–60	Sand	SP–SM or SM	A–2 or A–3	0
Em	>5	3–5	0–10	Clay	CH	A–7	0
			10–60	Sand	SP–SM or SM	A–2 or A–3	0
En	>5	3–5	0–10	Clay	CH	A–7	0
			10–60	Sand	SP–SM or SM	A–2 or A–3	0
Fallon:							
Fa, Fc Salinity of Fa at a depth of 0 to 48 inches is less than 2.	>5	3–5	0–24	Fine sandy loam and sandy loam.	SM	A–4	0
			24–48	Loamy coarse sand and gravelly coarse sand.	SP–SM or SM	A–1	0
			48–60	Clay	CH	A–7	0
Fd, Fe Seasonal high water table is at a depth of 1.5 to 3 feet in Fe.	>5	3–5	0–20	Fine sandy loam	SM	A–4	0
			20–44	Loamy sand	SM	A–2	0
			44–60	Silty clay loam	CL	A–6	0
Fernley:							
Fn	>5	3–5	0–60	Sand	SP–SM or SM	A–2 or A–1	0
Fo	>5	3–5	0–12	Loam	ML	A–4	0
			12–60	Sand	SP–SM or SM	A–2 or A–1	0
Fr	>5	3–5	0–8	Clay	CH	A–7	0
			8–60	Sand	SP–SM or SM	A–2 or A–1	0
Gardella: GA	0.5–1.0	>5	0–3	Gravelly silt loam	ML	A–4	0
			3–10	Stratified coarse sand and coarse sandy loam.	SM	A–2	0
			10–24	Silica-cemented hardpan.[3]			
			24–60	Silty clay	CH	A–7	0
*Hooten: HB For properties of Bango part, see Bango series, and for Tipperary part, see Tipperary series.	0.5–1.0	>5	0–5	Gravelly and very gravelly clay loam.	SC or GC	A–2 or A–6	0
			5–10	Silica-cemented hardpan.[3]			
			10–15	Silt loam	ML	A–4	0
			15–44	Stratified sand and very gravelly coarse sand.	SP or SP–SM	A–1	0
			44–60	Stratified sandy loam and silt loam.	ML	A–4	0
Huxley: HU	>5	>5	0–9	Very gravelly clay and clay loam.[4]	GC	A–6	5–10
			9–60	Fine sand and very fine sand.	SM	A–2 or A–4	0
Juva: JuA, JuB, JvB	>5	>5	0–6	Loam or silt loam	ML or CL	A–6	0
			6–25	Sandy loam	SM	A–2 or A–4	0–10
			25–65	Stratified very gravelly coarse sand, loamy sand, and very fine sandy loam.	SM	A–2	0–10

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-action potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
						In per hr	*In per inch of soil*	*pH*	*Mmhos per cm at 25°C*		
100	100	50–70	5–20	10–20	----	6. 0–20. 0	0. 05–0. 06	8. 2–8. 8	>16	Low	Low.
100	100	90–100	75–95	55–65	40–50	<0. 06	0. 13–0. 15	8. 2–8. 8	>16	High	Low.
100	100	85–95	60–75	30–40	15–25	0. 6–2. 0	0. 15–0. 17	7. 0–8. 2	<2	Moderate	Low.
100	100	50–70	5–20	10–20	----	6. 0–20. 0	0. 05–0. 06	7. 0–8. 2	<2	Low	Low.
100	100	85–95	60–75	30–40	15–25	0. 6–2. 0	0. 13–0. 15	8. 0–8. 8	>16	Moderate	Low.
100	100	50–70	5–20	10–20	----	6. 0–20. 0	0. 05–0. 06	7. 0–8. 5	>16	Low	Low.
100	100	90–100	75–95	55–65	40–50	0. 06–0. 2	0. 15–0. 17	8. 4–8. 6	4–8	High	Low.
100	100	50–70	5–20	15–25	----	6. 0–20. 0	0. 05–0. 06	8. 4–8. 6	4–8	Low	Low.
100	100	90–100	75–95	55–65	40–50	0. 06–0. 2	0. 15–0. 17	8. 5–9. 6	>16	High	Low.
100	100	50–70	5–20	15–25	----	6. 0–20. 0	0. 05–0. 06	8. 4–9. 0	>16	Low	Low.
100	100	75–85	40–50	25–35	5–10	2. 0–6. 0	0. 10–0. 13	6. 8–7. 6	<8	Moderate	Low.
80–100	75–95	35–50	5–25	10–20	----	6. 0–20. 0	0. 05–0. 08	7. 0–7. 6	<8	Low	Low.
100	100	90–100	75–95	55–65	40–50	<0. 06	0. 15–0. 17	7. 5–8. 6	4–8	High	Low.
100	100	70–85	40–50	25–35	5–10	2. 0–6. 0	0. 10–0. 13	7. 5–8. 5	>16	Low	Low.
100	95–100	50–70	15–30	10–20	----	6. 0–20. 0	0. 08–0. 10	8. 0–8. 6	>16	Low	Low.
100	100	95–100	85–95	30–40	15–25	0. 2–0. 6	0. 17–0. 18	8. 0–8. 8	>16	Moderate	Low.
100	90–100	45–70	5–15	10–20	----	>20. 0	0. 05–0. 06	7. 4–8. 8	<2	Low	Low.
100	100	85–95	60–75	25–35	5–10	0. 6–2. 0	0. 15–0. 17	7. 4–8. 0	<2	Low	Low.
100	90–100	45–70	5–15	10–20	----	>20. 0	0. 05–0. 06	7. 8–8. 8	<2	Low	Low.
100	100	90–100	75–95	50–65	30–40	0. 06–0. 2	0. 13–0. 15	7. 4–8. 0	<2	High	Low.
100	90–100	45–70	5–15	10–20	----	>20. 0	0. 05–0. 06	7. 8–8. 8	<2	Low	Low.
75–95	70–90	70–85	50–80	30–40	5–10	0. 6–2. 0	0. 13–0. 15	8. 6–9. 0	>16	Low	Low.
[1] 100	[1] 100	[1] 40–65	[1] 25–35	[1] 15–25	([1])	0. 06–0. 2	0. 07–0. 08	8. 6–9. 0	>16	Low	Low.
----	----	----	----	----	----	<0. 06	----	9. 0–9. 6	----	Low	Low.
100	100	95–100	75–95	55–65	30–45	<0. 06	0. 13–0. 15	8. 6–9. 6	>16	High	Low.
55–70	25–50	20–50	15–40	25–35	10–20	0. 2–0. 6	0. 10–0. 13	8. 5–9. 6	4–8	Moderate	Low.
----	----	----	----	----	----	<0. 06	----	9. 0–9. 6	----	Low	Low.
100	90–100	80–100	60–90	25–35	----	0. 2–0. 6	0. 15–0. 17	9. 0–9. 6	>16	Low	Low.
60–80	50–70	30–40	0–5	5–15	----	6. 0–20. 0	0. 03–0. 05	8. 5–9. 2	>16	Low	Low.
100	90–100	70–80	50–60	20–30	----	0. 6–2. 0	0. 10–0. 13	8. 5–9. 2	>16	Low	Low.
60–70	50–60	45–55	35–40	30–40	20–25	0. 06–0. 2	0. 15–0. 17	8. 5–9. 6	>16	High	Low.
100	100	70–80	30–50	15–25	----	6. 0–20. 0	0. 06–0. 07	8. 5–9. 6	>16	Low	Low.
100	100	75–100	60–90	25–35	10–20	2. 0–6. 0	0. 13–0. 15	8. 0–9. 0	<2	Moderate	Low.
85–95	70–90	55–60	30–40	15–25	----	2. 0–6. 0	0. 10–0. 13	8. 0–8. 8	<2	Low	Low.
85–95	70–90	50–70	15–30	10–20	----	2. 0–6. 0	0. 08–0. 10	8. 4–8. 6	<2	Low	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Hardpan or bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*In*				*Pct*
*Labou: LR	0. 5–1. 5	>5	0–7	Clay	CH	A–7	0
Rock outcrop part is variable; no estimates given for Rock outcrop.			7–11	Very gravelly sandy clay loam.	GC	A–2	0
			11–18	Hard cemented tufa			
Lahontan:							
Ls	>5	3–5	0–10	Clay or silty clay	CH	A–7	0
			10–63	Clay or silty clay	CH	A–7	0
Lt	>5	3–5	0–60	Clay or silty clay	CH	A–7	0
Marsh: Ma.							
Low, depressional, ponded areas. Variable; no estimates given.							
*Mazuma: MB	>5	>5	0–60	Stratified silt loam, loam, and very fine sandy loam.	ML	A–4	0
For properties of Bango part, see Bango series.							
Mine pits: MD.							
Open pit mining areas. Variable; no estimates given.							
Osobb	1. 0–1. 5	>5	0–17	Gravelly fine sandy loam	SM	A–2	40–80
Mapped only in an association with Pirouette soils.			17–20	Silica-cemented hardpan on tuff bedrock.			
*Parran: PA, PC	>5	3–5	0–60	Silty clay	CH	A–7	0
For properties of Tipperary part in PC, see Tipperary series.							
Patna: PD	>5	>5	0–6	Sand and loamy sand	SM	A–2	0
			6–24	Sandy loam	SM	A–2	0
			24–60	Sand and loamy sand	SM	A–2	0
Pelic:							
Pe	>5	0–3	0–38	Stratified sand, loamy sand, and sandy loam.	SM	A–2	0
			38–42	Silty clay	CH	A–7	0
			42–60	Sand and coarse sand	SP–SM or SP	A–3	0
Pf	>5	0–3	0–6	Clay	CH	A–7	0
			6–60	Stratified loamy sand, fine sand, fine sandy loam, and coarse sand.	SP–SM or SM	A–2	0
Ph	>5	0–3	0–40	Stratified sand and loamy fine sand.	SP–SM or SM	A–2	0
			40–60	Clay	CH	A–7	0
*Pirouette: PM, PO	1. 0–1. 5	>5	0–10	Stony and cobbly clay loam.	CL or SC	A–6	35–40
For properties of Bluewing part in PM, see Bluewing series. For properties of Osobb part in PO, see Osobb series.			10–19	Very cobbly sandy loam	SC	A–2	40–60
			19–20	Silica-cemented hardpan on hard olivine basalt.			
Playas: PY.							
Nearly level, slightly concave, intermittent lake basins. Highly variable material; no estimates given.							

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-action potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)			*In per hr*	*In per inch of soil*	*pH*	*Mmhos per cm at 25°C*		
100	100	90–100	75–95	50–65	30–45	0. 06–0. 2	0. 15–0. 17	8. 4–9. 6	8–16	High	Low.
35–60	25–50	20–45	15–25	25–35	10–20	0. 2–0. 6	0. 10–0. 13	8. 5–9. 0	8–16	Moderate	Low.
										Low	Low.
100	100	90–100	70–90	50–60	30–40	0. 06–0. 2	0. 15–0. 17	8. 2–9. 0	2–4	High	Low.
100	100	90–100	80–95	60–70	40–50	<0. 06	0. 13–0. 15	8. 2–9. 6	8–>16	High	Low.
100	100	90–100	80–95	60–70	40–50	<0. 06	0. 13–0. 15	8. 2–9. 6	>16	High	Low.
100	100	85–95	70–80	30–40	0–10	2. 0–6. 0	0. 15 0. 17	8. 0–8. 6	>16	Low	Low.
70–80	60–70	40–50	25–35	15–25	0–5	2. 0–6. 0	0. 10–0. 13	8. 0–9. 4	2–4	Low	Low.
						<0. 06		8. 4–9. 6		Low	Low.
100	100	95–100	90–95	60–75	30–50	<0. 06	0. 13–0. 15	8. 6–9. 6	>16	High	Low.
95–100	90–100	50–70	15–25	10–20		6. 0–20. 0	0. 06–0. 07	6. 8–7. 2	<2	Low	Low.
95–100	100	50–60	25–35	15–25		2. 0–6. 0	0. 08–0. 10	7. 4–7. 6	<2	Low	Low.
95–100	95–100	50–70	15–30	10–20		6. 0–20. 0	0. 07–0. 08	7. 6–8. 4	<2	Low	Low.
100	100	50–75	15–30	10–25		6. 0–20. 0	0. 06–0. 08	8. 2–8. 6	>16	Low	Low.
100	100	95–100	90–95	55–65	35–45	<0. 06	0. 13–0. 15	8. 2–8. 6	8–16	High	Low.
100	100	50–70	0–10	5–10		>20. 0	0. 03–0. 05	8. 2–8. 6	4–8	Low	Low.
100	100	95–100	90–95	55–65	35–45	<0. 06	0. 13–0. 15	8. 2–8. 6	>16	High	Low.
100	100	50–70	10–20	10–20		6. 0–20. 0	0. 05–0. 06	8. 4–8. 8	4–8	Low	Low.
100	100	50–70	10–25	10–20		6. 0–20. 0	0. 05–0. 06	8. 2–8. 4	>16	Low	Low.
100	100	95–100	90–95	55–65	35–45	<0. 06	0. 10–0. 13	8. 2–8. 5	8–16	High	Low.
70–75	65–70	60–65	45–55	30–40	15–25	0. 2–0. 6	0. 10–0. 13	8. 4–9. 0	2–4	Moderate	Low.
70–75	65–70	45–55	25–35	15–30	5–10	0. 6–2. 0	0. 07–0. 08	8. 0–8. 8	2–4	Low	Low.
						<0. 06		8. 5–9. 6		Low	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Hardpan or bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*In*				*Pct*
Ragtown:							
Ra, Rc	>5	3–5	0–42	Stratified sandy clay loam, clay loam, and silty clay loam.	CL	A–7	0
Salinity of Ra is less than 2.			42–64	Silty clay	CH	A–7	0
Rg	>5	3–5	0–42	Stratified clay loam, sandy clay loam, and silty clay loam.	CL	A–6	0
			42–60	Silty clay	CH	A–7	0
Sagouspe:							
Sa	>5	3–5	0–29	Loamy sand	SM	A–2	0
			29–58	Stratified sand to silty clay loam.	SM	A–4 or A–2	0
Sb	>5	3–5	0–29	Loamy sand	SM	A–2	0
			29–58	Stratified sand to silty clay loam.	SM	A–2 or A–4	0
*Soda Lake:							
ScA, SdA, SeD, SH	>5	>5	0–60	Stratified gravelly loamy sand, gravelly sand, fine sand, and loamy fine sand.	SM	A–2 or A–1	0
Rock outcrop part of SH variable; no estimates given for Rock outcrop.							
SfA	>5	3–5	0–16	Sandy loam	SM	A–2 or A–4	0
			16–60	Stratified gravelly sand to fine sandy loam.	SM	A–2 or A–1	0
SgA	>5	3–5	0–16	Sandy loam	SM	A–2 or A–4	0
			16–60	Stratified gravelly sand to fine sandy loam.	SM	A–2 or A–1	0
Stillwater:							
Sk, Sm	>5	3–5	0–60	Stratified clay loam, silty clay loam, and silty clay.	CL or CH	A–7	0
Salinity is less than 2 for unit Sk.							
Sn	>5	1. 5–3	0–60	Stratified clay loam, silty clay loam, and silty clay.	CL or CH	A–7	0
So	>5	1. 5–3	0–60	Clay loam, silty clay loam, and very fine sandy loam.	CL	A–6 or A–7	0
Sp	>5	3–5	0–30	Clay and silty clay loam.	CH	A–7	0
			30–60	Stratified silt loam, silty clay loam, and very fine sandy loam.	CL	A–6	0
Stumble	>5	>5	0–29	Loamy sand	SM	A–2 or A–1	0–5
Mapped only in an association with Bango soils.			29–60	Gravelly loamy sand	SM	A–2 or A–1	0–5

See footnotes at end of table.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-action potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
						In per hr	*In per inch of soil*	*pH*	*Mmhos per cm at 25°C*		
100	100	95–100	70–80	40–50	20–30	0. 2–0. 6	0. 18–0. 19	8. 0–8. 6	<8	Moderate	High.
100	100	95–100	90–95	50–60	30–40	0. 06–0. 2	0. 17–0. 18	8. 4–8. 8	<8	High	Moderate
100	100	95–100	70–80	40–50	20–30	0. 2–0. 6	0. 18–0. 19	8. 4–9. 4	>16	Moderate	Low.
100	100	95–100	90–95	50–60	30–40	0. 06–0. 2	0. 17–0. 18	8. 4–9. 4	>16	High	Low.
100	100	50–75	15–30	10–20		6. 0–20. 0	0. 09–0. 13	7. 0–8. 4	<2	Low	Low.
100	100	50–75	30–50	10–35	0–10	0. 6–2. 0	0. 13–0. 15	8. 0–8. 5	<2	Low	Low.
100	100	50–75	15–30	10–20		6. 0–20. 0	0. 10–0. 13	8. 4–9. 0	4–16	Low	Low.
100	100	50–70	30–50	10–35	0–10	0. 6–2. 0	0. 13–0. 15	8. 0–9. 0	4–16	Low	Low.
75–90	70–85	45–65	15–30	15–25		6. 0–20. 0	0. 07–0. 08	8. 2–9. 4	2–8	Low	Low.
100	100	50–60	30–40	20–30		2. 0–6. 0	0. 10 0. 13	8. 0–8. 4	<2	Low	Low.
75–90	70–85	45–65	15–30	15–25		6. 0–20. 0	0. 07–0. 08	8. 0–8. 4	<2	Low	Low.
100	100	50–60	30–40	20–30		2. 0–6. 0	0. 10–0. 13	8. 4–8. 6	>16	Low	Low.
75–90	70–85	45–65	15–30	15–25		6. 0–20. 0	0. 07–0. 08	8. 2–8. 8	>16	Low	Low.
100	100	90–100	75–95	40–60	25–40	0. 06–0. 2	0. 18–0. 19	8. 0–8. 6	4–8	High	Low.
100	100	90–100	75–95	40–60	25–40	0. 06–0. 2	0. 18–0. 19	8. 2–8. 6	>16	High	Low.
100	100	95–100	70–90	35–50	20–35	0. 2–0. 6	0. 18–0. 19	8. 2–8. 6	4–6	Moderate	Low.
100	100	90–100	75–95	50–60	30–40	0. 06–0. 2	0. 17–0. 18	8. 0–8. 5	<2	High	Low.
100	100	90–100	70–80	30–40	15–25	0. 2–0. 6	0. 17–0. 18	8. 0–8. 5	4–8	Moderate	Low.
95–100	90–100	45–75	15–30	15–25		6. 0–20. 0	0. 08–0. 10	8. 0–8. 3	<2	Low	Low.
80–100	70–80	40–65	10–25	10–20		6. 0–20. 0	0. 06–0. 09	8. 0–8. 3	2–4	Low	Low.

TABLE 7.—*Estimated soil properties*

Soil series and map symbols	Depth to—		Depth from surface	Classification			Coarse fraction greater than 3 inches
	Hardpan or bedrock	Seasonal high water table		USDA texture	Unified	AASHO	
	Feet	*Feet*	*In*				*Pct*
Swingler:							
Sr	>5	5–6	0–10	Sand	SP–SM or SM	A–2 or A–3	0
			10–25	Sandy loam	SM	A–2 or A–4	0
			25–60	Stratified silt loam and silty clay loam.	CL	A–6	0
Ss	>5	5–6	0–19	Sandy loam	SM or SC	A–2 or A–4	0
			19–60	Silt loam	CL	A–6	0
St, Su	>5	5–6	0–12	Clay loam	CL	A–7	0
Salinity of St at depth of 0 to 12 inches is less than 2, and it is 2 to 4 at depth of 12 to 60 inches. Seasonal high water table is at a depth of 3 to 5 feet in St.			12–60	Stratified silty clay loam, silt loam, and sand.	CL	A–6	0
Sv	>5	3–5	0–12	Clay loam	CL	A–6	0
			12–60	Stratified silt loam, silty clay loam, and fine sandy loam.	CL	A–6	0
Swope:							
Sw	>5	3–5	0–8	Sandy loam	SM	A–2 or A–4	0
			8–25	Silty clay loam	CL	A–7 or A–6	0
			25–60	Sand and coarse sand	SP–SM or or SM	A–2 or A–3	0
Sx	>5	3–5	0–27	Clay loam and silty clay loam.	CL	A–6 or A–7	0
			27–60	Sand and coarse sand	SP–SM or SM	A–1 or A–3	0
Sy	>5	3–5	0–7	Clay loam	CL	A–6 or A–7	0
			7–27	Silty clay loam	CL or CH	A–7	0
			27–60	Sand and coarse sand	SP–SM or SM	A–1 or A–3	0
Sz	>5	3–5	0–27	Clay loam and silty clay loam.	CL	A–6 or A–7	0
			27–60	Sand and coarse sand	SP–SM or SM	A–1 or A–3	0
*Tipperary: TnA, TnC, TPB, TPD, TR, TS, TU, TV. For properties of Appian parts in TR and TS, see Appian series. For properties of Lahontan part in TU, see Lahontan series. For properties of Parran part in TV, see Parran series.	>5	>5	0–62	Sand and fine sand	SP–SM	A–3	0
Weishaupt:							
Wc, We	>5	3–5	0–23	Clay loam and sandy clay loam.	CL	A–7 or A–6	0
Salinity of Wc at depth of 0 to 23 inches is less than 2.			23–60	Clay	CH	A–7	0
Wh	>5	3–5	0–23	Clay loam	CL	A–7 or A–6	0
			23–60	Clay	CH	A–7	0

[1] Estimates reflect percentage passing sieve, liquid limit, and plasticity index after mixing of stratified layers.
[2] Intermittently continuous cemented tufa that has tufa fragments the size of cobblestones and gravel.

significant to engineering—Continued

Percentage less than 3 inches passing sieve—				Liquid limit	Plasticity index	Permeability	Available water capacity	Reaction	Salinity	Shrink-swell potential	Frost-action potential
No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)								
						In per hr	*In per inch of soil*	*pH*	*M mhos per cm at 25°C*		
100	100	50–70	5–15	10–20	-------	6. 0–20. 0	0. 07–0. 08	7. 8–8. 2	<2	Low-------	Low
100	100	60–70	30–40	15–25	0–5	0. 6–2. 0	0. 10–0. 13	8. 0–8. 4	4–8	Low-------	Low
100	100	90–100	70–90	20–30	10–20	0. 2–0. 6	0. 15–0. 17	8. 0–8. 6	4–8	Moderate---	Low
100	100	60–70	30–40	15–25	5–10	0. 6–2. 0	0. 10–0. 13	7. 5–8. 0	2	Low-------	High
100	100	90–100	70–90	20–30	10–20	0. 2–0. 6	0. 15–0. 17	7. 5–8. 0	2–4	Moderate---	High
100	100	90–100	70–80	40–50	25–35	0. 2–0. 6	0. 18–0. 19	7. 5–8. 0	2–8	Moderate---	Low
100	100	90–100	70–90	20–30	10–20	0. 2–0. 6	0. 15–0. 17	7. 8–8. 4	2–8	Moderate---	Low
100	100	90–100	70–80	40–50	25–35	0. 2–0. 6	0. 18–0. 19	8. 0–8. 4	>16	Moderate---	High
100	100	90–100	70–90	20–30	10–20	0. 2–0. 6	0. 15–0. 17	8. 2–8. 6	>16	Moderate---	High
100	100	60–70	30–40	20–30	0–5	0. 6–2. 0	0. 10–0. 13	8. 4–8. 6	>16	Low-------	Low.
100	100	90–100	80–90	35–45	20–30	0. 2–0. 6	0. 17–0. 18	8. 4–8. 8	>16	Moderate---	Low.
100	100	50–70	5–15	10–20	-------	6. 0–20. 0	0. 05–0. 06	8. 2–8. 6	>16	Low-------	Low.
100	100	90–100	70–90	30–45	25–35	0. 2–0. 6	0. 18–0. 19	8. 0–8. 2	2–8	Moderate---	Low.
80–100	60–100	40–55	5–15	10–20	-------	6. 0–20. 0	0. 05–0. 06	7. 5–8. 2	<2	Low-------	Low.
100	100	90–100	70–80	30–45	25–35	0. 2–0. 6	0. 18–0. 19	8. 0–8. 2	4–8	Moderate---	High.
100	100	90–100	80–90	30–45	25–35	0. 2–0. 6	0. 18–0. 19	8. 4–8. 6	4–8	Moderate---	High.
100	95–100	40–55	5–15	10–20	-------	6. 0–20. 0	0. 05–0. 06	8. 0–8. 5	4–8	Low-------	Moderate.
100	100	90–100	70–90	30–45	20–30	0. 2–0. 6	0. 18–0. 19	8. 2–8. 6	>16	Moderate---	Low.
80–100	60–100	40–55	5–15	10–20	-------	6. 0–20. 0	0. 05–0. 06	8. 4–8. 6	>16	Low-------	Low.
95–100	90–100	70–85	5–10	5–15	-------	>20. 0	0. 06–0. 07	7. 8–8. 8	<2	Low-------	Low.
100	100	90–100	70–80	35–45	25–35	0. 2–0. 6	0. 18–0. 19	8. 0–8. 6	2–8	Moderate---	Low.
100	100	95–100	75–90	60–70	40–50	<0. 06	0. 15–0. 17	8. 0–8. 4	4–8	High-------	Low.
100	100	90–100	70–80	35–45	20–30	0. 2–0. 6	0. 18–0. 19	8. 4–8. 6	>16	Moderate---	High.
100	100	95–100	75–90	60–70	40–50	<0. 06	0. 15–0. 17	8. 4–8. 6	>16	High-------	Moderate.

[3] Platy, silica-cemented materials; may be ripped with heavy equipment.
[4] Gravel and cobblestones consist of tufa fragments. In places, tufa intermittently cements soil near surface.

TABLE 8.—*Interpretations of engineering*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in referring to other series that

Soil series and map symbols	Degree and kinds of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
Alluvial land: Ad	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: high water table; flooding.	Severe: poorly drained; flooding.
*Appian: Af, Am, Ao	Severe: water table at a depth of 3 to 5 feet.	Severe: water table at a depth of 3 to 5 feet; very rapid permeability at a depth of 2 to 5 feet.	Severe: stratified sand at a depth of 2 to 5 feet; water table at a depth of 3 to 5 feet.	Moderate: water table at a depth of 3 to 5 feet.	Severe: water table at a depth of 3 to 5 feet; stratified sand at a depth of 2 to 5 feet.	Moderate: moderate shrink-swell potential; CL or SC subgrade material.
An	Severe: water table at a depth of 3 to 5 feet.	Severe: water table at a depth of 3 to 5 feet; rapid permeability to a depth of about 4 feet and slow permeability below a depth of 4 feet.	Severe: stratified sand at a depth about 1 to 4 feet; water table at a depth of 3 to 5 feet.	Moderate: water table at a depth of 3 to 5 feet.	Severe: water table at a depth of 3 to 5 feet; stratified sand at a depth of about 1 to 4 feet.	Moderate: moderate shrink-swell potential; mostly CL or ML subgrade material.
Ap, AS. For interpretations of Tipperary part in AS, see Tipperary series.	Severe: slow permeability to a depth of about 4 feet.	Severe: rapid permeability to a depth of about 1 foot and slow permeability at a depth of 4 feet.	Severe: stratified sand at a depth of about 1 foot.	Slight	Severe: rapid permeability to a depth of about 1 foot; slow permeability at a depth of 4 feet.	Slight
AR, AT. For interpretations of Tipperary part in AR see Tipperary series. For Playas in AT see Playas.	Slight	Severe: rapid permeability at a depth of 1 to 5 feet.	Severe: stratified sandy material at a depth of about 1 foot.	Slight	Severe: very rapid permeability at a depth of about 1 foot.	Slight

See footnotes at end of table.

properties of the soils

such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for appear in the first column of this table]

Suitability as source of—				Soil features affecting—				Hydrologic group
Roadfill	Sand	Gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	
Material variable; onsite investigation required.	Material variable; onsite investigation required.	Material variable; onsite investigation required.	Material variable; onsite investigation required.	Material variable; onsite investigation required.	Material variable; onsite investigation required.	Not applicable.	Not applicable.	(1)
Fair: mostly SP-SM or SM material at a depth of 2 feet; water table at a depth of 3 to 5 feet.	Fair: mostly SP-SM or SM material at a depth of 2 to 5 feet.	Unsuited----	Fair for Af and Ao: about 2 feet of sandy loam and clay loam. Poor for Am: strongly saline.	High seepage below a depth of 2 feet; water table at a depth of 3 to 5 feet.	Mostly SP-SM or SM material; fair to poor stability; high permeability when compacted.	Seasonal water table at a depth of 3 to 5 feet; very rapid permeability at a depth of 2 to 5 feet. Am is strongly saline.	Seasonal water table at a depth of 3 to 5 feet; Am is strongly saline.	C
Fair: mostly SP-SM or SM material at a depth of 1 to 4 feet; somewhat poorly drained.	Unsuited: limited thickness.	Unsuited----	Fair: about 1 foot of sandy loam, clay loam, and silt loam; slightly saline.	High seepage at a depth of about 1 to 4 feet; water table at a depth of 3 to 5 feet.	Mostly SP-SM or SM material; high permeability when compacted; fair to good stability.	Seasonal water table at a depth of 3 to 5 feet; slightly saline; rapid permeability at a depth of 1 to 4 feet; slow permeability in clay below a depth of 4 feet.	Seasonal water table at a depth of 3 to 5 feet; slightly saline.	C
Good: mostly SP-SM or SM material at a depth of about 1 to 4 feet.	Unsuited: limited thickness.	Unsuited----	Poor: about 1 foot of slightly saline fine sand, silt loam, or clay loam.	High seepage at a depth of about 1 to 4 feet; slowly permeable clay at a depth of 4 feet.	Mostly SP-SM or SM material; poor stability; high permeability when compacted; fair resistance to piping.	Drainage needed if irrigated; saline; slow permeability at a depth of 40 to 60 inches.	Moderately saline; low available water capacity.	C
Good: mostly SM or SP-SM material at a depth of about 1 foot.	Fair: mostly SM or SP-SM material at a depth of about 1 foot.	Unsuited----	Poor: about 1 foot of sandy loam and clay loam; moderately saline.	High seepage below a depth of 1 foot.	Mostly SP-SM or SM material; fair to good stability; high permeability when compacted; fair resistance to piping.	Not applicable.	Moderately saline; low available water capacity.	C

TABLE 8.—*Interpretations of engineering*

Soil series and map symbols	Degree and kinds of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
Badland: BA. Material variable, onsite investigation required.						
*Bango: BdA, BdB, BeB, BhA, BK. For interpretations of Stumble part in BK, see Stumble series.	Slight: rapid permeability below a depth of 2.5 to 3.5 feet.[2]	Severe: rapid permeability below a depth of 2.5 to 3.5 feet.	Severe: sand and loamy sand at a depth of 2.5 to 3.5 feet.	Slight to moderate: mostly ML, CL, or SC material; CL material may have plasticity index of more than 15.	Severe: rapid permeability below a depth of 2.5 to 3.5 feet.	Moderate: mostly ML, CL, or SC material that is more than 30 percent fines.
Biddleman: BLB, BM.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.[2]	Severe: rapid to very rapid permeability at a depth of about 1 to 5 feet.	Severe: very gravelly and loamy sands at a depth of about 1 to 5 feet.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: very rapid permeability at a depth of about 1 to 5 feet.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.
Bluewing: BnC	Slight[2]	Severe: very rapid permeability.	Severe: very gravelly and cobbly loamy sand.	Slight	Severe: very rapid permeability.	Slight
*Bunejug: Bo, Br, Bs, BT. For interpretations of Erber part in BT, see Erber series.	Severe: water table at a depth of 3 to 5 feet.	Moderate: moderate permeability; mostly ML material; water table at a depth of 3 to 5 feet.	Moderate: mostly silt loam and very fine sandy loam; water table at a depth of 3 to 5 feet.	Moderate: mostly ML material; water table at a depth of 3 to 5 feet.	Severe: water table at a depth of 3 to 5 feet.	Moderate: mostly ML material.
Carcity: Ca, Cc, Cd	Severe: water table at a depth of 3 to 5 feet; slow permeability to a depth of about 2 feet and very rapid permeability below a depth of 2 feet.	Severe: slowly permeable material about 2.5 feet thick over very rapidly permeable sand; water table at a depth of 3 to 5 feet.	Severe: water table at a depth of 3 to 5 feet; sandy material at a depth of about 2 to 5 feet.	Severe: CH surface material; high shrink-swell potential.	Severe: rapid to very rapidly permeable sand at a depth of about 2 to 5 feet.	Severe: CH surface material; high shrink-swell potential.

See footnotes at end of table.

properties of the soils—Continued

Suitability as source of—				Soil features affecting—				Hydrologic group
Roadfill	Sand	Gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	
Fair: mostly SC, ML, or CL material that is more than 30 percent fines; CL material in places has plasticity index of more than 15.	Poor: mostly SM material below a depth of 2.5 to 3.5 feet.	Unsuited	Fair: at least 8 inches of sandy loam, silt, loam, and clay loam; slightly saline.	Rapid permeability below a depth of 3.5 to 4.5 feet.	Mostly SC, ML, or CL material; moderate to low stability; moderate to poor resistance to piping.	Not applicable.	Slightly saline; high available water capacity; slopes of 0 to 4 percent.	C
Good: mostly GP-GM or GP material.	Unsuited	Fair to good: mostly GP-GM or GP material.	Poor: more than 15 percent gravel and cobblestones.	Pervious material; high seepage.	Mostly GP-GM or GP material; good stability; high permeability when compacted.	Not applicable.	Not applicable.	C
Good: mostly nonplastic GP-GM material.	Unsuited	Fair: GP-GM material.	Poor: very gravelly and cobbly loamy sand.	Pervious material; high seepage.	Good stability; high permeability when compacted.	Not applicable.	Not applicable.	A
Fair: mostly ML material.	Unsuited	Unsuited	Fair for Bo and Br, slightly saline; poor for Bs and BT, strongly saline.	Moderate permeability.	Mostly ML material; fair to poor stability; low permeability when compacted; poor resistance to piping.	Water table at a depth of 3 to 5 feet; moderate permeability; slightly saline to strongly saline.	Water table at a depth of 3 to 5 feet; slightly saline to strongly saline.	C
Poor: about 2.5 feet of CH material underlain by SP-SM or SM material.	Fair: mostly SP-SM or SM material at a depth of 2 to 5 feet.[3]	Unsuited	Poor: upper 2.5 feet mostly clay and silty clay; Cc and Cd are saline.	Slow permeability in upper 2 feet; very rapid permeability below a depth of 2 feet; water table at a depth of 3 to 5 feet.	Mostly CH material underlain by SP-SM or SM material; fair to poor stability; low permeability when compacted.	Water table at a depth of 3 to 5 feet; very rapidly permeable sand at a depth of 2 to 5 feet; Cc and Cd are saline.	Slow intake rate; slow permeability; Cc and Cd are saline.	D

TABLE 8.—*Interpretations of engineering*

Soil series and map symbols	Degree and kinds of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
*Carson: CE, Cg, Ch, Ck, CM. For interpretations of Stillwater part in CM, see Stillwater series.	Severe: water table at a depth of 3 to 5 feet.	Moderate for CE, Cg, Ch, and Ck water table at a depth of 3 to 5 feet; severe for CM water table at a depth of 1.5 to 3 feet.	Severe: mostly clay to a depth of 5 feet.	Severe: CH material; high shrink-swell potential; water table in CM at a depth of 1.5 to 3 feet.	Severe: poorly drained clay.	Severe: CH material; high shrink-swell potential.
Celèton: CNE	Severe: diatomaceous bedrock at a depth of 0.5 to 1 foot; slopes of 8 to 30 percent.	Severe: diatomaceous bedrock at a depth of 0.5 to 1 foot; slopes of 8 to 30 percent.	Severe: diatomaceous bedrock at a depth of 0.5 to 1 foot; slopes of 8 to 30 percent.	Severe: diatomaceous bedrock at a depth of 0.5 to 1 foot; slopes of 8 to 30 percent.	Severe: diatomaceous bedrock at a depth of 0.5 to 1 foot; slopes of 8 to 30 percent.	Severe: about 0.5 to 1 foot of SM over diatomaceous bedrock; slopes of 8 to 30 percent.
*Churchill: CP For Playas part, see Playas.	Severe: water table at a depth of 3 to 5 feet; very slow permeability.	Moderate: water table at a depth of 3 to 5 feet.	Severe: water table at a depth of 3 to 5 feet; clay.	Severe: CH material; high shrink-swell potential.	Severe: silty clay; water table at a depth of 3 to 5 feet.	Severe: mostly CH material; high shrink-swell potential.
Dia: Da, Dc, Dd, De	Severe: water table at a depth of 1.5 to 3 feet.	Severe: ML or CL material; moderately slow permeability; underlain by very rapidly permeable sand at a depth of about 2 feet.	Severe: water table at a depth of 1.5 to 5 feet; sand at a depth of 2 to 5 feet.	Moderate for Da, Dc, Dd: somewhat poorly drained; mostly ML or CL material. Severe for De: water table at a depth of 1.5 to 3 feet.	Severe: water table at a depth of 1.5 to 3 feet; sand at a depth of about 2 to 5 feet.	Severe: mostly CL material that has a plasticity index of more than 15.
Dithod: Dh, Dk, Dm	Severe: water table at a depth of 3 to 5 feet.	Moderate: permeability of less than 2 inches per hour; mostly SM or CL material; water table at a depth of 3 to 5 feet.	Severe: water table at a depth of 3 to 5 feet.	Moderate: somewhat poorly drained; mostly SM or CL material.	Severe: water table at a depth of 3 to 5 feet.	Moderate: mostly SM or CL material; water table at a depth of 3 to 5 feet.

See footnotes at end of table.

properties of the soils—Continued

Suitability as source of—				Soil features affecting—				Hydrologic group
Roadfill	Sand	Gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	
Poor: mostly CH material; high shrink-swell potential.	Unsuited	Unsuited	Poor: clay and clay loam; saline.	Very slow permeability.	Mostly CH material; fair to poor stability; low permeability when compacted.	Very slow permeability; saline; high water table at a depth of 3 to 5 feet in CE, Cg, Ch, and Ck and at a depth of 1.5 to 3 feet in CM.	Slow intake rate; very slow permeability; saline; poorly drained.	D
Poor: about 0.5 to 1 foot of GP or GM material over diatomaceous bedrock.	Unsuited	Unsuited	Poor: less than 1 foot of very cobbly sandy loam.	Slopes restrict storage capacity; bedrock at a depth of 0.5 to 1 foot.	Limited quantity of nonplastic GP or GM material; high permeability when compacted.	Not applicable.	Not applicable.	D
Poor: mostly CH material; high shrink-swell potential.	Unsuited	Unsuited	Poor strongly, saline.	Very slow permeability; water table at a depth of 3 to 5 feet.	Mostly CH material; fair to poor stability; low permeability when compacted.	Not applicable.	Not applicable.	D
Fair: about 2 feet of CL material underlain by about 2 feet of nonplastic SP-SM or SM material; water table at a depth of 3 to 5 feet.	Poor: SP-SM or SM material at a depth of about 2 to 5 feet.[3]	Unsuited	Unsuited	Moderately slow permeability; very rapidly permeable sand at a depth of about 2 to 5 feet.	Mostly CL material underlain by SP-SM or SM material at a depth of 2 to 5 feet; fair stability; moderate to low permeability when compacted; poor resistance to piping.	Water table at a depth of 1.5 to 5 feet; Dc, Dd, and De are saline; moderately slow permeability; underlain by very rapidly permeable sand at a depth of 2 to 5 feet.	Water table at a depth of 1.5 to 5 feet; Dc, Dd, and De are saline.	C
Fair: mostly SM or CL material; water table at a depth of 3 to 5 feet.	Unsuited	Unsuited	Good for Dh. Fair for Dk: slightly saline. Poor for Dm: strongly saline.	Moderately slow to moderate permeability; high water table at a depth of 3 to 5 feet.	Mostly SM or CL material; fair stability; low to moderate permeability when compacted; fair resistance to piping.	Water table at a depth of 3 to 5 feet; Dk and Dm are saline; moderate to moderately slow permeability.	Water table at a depth of 3 to 5 feet; Dk and Dm are saline.	C

TABLE 8.—*Interpretations of engineering*

Soil series and map symbols	Degree and kinds of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
*Dune land: Dp. For Playas part, see Playas.	Slight: slope of individual dunes is variable.	Severe: very rapid permeability.	Severe: mostly loose sand and fine sand.	Slight: high hazard of blowing.	Severe: fine sand or sand.	Slight: high hazard of blowing.
East Fork: Ea, Ec, Ed.	Severe: moderately slow permeability; water table at a depth of 3 to 5 feet.	Moderate: water table at a depth of 3 to 5 feet.	Severe: water table at a depth of 3 to 5 feet.	Moderate: mostly CL material; moderate shrink-swell potential.	Severe: water table at a depth of 3 to 5 feet.	Severe: mostly CL material that has a plasticity index of more than 15.
Erber: Ee, Eg, Eh, Em, En.	Severe: water table at a depth of 3 to 5 feet.	Severe: rapid permeability; mostly SP–SM or SM material.	Severe: water table at a depth of 3 to 5 feet; mostly sand.	Slight: mostly SP–SM or SM material.	Severe: rapid permeability; water table at a depth of 3 to 5 feet.	Moderate: water table at a depth of 3 to 5 feet.
Fallon: Fa, Fc, Fd, Fe.	Severe: water table at a depth of 1.5 to 3 feet in Fe and at a depth of 3 to 5 feet in Fa, Fc, and Fd.	Severe: moderately rapid permeability.	Severe: water table at a depth of 1.5 to 3 feet in Fe.	Slight for Fa, Fc, and Fd: mostly SM or SP–SM material. Severe for Fe: water table at a depth of 1.5 to 3 feet.	Severe: water table at a depth of 1.5 to 5 feet.	Moderate: water table at a depth of 1.5 to 5 feet.
Fernley: Fn, Fo, Fr.	Severe: water table at a depth of 3 to 5 feet.	Severe: very rapid permeability.	Severe: water table at a depth of 3 to 5 feet; sand.	Moderate: somewhat poorly drained.	Severe: water table at a depth of 3 to 5 feet; very rapid permeability.	Moderate: water table at a depth of 3 to 5 feet.

See footnote at end of table.

properties of the soils—Continued

Suitability as source of—				Soil features affecting—				Hydrologic group
Roadfill	Sand	Gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	
Good: mostly SP–SM or SM material.	Fair: mostly SP–SM or SM material; mostly fine sand.	Unsuited	Poor: sand or fine sand.	Very rapid permeability; high seepage.	Mostly SP–SM or SM material; poor stability; high permeability when compacted; fair to poor resistance to piping.	Not applicable.	Not applicable.	(1)
Poor: mostly CL material that has a plasticity index of more than 15.	Unsuited	Unsuited	Fair for Ea and Ec: clay, loam textured. Ec slightly saline. Poor for Ed: strongly saline.	Moderately slow permeability; water table at a depth of 3 to 5 feet.	Mostly CL material; fair stability; low permeability when compacted; good resistance to piping.	Water table at a depth of 3 to 5 feet; moderately slow permeability; Ec and Ed are saline.	Water table at a depth of 3 to 5 feet; Ec and Ed are saline.	C
Fair: mostly SP–SM or SM material; water table at a depth of 3 to 5 feet.	Fair: mostly SP–SM or SM material. Ee and En underlain by clay at a depth of about 3.3 to 5 feet.	Unsuited	Poor for Ee: sandy; Fair for Eg: loamy; 8 to 16 inches thick. Poor for Em and En: strongly saline.	Rapid permeability; water table at a depth of 3 to 5 feet.	Mostly SP–SM or SM material; fair stability; high permeability when compacted; poor to fair resistance to piping.	Water table at a depth of 3 to 5 feet; rapid permeability. Em and En are strongly saline; Ee and En underlain by clay at a depth of 3.3 to 5 feet.	Low available water capacity; water table at a depth of 3 to 5 feet; Em and En are strongly saline.	C
Fair for Fa, Fc, and Fd; water table at a depth of 3 to 5 feet Poor for Fe: water table at a depth of 1.5 to 3 feet.	Poor: SM or SP–SM material less than 3 feet thick.	Unsuited	Good for Fa: sandy loam. Fair for Fc: slightly saline; sandy loam. Poor for Fd and Fe: strongly saline.	Moderately rapid to rapid permeability; water table at a depth of 1.5 to 5 feet.	Mostly SM or SP–SM material; fair stability; moderate permeability when compacted; fair resistance to piping.	Water table at a depth of 1.5 to 5 feet; moderately slow and slowly permeable clay loam and clay below a depth of 3 to 7 feet; Fc, Fd, and Fe are saline.	Water table at a depth of 1.5 to 5 feet; Fc, Fd, and Fe are saline.	C
Fair: water table at a depth of 3 to 5 feet.	Fair: mostly SP-SM or SM material.[2]	Unsuited	Poor for Fn and Fr: sand and clay. Fair for Fo: loam 8 to 16 inches thick.	Very rapid permeability: water table at a depth of 3 to 5 feet.	Mostly SP-SM or SM material; fair stability; high permeability when compacted; fair resistance to piping.	Water table at a depth of 3 to 5 feet; very rapidly permeable sand at a depth of about 1 to 5 feet.	Low available water capacity; water table at a depth of 3 to 5 feet.	C

TABLE 8.—*Interpretations of engineering*

Soil series and map symbols	Degree and kinds of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
Gardella: GA	Severe: silica-cemented hardpan at a depth of 0.5 to 2 feet; silty clay at a depth of 2 to 5 feet; very slow permeability.[4]	Slight[4]	Severe: silica-cemented hardpan over silty clay.[4]	Severe: CH material; high shrink-swell potential.[4]	Severe: silty clay.[4]	Severe: CH material; high shrink-swell potential.[4]
*Hooten: HB For interpretations of Bango part, see Bango series.	Silica-cemented hardpan at a depth of 0.5 to 1.0 feet underlain by moderately slowly permeable marial.[4]	Severe: permeability of more than 6 inches per hour.[4]	Severe: very gravelly coarse sand and coarse sand below hardpan.[4]	Slight[4]	Severe: very gravelly coarse sand and coarse sand.[4]	Slight[4]
Huxley: HU	Slight[3]	Severe: rapid permeability.	Severe: sand and very fine sand.	Slight	Severe: rapid permeability; sand and very fine sand.	Slight
Juva: JuA, JuB, JvB	Slight	Severe: moderately rapid permeability.	Moderate for JuA and JuB: some coarse sand and loamy sand layers. Slight for JvB.	Slight	Severe: moderately rapid permeability.	Slight
*Labou: LR Rock outcrop part not rated.	Severe: cemented tufa at a depth of 0.5 to 1.5 feet.	Severe: cemented tufa at a depth of 0.5 to 1.5 feet.	Severe: cemented tufa at a depth of 0.5 to 1.5 feet.	Severe: cemented tufa at a depth of 0.5 to 1.5 feet; about 25 percent Rock outcrop.	Severe: cemented tufa at a depth of 0.5 to 1.5 feet.	Severe: cemented tufa at a depth of 0.5 to 1.5 feet; about 25 percent Rock outcrop.
Lahontan: Ls, Lt	Severe: very slow permeability; water table at a depth of 3 to 5 feet.	Moderate: water table at a depth of 3 to 5 feet.	Severe: silty clay and clay.	Severe: CH material; high shrink-swell potential.	Severe: water table at a depth of 3 to 5 feet; silty clay and clay.	Severe: CH material; high shrink-swell potential.

See footnotes at end of table.

properties of the soil—Continued

Suitability as source of—				Soil features affecting—				Hydrologic group
Roadfill	Sand	Gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	
Poor: mostly CH material; high shrink-swell potential.[4]	Unsuited	Unsuited	Poor: strongly saline gravelly silt loam, coarse sand, and coarse sandy loam.	Very slow permeability.	Mostly CH material; fair to poor stability; low permeability when compacted; high shrink-swell potential.[4]	Not applicable.	Not applicable.	D
Good: mostly SP or SP-SM material below hardpan.[4]	Fair: about about 3 to 4 feet of SP or SP-SM material.	Unsuited	Poor: very gravelly material less than 8 inches thick.	Rapid permeability; high seepage.	Mostly SP or SP-SM material; fair stability; high permeability when compacted; poor resistance to piping.	Not applicable.	Not applicable.	D
Fair: SM material that has more than 30 percent fines.	Poor: mostly SM material.[2]	Unsuited	Poor: strongly saline.	Rapid permeability; high seepage.	Mostly SM material; fair stability; moderate permeability when compacted; poor resistance to piping.	Not applicable.	Not applicable.	C
Good	Unsuited	Unsuited	Good: loam or sandy loam more than 16 inches thick.	Moderately rapid permeability; moderate seepage in places.	SM material; fair stability; fair to poor resistance to piping.	Not applicable.	Moderate intake rate; moderately rapid permeability; moderate available water capacity.	B
Poor: cemented tufa at a depth of 0.5 to 1.5 feet.	Unsuited	Unsuited	Poor: moderately saline clay and very gravelly clay loam.	Cemented tufa at a depth of 0.5 to 1.5 feet; slopes of 2 to 15 percent.	Cemented tufa at a depth of 0.5 to 1.5 feet.	Not applicable.	Not applicable.	D
Poor: CH material; high shrink-swell potential.	Unsuited	Unsuited	Poor: clay texture; Lt strongly saline.	Very slow permeability; seasonal water table at a depth of 3 to 5 feet.	CH material; fair to poor stability; low permeability when compacted; high shrink-swell potential.	Very slow permeability; water table at a depth of 3 to 5 feet; saline.	Very slow intake rate and permeability; saline.	D

TABLE 8.—*Interpretations of engineering*

Soil series and map symbols	Degree and kinds of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
Marsh: Ma. Shallowly ponded areas; not suited to engineering use.						
*Mazuma: MB. For interpretations of Bango part, see Bango series.	Slight	Severe: moderately rapid permeability.	Slight	Moderate: ML material.	Severe: permeability of more than 2 inches per hour.	Moderate: ML material.
Mine pits: MD. Open pit mining areas; onsite investigation required.						
Osobb. Mapped only in an association with Pirouette soils.	Severe: silica-cemented hardpan over bedrock at a depth of 1.0 to 1.5 feet; slopes of 8 to 30 percent.	Severe: silica-cemented hardpan over bedrock at a depth of 1.0 to 1.5 feet; slopes of 8 to 30 percent.	Severe: silica-cemented hardpan over bedrock at a depth of 1.0 to 1.5 feet; slopes of 8 to 30 percent.	Severe: silica-cemented hardpan over bedrock at a depth of 1.0 to 1.5 feet; slopes of 8 to 30 percent.	Severe: silica-cemented hardpan over bedrock at a depth of 1.0 to 1.5 feet; slopes of 8 to 30 percent.	Severe: silica-cemented hardpan over bedrock at a depth of 1.0 to 1.5 feet; slopes of 8 to 30 percent.
*Parran: PA, PC. For interpretations of Tipperary part in PC, see Tipperary series.	Severe: water table at a depth of 3 to 5 feet; very slow permeability.	Moderate: water table at a depth of 3 to 5 feet.	Severe: sility clay.	Severe: CH material; high shrink-swell potential.	Severe: Silty clay; water table at a depth of 3 to 5 feet.	Severe: CH material; high shrink-swell potential.

See footnotes at end of table.

properties of the soils—Continued

Suitability as source of—				Soil features affecting—				Hydrologic group
Roadfill	Sand	Gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	
Fair: ML material.	Unsuited	Unsuited	Poor: strongly saline.	Moderately rapid permeability; moderate seepage.	Mostly ML material; fair to poor stability; low to moderate permeability when compacted; poor resistance to piping.	Not applicable.	High available water capacity; moderately rapid permeability; strongly saline.	C
Poor: less than 1.5 feet of SM material over silica-cemented hardpan.	Unsuited	Unsuited	Poor: very stony and gravelly.	Silica-cemented hardpan over bedrock at a depth of 1.0 to 1.5 feet; slopes of 8 to 30 percent.	Less than 1.5 feet of SM material available above hardpan; good stability; low to moderate permeability when compacted; fair resistance to piping.	Not applicable.	Not applicable.	D
Poor: CH material; high shrink-swell potential.	Unsuited	Unsuited	Poor: strongly saline; silty clay.	Very slow permeability.	Mostly CH material; poor stability; low permeability when compacted; fair resistance to piping; high shrink-swell potential.	Not applicable.	Not applicable.	D

TABLE 8.—*Interpretations of engineering*

Soil series and map symbols	Degree and kinds of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
Patna: PD	Slight [1]	Severe: rapid permeability below a depth of 2 feet.	Severe: sand and loamy sand at a depth of about 2 to 5 feet.	Slight	Severe: rapid permeability below a depth of 2 feet.	Slight
Pelic: Pe, Pf, Ph	Severe: water table at a depth of 0 to 3 feet.	Severe: water table at a depth of 0 to 3 feet.	Severe: water table at a depth of 0 to 3 feet.	Severe: water table at a depth of 0 to 3 feet.	Severe: water table at a depth of 0 to 3 feet.	Severe: water table at a depth of 0 to 3 feet.
*Pirouette: PM, PO— For interpretations of Bluewing part in PM, see Bluewing series. For interpretations of Osobb part in PO, see Osobb series.	Severe: silica-cemented hardpan over basalt at a depth of 1 to 1.5 feet.	Severe: silica-cemented hardpan over basalt at a depth of 1 to 1.5 feet.	Severe: silica-cemented hardpan over basalt at a depth of 1 to 1.5 feet.	Severe: silica-cemented hardpan over basalt at a depth of 1 to 1.5 feet.	Severe: silica-cemented hardpan over basalt at a depth of 1 to 1.5 feet.	Severe: silica-cemented hardpan over basalt at a depth of 1 to 1.5 feet.
Playas: PY— Lake basins; intermittently flooded, highly variable ranging from sand to clay; onsite investigation required.						
Ragtown: Ra, Rc, Rg	Severe: water table at a depth of 3 to 5 feet; slow permeability.	Moderate: water table at a depth of 3 to 5 feet.	Moderate: water table at a depth of 3 to 5 feet; clay loam and silty clay loam.	Moderate: CL material; moderate shrink-swell potential.	Severe: water table at a depth of 3 to 5 feet; clay loam and silty clay loam.	Severe: mostly CL material that has a plasticity index of more than 15.

See footnotes at end of table.

properties of the soils—Continued

Suitability as source of—				Soil features affecting—				Hydrologic group
Roadfill	Sand	Gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	
Good: SM material.	Poor: SM material.	Unsuited	Poor: sand and loamy sand less than 8 inches thick.	Rapid permeability; high seepage.	Mostly SM material; good stability; moderate permeability when compacted; fair resistance to piping.	Not applicable.	High intake rate; moderate available water capacity; rapid permeability.	B
Poor: water table at a depth of 0 to 3 feet.	Fair: SP-SM or SM material.[3]	Unsuited	Poor: very poorly drained.	Water table at a depth of 0 to 3 feet; rapidly permeable layers.	Water table at a depth of 0 to 3 feet; mostly SM material when mixed.	Not applicable.	Not applicable.	D
Poor: less than 1.5 feet of CL and SC material available.	Unsuited	Unsuited	Unsuited	Silica-cemented hardpan over basalt at a depth of 1 to 1.5 feet; slopes of 0 to 8 percent.	Less than 1.5 feet of CL and SC material available; good stability and low permeability when compacted.	Not applicable.	Not applicable.	D
Poor: mostly CL material that has a placticity index of more than 15.	Unsuited	Unsuited	Fair for Ra and Rc, clay loam; slightly saline to nonsaline; poor for Rg, strongly saline.	Slow permeability; water table at a depth of 3 to 5 feet.	Mostly CL material; fair stability; low permeability when compacted; medium to high resistance to piping.	Water table at a depth of 3 to 5 feet; slow permeability; Rc and Rg are saline.	Water table at a depth of 3 to 5 feet; slow to moderately slow intake rate; Rc and Rg are saline.	D

TABLE 8.—*Interpretations of engineering*

Soil series and map symbols	Degree and kinds of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
Sagouspe: Sa, Sb	Severe: water table at a depth of 3 to 5 feet.	Moderate: moderately slow permeability; contains some sand and loamy sand layers.	Moderate: water table at a depth of 3 to 5 feet.	Slight: SM material.	Severe: water table at a depth of 3 to 5 feet.	Moderate: water table at a depth of 3 to 5 feet.
*Soda Lake: ScA, SdA, SeD, SH. Rock outcrop part of SH, not rated.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: rapid permeability.	Severe: gravelly sand, sand, and loamy sand.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.	Severe: rapid permeability.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.
SfA, SgA	Severe: water table at a depth of 3 to 5 feet.	Severe: rapid permeability.	Severe: water table at a depth of 3 to 5 feet.	Slight	Severe: water table at a depth of 3 to 5 feet; rapid permeability.	Moderate: water table at a depth of 3 to 5 feet.
Stillwater: Sk, Sm, Sn, So, Sp.	Severe: water table at a depth of 3 to 5 feet; slow and moderately slow permeability.	Severe: for So: water table at a depth of 1.5 to 3 feet. Moderate for Sk, Sm, Sn, and Sp. water table at a depth of 3 to 5 feet.	Severe for So: water table at a depth of 1.5 to 3 feet. Moderate for Sk, Sm, Sn, and Sp. water table at a depth of 3 to 5 feet; clay loam and and silty clay loam.	Severe: for So: water table at a depth of 1.5 to 3 feet. Moderate for Sk, Sm, Sn: and Sp: CL or CH material; moderate shrink-swell potential.	Severe: water table at a depth of 1.5 to 5 feet.	Severe: CL or CH material that has a plasticity index of more than 15; water table at a depth of 1.5 to 5 feet.
Stumble Mapped only in an association with Bango soils.	Slight[2]	Severe: rapid permeability.	Severe: gravelly loamy sand.	Slight	Severe: rapid permeability.	Slight

See footnote at end of table.

properties of the soils—Continued

Suitability as source of—				Soil features affecting—				Hydrologic group
Roadfill	Sand	Gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	
Fair: water table at a depth of 3 to 5 feet; mostly SM material.	Poor	Unsuited	Good for Sa, poor for Sb; slightly saline to moderately saline.	Moderately slow permeability; seepage in places.	Mostly SM material; fair to poor stability; moderate permeability when compacted; fair resistance to piping.	Water table at a depth of 3 to 5 feet; moderate permeability; Sb slightly saline to moderately saline.	Water table at a depth of 3 to 5 feet; Sb slightly saline to moderately saline.	C
Good: mostly nonplastic SM material.	Poor: SM material.	Unsuited	Poor: mostly gravelly loamy sand.	Rapid permeability; high seepage.	SM material; good stability; high to moderate permeability when compacted; fair resistance to piping.	Not applicable.	High intake rate; low available water capacity; SeD and SH not suited to irrigation.	B
Good: mostly nonplastic SM material.	Poor: SM material.	Unsuited	Fair for SfA. about 8 to 16 inches of sandy loam. Poor for SgA. strongly saline sandy loam.	Rapid permeability; high seepage; water table at a depth of 3 to 5 feet.	SM material; good stability; high to moderate permeability when compacted; fair resistance to piping.	Water table at a depth of 3 to 5 feet; rapid permeability; SgA is strongly saline.	High intake rate; water table at a depth of 3 to 5 feet; low available water capacity; SgA is strongly saline.	B
Poor: CL or CH material that has a plasticity index of more than 15.	Unsuited	Unsuited	Fair for Sk and Sp: clay loam. fair for Sm and So: slightly saline clay loam. Poor for Sn: strongly. saline clay.	Slow and moderately slow permeability; water table at a depth of 1.5 to 5 feet.	Mostly CL or CH material; fair stability low permeability when compacted.	Water table at a depth of 1.5 to 3 feet; slow and moderately slow permeability; Sm, Sn, So, Sp have excess salt.	Water table at a depth of 1.5 to 3 feet; slow and moderately slow permeability, Sm, Sn, So, and Sp have excess salt.	D
Good: nonplastic SM material.	Poor: mostly SM material.	Unsuited	Poor: loamy sand.	Rapid permeability; high seepage.	Mostly SM material; good stability; moderate permeability when compacted; fair resistance to piping.	Not applicable.	High intake rate; rapid permeability; moderately low available water capacity.	A

TABLE 8.—*Interpretations of engineering*

Soil series and map symbols	Degree and kinds of limitation for—					
	Septic tank absorption fields	Sewage lagoons	Shallow excavations	Dwellings without basements	Sanitary landfill (trench type)	Local roads and streets
Swingler: Sr, Ss, St	Severe: moderately slow permeability.	Slight	Moderate: mostly clay loam, silt loam, and sandy loam.	Moderate: mostly CL material; moderate shrink-swell potential.	Severe: water table at a depth of 5 to 6 feet.	Severe: mostly CL material that has a plasticity index of more than 15.
Su, Sv	Severe: water table at a depth of 3 to 5 feet; moderately slow permeability.	Moderate: water table at a depth of 3 to 5 feet.	Moderate: water table at a depth of 3 to 5 feet; mostly clay loam, silt loam, and sandy loam.	Moderate: mostly CL material; moderate shrink-swell potential.	Severe: water table at a depth of 3 to 5 feet.	Severe: mostly CL material that has a plasticity index of more than 15.
Swope: Sw, Sx, Sy, Sz.	Severe: water table at a depth of 3 to 5 feet.	Severe: rapid permeability at a depth of about 2 to 5 feet.	Severe: sand and coarse sand at a depth of 2 to 5 feet.	Moderate: CL material: moderate shrink-swell potential.	Severe: water table at a depth of 3 to 5 feet.	Severe: CL material that has a plasticity index of more than 15.
*Tipperary: TnA, TnC, TPB, TPD, TR, TS, TU, TV. For interpretations of Appian part in TR and TS, see Appian series. For interpretations of Lahontan part in TU, see Lahontan series. For interpretations of Parran part in TV, see Parran series.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.[2]	Severe: very rapid permeability.	Severe: sand and fine sand.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent: subject to severe blowing.	Severe: very rapid permeability.	Slight where slopes are less than 8 percent. Moderate where slopes are 8 to 15 percent.
Weishaupt: Wc, We, Wh.	Severe: water table at a depth of 3 to 5 feet; very slow permeability.	Moderate: water table at a depth of 3 to 5 feet.	Severe: clay	Severe: CH material; high shrink-swell potential.	Severe: water table at a depth of 3 to 5 feet.	Severe: CL and CH material.

[1] Not placed in hydrologic group.
[2] Contamination of water supplies is a hazard in places.

properties of the soils—Continued

Suitability as source of—				Soil features affecting—				Hydrologic group
Roadfill	Sand	Gravel	Topsoil	Pond reservoir areas	Embankments, dikes, and levees	Drainage for crops and pasture	Irrigation	
Poor: mostly CL material that has a plasticity index of more than 15.	Unsuited: limited material.	Unsuited	Poor for Sr: sand. Slight for Ss: sandy loam. Fair for St: clay loam.	Moderately slow permeability.	Mostly CL material; fair stability; low permeability when compacted.	Water table at a depth of 5 to 6 feet.	Moderately slow permeability; moderately high available water capacity.	D
Poor: mostly CL material that has a plasticity index of more than 15.	Unsuited: limited material.	Unsuited	Fair for Su: slightly saline clay loam. Poor for Sv: strongly saline clay loam.	Moderately slow permeability; water table at a depth of 3 to 5 feet.	Mostly CL material; fair stability; low permeability when compacted.	Water table at a depth of 3 to 5 feet; slightly saline to strongly saline.	Moderately slow permeability; water table at a depth of 3 to 5 feet; slightly saline to strongly saline.	D
Good: SC material when mixed.	Fair: SP-SM or SM material at a depth of about 2 to 5 feet.[3]	Unsuited	Fair for Sx: clay loam. Fair for Sy: slightly saline clay loam. Poor for Sw and Sz: strongly saline.	Rapid permeability below a depth of about 2 feet.	Mostly SC material when mixed; good stability; low permeability when compacted.	Water table at a depth of 3 to 5 feet; Sw, Sy, and Sz are saline.	Water table at a depth of 3 to 5 feet; Sw, Sy, and Sz are saline.	D
Good: mostly SP-SM material.	Fair: mostly SP-SM material.	Unsuited	Poor: sand and fine sand.	Very rapid permeability; high seepage.	Mostly SP-SM material; good stability; high permeability when compacted; fair resistance to piping.	Not applicable.	High intake rate; low available water capacity.	A
Poor: mostly CH material; high shrink-swell potential.	Unsuited	Unsuited	Fair for Wc: clay loam and sandy clay loam. Fair for We: slightly saline clay loam. Poor for Wh: strongly saline.	Very slow permeability; high water table at a depth of 3 to 5 feet.	Mostly CH material; fair to poor stability; low permeability when compacted.	Water table at a depth of 3 to 5 feet; very slow permeability; We and Wh are saline.	Water table at a depth of 3 to 5 feet; very slow permeability; We is slightly saline; Wh is strongly saline.	D

[3] Material observed to a depth below 5 feet.
[4] Silica-cemented hardpan that is rippable with light power equipment.

TABLE 9.—*Engineering*

[Tests performed by the Nevada Department of Highways in accordance with standard procedures of the American

Soil name and location	Parent material	Report No.	Depth
			Inches
Carson clay, slightly saline:			
500 feet W. and 100 feet N. of SE. corner, sec. 13, T. 19 N., R. 30 E.	Mixed clayey alluvium.	S-1572-61	7-17
		S-1573-61	17-27
East Fork clay loam:			
1,640 feet S. and 370 feet E. of N. quarter corner, sec. 30, T. 19 N., R. 29 E.	Mixed loamy alluvium.	S-1592-61	6-14
		S-1588-61	14-27
Lahontan clay, slightly saline:			
150 feet W. and 30 feet N. of SE. corner, sec. 19, T. 17 N., R. 30 E.	Mixed clayey alluvium.	S-1590-61	10-21
		S-1587-61	21-33
Ragtown sandy clay loam:			
500 feet E. and 350 feet S. of NW. corner, sec. 32, T. 19 N., R. 29 E.	Lacustrine sediment.	S-1589-61	10-23
		S-1591-61	23-42
Tipperary sand:			
500 feet S. and 25 feet E. of N. quarter corner, sec. 18, T. 19 N., R. 27 E.	Mixed sandy alluvium.	S-1576-61	4-25
		S-1577-61	25-41
110 feet E. and 30 feet S. of NW. corner, sec. 20, T. 19 N., R. 27 E. (Virgin)	Mixed sandy alluvium.	S-1575-61	5-17
Weishaupt clay loam, slightly saline:			
1,400 feet W. and 1,300 feet S. of E. quarter corner, sec. 6, T. 19 N., R. 31 E.	Mixed clayey alluvium.	S-1571-61	5-11
		S-1574-61	23-31

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

In the Unified system (*15*) soils are classified according to particle-size distribution, plasticity, liquid limit, and organic-matter content. Soils are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils on the borderline between two classes are designated by symbols for both classes; for example, SP-SM.

The AASHO system (*1*) is used to classify soils according to those properties that affect use in highway construction and maintenance. In this system, a soil is placed in one of seven basic groups ranging from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrade (foundation). At the other extreme, in group A-7, are clay soils that have low strength when wet and that are the poorest soils for subgrade. Where laboratory data are available to justify a further breakdown, the A-1, A-2, and A-7 groups are divided as follows: A-1-a, A-1-b, A-2-4, A-2-5, A-2-6, A-2-7, A-7-5, and A-7-6. As an additional refinement, the engineering value of a soil material can be indicated by a group index number. Group indexes range from 0 for the best material to 20 or more for the poorest. The AASHO classification for tested soils, with group index numbers in parentheses, is shown in table 9; the estimated classification, without group index numbers, is given in table 7 for all soils mapped in the survey area.

Soil properties significant to engineering

Several estimated soil properties significant in engineering are given in table 7. These estimates are made for typical soil profiles, by layers sufficiently different to have different significance for soil engineering. The estimates are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with the same kinds of soil in other counties. Following are explanations of some of the columns in table 7.

Depth to hardpan or bedrock is the distance from the surface of the soil to the upper surface of the rock layer.

Depth to seasonal high water table is the distance from the surface of the soil to the highest level that ground water reaches in the soil in most years.

Soil texture is described in table 7 in the standard

test data

Association of State Highway Officials (AASHO). Absence of an entry indicates no determination was made]

Horizon	Mechanical analysis [1]					Liquid limit	Plasticity index	Classification	
	Percentage less than 3 inches passing sieve—							AASHO [2]	Unified [3]
	¾ in	No. 4 (4.7 mm)	No. 10 (2.0 mm)	No. 40 (0.42 mm)	No. 200 (0.074 mm)				
C1			100	99	88	64	42	A-7-6(20)	CH
C2g				100	89	60	38	A-7-6(20)	CH
C1			100	97	64	34	20	A-6(10)	CL
C2			100	96	60	34	19	A-6(9)	CL
C1			100	99	92	65	46	A-7-6(20)	CH
C2			100	99	93	65	48	A-7-6(20)	CH
C1			100	93	60	34	20	A-6(9)	CL
C2g		100	99	96	87	52	34	A-7-6(18)	CH
C2	100	94	92	79	9	19	(4)	A-3(0)	SP-SM
C3	100	97	96	79	7	22	(4)	A-3(0)	SP-SM
C2	100	99	98	82	8	22	(4)	A-3(0)	SP-SM
A12			100	99	66	43	28	A-7-6(14)	CL
C3g			100	99	89	65	49	A-7-6(20)	CH

[2] Based on AASHO Designation M 154–49 (*1*).
[3] Based on the Unified soil classification system (*15*).
[4] Nonplastic.

terms used by the U.S. Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2 millimeters in diameter. "Loam," for example, is soil material that contains 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added; for example, "gravelly loamy sand." "Sand," "silt," "clay," and some of the other terms used in USDA textural classification are defined in the Glossary of this soil survey.

Percentage less than 3 inches passing sieve shows the percentages, by weight, of soil particles that pass sieves of specified sizes. Sand and other coarser materials do not pass through the No. 200 sieve. Silt and clay pass through the No. 200 sieve. Percentage fractions smaller than openings in the No. 200 sieve were determined by the hydrometer method rather than by the pipette method most soils scientists use in determining the clay in soil samples.

Liquid limit and plasticity index indicate the effect of water on the strength and consistence of soil material. As the moisture content of a clayey soil is increased from a dry state, the material changes from a semisolid to a plastic state. If the moisture content is further increased, the material changes from a plastic to a liquid state. The plastic limit is the moisture content at which the soil material changes from the semisolid to plastic state; and the liquid limit, from a plastic to a liquid state. The plasticity index is the numerical difference between the liquid limit and the plastic limit. It indicates the range of moisture content within which a soil material is plastic. Liquid limit and plasticity index are estimated in table 7, but in table 9 the data on liquid limit and plasticity index are based on tests of soil samples.

Permeability is that quality of a soil that enables it to transmit water or air. It is estimated on the basis of those soil characteristics observed in the field, particularly structure and texture. The estimates in table 7 do not take into account lateral seepage or such transient soil features as plowpans and surface crusts.

Available water capacity is the ability of soils to hold water for use by most plants. It is commonly defined as the difference between the amount of water in the soil at field capacity and the amount at the wilting point of most crop plants.

Reaction is the degree of acidity or alkalinity of a soil,

expressed in pH values. The pH value and terms used to describe soil reaction are explained in the Glossary.

Salinity refers to the amount of soluable salts in the soil. It is expressed as the electrical conductivity of the saturation extract, in millinhos per centimeter at 25°C. Salinity affects the suitability of a soil for crop production, its stability when used as construction material, and its corrosiveness to metals and concrete.

Shrink-swell potential is the relative change in volume to be expected of soil material with changes in moisture content, that is, the extent to which the soil shrinks as it dries out or swells when it gets wet. Extent of shrinking and swelling is influenced by the amount and kind of clay in the soil. Shrinking and swelling of soils cause much damage to building foundations, roads, and other structures. A *high* shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with material having this rating.

Frost-action potential is the potential effect on structures resulting from freezing, and subsequent thawing of soil materials. Frost action in soils pertains not only to heaving as freezing progresses but also to excessive wetting and loss of soil strength upon thawing.

Engineering interpretations of the soils

The estimated interpretations in table 8 are based on the engineering properties of soils shown in table 7, on test data for soils in this survey area and other's nearby or adjoining, and on the experience of engineers and soil scientists with the soils of Fallon-Fernley Area. In table 8, ratings are used to summarize limitation or suitability of the soils for all listed purposes other than drainage for crops and pasture, irrigation, pond reservoir areas, and embankments, dikes and levees. For these particular uses, table 8 lists those soil features not to be overlooked in planning, installation, and maintenance.

Soil limitations are indicated by the ratings slight, moderate, and severe. *Slight* means that soil properties generally are favorable for the rated use, or in other words, limitations that are minor and easily overcome. *Moderate* means that some soil properties are unfavorable but can be overcome or modified by special planning and design. *Severe* means that soil properties are so unfavorable and so difficult to correct or overcome as to require major soil reclamation and special designs.

Soil suitability is rated by the terms *good*, *fair*, and *poor*, which have, respectively, meanings approximately parrellel to the terms slight, moderate, and severe.

Following are explanations of some of the columns in table 8.

Septic tank absorption fields are subsurface systems of tile or perforated pipe that distribute effluent from a septic tank into natural soil. The soil properties considered are those that affect both absorption of effluent and construction and operation of the system. Properties that affect absorption are permeability, depth to water table or rock and hardpan, and susceptibility to flooding. Slope is a soil property that affects difficulty of layout and construction and also the risk of soil erosion, lateral seepage, and downslope flow of effluent. Large rocks or boulders increase construction costs. The rating is also based on the assumption that tile are at a depth of not less than 2 feet and are in a 12-inch gravel envelope.

Sewage lagoons are shallow ponds constructed to hold sewage, within a depth of 2 to 5 feet, long enough for bacteria to decompose the solids: A lagoon has a nearly level floor, and sides, or embankments, of compacted soil material. The assumption is made that the embankment is compacted to medium density and the pond is protected from flooding. Properties are considered that affect the pond floor and the embankment. Those that affect the pond floor are permeability, content of organic matter, and slope, and if the floor needs to be leveled, depth to bedrock is important. The soil properties that affect the embankment are the engineering properties of the embankment material, as interpreted from the Unified soil classification system, and the amounts of stones, if any, that influence the ease of excavation and compaction of the embankment material.

Shallow excavations require digging or trenching to a depth of less than 6 feet; for example, excavations for pipelines, sewer lines, phone and power transmission lines, basements, open ditches, and cemeteries. Desirable soil properties are good workability, moderate resistance to sloughing, gentle slopes, absence of rock outcrop or big stones, and freedom from flooding or a high water table.

Dwellings, as rated in table 8, are not more than three stories high and are supported by foundation footings placed in undisturbed soil at a depth of not less than 2 feet. The features that affect the rating of a soil for dwellings are those that relate to capacity to support load and resist settlement under load, and those that relate to ease of excavation. Soil properties that affect capacity to support load are wetness, susceptibility to flooding, density, plasticity, texture, and shrink-swell potential. Those that affect excavation are wetness, slope, depth to bedrock, and content of stones and rocks.

Sanitary landfill is a method of disposing of refuse in dug trenches. The waste is spread in thin layers, compacted, and covered with soil throughout the disposal period. Landfill areas are subject to heavy vehicular traffic. Some soil properties that affect suitability for landfill are ease of excavation, hazard of polluting ground water, and trafficability. The best soils have moderately slow permeability, withstand heavy traffic, and are friable and easy to excavate. Unless otherwise stated, the ratings in table 8 apply only to a depth of about 6 feet, and therefore limitation ratings of slight or moderate may not be valid if trenches are to be much deeper than 6 feet. For some soils, reliable predictions can be made to a depth of 10 to 15 feet, but regardless of that, every site should be investigated before it is selected.

Local roads and streets, as rated in table 8, have an all-weather surface expected to carry automobile traffic all year. They have a subgrade of underlying soil material; a base consisting of gravel, crushed rock, or soil material stabilized with lime or cement; and a flexible or rigid surface, commonly asphalt or concrete. These roads are graded to shed water and have ordinary provisions for drainage. They are built mainly from soil at hand, and most cuts and fills are less than 6 feet deep. In rating the soil as a source of material for local roads and streets, it is assumed that the penetration of frost will be less than 6 inches and that the surface foot of soil material is removed.

Major soil properties that affect design and construction of roads and streets are load-supporting capacity and stability of the subgrade, and the workability and quantity of cut and fill material available. The AASHO and Unified classifications of the soil material, and also the shrink-swell potential, indicate traffic-supporting capacity. Wetness and flooding affect stability of the material. Slope, depth to hard rock, content of stones and rocks, and wetness affect ease of excavation and amount of cut and fill needed to reach an even grade.

Roadfill is soil material used in embankments for roads. The suitability ratings reflect: (1) the predicted performance of soil after it has been placed in an embankment that has been properly compacted and provided with adequate drainage and (2) the relative ease of excavating the material at borrow areas.

Sand and gravel are used in great quantities in many kinds of construction. The ratings in table 8 provide guidance about where to look for probable sources. A soil rated *good* or *fair* source of sand or gravel generally has a layer at least 3 feet thick, the top of which is within a depth of 6 feet. The ratings do not take into account thickness of overburden, location of the water table, or other factors that affect mining of the materials, and neither do they indicate quality of the deposit.

Topsoil is used for topdressing an area where vegetation is to be established and maintained. Suitability is affected mainly by ease of working and spreading the soil material, as for preparing a seedbed; natural fertility of the material, or its response of plants when fertilizer is applied; and absence of substances toxic to plants. Texture of the soil material and its content of stone fragments are characteristics that affect suitability, but also considered in the ratings is damage that will result at the area from which topsoil is taken.

Pond reservoir areas hold water behind a dam or embankment. Soils suitable for pond reservoir areas have low seepage, which is related to their permeability and depth to fractured or permeable bedrock or other permeable material.

The soil features that affect embankments, dikes, and levees in table 8 are for the whole soil and are based on the assumption that the penetration of frost is less than 6 inches. Embankments, dikes, and levees require soil material resistant to seepage and piping and of favorable stability, shrink-swell potential, shear strength, and compactibility. Presence of stones of organic material in a soil are among factors that are unfavorable. It is assumed the penetration of frost will be less than 6 inches. The rating is based upon the soil profile being mixed.

Drainage for crops and pasture is affected by such soil properties as permeability, texture, and structure; depth to claypan, rock, or other layers that influence the rate of water movement; depth to the water table; slope; stability in ditchbanks; susceptibility to stream overflow; salinity or alkalinity; and availability of outlets for drainage.

Irrigation of a soil is affected by such features as slope; susceptibility to stream overflow, water erosion, soil blowing; soil texture; content of stones; accumulations of salts and also alkalinity; depth of root zone; rate of water intake at the surface; permeability of soil layers below the surface layer and in fragipans or other layers that restrict movement of water; amount of water held available to plants; and need for drainage, or depth to water table or bedrock.

In the hydrologic groups are soils that have similar rates of infiltration, when wet, and similar rates of water transmission within the soil. Four such groups currently are recognized.

Soils in group A have a high infiltration rate, even when thoroughly wet. They have a high rate of water transmission and low runoff potential. The soils of this group are deep, are well drained or excessively drained, and consist chiefly of sand, gravel, or both.

Soils in group B have a moderate infiltration rate when thoroughly wet. Their rate of water transmission and their runoff potential are moderate. These soils are moderately deep or deep, are moderately well drained or well drained, and have fine texture to moderately coarse texture.

Soils of group C have a slow infiltration rate when thoroughly wet. Their rate of water transmission is slow, and their potential runoff is high. These soils have a layer that impedes the downward movement of water, or they are moderately fine textured or fine textured and have a slow infiltration rate.

Soils of group D have a slow infiltration rate when thoroughly wet. Their rate of water transmission is very slow, and their runoff potential is very high. In this group are (1) clay soils that have high shrink-swell potential; (2) soils that have a permanent high water table; (3) soils that have a claypan or clay layer at or near the surface; and (4) soils that are shallow over nearly impervious material.

Soil test data

Table 9 contains engineering test data for some of the major soil series in the Fallon-Fernley Area. These tests were made to help evaluate the soils for engineering purposes. The engineering classifications given are based on data obtained by mechanical analyses and by tests to determine liquid limits and plastic limits. The mechanical analyses were made by the sieve method.

Tests to determine liquid limit and plastic limit measure the effect of water on the consistence of soil material, as explained for table 7.

General engineering information

Wetness, excess salts, clayey soils, and the variability in soil profiles because of stratification are major concerns in engineering in the Fallon-Fernley Area.

Soil wetness, mainly the result of irrigation water losses and irrigation practices, is indicated by a rising water table during the irrigation season and a general lowering of the water table during winter. Excess water in the soils seriously limits the effective operation of sewage disposal systems, excavations, and sanitary landfill. It also affects the structural integrity of dwellings, concrete canals, and other structures. Wetness or a fluctuating high water table also accelerates corrosion of untreated steel that is in contact with soil.

Excess soluble salts in the soils in the Area contribute to the accelerated rate of corrosion of untreated steel and concrete that are in contact with soil. Excess salt can also contribute to volume variations resulting from crys-

tallization of salts during drying cycles, especially if excess sodium sulfate is present.

Clayey soils are extensive in the Area and exhibit considerable volume change when there is a change in moisture. This is especially significant during wetting and drying cycles in irrigated, clayey soils. Extensive permanent drainage and drying of clayey soils in the Area can seriously damage existing structures because of differential settlement of the foundation soil.

Textural variability, resulting from both coarse and fine stratification in many soils in the Area, is a factor contributing to a rapid rate of corrosion of untreated steel in soil. It also presents serious concerns to engineers in the design, construction, and effective performance of buildings, drainage systems, sewage and garbage disposal systems, and irrigation conveyances and appurtenances.

Wetness, salts, and the stratification and textural variability of soil contribute generally to a serious corrosion potential for untreated steel and concrete in soils in the Fallon-Fernley Area. For this reason, the soils of the Area have not been rated for corrosivity, and generally all the soils within the Area can be expected to have a moderate to very high potential for corrosion.

Use of the soils for recreational development

Knowledge of soils is necessary in planning, developing, and maintaining areas used for recreation. In table 10 the soils of the Fallon-Fernley Area are rated according to limitations that affect their suitability for camp areas, play areas, picnic areas, and paths and trails.

In table 10 the soils are rated as having slight, moderate, or severe limitations for the specified uses. For all of these ratings, it is assumed that a good cover of vegetation can be established and maintained. A limitation of *slight* means that soil properties are generally favorable and limitations are so minor that they can be easily overcome. A *moderate* limitation can be overcome or modified by planning, by design, or by special maintenance. A *severe* limitation means that costly soil reclamation, special design, intense maintenance, or a combination of these, is required.

Camp areas are used intensively for tents and small camp trailers and the accompanying activities of outdoor living. Little preparation of the site is required, other than shaping and leveling for tent and parking areas. Camp areas are subject to heavy foot traffic and limited vehicular traffic. The best soils have mild slopes, good

TABLE 10.—*Soil interpretations for recreation*

[An asterisk in the first column indicates that at least one mapping unit in this series is made up of two or more kinds of soil. The soils in such mapping units may have different properties and limitations, and for this reason it is necessary to follow carefully the instructions for referring to other series that appear in the first column of this table]

Soil series and map symbol	Degree and kind of limitation for—			
	Camp areas (intensive use)	Play areas (intensive use)	Picnic areas	Paths and trails
Alluvial land: Ad	Severe: very frequently flooded; variable texture; high water table at a depth of 3 to 5 feet in most places, but variable in some.	Severe: very frequently flooded; variable texture; high water table at a depth of 3 to 5 feet in most places, but variable in some.	Severe: very frequently flooded; variable texture; high water table at a depth of 3 to 5 feet in most places, but variable in some.	Severe: very frequently flooded; variable texture; high water table at a depth of 3 to 5 feet in most places, but variable in some.
*Appian:				
Af, Am, Ao	Moderate: somewhat poorly drained; water table at depth of 3 to 5 feet during season of use; moderately slow permeability.	Moderate: somewhat poorly drained; water table at depth of 3 to 5 feet during season of use; moderately slow permeability.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
AT, AR. For Playas part in AT, see Playas. For interpretations of Tipperary part in AR, see Tipperary series.	Moderate: moderately slow permeability; dry for long periods; dusty.	Moderate: moderately slow permeability; dry for long periods; dusty.	Moderate: sandy loam surface layer; subject to blowing during dry periods.	None to slight: dusty.
An	Moderate: somewhat poorly drained; water table at depth of 3 to 5 feet during season of use; moderately slow permeability.	Moderate: somewhat poorly drained; water table at depth of 3 to 5 feet during season of use; moderately slow permeability.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Ap, AS. For interpretations of Tipperary part in AS, see Tipperary series.	Severe: where surface layer is fine sand; moderate where it is clay loam.	Severe: fine sand surface layer; subject to blowing.	Severe: fine sand surface layer; subject to blowing.	Severe: fine sand surface layer; dusty.

TABLE 10.—*Soil interpretations for recreation*—Continued

Soil series and map symbol	Degree and kind of limitation for—			
	Camp areas (intensive use)	Play areas (intensive use)	Picnic areas	Paths and trails
Badland: BA. Highly variable, saline-alkaline soil; barren; severely eroded.				
*Bango:				
BdA, BdB	Severe: loamy sand surface layer; subject to blowing.	Severe: loamy sand surface layer; subject to blowing.	Moderate: loamy sand surface layer; subject to soil blowing.	Moderate: loamy sand surface layer; dusty.
BhA	Moderate: slow to very slow permeability; dry during season of use.	Moderate: slow to very slow permeability; dry for long periods; dusty.	None to slight	None to slight.
BeB, BK. For interpretations of Stumble part in BK see Stumble series.	Moderate: moderately slow permeability; dry for long periods; dusty.	Moderate: moderately slow permeability; dry for long periods; dusty.	Slight: subject to some soil blowing.	None to slight.
Biddleman: BLB, BM	Moderate: moderately slow permeability; slopes as much as 15 percent; more than 20 percent coarse fragments on surface.	Severe: slopes as much as 15 percent; more than 20 percent coarse fragments on surface.	Moderate: slopes as much as 15 percent.	Moderate: more than 20 percent coarse fragments on surface.
Bluewing: BnC	Moderate: loamy sand surface layer; subject to flooding during season when not used.	Moderate: loamy sand surface layer; as much as 20 percent gravel on surface.	Moderate: loamy sand surface layer.	Moderate: loamy sand surface layer; as much as 20 percent gravel on surface.
*Bunejug:				
Bo, Br, Bs	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained.
BT. For interpretations of Erber part, see Erber series.	Moderate: clay loam surface layer; somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: moderate trafficability; clay loam surface layer; somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained; moderate trafficability; clay loam surface layer.	Moderate: somewhat poorly drained; moderate traffica-cability; clay loam surface layer.
Carcity: Ca, Cc, Cd	Severe: clay surface layer; somewhat poorly drained.	Severe: clay surface layer; somewhat poorly drained.	Severe: clay surface layer.	Severe: clay surface layer.
*Carson:				
CE	Severe: very slow permeability; somewhat poorly drained.	Severe: very slow permeability; somewhat poorly drained.	Moderate: moderate trafficability; very slow permeability; clay loam surface layer; somewhat poorly drained.	Moderate: somewhat poorly drained; moderate traffica-bility; clay loam surface layer.
Cg, Ch, Ck	Severe: clay surface layer; very slow permeability; somewhat poorly drained.	Severe: clay surface layer; very slow permeability; somewhat poorly drained.	Severe: clay surface layer.	Severe: clay surface layer.
CM. For interpretations of Stillwater part, see Stillwater series.	Severe: poorly drained; clay surface layer; very slow permeability.	Severe: poorly drained; clay surface layer; very slow permeability.	Severe: poorly drained; clay surface layer.	Severe: poorly drained; clay surface layer.

TABLE 10.—*Soil interpretations for recreation*—Continued

Soil series and map symbol	Degree and kind of limitation for—			
	Camp areas (intensive use)	Play areas (intensive use)	Picnic areas	Paths and trails
Celeton: CNE	Severe: slopes of as much as 30 percent; more than 50 percent coarse fragments on surface.	Severe: slopes of more than 6 percent; more than 50 percent coarse fragments on surface; bedrock at depth of less than 20 inches.	Severe: slopes of as much as 30 percent; more than 50 percent coarse fragments on surface.	Severe: slopes of as much as 30 percent; more than 50 percent coarse fragments on surface.
*Churchill: CP. For Playas part, see Playas.	Severe: very slow permeability; somewhat poorly drained.	Severe: very slow permeability; somewhat poorly drained.	Moderate: somewhat poorly drained; erosion pavement that has more than 30 percent coarse fragments on surface.	Moderate: somewhat poorly drained; more than 20 percent coarse fragments on surface.
Dia:				
Da, Dc, Dd	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained.
De	Severe: poorly drained; water table at a depth of 1½ to 3 feet during season of use.	Severe: poorly drained; water table at a depth of 1½ to 3 feet during season of use.	Severe: poorly drained; water table at a depth of 1½ to 3 feet during season of use.	Severe: poorly drained; water table at a depth of 1½ to 3 feet during season of use.
Dithod: Dh, Dk, Dm	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; moderate permeability.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; moderate permeability.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
*Dune land: Dp. Barren dunes; fine sand texture; hazard of severe blowing. For Playas part, see Playas.				
East Fork: Ea, Ec, Ed	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; moderately slow permeability.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; moderately slow permeability.	Moderate: somewhat poorly drained; clay loam surface layer.	Moderate: somewhat poorly drained; clay loam surface layer.
Erber:				
Ee	Severe: loose sand surface layer; somewhat poorly drained.	Severe: sand surface layer; somewhat poorly drained.	Severe: loose sand surface layer.	Severe: sand surface layer.
Eg, Eh	Moderate: somewhat poorly drained; water table at a depth of about 3 feet during season of use.	Moderate: somewhat poorly drained; water table at a depth of about 3 feet during season of use.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Em, En	Severe: clay surface layer; somewhat poorly drained.	Severe: clay surface layer; somewhat poorly drained.	Severe: clay surface layer.	Severe: clay surface layer.
Fallon:				
Fa, Fc, Fd	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Fe	Severe: poorly drained; water table at a depth of 1½ to 3 feet during season of use.	Severe: poorly drained; water table at a depth of 1½ to 3 feet during season of use.	Severe: poorly drained; water table at a depth of 1½ to 3 feet during season of use.	Severe: poorly drained; water table at a depth of 1½ to 3 feet during season of use.

TABLE 10.—*Soil interpretations for recreation*—Continued

Soil series and map symbol	Degree and kind of limitation for—			
	Camp areas (intensive use)	Play areas (intensive use)	Picnic areas	Paths and trails
Fernley:				
Fn	Severe: loose sand surface layer; somewhat poorly drained.	Severe: sand surface layer; somewhat poorly drained.	Severe: loose sand surface layer.	Severe: sandy surface layer.
Fo	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Fr	Severe: clay surface layer; somewhat poorly drained.	Severe: clay surface layer; somewhat poorly drained.	Severe: clay surface layer.	Severe: clay surface layer.
Gardella: GA	Severe: very slow permeability; erosion pavement; silica-cemented hardpan at a depth of 6 to 10 inches.	Severe: erosion pavement that has more than 20 percent coarse fragments on surface; silica-cemented hardpan at a depth of 6 to 10 inches.	Moderate: erosion pavement that has more than 20 percent coarse fragments on surface.	Moderate: erosion pavement that has more than 20 percent coarse fragments on surface.
*Hooten: HB. For interpretations of Bango part, see Bango series.	Severe: more than 50 percent coarse fragments on surface; silica-cemented hardpan at a depth of 5 to 11 inches.	Severe: more than 50 percent coarse fragments on surface; silica-cemented hardpan at a depth of 5 to 11 inches.	Severe: more than 50 percent coarse fragments on surface.	Severe: more than 50 percent coarse fragments on surface.
Huxley: HU	Moderate: slow permeability; more than 20 percnt coarse fragments on surface.	Severe: more than 20 percent coarse fragments on surface.	Moderate: more than 20 percent coarse fragments on surface.	Moderate: more than 20 percent coarse fragments on surface.
Juva:				
JuA	None to slight	None to slight	None to slight	None to slight.
JuB	None to slight	Moderate: slopes of 2 to 4 percent.	None to slight	None to slight.
JvB	Moderate: subject to flooding, but not during season of use.	Moderate: slopes of 2 to 4 percent.	None to slight	None to slight.
*Labou: LR. Rock outcrop part not rated.	Severe: very slow permeability; rock outcrop; bedrock at a depth of 12 to 18 inches.	Severe: very slow permeability; rock outcrop; bedrock at a depth of 12 to 18 inches.	Severe: rock outcrop	Severe: rock outcrop.
Lahontan: Ls, Lt	Severe: clay surface layer; very slow permeability; runoff very slow or ponded.	Severe: clay surface layer; very slow permeability; runoff very slow or ponded.	Severe: clay surface layer; runoff very slow or ponded.	Severe: clay sruface layer; runoff very slow or ponded.
Marsh: Ma. Ponded areas; on-site investigation required.				
*Mazuma: MB. For interpretations of Bango part, see Bango series.	None to slight	None to slight	None to slight	None to slight.
Mine pits: MD. Mined areas; not suitable for recreational purposes.				

TABLE 10.—*Soil interpretations for recreation*—Continued

Soil series and map symbol	Degree and kind of limitation for—			
	Camp areas (intensive use)	Play areas (intensive use)	Picnic areas	Paths and trails
Osobb Mapped only in a complex with Pirouette soil.	Severe: more than 50 percent coarse fragments on surface; slopes of as much as 30 percent; very stony; bedrock at a depth of 10 to 20 inches.	Severe: more than 50 percent coarse fragments on surface; slopes of as much as 30 percent; very stony; bedrock at a depth of 10 to 20 inches.	Severe: more than 50 percent coarse fragments on surface; slopes of as much as 30 percent.	Severe: more than 50 percent coarse fragments on surface; slopes of as much as 30 percent; very stony.
*Parran: PA, PC For interpretations of Tipperary soil in PC, see Tipperary series.	Severe: silty clay surface layer; somewhat poorly drained; runoff very slow or ponded.	Severe: silty clay surface layer; somewhat poorly drained; runoff very slow or ponded.	Severe: silty clay surface layer; runoff very slow or ponded.	Severe: silty clay surface layer; runoff very slow or ponded.
Patna: PD	Severe: loose sand surface layer.	Severe: sand surface layer.	Severe: loose sand surface layer.	Severe: sand surface layer.
Pelic: Pe, Ph	Severe: poorly drained to very poorly drained; frequently ponded.	Severe: poorly drained to very poorly drained; frequently ponded.	Severe: poorly drained to very poorly drained; frequently ponded.	Severe: poorly drained to very poorly drained; frequently ponded.
Pf	Severe: poorly drained to very poorly drained; frequently ponded; clay surface layer.	Severe: poorly drained to very poorly drained; frequently ponded; clay surface layer.	Severe: poorly drained to very poorly drained; frequently ponded; clay surface layer.	Severe: poorly drained to very poorly drained; frequently ponded; clay surface layer.
*Pirouette: PM, PO For interpretations of Bluewing part in PM, see Bluewing series. For interpretations of Osobb part in PO, see Osobb series.	Severe: more than 50 percent coarse fragments on surface; very stony; bedrock at a depth of 11 to 20 inches.	Severe: more than 50 percent coarse fragments on surface; very stony; bedrock at a depth of 11 to 20 inches.	Severe: more than 50 percent coarse fragments on surface.	Severe: more than 50 percent coarse fragments on surface.
Playas: PY. Closed basins and intermittent lakes; generally clayey texture; strongly alkaline; barren; no outlets.				
Ragtown: Ra, Rc, Rg	Moderate: slow permeability; clay loam or sandy clay loam surface layer; moderately well drained.	Moderate: slow permeability; clay loam or sandy clay loam surface layer; moderately well drained.	Moderate: moderate trafficability; clay loam or sandy clay loam surface layer.	Moderate: moderate trafficability; clay loam or sandy clay loam surface layer.
Sagouspe: Sa, Sb	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; loamy sand surface layer.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; loamy sand surface layer.	Moderate: somewhat poorly drained; loamy sand surface layer.	Moderate: somewhat poorly drained; loamy sand surface layer.

TABLE 10.—*Soil interpretations for recreation*—Continued

Soil series and map symbol	Degree and kind of limitation for—			
	Camp areas (intensive use)	Play areas (intensive use)	Picnic areas	Paths and trails
Soda Lake:				
ScA, SdA	Moderate: loamy sand surface layer; more than 20 percent coarse fragments on surface.	Severe: more than 20 percent coarse fragments on surface.	Moderate: loamy sand surface layer; more than 20 percent coarse fragments on surface.	Moderate: loamy sand surface layer; more than 20 percent coarse fragments on surface.
SeD, SH Rock outcrop part not rated.	Moderate: loamy sand surface layer; more than 20 percent coarse fragments on surface; slopes as much as 15 percent.	Severe: more than 20 percent coarse fragments on surface; slopes of as much as 15 percent; associated with Rock outcrop.	Moderate: loamy sand surface layer; more than 20 percent coarse fragments on surface; slopes of as much as 15 percent.	Moderate: loamy sand surface layer; more than 20 percent coarse fragments on surface.
SfA, SgA	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.
Stillwater:				
Sk, Sm, Sn	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; clay loam surface layer; moderately slow to slow permeability.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; clay loam surface layer; moderately slow to slow permeability.	Moderate: somewhat poorly drained; clay loam surface layer.	Moderate: somewhat poorly drained; clay loam surface layer.
So	Severe: poorly drained; water table at a depth of 1½ to 3 feet.	Severe: poorly drained; water table at a depth of 1½ to 3 feet.	Severe: poorly drained; water table at a depth of 1½ to 3 feet.	Severe: poorly drained; water table at a depth of 1½ to 3 feet.
Sp	Severe: clay surface layer; somewhat poorly drained; water table at a depth of 3 to 5 feet.	Severe: clay surface layer; somewhat poorly drained; water table at a depth of 3 to 5 feet.	Severe: clay surface layer.	Severe: clay surface layer.
Stumble Mapped only in a complex with Bango soils.	Severe: loamy sand surface layer; dusty.	Severe: loamy sand surface layer; dusty.	Severe: loamy sand surface layer; dusty.	Moderate: loamy sand surface layer.
Swingler:				
Sr	Severe: sand surface layer.	Severe: sand surface layer.	Severe: sand surface layer.	Severe: sand surface layer.
Ss	Slight: moderately slow permeability in lower part of the soil.	Slight: moderately slow permeability in lower part of the soil.	None to slight	None to slight.
St	Moderate: moderate trafficability; clay loam surface layer.	Moderate: moderate trafficability; clay loam surface layer.	Moderate: moderate trafficability; clay loam surface layer.	Moderate: moderate trafficability; clay loam surface layer.
Su, Sv	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; clay loam surface layer.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use; clay loam surface layer.	Moderate: somewhat poorly drained; clay loam surface layer.	Moderate: somewhat poorly drained; clay loam surface layer.
Swope: Sw, Sx, Sy, Sz.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained; water table at a depth of 3 to 5 feet during season of use.	Moderate: somewhat poorly drained.	Moderate: somewhat poorly drained.

TABLE 10.—*Soil interpretations for recreation*—Continued

Soil series and map symbol	Degree and kind of limitation for—			
	Camp areas (intensive use)	Play areas (intensive use)	Picnic areas	Paths and trails
*Tipperary: TnA, TnC, TPB, TPD, TR, TS, TU, TV. For interpretations of Appian part in TR and TS, see Appian series. For interpretations of Lahontan part in TU, see Lahontan series. For interpretations of Parran part in TV, see Parran series.	Severe: loose sand surface layer.	Severe: sand surface layer.	Severe: loose sand surface layer.	Severe: sand surface layer.
Weishaupt: Wc, We, Wh.	Severe: very slow permeability; somewhat poorly drained.	Severe: very slow permeability; somewhat poorly drained.	Moderate: somewhat poorly drained; clay loam surface layer.	Moderate: somewhat poorly drained; clay loam surface layer.

drainage, a surface free of rocks and coarse fragments, freedom from flooding during periods of heavy use, and a surface that is firm after rains but not dusty when dry.

Play areas are used intensively for baseball, football, badminton, and similar organized games. Soils suitable for this use need to withstand intensive foot traffic. The best soils are nearly level and free of coarse fragments and rock outcrop, have good drainage, are free from flooding during periods of heavy use, and have a surface that is firm after rains but not dusty when dry. If grading and leveling are required, depth to rock is important.

Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic. Most of the vehicular traffic, however, is confined to access roads. The best soils are firm when wet but not dusty when dry, are free of flooding during the season of use; do not have slopes or stones that greatly increase the cost of leveling sites or of building access roads.

Paths and trails are used for local and cross-country travel by foot or horseback. Design and layout should require little or no cutting and filling. The best soils are at least moderately well drained, are firm when wet but not dusty when dry, are flooded not more than once during the season of use, have slopes of less than 15 percent, and have few or no rocks or stones on the surface.

Formation and Classification of Soils

In this section the factors that have affected the formation of the soils in the Fallon-Fernley Area are briefly discussed. The soils are then classified into higher categories according to the system of classification now in use in the United States.

Factors of Soil Formation

Soil is the collection of natural bodies on the Earth's surface, containing living matter and supporting or capable of supporting plants (*10*, *11*). Soils differ one from the other in different localities within very short distances. The differences are the result of the interaction of the five soil-forming factors. These factors are (1) the parent material; (2) the climate in which the soil material has accumulated and existed since accumulation; (3) the relief or topography, which influences the local or internal environment of the soil; drainage, moisture content, aeration, susceptibility to erosion, and exposure to sun and wind; (4) the biological forces that act upon the soil material—the plants and animals living on and in it; and (5) the length of time the climate and biological forces have acted on the soil material. The relative effect of each of these factors varies with each soil.

The processes of soil formation are quite complex. In the following paragraphs these relationships as they exist in the Fallon-Fernley Area are briefly described.

Parent material

Differences in parent material bring about corresponding differences in the characteristics of the soils that form.

Soils on bottom lands in the Area formed in valley fill material. Both the lacustrine sediment and the stream-deposited alluvium were derived from mixed rock. Because of the mixed rock origin, the particles weathered to all sizes. Example are quartz that weathered to sand-size particles and feldspars that weathered to clay. This results in texture that ranges from sand to clay.

The salt content and the percentage of exchangeable sodium of the material in which the soils are forming affects soil formation. A high percentage of exchangeable

sodium increases dispersion and increases clay movement to form a B2t horizon.

The alluvial fans in the Area have soils that are well drained to excessively drained. These soils formed in alluvium from volcanics and mixed rock. They exhibit slight to moderate development. However, for soils of comparable age, the soil that formed in alluvium from volcanics exhibit stronger development than those that formed in mixed alluvium.

The upland soils in the Area formed in various parent materials. The Pirouette soils formed dominantly in residuum derived from basalt. Even though basalt weathers relatively slowly, the age of the Pirouette soils and their gentle relief account for their strong development thick soil profile, which is as much as 20 inches in thickness. The Osobb soils formed in residuum and colluvium derived from dominantly soft tuffs. Tuffs weather faster than basalts and account for the 14 to 20 inches of soil in the profile of the Osobb soils, in spite of a considerable amount of past erosion. Celeton soils formed in residuum from diatomaceous earth, which is dominantly siliceous. Because no clay-forming minerals are present, little or no crystalline clay is present in these soils.

Climate

The Fallon-Fernley Area is typified by a cool, arid to semiarid climate that has an average annual precipitation of as little as 4 inches in the valley bottom and as much as 7 inches on uplands. The average annual air temperature is 50° to 55° F. The daily range in temperature is wide. The frost-free season is about 120 to 140 days.

The climatic conditions that have the most pronounced effect on soil formation and morphological characteristics in this Area are precipitation, temperature, and wind.

The scanty precipitation in this Area slows the rate of weathering because water is the medium in which reaction takes place. Water is a major source of hydrogen ions, a principal agent of weathering, and by carrying away the end products of chemical reactions, water allows the reaction to continue. If the depth of moisture penetration is limited, leaching is also limited, the end products accumulate, and weathering is slowed down or temporarily stopped. This effect is exemplified by the thin argillic horizons that form within inches of the surface in the Appian and Churchill soils. The calcium carbonate and salt accumulations that occur in the well-drained soils also show the effect of limited wetting. The limited rainfall is a major factor that accounts for the low-density stands of native plants that occur throughout the Area, except for the soils that formed on the flood plains and deltas that receive water from other sources. The low-density stands of native plants account for the low organic-matter content found in the A horizon of these soils.

High temperatures generally speed up the weathering of soil materials, but in this Area it is more than offset by the scanty precipitation. The warm temperatures in summer and the cool temperatures in winter limit the kinds of plants that will grow in the Area, and the high evaporation rate limits the density of these plants. This combination results in low organic-matter content in the A horizon of the soils in the Area.

In this Area, wind is particularly important to soil formation. The wind shaped the landscape of the Tipperary soils. The wind would severely erode Tipperary and other coarse-textured soils if they lacked vegetation. Wind has stripped the clay from the immediate surface of some of the loamy or clayey soils and has deposited it on coarse-textured soils where it has illuviated and formed argillic horizons, as in the Patna soils. The wind has blown salt from the flats and playas, and deposited it on the upland soils.

Biological activity

The biological factors in soil formation—plant and animal life—are concerned chiefly with the cover of plants and with the accumulation and decomposition of organic matter from the remains of plants. Micro-organisms, both plant and animal, earthworms, rodents, and man are regarded as important components of the biological factors. Two of the chief functions of plant and animal life consist of supplying organic matter for the soil and of recycling plant nutrients from the lower horizons to the upper horizons. Organic matter in the soil generally darkens the color, improves tilth, increases movement of water into and through the soil, and releases plant nutrients for plant use.

On the alluvial fans and high terraces and in the surrounding hills and mountains, the plants consist of desert shrubs and a few grasses. Because the soils are well drained to excessively drained and are dry for long periods, these plants cover only a small part of the surface. They add little organic matter to the soil, give scant protection from water and wind, and provide meager shade. For these reasons, the soils have a low organic-matter content and are poor habitat for micro-organisms. The low organic-matter content is evidenced by the light-colored A horizon present in soils in the Biddleman and Stumble series.

On flat bottom lands the biological forces are largely dependent on drainage, the runoff that is received on these soils, and the salinity and alkalinity of the soil. In somewhat poorly drained areas that receive little runoff, the scanty plant cover is mainly black greasewood, which extends roots into the capillary zone to obtain water. Shallow-rooted shrubs, grasses, and forbs depend on the limited precipitation for water. The salt and alkali content of these soils is generally high because of capillary water movement and the recycling of salts by plants. Such plants as greasewood are responsible for recycling sodium salts from deeper layers and concentrating them on the soil surface in the form of leaf litter. Consequently the pH value is generally higher directly under the greasewood bush than it is on the open ground. The scanty vegetation and high salt and alkali content create an unfavorable habitat for micro-organisms and there is very little biological activity. In somewhat poorly drained areas that receive large amounts of runoff, the biological forces are directly related to the salt and alkali content. When the salt and alkali content are high, black greasewood and an understory of saltgrass is the dominant vegetation, and micro-organism activity is limited, which creates a thin dark-colored A horizon. Dense stands of water-loving plants grow in areas that are not high in salt or alkali, or that were not high when the

soils were forming. A considerable amount of organic matter is returned to the soil and micro-organism activity is high, resulting in a thick dark-colored A horizon as in the Dia and Dithod soils.

Where the soils formed under conditions of poor or very poor drainage, the vegetation consisted of very dense stands of water-loving grasses and other aquatic plants. Consequently, these soils are the darkest in the Area. Carson and Stillwater soils are examples.

Earthworms are probably the most obvious form of animal life in most soils. Burrowing earthworms leave worm casts, which are round granular excretions. Worm casts add to the fertility of soils and to the movement of air, water, and plant roots through the soil.

Because of the part they play in releasing plant nutrients from the parent material, micro-organisms are especially important in the formation of soils. They take nitrogen from the air and store it in the soil. Also, they are active in helping to decompose plant residue.

In some soils, rodents that dwell in the soils have played a part in the development of a soil profile. By their burrowing, these animals mix the soil material, and this mixing tends to offset the effects of the leaching of carbonates and the downward movement of clay. The carbonates found on the surface of Stumble soils have generally been brought up by burrowing rodents.

Man has a tremendous effect on the biological forces that contribute to soil formation. He introduces new plant species, reclaims saline-alkali soils, plows under crop residue, and adds commercial fertilizer to assist the micro-organisms to decompose the organic matter. Also, man has altered the drainage, which has changed the kind and amounts of plants growing in the soils.

Relief

Relief influences the formation of soils, mostly through its effect on drainage and runoff. If other factors of soil formation are equal, the degree of profile development depends mainly on the average amount of moisture that enters and passes through the soil. Steep soils absorb less moisture than less sloping ones, and they are more susceptible to erosion. Therefore, they generally have a thinner and less developed profile. Steepness is one of the reasons that Osobb soils are less developed than the Pirouette soils. In some areas the aspect of the slope is important in soil formation. The amount and type of vegetation is partly related to this aspect, which in turn influences the amount of water entering and passing through the soil, the rate of water movement, the aeration, and the organic-matter content.

The soils on the high terraces and alluvial fans are well-drained to excessively drained. They are level to slightly convex and nearly level to strongly sloping. They are dissected by shallow channels and a few broad, deep channels. Such soils as Bluewing soils are still receiving material, and other material is washing away. All these soils have a pale color and lack mottles, except for a few relict mottles.

The soil characteristics of soils on the nearly level bottom lands are in many places directly related to the drainage, either when the soil was forming or its present altered drainage. The kind and amount of vegetation is partly dependent upon the drainage, and it influences the amount of organic matter in the soil. Organic matter generally darkens the topsoil, as in the Stillwater soils.

Soils are strongly influenced by iron, a constituent of many minerals, that is largely responsible for the bright colors in soils. Iron generally occurs in the ferric form and in this form is insoluble if air is present. But in soils containing large amounts of organic matter and water, iron is reduced to ferrous forms that are soluble and move readily in water. This change, called reduction, takes place in soils on the flood plains and deltas. Ferrous iron goes into solution and is removed from the soil in drainage water. As a result, the colors of these soils are materially affected. They have (1) chromas of 2 or less; (2) hues of neutral, yellow (2.5Y or 5Y), or greenish yellow (5GY); or (3) both such chromas and hues. Soils that have yellowish hues are sometimes referred to as gleyed. Intense gleying generally takes place in soils that are poorly drained. Carson and Bunejug soils are examples of soils that formed under conditions of poor and very poor drainage. These soils have a dark-colored surface layer underlain by layers that have neutral or yellowish hues and low chromas. Iron is also reduced in soils that have a fluctuating water table but is not removed by drainage water. When the water table falls, aeration improves, the content of oxygen increases, and the ferrous iron in solution is oxidized and precipitated as ferric oxide. Ferric oxide is reddish and spots the soil with mottles in places where it is precipitated. Sagouspe soils show such mottling.

Nearly all of the soils on the flood plains and deltas that have not been reclaimed are strongly affected by salts and alkali. The water table is shallow in these soils, and the ground water has a high content of salts. Excessive salts and alkali accumulate, generally on or near the surface, when saline ground water rises through capillary action and is evaporated. The runoff from other areas accumulates on these soils and deposits salt in the profile. Such plants as greasewood and shadscale, through their normal activity, also add salts to the soil.

Man has significantly altered the relief in this area. By land leveling he has cut the surface of some soils and filled or covered the surface layer of others. He has diverted water and put in drains to improve the drainage in some areas. In other areas wetness has been aggravated by seepage from canals, excessive irrigation, and destruction of natural sand channels that acted as drains. By manipulation of the water, man has been able to remove excessive salt and alkali from the soil. Plowing has interrupted the formation of thin argillic horizons in some of the soils by mixing these horizons into the surface layer.

Time

Time is required for the formation of soil. The amount of time required depends on the other soil-forming factors. The degree of expression of genetic soil horizons is directly related to the length of time that other soil-forming factors have exerted their influence on the parent material. A young soil is one on which climate, plant and animal life, and relief have only begun to alter the parent material. Thus, the age of a soil is determined by the degree to which the parent material has

been changed toward the development of a soil that has its own unique set of characteristics.

The Fallon-Fernley Area offers a good opportunity to compare age relationships of soils because of the excellent controls available on the age of geomorphic surfaces and the lithologic character of the parent material. The major physiographic feature responsible for these controls is the complex of relict landforms generated during the late Pleistocene expansions and contractions of Lake Lahontan. All the Area below 4,380 feet in elevation was periodically inundated by pluvial Lake Lahontan.

Studies of Quaternary geology in the Area have been conducted by I. C. Russell (*9*), Ernst Antevs (*3*, *4*), and more recently by R. B. Morrison (*6*). The studies of Morrison are of particular interest to soil scientists because he has designated rock-and-soil stratigraphic units in the sequence of later Quaternary deposits and basin-and valley-fill deposits and has developed a hypothetical chronology of lake fluctuations for the past 75,000 years (*7*). The lake fluctuations identified by Morrison indicated several significant elevation maximums separated by minimums during which, in several instances, complete desiccation occurred. The deepest stand of Lake Lahontan has been identified by Morrison at 4,380 feet about 53,000 years ago. Subsequent significant maximums occurred at 4,345 feet about 42,000 years ago; 4,370 feet about 18,000 years ago; and 4,245 feet about 13,000 years ago. Elevation maximums below 4,010 feet have occurred intermittently since about 11,000 years ago.

Lake fluctuations destroyed continually modified landforms and covered inundated areas with sediment. Recession of the lake during interpluvial periods exposed land surfaces to weathering and soil formation. Comprehension of these processes and the availability of Morrison's chronology makes it possible to compare age relationships among various soils in the Area.

In general, dune land, playas, stream flood plains, and presently aggrading alluvial fans are the most recent parent materials. Some recent materials exposed to weathering by erosion are also present on uplands. Soils on these recent surfaces have little or no profile development other than the formation of an A horizon. The Bluewing soils on alluvial fans and Dia and East Fork soils on flood plains are examples of several of the most recent soils that formed in the past.

The lake maximums dropped from about 4,245 feet about 13,000 years ago to below 4,000 feet for the last time about 11,000 years ago. Soils on relict landforms exposed at that time, and likely to have been inundated by more recent elevation maximums below 4,000 feet, are theorized to have been subjected to soil formation for at least 11,000 years. The Churchill, Lahontan, Parran, Bango, Appian, and Patna soils are examples of soils in this age group.

About 18,000 years ago, the lake elevation stood at 4,370 feet. Surfaces exposed by recession of this maximum of 4,245 feet about 13,000 years ago can be as old as about 18,000 years ago. The soils of the Biddleman series are thought to range into this time interval.

Only those relict land surfaces above elevations of 4,370 feet, the second highest stand of Lake Lahontan, about 18,000 years ago, can be older than 18,000 years. The Pirouette soils that exhibit the strongest soil development in the Area have formed on stable upland surfaces and are possibly older than 18,000 years ago. Pirouette soils are believed to represent the oldest soils occurring in the Area.

Classification of the Soils

Classification consists of an orderly grouping of soils according to a system designed to make it easier to remember soil characteristics and interrelationships. Classification is useful in organizing and applying the results of experience and research. Soils are placed in narrow classes for discussion in detailed soil surveys and for application of knowledge within farms and fields. The many thousands of narrow classes are then grouped into progressively fewer and broader classes in successively higher categories, so that information can be applied to large geographic areas.

The system of classification used by the National Cooperative Soil Survey was adopted in 1965 (*13*). It is under continual study.

The system of classification has six categories. Beginning with the most inclusive, these categories are the order, the suborder, the great group, the subgroup, the family, and the series. The criteria for classification are soil properties that are observable or measurable, but the properties are selected so that soils of similar genesis are grouped together. The placement of some soil series in the system of classification, particularly in families, may change as more precise information becomes available.

Table 11 shows the classification of each soil series of the Area by family, subgroup, and order, according to the current system. The categories of the classification system are briefly described in the paragraphs that follow.

ORDER: Soils are grouped into orders according to properties that seem to have resulted from the same processes acting to about the same degree on the parent material. Ten soil orders are recognized in the current system: Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. Entisols, Aridisols, and Mollisols are represented in the Fallon-Fernley Area.

Entisols are recent soils in which there has been little or no horizon development. Aridisols are primarily soils of dry places. Mollisols have a thick, dark-colored surface layer, moderate to strong structure, and base saturation of more than 50 percent.

SUBORDER: Each order is divided into suborders, primarily on the basis of soil characteristics that indicate genetic similarity. The suborders have a narrower climatic range than the orders. The criteria for suborders reflect either the presence or absence of waterlogging, or soil differences resulting from climate or vegetation.

GREAT GROUP: Each suborder is divided into great groups on the basis of uniformity in kind and sequence of genetic horizons. The great group is not shown in table 11, because the name of the great group is the same as the last word in the name of the subgroup.

SUBGROUP: Each great group is divided into subgroups, one representing the central (typic) concept of the group, and other groups, called intergrades, that

TABLE 11.—*Classification of soils series*

Series	Family	Subgroup	Order
Appian	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Natrargids	Aridisols.
Bango	Fine-loamy, mixed, mesic	Haplic Natrargids	Aridisols.
Biddleman	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Typic Natrargids	Aridisols.
Bluewing	Sandy-skeletal, mixed, mesic	Typic Torriorthents	Entisols.
Bunejug	Coarse-loamy, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols.
Carcity	Clayey over sandy or sandy-skeletal, montmorillonitic, mesic	Cumulic Haplaquolls	Mollisols.
Carson	Very fine, montmorillonitic, mesic	Vertic Haplaquolls	Mollisols.
Celeton	Loamy-skeletal, mixed (calcareous), mesic, shallow	Typic Torriorthents	Entisols.
Churchill	Fine, montmorillonitic, mesic	Typic Natrargids	Aridisols.
Dia	Fine-loamy over sandy or sandy-skeletal, mixed, mesic	Fluvaquentic Haploxerolls	Mollisols.
Dithod	Fine-loamy, mixed, mesic	Fluvaquentic Haploxerolls	Mollisols.
East Fork	Fine-loamy, mixed, mesic	Fluvaquentic Haploxerolls	Mollisols.
Erber	Sandy, mixed, mesic	Fluvaquentic Haplaquolls	Mollisols.
Fallon	Coarse-loamy, mixed, nonacid, mesic	Aquic Xerofluvents	Entisols.
Fernley	Mixed, mesic	Aquic Xeropsamments	Entisols.
Gardella	Sandy, mixed, mesic	Entic Durorthids	Aridisols.
Hooten	Loamy-skeletal, mixed, mesic	Entic Durorthids	Aridisols.
Huxley	Clayey-skeletal over sandy or sandy-skeletal, montmorillonitic, mesic.	Typic Natrargids	Aridisols.
Juva	Coarse-loamy, mixed (calcareous), mesic	Typic Torrifluvents	Entisols.
Labou	Clayey-skeletal, montmorillonitic, mesic	Lithic Natrargids	Aridisols.
Lahontan	Fine, montmorillonitic (calcareous), mesic	Aquic Xerofluvents	Entisols.
Mazuma	Coarse-loamy, mixed (calcareous), mesic	Typic Torriorthents	Entisols.
Osobb	Loamy-skeletal, mixed, mesic	Typic Durorthids	Aridisols.
Parran	Fine, montmorillonitic, mesic	Typic Salorthids	Aridisols.
Patna	Coarse-loamy, mixed, mesic	Typic Haplargids	Aridisols.
Pelic	Sandy, mixed, mesic	Typic Fluvaquents	Entisols.
Pirouette	Loamy-skeletal, mixed, mesic	Typic Nadurargids	Aridisols.
Ragtown	Fine, montmorillonitic (calcareous), mesic	Typic Torriorthents	Entisols.
Sagouspe	Sandy, mixed, mesic	Aquic Xerofluvents	Entisols.
Soda Lake	Sandy, mixed, mesic	Typic Torriorthents	Entisols.
Stillwater	Fine, montmorillonitic (calcareous), mesic	Fluvaquentic Haplaquolls	Mollisols.
Stumble	Mixed, mesic	Typic Torripsamments	Entisols.
Swingler	Fine-silty, mixed (calcareous), mesic	Typic Torriorthents	Entisols.
Swope	Fine-loamy over sandy or sandy-skeletal, mixed (calcareous), mesic.	Fluvaquentic Haplaquolls	Mollisols.
Tipperary	Mixed, mesic	Typic Torripsamments	Entisols.
Weishaupt	Fine-loamy over clayey, mixed (calcareous), mesic	Cumulic Haplaquolls	Mollisols.

have properties of one great group but also one or more properties of another great group.

FAMILY: Families are established within subgroups primarily on the basis of properties important to plant growth. Some of these properties are texture, mineralogy, reaction, soil temperature, permeability, consistence, and thickness of horizons.

SERIES: The series has the narrowest range of characteristics of the categories in the classification system. It is explained in the section "How This Survey Was Made."

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Glossary

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

Alkali soil. Generally, a highly alkaline soil. Specifically, an alkali soil has so high a degree of alkalinity (pH 8.5 or higher) or so high a percentage of exchangeable sodium (15 percent or more of the total exchangeable bases), or both, that the growth of most crop plants is low from this cause.

Alkaline soil. A soil that has a pH greater than 7.0. See also Reaction, soil.

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams.

Available water capacity (also termed 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 capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil.

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 clay on the surface of a soil aggregate. Synonyms: clay coat, clay skin.

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 and brittle; little affected by moistening.

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

Excessively drained soils are commonly very porous and rapidly permeable and have a low water-hold capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum. They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons.

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches.

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils.

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Erosion. The wearing away of the land surface by wind (sandblast), running water, and other geological agents.

Erosion pavement. A layer of gravel or stones on the ground surface that remains after the fine particles are removed by wind or water. Desert pavements result from exposure to dry winds.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially.

Gleyed soil. A soil in which waterlogging and lack of oxygen have caused the material in one or more horizons to be neutral gray in color. The term "gleyed" is applied to soil horizons with yellow and gray mottling caused by intermittent waterlogging.

Ground water (geology). Water that fills all the unblocked pores of underlying material below the water table, which is the upper limit of saturation.

Hardpan. A hardened or cemented soil horizon, or layer. The soil material may be sandy or clayey, and it may be cemented by iron oxide, silica, calcium carbonate, or other substance.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon.—The layer of organic matter on the surface of a mineral soil. This layer consists of decaying plant residues.

A horizon.—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides).

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these; (2) by prismatic or blocky structure; (3) by redder or stronger colors than the A horizon; or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil. If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon.—The weathered rock material immediately beneath the solum. In most soils this material is presumed to be like that from which the overlying horizons were formed. If the material is known to be different from that in the solum, a Roman numeral precedes the letter C.

R layer.—Consolidated rock beneath the soil. The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Infiltration rate. The rate at which water penetrates the surface of a soil at any given instant, usually expressed in inches per hour. It may be limited either by the capacity of the soil or by the rate at which water is applied to the surface layer.

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 relatively level plots surrounded by levees or dikes.

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

Corrugation.—Water is applied to small, closely spaced furrows or ditches in fields of close-growing crops, or in orchards, to confine the flow of water to one direction.

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

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

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

Wild flooding.—Irrigation water, released at high points, flows onto the field without controlled distribution.

Irrigation efficiency. The ratio of water consumed by crops on an irrigated farm to the water diverted from a river or other natural source into the farm canals.

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

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size. Mottling in soils usually indicates poor aeration and lack of 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 these: *fine*, less than 5 millimeters (about 0.2 inch) in diameter along the greatest dimension; *medium*, ranging from 5 millimeters to 15 millimeters (about 0.2 to 0.6 inch) in diameter along the greatest dimension; and *coarse*, more than 15 millimeters (about 0.6 inch) in diameter along the greatest dimension.

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction. In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6.6 to 7.3
Very strongly acid	4.5 to 5.0	Mildly alkaline	7.4 to 7.8
Strongly acid	5.1 to 5.5	Moderately alkaline	7.9 to 8.4
Medium acid	5.6 to 6.0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9.1 and higher

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

Saline soil. A soil that contains soluble salts in amounts that impair growth of plants but that does not contain excess exchangeable sodium.

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0.05 to 2.0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Solum. The upper part of a soil profile, above the parent material, in which the processes of soil formation are active. The solum in mature soil includes 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 other plant and animal life characteristic of the soil are largely confined to the solum.

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. 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 grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

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

Subsoiling. Tillage of a soil below normal depth ordinarily to shatter a hardpan or claypan.

Substratum. Technically, the part of the soil below the solum.

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide.

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."

Variant, soil. A soil having properties sufficiently different from those of other known soils to suggest establishing a new soil series, but a soil of such limited known area that creation of a new series is not believed to be justified.

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water. In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

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