

SOIL SURVEY OF
Box Elder County, Utah
Eastern Part



**United States Department of Agriculture
Soil Conservation Service and
United States Department of the Interior
Fish and Wildlife Service
Bureau of Land Management
In cooperation with
Utah Agricultural Experiment Station**

Major fieldwork for this soil survey was done in the period 1964-68. Soil names and descriptions were approved in 1969. Unless otherwise indicated, statements in this publication refer to conditions in the survey area in 1969. This survey was made cooperatively by the Soil Conservation Service, the Fish and Wildlife Service, the Bureau of Land Management, and the Utah Agricultural Experiment Station. It is a part of the technical assistance furnished to the Northern Utah, the South Box Elder, and the West Box Elder Soil Conservation Districts.

Copies of the soil map in this publication can be made by commercial photographers or can be purchased on individual order from the Cartographic Division, Soil Conservation Service, USDA, Washington, D.C. 20250.

HOW TO USE THIS SOIL SURVEY

THIS SOIL SURVEY of Box Elder County, Utah, Eastern Part, contains information that can be applied in managing farms, ranches, and woodlands; 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 Box Elder County, Eastern Part, are shown in the detailed map at the back of this soil survey. This map consists of many sheets that are made from aerial photographs. Each sheet is numbered to correspond with numbers 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 in the survey. This guide lists all the soils of the survey area 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 capability unit or units and the 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 the soil descriptions and from the discussions of the capability units and the range sites.

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

Game managers, sportsmen, and others can find information about soils and wildlife in the section "Use and Management of the Soils for Wildlife."

Community planners and others can read about soil properties that affect the choice of sites for dwellings, industrial buildings, and recreation areas in the section "Soils for Recreational Development."

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 the Soils."

Newcomers to Box Elder County, Eastern Part, 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 county given at the beginning of the publication and in the section "Additional Facts About Box Elder County, Eastern Part."

Cover: Nonirrigated grain stubble on DeJarnet gravelly silt loam, 1 to 6 percent slopes, in Blue Creek Valley.

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SOIL SURVEY OF BOX ELDER COUNTY, UTAH, EASTERN PART

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UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, AND UNITED STATES DEPARTMENT
OF THE INTERIOR, FISH AND WILDLIFE SERVICE AND BUREAU OF LAND MANAGEMENT, IN COOPERATION WITH
UTAH AGRICULTURAL EXPERIMENT STATION

BOX ELDER COUNTY, EASTERN PART (also called the survey area in this publication) is in the extreme north-central part of Utah (fig. 1) and takes in the entire eastern part of Box Elder County.

The survey area is bounded on the north by the State of Idaho; on the east by Cache County; on the south by Weber County and Great Salt Lake; and on the west by the remaining part of Box Elder County. The total area of the survey is 1,259,278 acres, or about 1,968 square miles. The entire area is in Box Elder County except for

Fremont Island, which is in adjoining Weber County. This island is 2 miles offshore from the southern tip of Promontory Point. Fremont Island, which is about 1 square mile in size, is the third largest island in the Great Salt Lake. Brigham City, having a population of 14,000, is the largest city in the survey area and is the county seat. It is situated at the base of the Wasatch Mountains, 60 miles north of Salt Lake City.

The survey area consists of a series of gently sloping terraces and alluvial fans and of rolling uplands and mountains. Except for the mountainous land, a large part of the area was covered by ancient Lake Bonneville, a freshwater lake. Along the mountain sides and on alluvial fans are shore features consisting of terraces, beaches, and bars that were formed by this lake. The alkali flats and desert areas that are so prominent in this area represent the floor of the ancient lake. Elevation ranges from about 4,200 feet along the shores of Great Salt Lake to about 8,900 feet in the high mountains. The precipitation varies generally with the elevation. At 4,200 feet above sea level, the precipitation is about 7 inches, but it ranges to near 30 inches annually in the high mountains. The area is drained into Great Salt Lake through numerous small drainageways. Two major rivers enter the area from Idaho.

The irrigated cropland is concentrated in the eastern part of the survey area. The irrigated soils occur on the low terraces and flood plains in Bear River Valley and the alluvial fans along the mountain front. This irrigated cropland occupies about 86,000 acres. There is a plentiful supply of high-quality irrigation water, which is delivered by a system of canals 120 miles long. The area is very important agriculturally and ranks high in the production of farm crops. Crops commonly grown are sugar beets, alfalfa, small grain, tomatoes, corn for silage, and some celery, onions, peas, and bush beans. The area has the largest acreage of sugar beets in the State. It is widely acclaimed for the fruit orchards along the mountain front, where peaches, cherries, apples, apricots, and some melons and sweet corn are grown. Killing frosts are common in the fruit-producing area.

Beef is the principal livestock product. Dairy and poultry products and turkeys are also produced in quantity, since feed grains are plentiful.

The nonirrigated cropland is mainly in the north-central part of the survey area and is on gently sloping

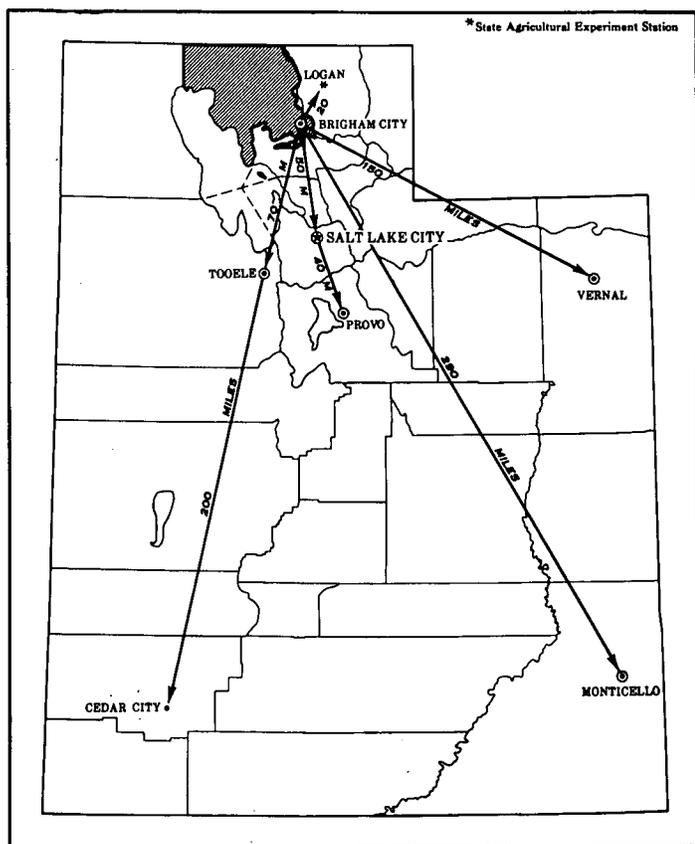


Figure 1.—Location of Box Elder County, Eastern Part, in Utah.

terraces and rolling uplands. About 238,000 acres are used for nonirrigated crops, the highest acreage of any county in the State. Wheat is the principal crop.

The mountainous lands and areas of precipitation less than that needed for nonirrigated farming make up the range. Juniper-covered areas have little value as woodland and therefore are considered range. Wide extremes of climatic factors and elevations affect the range vegetation. The per-acre production varies from only a little plant growth near the shores of Great Salt Lake to abundant growth in the high mountains. Cattle production is a major source of agricultural income.

The small communities along the mountain front, along with Brigham City, have grown in population during the last decade.

Tremonton, in the heart of the irrigated valley, had a population of 2,974 in 1970, an increase of 38 percent over its 1960 population. Small communities in other parts of the survey area have declined in population during the last decade.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in Box Elder County, Eastern Part, where they are located, and how they can be used. The soil scientists went into the survey 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 roots of plants.

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. Hansel and Thiokol, 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, salinity, 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, Hansel silt loam, 1 to 6 percent slopes, is one of several phases within the Hansel 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 photo-

graphs show woodlands, buildings, field borders, trees, and other details that help in drawing boundaries accurately. The soil map at the back of this survey 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 other 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 more than one series or of different phases within one series. Two such kinds of mapping units are shown on the soil map of Box Elder County, Eastern Part: 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. Pasleys-Munk complex, 10 to 20 percent slopes, 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. Broad-Middle association, steep, 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. Gullied land 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 kind 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 kind 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 or 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 Map¹

The general soil map at the back of this survey shows, in color, the soil associations in Box Elder County, Eastern Part. 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 a survey area, who want to compare different parts of a survey 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 other 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 this survey area have been grouped into five general kinds of landscapes 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 of the major soils. For example, in the title of association 1, the words, "silt loams, gravelly loams, and very stony loams" refer to the texture of the surface layer.

Well-Drained and Somewhat Excessively Drained Soils of the Mountains

These soils are on mountain slopes and alluvial fans in the mountains and high mountains. They are silt loams, gravelly loams, and very stony loams that formed in residuum, colluvium, and alluvium derived from quartzite, sandstone, and limestone.

Elevations of these soils are 5,200 to 8,000 feet. The average annual precipitation is 18 to 26 inches. The mean annual temperature is 40° to 47° F., and the frost-free season is 60 to 100 days. These soils are used for range, wildlife habitat, and water supply.

This association of Box Elder County, Eastern Part, is in this group. It makes up about 2 percent of the survey area.

¹ LUDENE CAMPBELL, soil scientist, Soil Conservation Service, assisted in preparing this section.

1. *Foxol-Elzinga-Agassiz association*

Well-drained and somewhat excessively drained, very steep silt loams, gravelly loams, and very stony loams; on mountains and alluvial fans

This association is mainly in scattered locations along the eastern border of the survey area. The soils formed in residuum, colluvium, and alluvium derived from quartzite, sandstone, and limestone. Slopes are 25 to 70 percent. The vegetation is bluebunch wheatgrass, buckwheat, low sagebrush, sugar balsamroot, and annual weeds on the Foxol and Agassiz soils, and it is maple, chokecherry, snowberry, western cornflower, mountain brome, and bearded wheatgrass on the Elzinga soils. Elevations are 5,200 to 8,000 feet. The average annual precipitation is 18 to 26 inches. The mean annual temperature is 40° to 47° F., and the frost-free season is about 60 to 100 days.

This association makes up about 2 percent of the survey area. It is about 25 percent Foxol soils, 25 percent Elzinga soils, and 20 percent Agassiz soils. Small areas of Picayune, Richmond, Ridd, and Middle soils under a cover of grass and maple, Lucky Star soils under a cover of aspen, and Bickmore soils under a cover of Douglas-fir make up the remaining 30 percent of the association.

The Foxol soils are somewhat excessively drained and are 14 to 20 inches deep to quartzite bedrock. The surface layer and subsoil are brown gravelly loam. The substratum is very gravelly loam that is underlain by quartzite bedrock.

The Elzinga soils are well drained and are more than 60 inches deep. The surface layer is very dark gray silt loam and loam, the subsurface layer is pale-brown very gravelly silt loam, and the subsoil is light-brown gravelly clay loam.

The Agassiz soils are somewhat excessively drained and are 14 to 19 inches deep to limestone. The surface layer is brown very stony loam and very cobbly loam. The next layer is yellowish-brown very cobbly loam that is underlain by limestone bedrock.

The major soils in this association are used as range for cattle and sheep. They are also valuable as wildlife habitat and watershed. Big-game animals and upland birds thrive on the soils of this association. Rocky Mountain bighorn sheep have recently been introduced into this area.

Well-Drained Soils of the Mountain Foot Slopes, High Fans, and Terraces

These soils are mainly on mountain foot slopes and associated alluvial fans and high lake terraces. They are silt loams and loams that are cobbly in some areas. The soils formed in residuum and colluvium derived from sandstone, limestone, basalt, and quartzite and in alluvium derived from sandstone, limestone, and quartzite.

Elevations of these soils are 4,800 to 7,000 feet. The average annual precipitation is 15 to 21 inches. The mean annual temperature is 42° to 50° F., and the frost-free season is 75 to 130 days. These soils are used for non-irrigated crops, range, wildlife habitat, and water supply.

Two associations of Box Elder County, Eastern Part, are in this group. They make up 14 percent of the survey area.

2. *Middle-Broad association*

Well-drained, gently sloping to very steep cobbly silt loams and cobbly loams; on mountain foot slopes

This association is mainly in low, mountainous areas of the Malad River and between Blue Creek and Hansel Valleys in the northern part of the survey area. The soils formed in residuum and colluvium derived from sandstone, limestone, basalt, and quartzite. Slopes are 10 to 70 percent. The vegetation is dominantly bluebunch wheatgrass, sagebrush, bitterbrush, Sandberg bluegrass, snowberry, and annual grasses. Elevations are 4,800 to 6,600 feet. The average annual precipitation is 15 to 19 inches. The mean annual temperature is 42° to 48° F., and the frost-free season is 75 to 100 days.

This association makes up about 11 percent of the survey area. It is about 60 percent Middle soils and 30 percent Broad soils. The Gemson and Snowville soils are minor soils and make up the remaining 10 percent of the association.

The Middle soils have a surface layer of grayish-brown cobbly silt loam, a subsoil of brown very cobbly silt loam, and a substratum of very pale brown very cobbly loam. Limestone bedrock is at a depth of 24 to 38 inches.

The Broad soils have a surface layer of dark grayish-brown cobbly loam, a subsoil of brown gravelly clay loam, and a substratum of very pale brown very gravelly heavy loam. Fractured sandstone bedrock is at a depth of 30 to 40 inches.

The soils in this association are used for range, wildlife habitat, and water supply. They are a source of valuable habitat for upland game birds.

3. *Hendricks-Forsgren-Manila association*

Well-drained, gently sloping to very steep silt loams and loams; on foothills, alluvial fans, and high lake terraces

This association is mostly in mountain valleys near Mantua in the southeastern part of the survey area and near Pocatello Valley and Whites Valley in the northeastern part. The soils formed in residuum, colluvium, and alluvium derived from sandstone, quartzite, and limestone. Slopes are 1 to 20 percent on the Hendricks and Forsgren soils and 6 to 60 percent on the Manila soils. The vegetation is dominantly bluebunch wheatgrass, big sagebrush, Great Basin wildrye, serviceberry, yarrow, and annual grasses but includes other grasses and shrubs. Elevations are 4,900 to 6,800 feet. The average annual precipitation is 16 to 21 inches. The mean annual temperature is 42° to 50° F., and the frost-free season is 85 to 130 days.

This association makes up 3 percent of the survey area. It is about 20 percent Hendricks soils, 20 percent Forsgren soils, and 20 percent Manila soils. The Parleys, Goring, Yeates Hollow, Red Rock (high rainfall), Gemson, Obay, and Smarts soils are minor soils and make up the remaining 40 percent of the association.

The Hendricks soils have a surface layer of dark grayish-brown silt loam and a subsoil of grayish-brown, brown, and light yellowish-brown silty clay loam. These soils are more than 60 inches deep.

The Forsgren soils have a surface layer of dark grayish-brown heavy silt loam, a subsoil of brown and light-brown silty clay loam and silty clay, and a substratum of light-brown silt loam. These soils also are more than 60 inches deep.

The Manila soils have a surface layer of dark grayish-brown loam, a subsoil of grayish-brown silty clay loam, grayish-brown and brown silty clay, and light-brown clay, and a substratum of very cobbly silt loam. These soils are 50 to 60 inches deep to weathered sandstone and fractured limestone bedrock.

These soils are used for nonirrigated crops, range, wildlife habitat, and water supply. Upland game birds are found on this association.

Moderately Well Drained to Somewhat Excessively Drained Soils of the High, Medium, and Low Lake Terraces and Fans

These soils are mainly on lake terraces, alluvial fans, and associated mountains and foot slopes. They are silt loams, loams, and sandy loams that are cobbly or gravelly in some areas. The soils formed mostly in alluvium and colluvium derived from sandstone, quartzite, limestone, and some gneiss, schist, and lake sediments. A few soils formed in residuum derived from sandstone, quartzite, and limestone.

Elevations of these soils are 4,220 to 6,800 feet. The average annual precipitation is 8 to 18 inches. The mean annual temperature is 45° to 52° F., and the frost-free season is 100 to 160 days. These soils are chiefly used for nonirrigated crops, range, wildlife habitat, and water supply. Small areas are used for irrigated crops and urban developments.

Five associations of Box Elder County, Eastern Part, are in this group. They make up about 44 percent of the survey area.

4. *Sandall-Rozlee-Promo association*

Somewhat excessively drained and well-drained, moderately sloping to very steep cobbly silt loams; on terraces and mountain foot slopes

This association is mostly on high terraces surrounding Hansel Valley and Blue Creek Valley, and along the Promontory Mountains. Generally, the soils formed in alluvium, colluvium, and residuum derived from sandstone, limestone, and quartzite. At lower elevations, however, the soils formed in mixed lake sediments. Slopes are 3 to 70 percent. The vegetation is mainly bluebunch wheatgrass, juniper, cheatgrass, big sagebrush, bitterbrush, and annual grasses and weeds. Elevations are 4,350 to 6,800 feet. The average annual precipitation is 11 to 15 inches. The mean annual temperature is 45° to 52° F., and the frost-free season is 100 to 130 days.

This association makes up about 8 percent of the survey area. It is about 70 percent Sandall soils, 15 percent Rozlee soils, and 10 percent Promo soils. The Middle and Broad soils make up the remaining 5 percent of the association.

The Sandall soils are somewhat excessively drained. The surface layer is pale-brown cobbly silt loam, the subsoil is very pale brown gravelly heavy loam, and the substratum is light yellowish-brown and white very cobbly loam. Limestone bedrock is at a depth of 22 to 40 inches.

The Rozlee soils are well drained. The surface layer is grayish-brown cobbly silt loam, the subsoil is brown cobbly silt loam, and the substratum is very pale brown very cobbly silt loam. Fractured limestone bedrock is at a depth of 24 to 38 inches.

The Promo soils are somewhat excessively drained. They are pale-brown cobbly silt loam and cobbly loam throughout and are underlain, at a depth of 12 to 20 inches, by limestone bedrock.

The major soils in this association are used for range, wildlife habitat, and water supply. Upland game birds are common, and a few big-game animals inhabit the area.

5. Hupp-Sterling-Abela association

Well-drained and somewhat excessively drained, gently sloping to very steep gravelly silt loams and gravelly loams; on alluvial fans, lake terraces, escarpments, and mountain foot slopes

This association is on alluvial fans, lake terraces, and escarpments in several valleys in the survey area and along the Promontory Mountains. The soils formed in alluvium and colluvium derived from limestone, dolomite, sandstone, and quartzite and in mixed lake sediments. Slopes are 1 to 50 percent. The vegetation is big sagebrush, bluebunch wheatgrass, Sandberg bluegrass, yellowbrush, cheatgrass, and annual weeds. Elevations are 4,300 to 5,400 feet. The average annual precipitation is 13 to 17 inches. The mean annual temperature is 45° to 49° F., and the frost-free season is 100 to 150 days.

This association makes up 7 percent of the survey area. It is 30 percent Hupp soils, 25 percent Sterling soils, and 25 percent Abela soils. The Bingham, Blue Star, Kapod, Pass Canyon, and Sheeprock soils are minor soils that make up the remaining 20 percent of the association.

All of the major soils in this association are more than 60 inches deep.

The Hupp soils are well drained. Slopes are 1 to 10 percent. The surface layer is grayish-brown and brown gravelly silt loam, and the subsoil and substratum are very gravelly silt loam.

The Sterling soils are somewhat excessively drained. Slopes are 1 to 50 percent. The surface layer is grayish-brown and brown gravelly loam, and the substratum is brown cobbly loam or very cobbly loam.

The Abela soils are well drained. Slopes are 6 to 20 percent. The surface layer is grayish-brown gravelly loam, the subsoil is pale-brown gravelly loam, and the substratum is pale-brown and very pale brown gravelly loam or very gravelly sandy loam.

The soils in this association are used chiefly for non-irrigated crops, range, wildlife habitat, and water supply. Some areas are used for urban development or as a source of gravel for construction purposes. These soils provide habitat for game birds.

6. Kearns-Parleys association

Well drained and moderately well drained, nearly level to steep silt loams; on alluvial fans and lake terraces

This soil association is mostly in Pocatello Valley, in the north end of Hansel Valley and the west side of Blue Creek Valley southward towards Golden Spike National Monument. The soils formed in alluvium derived from mixed lake sediments. Slopes are 0 to 20 percent. The vegetation is bluebunch wheatgrass, big sagebrush, cheatgrass, Sandberg bluegrass, western wheatgrass, yellowbrush, phlox, balsamroot, and annual weeds. Elevations are 4,220 to 5,575 feet. The average annual precipitation

is 13 to 18 inches. The mean annual temperature is 45° to 51° F., and the frost-free season is 110 to 160 days.

This association makes up about 10 percent of the survey area. It is about 30 percent Kearns soils, 30 percent Parleys soils, and 20 percent Timpanogos, Fielding, and Kidman soils. The Red Rock, DeJarnet, Anty, Munk, Snowville, Gemson, Sterling, and Hupp soils make up the remaining 20 percent of the association.

The Kearns soils are well drained. The surface layer is grayish-brown silt loam, the subsoil is pale-brown silt loam, and the substratum is pale-brown and very pale brown silt loam or loam. These soils are more than 60 inches deep.

The Parleys soils are moderately well drained and well drained. The surface layer is grayish-brown silt loam, the subsoil is brown and pale-brown silty clay loam, and the substratum is pale-brown loam. These soils also are more than 60 inches deep. A water table is at a depth of 46 to more than 60 inches.

The major soils in this association are used for irrigated and nonirrigated crops and as wildlife habitat. Small areas are also used for urban development. These soils provide a good habitat for upland game birds.

7. Sanpete-Stingal-Hansel association

Somewhat excessively drained and well-drained, gently sloping to steep gravelly silt loams and silt loams; on lake terraces and escarpments

This association is in the lower part of Blue Creek Valley, in Hansel Valley, and near Snowville in Curlew Valley. The soils formed in mixed lake sediments and in alluvium and colluvium derived from limestone, sandstone, and quartzite. Slopes are 1 to 50 percent. The vegetation is big sagebrush, bluebunch wheatgrass, annual weeds and lesser amounts of other bunchgrasses and shrubs. Elevations are 4,300 to 5,300 feet. The average annual precipitation is 8 to 14 inches. The mean annual temperature is 46° to 51° F., and the frost-free season is 100 to 140 days.

This association makes up about 16 percent of the survey area. It is about 30 percent Sanpete soils, 20 percent Stingal soils, and 20 percent Hansel soils. Another 15 percent is Thiokol soils. The Eccles, Pomat, and Windmill soils make up the remaining 15 percent of the association.

All of the major soils in this association are more than 60 inches deep.

The Sanpete soils are somewhat excessively drained. Slopes are 1 to 50 percent. The surface layer is pale-brown gravelly silt loam, and the subsoil is pale-brown gravelly loam. The substratum is light-gray very gravelly heavy sandy loam or very pale brown very gravelly silt loam.

The Stingal soils are well drained. Slopes are 1 to 10 percent. The surface layer is light brownish-gray loam, the subsoil is very pale brown loam, and the substratum is pale-brown loam, white loam, and white very fine sandy loam.

The Hansel soils are well drained. Slopes are 1 to 10 percent. The surface layer is light brownish-gray silt loam, the subsoil is light-gray silty clay loam, and the substratum is light-gray silty clay loam.

The soils in this association are used for irrigated and nonirrigated crops, range, wildlife habitat, and industrial development. Upland game birds inhabit areas of this association.

8. *Fielding-Kilburn-Kidman association*

Well-drained and somewhat excessively drained, nearly level to very steep silt loams, gravelly sandy loams, and fine sandy loams; on lake terraces, benches, alluvial fans, and broad valley plains

This association is south of Garland and south of Brigham City. The soils formed in mixed lake sediments and alluvium derived from limestone, quartzite, sandstone, gneiss, and schist. Slopes are 0 to 60 percent. The vegetation is bluestem wheatgrass, big sagebrush, western wheatgrass, annual grasses, and other bunchgrasses and shrubs. Elevations are 4,250 to 5,150 feet. The average annual precipitation is 13 to 18 inches. The mean annual temperature is 46° to 51° F., and the frost-free season is 115 to 160 days.

This association makes up about 2 percent of the survey area. It is about 25 percent Fielding soils, 20 percent Kilburn soils, and 20 percent Kidman soils. The Parleys, Wasatch, Timpanogos, Millville, Francis, and Dagor soils and Stony alluvial land make up the remaining 35 percent of the association.

All of the major soils in this association are more than 60 inches deep.

The Fielding soils are well drained. Slopes are 0 to 3 percent. The surface layer is grayish-brown silt loam, the subsoil is pale-brown silt loam, and the substratum is light-gray loam, very pale brown-silt loam, white silt loam, or pink silty clay loam.

The Kilburn soils are somewhat excessively drained. Slopes are 1 to 60 percent. The surface layer is dark grayish-brown gravelly sandy loam or brown sandy loam, the subsoil is brown gravelly loam, and the substratum is brown very gravelly sandy loam or brown very gravelly loamy sand.

The Kidman soils are well drained. Slopes are 1 to 20 percent. The surface layer and subsoil are brown fine sandy loam, and the substratum is light-gray, pinkish-gray, and very pale brown fine sandy loam. A water table is at a depth of 50 to 60 inches.

The soils in this association are used mainly for irrigated and nonirrigated crops, for range, and as wildlife habitat. Some areas are used for urban development or as a source of sand and gravel for construction purposes.

Moderately Well Drained and Well Drained Soils of the Medium and Low Lake Terraces and Lake Plains

These soils are on medium and low lake terraces and lake plains. They are silt loams that formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone.

Elevations of these soils are 4,225 to 5,125 feet. The average annual precipitation is 6 to 14 inches. The mean annual temperature is 45° to 52° F., and the frost-free season is 85 to 130 days. These soils are used for range, irrigated crops, nonirrigated crops, and wildlife habitat. In addition, small areas are used for industrial development.

Two associations of Box Elder County, Eastern Part, are in this group. They make up about 17 percent of the survey area.

9. *Bram-Thiokol-Palisade association*

Moderately well drained and well drained, nearly level to strongly sloping silt loams; on medium and low lake terraces and lake plains

This association is in Curlew Valley west of Snowville, southwest of Hansel Valley, and on Rozel Flats. The soils formed in calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 10 percent. The vegetation is big sagebrush, annual mustard, greasewood, cheatgrass, squirreltail, winterfat, Russian-thistle, and annual weeds. Elevations are 4,230 to 5,125 feet. The average annual precipitation is 8 to 14 inches, although in most areas it is 8 to 11 inches. The mean annual temperature is 45° to 52° F., and the frost-free season is 85 to 130 days.

This association makes up about 15 percent of the survey area. It is about 35 percent Bram soils, 30 percent Thiokol soils, and 15 percent Palisade soils. Another 10 percent is Saxby soils and Very stony land. The minor soils are the Mellor, Harding, Sanpete, and Etil soils and Gullied land, which together make up the remaining 10 percent of the association.

All of the major soils in this association are more than 60 inches deep.

The Bram soils are moderately well drained. The surface layer is light brownish-gray silt loam, the subsoil is very pale brown silt loam, and the substratum is very pale brown and light-gray silt loam.

The Thiokol soils are well drained. The surface layer and subsoil are light brownish-gray silt loam, and the substratum is white silt loam.

The Palisade soils are well drained. The surface layer is pale-brown silt loam, the subsoil is very pale brown silt loam, and the substratum is very pale brown silt loam, light-gray loam, or pale-brown very fine sandy loam.

The major soils in this association are used for range, nonirrigated and irrigated crops, wildlife habitat, and industrial development. Recreation is also an important use. Antelope and rabbits inhabit these soils and are hunted in season.

10. *Drum-Uffens association*

Moderately well drained and well drained, nearly level to moderately sloping silt loams; on low lake terraces and lake plains

This association is in the southwestern part of the survey area. The soils formed in calcareous lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 6 percent. The vegetation is greasewood, shadscale, pickleweed, kochia, rubber rabbitbush, annual mustard, cheatgrass, and annual weeds. Elevations are 4,225 to 4,450 feet. The average annual precipitation is 6 to 8 inches. The mean annual temperature is 48° to 51° F., and the frost-free season is 100 to 120 days.

This association makes up about 2 percent of the survey area. It is about 75 percent Drum soils and 20 percent Uffens soils. Small areas of Bram and Saltair soils and Playas make up the remaining 5 percent of the association.

The Drum soils are moderately well drained. The surface layer is light-gray silt loam, the subsoil is very pale brown silt loam, and the substratum is very pale brown and white silt loam or very pale brown and light-gray silty clay loam. These soils are more than 60 inches deep.

The Uffens soils are well drained. The surface layer is light brownish-gray silt loam, the subsoil is pale-brown and very pale brown silty clay loam, and the substratum is light-gray silt loam and white silty clay loam. These soils also are more than 60 inches deep.

The soils in this association are used for range and as wildlife habitat. Rabbits are hunted on these soils in winter and early in spring.

Moderately Well Drained to Poorly Drained Soils of the Low Lake Terraces and Lake Plains

These soils are on broad low lake terraces, broad lake plains, associated alluvial fans, and playas. They are silt loams and silty clay loams that formed in mixed lake sediments derived from many kinds of rocks.

Elevations of these soils are 4,205 to 4,600 feet. The average annual precipitation is 11 to 16 inches. The mean annual temperature is 46° to 51° F., and the frost-free season is 100 to 150 days. These soils are used for irrigated crops, native pasture, nonirrigated crops, range, and wildlife habitat.

Three associations of Box Elder County, Eastern Part, are in this group. They make up about 23 percent of the survey area.

11. Honeyville-Greenson-Collett association

Moderately well drained and somewhat poorly drained, nearly level silty clay loams and silt loams; on broad low lake terraces and lake plains

This association is southwest of Tremonton and extends southward from Brigham City to Willard Bay Reservoir. The soils formed in fine textured and moderately fine textured, mixed lake sediments derived dominantly from sandstone and limestone. Slopes are 0 to 1 percent. The vegetation is Great Basin wildrye, western wheatgrass, big sagebrush, and annual weeds on the Honeyville soils; saltgrass, alkali sacaton, greasewood, alkali bluegrass, and some foxtail and sedges on the Greenson soils; and Kentucky bluegrass, Great Basin wildrye, saltgrass, foxtail, and sedges on the Collett soils. Elevations are 4,250 to 4,355 feet. The average annual precipitation is 13 to 16 inches. The mean annual temperature is 47° to 51° F., and the frost-free season is 130 to 150 days.

This association makes up about 3 percent of the survey area. It is about 25 percent Honeyville soils, 15 percent Greenson soils, and 15 percent Collett soils. Another 25 percent is Roshe Springs, Logan, and Kirkham soils. The Cudahy, Draper, James Canyon, Magna, Martini, Peteetneet, Sunset, and Woods Cross soils make up the remaining 20 percent of the association.

The Honeyville soils are moderately well drained. The surface layer is silty clay loam, the subsoil is brown and pale-brown silty clay loam, and the substratum is pale-brown and pinkish-gray silty clay loam. A water table is at a depth of 30 to more than 60 inches.

The Greenson soils are somewhat poorly drained. The surface layer is grayish-brown silt loam, and the subsoil is pale-brown heavy silt loam. The substratum is stratified, very pale brown and light-gray silt loam and loam, pink silty clay, or light-gray fine sandy loam. A water table is at a depth of 30 to more than 60 inches.

The Collett soils are somewhat poorly drained. The surface layer is grayish-brown silty clay loam, the subsoil

is light brownish-gray silty clay, and the substratum is white silty clay or light-gray and pink silty clay loam. A water table is at a depth of 30 to more than 60 inches.

The soils in this association are used for irrigated crops and native pasture.

12. Lasil-Fridlo association

Somewhat poorly drained and moderately well drained, nearly level and gently sloping silt loams; on broad low lake terraces and lake plains

This association is in the valley southwest of Bear River City and Corinne, in the central and southern parts of Blue Creek Valley, and along the eastern side of the Promontory Mountains. The soils formed in mixed lake sediments. The vegetation is saltgrass, greasewood, alkali sacaton, and annual weeds and grasses. Elevations are 4,220 to 4,600 feet. The average annual precipitation is 11 to 14 inches. The mean annual temperature is 46° to 50° F., and the frost-free season is 100 to 150 days.

This association makes up about 5 percent of the survey area. It is about 25 percent Lasil soils and about 15 percent Fridlo soils. The Airport, Stokes, and Placeritos soils each make up about 10 percent of this association, and the Arave and Payson soils each about 5 percent. The Gooch, Lakeshore, Lewiston, Woods Cross, Warm Springs, Syracuse, Greenson, and Refuge soils make up the remaining 20 percent of the association.

The Lasil soils are somewhat poorly drained. The surface layer is light brownish-gray and pale-brown silt loam, and the subsoil is pale-brown, light-gray, and very pale brown silty clay loam. The substratum is very pale brown and white silty clay loam. A water table is at a depth of 20 to 40 inches.

The Fridlo soils are moderately well drained. The surface layer is grayish-brown silt loam, and the subsoil is brown silt loam, pale-brown silty clay loam, or very pale brown silty loam. The substratum is light-gray and white silty clay loam. A water table is at a depth of 30 to more than 60 inches.

The soils in this association are used for irrigated and nonirrigated crops and for range.

13. Playas-Saltair association

Playas and poorly drained, nearly level silty clay loams; on lake beds and broad plains

This association surrounds the Great Salt Lake. The soils formed in strongly calcareous, mixed lake sediments. Slopes are less than 1 percent. These areas are nearly bare; the only vegetation is scattered areas of pickleweed and samphire. Elevations are 4,205 to 4,225 feet. The average annual precipitation is 12 to 15 inches. The mean annual temperature is 47° to 50° F., and the frost-free season is 110 to 150 days.

This association makes up about 15 percent of the survey area. It is about 65 percent Playas and 20 percent Saltair soils. The Logan, Pogal, and Refuge soils and Fresh water marsh make up the remaining 15 percent of the association.

Playas consist of stratified layers of silty clay, silty clay loam, and silt loam. They have a water table within 20 inches of the surface, and they are filled with water after heavy rains.

The Saltair soils are poorly drained. The surface layer is gray silty clay loam, and the substratum is light-gray silty clay loam and silt loam.

This association is used mainly for recreation and as a wildlife habitat. On the Playas, solar ponds and dikes have been constructed to impound mineral-heavy water pumped from the lake.

Descriptions of the Soils

This section describes the soil series and mapping units in Box Elder County, Eastern Part. 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. Gullied land, for example, does not belong to a soil series, but nevertheless is listed in alphabetical 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 are the capability unit or units and the range site in which the mapping unit has been placed. The page for the description of each capability unit and range site can be learned by referring to the "Guide to Mapping Units" at the back of this survey.

The soils of Box Elder County, Eastern Part, were mapped at two intensities, high and low. In the high-intensity survey, where detailed information was needed, the mapping was done in considerable detail. In the low-intensity survey, which is mainly range, the need for detail was less and the mapping was more generalized.

The intensity of the mapping for the units described in the following pages is indicated by the soil symbol in parentheses after the name of each mapping unit. This symbol also identifies the mapping unit on the detailed soil map. If the second letter of a symbol is a small letter, the unit was mapped at high intensity. A symbol having the second letter a capital represents low-intensity mapping. The composition of units mapped at low intensity is more variable than that of units mapped at high intensity, but composition has been controlled well enough to allow interpretations for expected uses.

The acreage and proportionate extent of each mapping unit are shown in table 1. 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" (10).²

² Italic numbers in parentheses refer to Literature Cited, p. 220.

TABLE 1.—Approximate acreage and proportionate extent of the soils

Soil	Acres	Percent	Soil	Acres	Percent
Abela gravelly loam, 10 to 20 percent slopes...	16,500	1.3	Collinston-Wheelon silt loams, 6 to 10 percent slopes.....	1,500	0.1
Abela stony loam, 6 to 20 percent slopes.....	3,600	.3	Cudahy silt loam.....	865	.1
Agassiz-Picayune association, very steep.....	5,350	.4	Dagor loam, 3 to 6 percent slopes.....	425	(¹)
Airport silt loam.....	3,150	.2	DeJarnet gravelly silt loam, 1 to 6 percent slopes.....	2,710	.2
Airport silt loam, sandy substratum.....	1,300	.1	DeJarnet gravelly silt loam, 6 to 10 percent slopes.....	2,300	.2
Airport silt loam, strongly alkali.....	1,350	.1	Draper loam, 0 to 3 percent slopes.....	255	(¹)
Anty fine sandy loam, 1 to 6 percent slopes.....	1,200	.1	Drum silt loam.....	13,250	1.1
Anty fine sandy loam, 6 to 10 percent slopes.....	1,150	.1	Eccles fine sandy loam, 0 to 1 percent slopes.....	205	(¹)
Arave silty clay loam.....	3,350	.3	Eccles fine sandy loam, 1 to 6 percent slopes.....	3,500	.3
Bickmore loam, 50 to 70 percent slopes.....	580	(¹)	Eccles fine sandy loam, 6 to 10 percent slopes.....	1,000	.1
Bingham loam, 1 to 6 percent slopes.....	2,750	.2	Eccles loamy sand, sandy variant, 1 to 6 percent slopes.....	510	(¹)
Bingham gravelly loam, 1 to 6 percent slopes.....	1,650	.1	Elzinga-Agassiz association, steep.....	900	.1
Bingham gravelly loam, 6 to 10 percent slopes.....	1,400	.1	Elzinga-Maughan complex, 25 to 50 percent slopes.....	800	.1
Blue Star gravelly loam, 6 to 20 percent slopes.....	2,300	.2	Etil loamy sand, 1 to 6 percent slopes.....	2,600	.2
Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes.....	860	.1	Fielding silt loam.....	9,700	.8
Blue Star association, steep.....	900	.1	Fielding silt loam, warm.....	8,250	.7
Borrow pits.....	495	(¹)	Forsgren silt loam, 1 to 6 percent slopes.....	1,400	.1
Bram silt loam.....	58,000	4.6	Forsgren silt loam, 6 to 10 percent slopes.....	2,060	.2
Broad cobbly loam, 20 to 30 percent slopes.....	265	(¹)	Forsgren silt loam, 10 to 20 percent slopes.....	3,065	.2
Broad cobbly loam, 30 to 60 percent slopes.....	6,400	.5	Foxol-Elzinga association, steep.....	11,820	.9
Broad-Manila association, steep.....	8,200	.7			
Broad-Middle association, steep.....	10,850	.9			
Broad-Smarts association, steep.....	17,370	1.4			
Collett silty clay loam.....	5,200	.4			

See footnotes at end of table.

TABLE 1.—Approximate acreage and proportionate extent of the soils—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Foxol-Rock outcrop complex, 50 to 70 percent slopes	1,440	0.1	Mellor silt loam, 1 to 6 percent slopes	9,200	0.7
Fresh water marsh	6,770	.5	Mellor-Thiokol silt loams, 1 to 6 percent slopes	8,800	.7
Francis loamy fine sand, 3 to 6 percent slopes	470	(¹)	Middle cobbly silt loam, 10 to 30 percent slopes	13,800	1.1
Fridlo silt loam	4,440	.3	Middle cobbly silt loam, 30 to 70 percent slopes	36,500	2.9
Fridlo silt loam, moderately alkali	6,500	.5	Middle-Broad association, steep	45,450	3.6
Gemson silty clay loam, 6 to 10 percent slopes	900	.1	Middle-Rock outcrop complex, 10 to 30 percent slopes	950	.1
Gemson silty clay loam, 10 to 20 percent slopes	760	.1	Middle-Rock outcrop complex, 30 to 60 percent slopes	1,575	.1
Gemson-Rock land association, moderately steep	560	(¹)	Mendon silt loam, 1 to 6 percent slopes	920	.1
Gooch silt loam	1,645	.1	Mendon silt loam, 6 to 10 percent slopes	360	(¹)
Goring-Yeates Hollow association, moderately steep	2,165	.2	Millville silt loam, 0 to 2 percent slopes	460	(¹)
Goring loam, brown subsoil variant	550	(¹)	Millville silt loam, 2 to 4 percent slopes	530	(¹)
Gravel pits	1,000	.1	Millville silt loam, moderately deep water table, 2 to 4 percent slopes	325	(¹)
Greenson silt loam, clay substratum	5,210	.4	Munk gravelly silt loam, 10 to 20 percent slopes	610	.1
Greenson silt loam, strongly alkali	545	(¹)	Obray clay, 10 to 25 percent slopes	1,050	.1
Gullied land	2,275	.2	Palisade silt loam, 1 to 6 percent slopes	26,750	2.1
Hansel silt loam, 0 to 1 percent slopes	6,800	.5	Palisade silt loam, 6 to 10 percent slopes	1,025	.1
Hansel silt loam, 1 to 6 percent slopes	25,100	2.0	Parleys loam, 0 to 3 percent slopes	2,300	.2
Hansel silt loam, 6 to 10 percent slopes	3,250	.2	Parleys loam, cool, 0 to 3 percent slopes	4,900	.4
Harding silt loam	5,500	.4	Parleys silt loam, 0 to 1 percent slopes	790	.1
Hendricks silt loam, 1 to 6 percent slopes	730	.1	Parleys silt loam, 1 to 6 percent slopes	17,400	1.4
Hendricks silt loam, 6 to 10 percent slopes	955	.1	Parleys silt loam, 6 to 10 percent slopes	6,300	.5
Hendricks silt loam, 10 to 20 percent slopes	1,200	.1	Parleys silt loam, 10 to 20 percent slopes	1,600	.1
Hendricks complex, 6 to 10 percent slopes	3,900	.3	Parleys silty clay loam, 0 to 3 percent slopes	295	(¹)
Honeyville silty clay loam	9,700	.8	Parleys-Munk complex, 6 to 10 percent slopes	845	.1
Hupp gravelly silt loam, 1 to 6 percent slopes	7,800	.6	Parleys-Munk complex, 10 to 20 percent slopes	3,900	.3
Hupp gravelly silt loam, 6 to 10 percent slopes	16,400	1.3	Parleys-Pomat silt loams, 6 to 10 percent slopes	4,300	.3
Hupp silt loam, 3 to 6 percent slopes	1,115	.1	Pass Canyon-Rock outcrop complex, 6 to 30 percent slopes	1,520	.1
Hupp silt loam, 6 to 10 percent slopes	1,225	.1	Payson silt loam	2,000	.1
James Canyon loam, 0 to 3 percent slopes	1,550	.1	Petetneet peat, moderately deep variant	605	.1
Kapod stony loam, 6 to 20 percent slopes	3,675	.3	Placeritos silt loam	6,400	.5
Kearns silt loam, 1 to 3 percent slopes	13,300	1.0	Playas	125,063	9.9
Kearns silt loam, 3 to 6 percent slopes	16,350	1.3	Pogal silt loam, rolling	7,100	.6
Kearns silt loam, 6 to 10 percent slopes	6,250	.5	Pomat silt loam, 6 to 10 percent slopes	3,500	.3
Kearns silt loam, 10 to 20 percent slopes	475	(¹)	Pomat silt loam, 10 to 30 percent slopes	5,250	.4
Kearns-Stingal complex, 6 to 10 percent slopes	2,140	.2	Pomat silt loam, 30 to 40 percent slopes, eroded	1,800	.1
Kearns silt loam, high lime variant, 10 to 20 percent slopes	1,350	.1	Pomat-Kearns silt loams, 10 to 30 percent slopes	1,450	.1
Kidman fine sandy loam, 0 to 2 percent slopes	6,125	.5	Pomat-Parleys silt loams, 10 to 30 percent slopes	2,880	.2
Kidman fine sandy loam, 2 to 4 percent slopes	435	(¹)	Red Rock silt loam, high rainfall, 0 to 3 percent slopes	1,415	.1
Kidman loam, 0 to 1 percent slopes	300	(¹)	Red Rock silt loam, 0 to 1 percent slopes	1,450	.1
Kidman loam, 1 to 6 percent slopes	2,500	.2	Red Rock silt loam, 1 to 6 percent slopes	2,500	.2
Kidman loam, 6 to 10 percent slopes	560	(¹)	Refuge loam	270	(¹)
Kidman loam, 10 to 20 percent slopes	640	.1	Richmond-Middle complex, 30 to 70 percent slopes, eroded	4,100	.3
Kilburn gravelly loam, 1 to 3 percent slopes	3,000	.2	Ridd-Rock outcrop complex, 10 to 30 percent slopes	375	(¹)
Kilburn gravelly sandy loam, 3 to 6 percent slopes	1,525	.1	Ridd-Rock outcrop complex, 30 to 70 percent slopes	610	.1
Kilburn gravelly sandy loam, 6 to 10 percent slopes	650	.1	Rock land	6,900	.5
Kilburn gravelly sandy loam, 10 to 20 percent slopes	520	(¹)	Rock outcrop	1,750	.1
Kilburn gravelly sandy loam, 20 to 30 percent slopes	460	(¹)	Roshe Springs silt loam	4,400	.3
Kilburn gravelly sandy loam, 30 to 60 percent slopes	1,225	.1	Rough broken land	4,100	.3
Kirkham silt loam	3,050	.2	Rozlee-Rock outcrop complex, 30 to 70 percent slopes	4,500	.3
Lakeshore fine sandy loam	1,600	.1	Saltair silty clay loam	39,100	3.1
Lasil silt loam	1,730	.1	Saltair-Fresh water marsh association	12,250	1.0
Lasil silt loam, moderately alkali	12,200	1.0	Saltair-Logan association	16,400	1.3
Lasil-Airport silt loams	1,110	.1	Saltair-Refuge complex	3,100	.2
Lewiston fine sandy loam	1,950	.1	Sandall cobbly silt loam, 10 to 30 percent slopes	5,600	.4
Logan silty clay loam	2,180	.2			
Lucky Star-Elzinga association, steep	1,700	.1			
Magna silty clay loam	865	.1			
Manila loam, 6 to 10 percent slopes	720	.1			
Manila loam, 10 to 25 percent slopes	2,550	.2			
Manila loam, 25 to 60 percent slopes	785	.1			
Manila-Smarts association, steep	2,100	.2			
Martini fine sandy loam	1,900	.1			

See footnotes at end of table.

TABLE 1.—Approximate acreage and proportionate extent of the soils—Continued

Soil	Acres	Percent	Soil	Acres	Percent
Sandall cobbly silt loam, 30 to 60 percent slopes	12,400	1.0	Thiokol silt loam, 6 to 10 percent slopes	3,910	0.3
Sandall-Broad association, steep	7,600	.6	Thiokol silt loam, low rainfall, 0 to 1 percent slopes	31,400	2.5
Sandall-Promo association, steep	27,540	2.2	Thiokol silt loam, low rainfall, 1 to 3 percent slopes	10,400	.8
Sandall-Rock outcrop complex, 3 to 30 percent slopes	10,600	.9	Timpanogos loam, 0 to 3 percent slopes	1,700	.1
Sandall-Rozlee association, steep	30,450	2.4	Timpanogos loam, 3 to 6 percent slopes	400	(¹)
Sanpete gravelly silt loam, 6 to 30 percent slopes	2,780	.2	Timpanogos loam, cool, 0 to 3 percent slopes	590	.1
Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes	11,000	.9	Timpanogos silt loam, 1 to 6 percent slopes	8,200	.7
Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes	15,030	1.2	Timpanogos silt loam, 6 to 10 percent slopes	1,400	.1
Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes	18,500	1.5	Uffens silt loam	3,605	.3
Sanpete gravelly silt loam, high rainfall, 30 to 50 percent slopes	3,115	.2	Very stony land	2,320	.2
Saxby-Thiokol complex, 1 to 6 percent slopes	15,100	1.2	Warm Springs fine sandy loam	1,210	.1
Saxby-Very stony land association	14,200	1.1	Wasatch gravelly sandy loam, 3 to 10 percent slopes	560	(¹)
Sheeprock gravelly sandy loam, 6 to 10 percent slopes	705	.1	Wasatch gravelly sandy loam, 10 to 25 percent slopes	610	.1
Sheeprock gravelly loam, 10 to 40 percent slopes, severely eroded	2,850	.2	Wasatch gravelly sandy loam, gravelly subsoil variant, 30 to 70 percent slopes	580	.1
Smarts loam, 30 to 70 percent slopes	315	(¹)	Wasatch cobbly sandy loam, gravelly subsoil variant, 10 to 20 percent slopes	595	.1
Snowville gravelly silt loam, 6 to 20 percent slopes	3,000	.2	Wheelon silt loam, 30 to 60 percent slopes	725	.1
Sterling gravelly loam, 1 to 6 percent slopes	765	.1	Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes	1,940	.1
Sterling gravelly loam, 6 to 20 percent slopes	9,810	.8	Wheelon-Collinston silt loams, 10 to 30 percent slopes	3,240	.2
Sterling gravelly loam, 20 to 30 percent slopes	3,375	.3	Windmill gravelly loam, 1 to 6 percent slopes	4,950	.4
Sterling gravelly loam, 30 to 50 percent slopes	2,245	.2	Windmill gravelly loam, 6 to 10 percent slopes	3,920	.3
Sterling very stony loam, 10 to 30 percent slopes	2,080	.2	Windmill gravelly loam, 10 to 20 percent slopes	2,150	.2
Sterling-Parleys complex, 6 to 20 percent slopes	3,690	.3	Woods Cross silty clay loam	1,220	.1
Stingal loam, 1 to 6 percent slopes	30,570	2.4	Woods Cross silty clay loam, moderately saline	1,880	.1
Stingal loam, 6 to 10 percent slopes	3,960	.3	Yeates Hollow cobbly clay loam, 20 to 30 percent slopes	1,100	.1
Stokes silt loam	6,350	.5	Yeates Hollow cobbly clay loam, 30 to 60 percent slopes	4,720	.4
Stony alluvial land	2,450	.2	Yeates Hollow-Goring association, steep	1,960	.1
Sunset silt loam	1,100	.1			
Syracuse fine sandy loam	1,300	.1			
Thiokol silt loam, 0 to 1 percent slopes	9,080	.7			
Thiokol silt loam, 1 to 6 percent slopes	17,000	1.3			
			Total	1,259,278	100.0

¹ Less than 0.05 percent.

Abela Series

The Abela series consists of well-drained soils. These soils are on alluvial fans and lake terraces. They formed in very gravelly and cobbly alluvium derived mostly from limestone but partly from sandstone and quartzite. Slopes range from 6 to 20 percent. Vegetation consists of big sagebrush, yellowbrush, bluebunch wheatgrass, cheatgrass, annual weeds, and in some places, juniper. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation is 13 to 14 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,400 to 5,300 feet.

In a representative profile, the surface layer is grayish-brown gravelly loam about 14 inches thick. The subsoil is pale-brown gravelly heavy loam about 14 inches thick. The substratum is pale-brown very gravelly loam in the upper part and very pale brown very gravelly loam and very gravelly sandy loam in the lower part. It extends to a depth of about 60 inches. The surface layer is moderately alkaline and moderately calcareous, the subsoil is strongly alkaline and strongly calcareous, and the substratum is very strongly alkaline and strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 4 to 5 inches to a depth of 5 feet. The water-supplying capacity is about 7 to 8 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most roots are in the upper 30 inches of soil.

These soils are used mainly for range and wildlife habitat. A few small areas are used for nonirrigated crops.

Representative profile of Abela gravelly loam, 10 to 20 percent slopes, in range, 700 feet west and 600 feet south of the southeast corner of section 25, T. 10 N., R. 7 W., about 5 miles southwest of Golden Spike National Monument:

A11—0 to 5 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; 30 percent gravel; moderately calcareous; moderately alkaline (pH 8.3); abrupt, wavy boundary.

A12—5 to 14 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 3/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and

- very fine roots; common very fine pores; 30 percent gravel; moderately calcareous; moderately alkaline (pH 8.3); clear, wavy boundary.
- B2—14 to 28 inches, pale-brown (10YR 6/3) gravelly heavy loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common very fine pores; 30 percent gravel; strongly calcareous, thin lime coating on bottom side of pebbles; strongly alkaline (pH 8.6); clear, wavy boundary.
- C1ca—28 to 39 inches, pale-brown (10YR 6/3) very gravelly loam, dark brown (10YR 4/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and very fine roots; 55 percent gravel and 2 percent cobblestones; strongly calcareous, lime coating on pebbles; strongly alkaline (pH 9.0); abrupt, wavy boundary.
- C2ca—39 to 49 inches, very pale brown (10YR 7/3) very gravelly loam, brown (10YR 5/3) when moist; massive; 80 percent gravel and 5 percent cobblestones; strongly calcareous, lime is strongly cemented; very strongly alkaline (pH 9.2); abrupt, wavy boundary.
- C3—49 to 60 inches, very pale brown (10YR 7/3) very gravelly sandy loam, brown (10YR 5/3) when moist; massive; loose; 60 percent gravel and 10 percent cobblestones; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Depth to very gravelly or very cobbly material ranges from 11 to 28 inches. Between depths of 10 and 40 inches, the material is gravelly, very gravelly, or cobbly loam that is 35 to 80 percent coarse fragments. The coarse fragments are mainly gravel-size and cobblestone-size angular limestone, sandstone, and quartzite that are mostly more than 1 inch in diameter. They have coatings of lime on all surfaces and, in places, are strongly cemented together. The soils are usually dry in all parts between depths of 8 and 24 inches.

In the A1 horizon, chroma is 2 or 3. Texture is gravelly loam, gravelly silt loam, or very gravelly loam that is 20 to 60 percent gravel. The A1 horizon is moderately alkaline to strongly alkaline and is slightly calcareous to moderately calcareous. In the B2 horizon, value is 3 or 4 when the soils are moist; chroma ranges from 2 to 4. The B2 horizon is moderately alkaline to strongly alkaline and moderately calcareous to strongly calcareous. In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; chroma is 2 or 3. Reaction is strongly alkaline to very strongly alkaline.

Abela gravelly loam, 10 to 20 percent slopes (ABE).—This soil is mainly in east- or west-facing areas and on alluvial fans and lake terraces. Slopes are medium to long. A profile of this soil is the one described as representative for the Abela series. Moderate sheet and rill erosion is common. Runoff is medium, and the hazard of erosion is moderate. Deep drainageways having steep side slopes dissect this soil in many places.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Middle cobbly silt loam, 10 to 30 percent slopes; Sanpete gravelly silt loam, 6 to 30 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used mainly for range and wildlife habitat. A few small areas are used for nonirrigated crops. Capability unit VI_s-U, nonirrigated; Upland Stony Loam range site.

Abela stony loam, 6 to 20 percent slopes (AEE).—This soil is on alluvial fans. Slopes are medium to long and are slightly convex. The profile of this soil is similar to that described as representative for the Abela series, but this soil is covered with stones on about 5 percent of its surface. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Middle cobbly silt loam, 10 to 30 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VII_s-U, nonirrigated; Upland Stony Loam range site.

Agassiz Series

The Agassiz series consists of somewhat excessively drained soils. These soils are on south- and west-facing mountains east of Mantua. They formed in residuum and colluvium derived from limestone. Slopes range from 30 to 70 percent. The vegetation consists of bluebunch wheatgrass, sagebrush, balsamroot, and buckwheat. Mean annual air temperature ranges from 44° to 47° F. Average annual precipitation ranges from 18 to 26 inches, and the frost-free period is 60 to 100 days. Elevations range from 5,200 to 7,500 feet.

In a representative profile, the surface layer is brown very stony loam and very cobbly loam about 14 inches thick. The underlying layer is yellowish-brown very cobbly loam about 5 inches thick. It overlies fractured limestone bedrock at a depth of about 19 inches. The profile is moderately alkaline throughout, and the substratum is strongly calcareous.

Permeability is moderate, and the rate of water intake is slow. Available water holding capacity is 2 to 3 inches to bedrock. The water-supplying capacity is 6.5 to 9 inches before moisture is depleted. Roots penetrate to bedrock.

Agassiz soils are used for range, wildlife habitat, and water supply. Runoff carries a large amount of silt from these soils if they are not protected during periods of rapid rainfall.

Representative profile of Agassiz very stony loam, 30 to 70 percent slopes, in an area of Agassiz-Picayune association, very steep, in range, 1,000 feet west and 400 feet north of the southeast corner of section 23, T. 9 N., R. 1 W., east of Mantua:

A11—0 to 5 inches, brown (10YR 5/3) very stony loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many fine interstitial pores; 25 percent cobblestones, gravel, and stones; moderately alkaline (pH 8.0); clear, wavy boundary.

A12—5 to 14 inches, brown (10YR 5/3) very cobbly heavy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine interstitial pores; 50 percent cobblestones and gravel; moderately alkaline (pH 8.0); gradual, wavy boundary.

Cca—14 to 19 inches, yellowish-brown (10YR 5/4) very cobbly heavy loam, dark yellowish brown (10YR 4/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine interstitial pores; 75 percent cobblestones and gravel; strongly calcareous; moderately alkaline (pH 8.2); abrupt, irregular boundary.

R—19 inches, fractured limestone bedrock.

Depth to fractured limestone bedrock ranges from 14 to 19 inches. The soils are usually moist but are dry for 60 to 90 consecutive days in summer. The surface layer contains 20 to 50 percent cobblestones and 3 percent stones.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture in the A1

horizon is cobbly loam or very cobbly heavy loam. Reaction is mildly alkaline to moderately alkaline. In the Cca horizon, value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; chroma is 3 or 4. Texture in the Cca horizon is very cobbly heavy loam or very cobbly loam.

Agassiz-Picayune association, very steep (AGG).—This mapping unit is on the mountains east of the town of Mantua. It consists of about 60 percent Agassiz very stony loam, 30 to 70 percent slopes, and 25 percent Picayune gravelly loam, 40 to 70 percent slopes. Included with these soils in mapping are small areas of Elzinga silt loam, 25 to 50 percent slopes. This included soil makes up about 11 percent of the total acreage. Also included are small areas of Rock land, which makes up 3 percent, and Rock outcrop, which makes up 1 percent.

The Agassiz soil is on south- and west-facing, slightly concave to slightly convex mountain slopes under a cover of bunchgrass and sagebrush. The Picayune soil also is on south- and west-facing slopes under a cover of bunchgrass and sagebrush, but it is limited to concave positions. The Elzinga soil is in canyon bottoms and draws under maple trees. Rock land and Rock outcrop are on the knobs and tops of ridges.

Runoff is rapid on the soils of this association, and the hazard of erosion is high. Elevations range from 5,200 to 6,500 feet. The frost-free period is 70 to 100 days, and the average annual precipitation is 18 to 24 inches.

The soils of this association are used for range, wildlife habitat, and water supply. Agassiz very stony loam is in capability unit VII-M, nonirrigated; Mountain Shallow Loam range site. Picayune gravelly loam is in capability unit VII-M, nonirrigated; Mountain Loam range site.

Airport Series

The Airport series consists of somewhat poorly drained soils that are affected by alkali. These soils are on lake plains and low lake terraces in the valleys of the Bear River and the Malad River. They formed in mixed lake sediments. Slopes are less than 1 percent. The vegetation in noncultivated areas is saltgrass, alkali sacaton, and greasewood. Mean annual air temperature ranges from 47° to 52° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is from 110 to 115 days. Elevations range from 4,220 to 4,460 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 8 inches thick. The subsoil is brown and light brownish-gray silty clay loam about 10 inches thick. The substratum is light-gray and light-brown silty clay loam that extends to a depth of about 60 inches. The lower part of the subsoil and upper part of the substratum have accumulations of calcium carbonate. The surface layer is strongly alkaline and slightly calcareous. The subsoil and substratum are very strongly alkaline and slightly to strongly calcareous.

Permeability is slow, and the rate of water intake is slow. Roots penetrate to a depth of 60 inches.

Airport soils are used mainly for irrigated crops and range.

Representative profile of Airport silt loam, in a cultivated area, 225 feet west and 400 feet south of east quarter corner of section 34, T. 10 N., R. 3 W., 2½ miles west of the town of Corinne:

Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, subangular blocky structure;

very hard, friable, slightly sticky and plastic; slightly calcareous; strongly alkaline (pH 8.1); abrupt, smooth boundary.

- B21t—8 to 13 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; moderate, medium, prismatic structure; extremely hard, firm, sticky and very plastic; few medium pores; continuous moderately thick clay films on ped faces; slightly calcareous; strongly alkaline (pH 8.9); clear, wavy boundary.
- B22tca—13 to 18 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; many fine and very fine pores; many thin clay films on ped faces; moderately calcareous; very strongly alkaline (pH 9.6); clear, wavy boundary.
- C1ca—18 to 24 inches, light-gray (10YR 7/2) silty clay loam, brown (10YR 5/3) when moist; massive; very hard, firm, sticky and plastic; few fine roots; many very fine pores; strongly calcareous; very strongly alkaline (pH 9.6); gradual, wavy boundary.
- C2—24 to 34 inches, very pale brown (10YR 7/3) silty clay loam, pale brown (10YR 6/3) when moist; few, fine, distinct, brown (7.5YR 4/4) mottles; massive; very hard, firm, sticky and plastic; few fine roots; many fine and very fine pores; moderately calcareous; very strongly alkaline (pH 9.6); gradual, wavy boundary.
- C3—34 to 47 inches, light-brown (7.5YR 6/4) lake sediments consisting mainly of silty clay loam stratified with ½- to 2-inch layers of fine sandy loam, brown (7.5YR 4/4) when moist; few, fine, faint, brown (7.5YR 4/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine pores; slightly calcareous; strongly alkaline (pH 9.0); gradual, wavy boundary.
- C4—47 to 60 inches, light-brown (7.5YR 6/4) heavy silty clay loam, brown (7.5YR 5/4) when moist; common, medium, faint, brown (7.5YR 4/4) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; many very fine pores; slightly calcareous; strongly alkaline (pH 9.0).

Depth to the horizon of carbonate accumulation ranges from 11 to 18 inches.

In the A1 horizon, value is 4 or 5 when the soils are dry and is 2 or 3 when they are moist; chroma is 1 or 2. Texture in the A1 horizon is dominantly silt loam but may be loam or light silty clay loam. Reaction is moderately alkaline to very strongly alkaline. The A1 horizon is slightly calcareous to strongly calcareous and ranges from 5 to 14 inches in thickness.

In the B2t horizon, hue is 10YR or 2.5Y; value ranges from 4 to 7 when the soils are dry and from 2 to 6 when they are moist; and chroma ranges from 1 to 3. Texture in the B2t horizon is dominantly silty clay loam but may be clay loam. Reaction is strongly alkaline to very strongly alkaline. The B2t horizon is slightly calcareous to strongly calcareous. The B2t horizon ranges from 5 to 16 inches in thickness.

In the Cca horizon, hue ranges from 7.5YR to 2.5Y; value is 7 or 8 when the soils are dry and ranges from 4 to 7 when they are moist; and chroma ranges from 1 to 3. Texture in the Cca horizon is dominantly silty clay loam but may be silty clay or clay loam. Reaction is moderately alkaline to very strongly alkaline. In the C horizon, hue ranges from 7.5YR to 5Y; value ranges from 5 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 1 to 4. Texture of the C horizon is clay loam, heavy silty clay loam, silty clay loam, silt loam, fine sandy loam, or sandy loam. Reaction is strongly alkaline to very strongly alkaline. The C horizon is slightly calcareous to strongly calcareous. The depth to the water table ranges from 26 to more than 60 inches.

Airport silt loam (A₀).—This soil is on lake plains and low lake terraces. Slopes are 0 to 1 percent. A profile of this soil is the one described as representative for the Airport series. The surface layer ranges from 8 to 14 inches in thickness and is moderately alkaline to strongly alkaline. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 10 to 12 inches to

a depth of 5 feet. Elevations range from 4,225 to 4,300 feet, and the frost-free period is 130 to 150 days. This soil is slightly to moderately affected by salts and alkali.

Included with this soil in mapping are small areas of Lasil silt loam; Fridlo silt loam, moderately alkali; and Airport silt loam, sandy substratum.

This soil is used for irrigated crops and range. Irrigated crops are alfalfa, sugar beets, small grains, corn for silage, and pasture. Native vegetation is mostly saltgrass and greasewood. Improved range is mostly tall wheatgrass. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Airport silt loam, sandy substratum (Ap).—This soil is on lake plains and low lake terraces. Slopes are 0 to 1 percent. The profile of this soil is similar to that described as representative for the Airport series, but the surface layer ranges from 5 to 9 inches in thickness and is moderately alkaline to strongly alkaline. The texture is mainly sandy loam between depths of 36 and 60 inches. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 10 to 12 inches to a depth of 5 feet. Elevations range from 4,220 to 4,300 feet, and the frost-free period is 140 to 150 days. This soil is slightly to moderately affected by alkali and is slightly affected by salts.

Included with this soil in mapping are small areas of Airport silt loam, Payson silt loam, and Lasil silt loam.

This soil is used chiefly for irrigated alfalfa, small grains, sugar beets, corn for silage, sweet corn, and tomatoes. Capability unit IIIw-28, irrigated; Alkali Bottom range site.

Airport silt loam, strongly alkali (Ar).—This soil is on lake plains. Slopes are 0 to 1 percent. The profile of this soil is similar to that described as representative for the Airport series, but the surface layer ranges from 8 to 11 inches in thickness, is very strongly alkaline, and is silt loam or silty clay loam. Runoff is slow, and the hazard of erosion is slight. Because of the salt content, the water available to plants is only about 7 to 9 inches to a depth of 5 feet. If the soil is reclaimed, however, the available water holding capacity is 10 to 12 inches to that depth. Elevations range from 4,300 to 4,460 feet, and the frost-free period is 110 to 130 days.

Included with this soil in mapping are small areas of Lasil silt loam and Airport silt loam.

This soil is used mainly for range. Tall wheatgrass has been planted in some areas. Native vegetation consists of saltgrass, alkali sacaton, annual mustard, and greasewood. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Anty Series

The Anty series consists of well-drained soils. These soils are on intermediate and high lake terraces west and north of the town of Plymouth. They formed in strongly calcareous, mixed lake sediments and alluvium derived dominantly from limestone but partly from sandstone and quartzite. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of big sagebrush, yellowbrush, Indian ricegrass, bluebunch wheatgrass, cheatgrass, and annual weeds. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period

is 120 to 140 days. Elevations range from 4,400 to 5,000 feet.

In a representative profile, the surface layer is grayish-brown and dark grayish-brown fine sandy loam about 10 inches thick. The subsoil is pale-brown and light-gray fine sandy loam about 9 inches thick. The substratum is white fine sandy loam and sandy loam in the upper 16 inches and is loamy fine sand between depths of 35 and 62 inches. The surface layer is mildly alkaline and moderately calcareous, and the subsoil is mildly and moderately alkaline and moderately to strongly calcareous. The substratum is strongly alkaline and strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 7.5 to 8.5 inches to a depth of 5 feet. The water-supplying capacity is 11 to 12 inches before the moisture is depleted. Roots penetrate easily to a depth of 48 inches but may extend to a depth of 60 inches or more.

These soils are used for nonirrigated crops.

Representative profile of Anty fine sandy loam, 1 to 6 percent slopes, in a cultivated field, 1,200 feet north and 700 feet west of the southwest corner of section 3, T. 13 N., R. 3 W., west of Plymouth:

- Ap—0 to 5 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; soft, friable, non-sticky and nonplastic; few very fine roots; common very fine pores; moderately calcareous; mildly alkaline (pH 7.6); clear, smooth boundary.
- A1—5 to 10 inches, dark grayish-brown (10YR 4/2) light fine sandy loam, dark brown (10YR 3/3) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; common very fine pores; moderately calcareous; mildly alkaline (pH 7.8); clear, smooth boundary.
- B21—10 to 15 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and nonplastic; few very fine roots; common very fine pores; moderately calcareous; moderately alkaline (pH 8.0); gradual, wavy boundary.
- B22ca—15 to 19 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and nonplastic; few very fine roots; few very fine pores; few krotovinas 10 to 15 millimeters in diameter, brown (10YR 4/3) when moist; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, irregular boundary.
- C1ca—19 to 26 inches, white (10YR 8/2) fine sandy loam, light brownish gray (2.5Y 6/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and nonplastic; few very fine roots; few very fine pores; few krotovinas ½ to ¾ inch in diameter, brown (10YR 4/3) when moist; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.0); gradual, irregular boundary.
- C2ca—26 to 35 inches, white (10YR 8/2) sandy loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine pores; few krotovinas ½ to ¾ inch in diameter, brown (10YR 4/3) when moist; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.
- C3—35 to 62 inches, white (10YR 8/2) loamy fine sand, pale brown (10YR 6/3) when moist; few, medium, faint, dark yellowish-brown (10YR 4/4) mottles below a depth of 48 inches; massive; soft, friable; few very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9).

Depth to the horizon of carbonate accumulation ranges from 12 to 28 inches. Between depths of 10 and 40 inches, the texture

is commonly fine sandy loam and content of clay ranges from 14 to 18 percent. The soils are usually moist, but in most years they are dry in all parts at depths between 8 and 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry; chroma is 2 or 3. Texture is fine sandy loam or sandy loam. Reaction is mildly alkaline to moderately alkaline. The A1 horizon is slightly calcareous to moderately calcareous and ranges from 7 to 16 inches in thickness.

In the B2 horizon, value ranges from 5 to 7 when the soils are dry; chroma is 2 or 3. Texture is very fine sandy loam, fine sandy loam, or sandy loam. Reaction is mildly alkaline to strongly alkaline.

In the Cca and C horizons, hue is 10YR or 2.5Y; value is 7 or 8 when the soils are dry and 5 or 6 when they are moist; and chroma ranges from 2 to 4. Texture of the C horizon is fine sandy loam, sandy loam, loamy fine sand, or loamy sand.

Anty fine sandy loam, 1 to 6 percent slopes (AtB).— This soil is on south- and west-facing slopes on intermediate terraces. A profile of this soil is the one described as representative for the Anty series. Slopes are slightly convex and medium in length and most commonly are 1 to 3 percent. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Anty fine sandy loam, 6 to 10 percent slopes; Hansel silt loam, 1 to 6 percent slopes; and Kearns silt loam, 1 to 3 percent and 3 to 6 percent slopes.

This soil is used for nonirrigated crops. Wheat is the main crop grown. Capability unit IIIe-U, nonirrigated; range site not assigned.

Anty fine sandy loam, 6 to 10 percent slopes (AtD).— This soil is on south-facing slopes on intermediate and high lake terraces. Slopes are convex and short to medium in length. Runoff is medium, and the hazard of erosion is moderate. On the more prominent knolls and ridges, part of the original surface layer has been lost through erosion and the soil is moderately calcareous to strongly calcareous to the surface.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Timpanogos silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated wheat and alfalfa. Capability unit IIIe-U, nonirrigated; range site not assigned.

Arave Series

The Arave series consists of poorly drained soils that are affected by alkali. These soils are on low lake plains and low lake terraces. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes range from 0 to 1 percent. The vegetation consists of saltgrass, alkali saccation, and some greasewood, foxtail, cheatgrass, sedges, and wiregrass. Mean annual air temperature ranges from 49° to 52° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,210 to 4,250 feet.

In a representative profile, the surface layer is light brownish-gray light silty clay loam about 4 inches thick, the subsoil is light brownish-gray silty clay loam about 7 inches thick, and the substratum is mostly white silty clay loam that extends to a depth of 60 inches. The surface layer and subsoil are very strongly alkaline and strongly

calcareous, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderately slow, and the rate of water intake is slow. Because of the salt content, the water available to plants is only about 3 to 8 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 12 inches to that depth. Roots penetrate to a depth of 60 inches but are commonly concentrated in the upper 24 inches.

These soils are used for range.

Representative profile of Arave silty clay loam, in range, about 2,100 feet east and 800 feet north of the southwest corner of section 32, T. 9 N., R. 6 W.:

- A1—0 to 4 inches, light brownish-gray (10YR 6/2) light silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy structure; hard, firm, sticky and plastic; many very fine and fine roots; common very fine vesicular pores; strongly calcareous; very strongly alkaline (pH 9.2); clear, smooth boundary.
- B2t—4 to 11 inches, light brownish-gray (10YR 6/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and plastic; many very fine and fine roots; common very fine vesicular pores; many thin clay films on ped faces; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.1); clear, smooth boundary.
- C1ca—11 to 15 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; very hard, firm, sticky and plastic; common very fine and fine roots; many very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); clear, smooth boundary.
- C2ca—15 to 28 inches, white (10YR 8/1) heavy silty clay loam, light gray (2.5Y 7/1) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; weak, fine and medium, blocky structure; hard, firm, very sticky and very plastic; few fine and very fine roots; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); gradual, wavy boundary.
- C3ca—28 to 38 inches, white (10YR 8/1) silty clay loam, light gray (2.5Y 7/1) when moist; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few fine and very fine roots; common very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); gradual, wavy boundary.
- C4—38 to 60 inches, white (10YR 8/2) light silty clay loam, light brownish gray (2.5Y 6/2) when moist; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few fine roots; strongly calcareous, lime disseminated; strongly alkaline (pH 9.0).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 10 to 19 inches. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer. Depth to the water table ranges from 12 to 30 inches. The effect of alkali and salts is moderate to strong. Distinct mottles are at a depth between 15 and 30 inches.

In the A1 horizon, value is 4 or 5 when the soils are moist; chroma is 1 or 2. Texture is light silty clay loam or silt loam. Reaction is strongly alkaline to very strongly alkaline. The A1 horizon is moderately calcareous to strongly calcareous and ranges from 4 to 8 inches in thickness.

In the B2t horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 3 or 4 when they are moist; and chroma is 1 or 2. Texture is silty clay loam or light silty clay loam; content of clay ranges from 27 to 35 percent. Structure is weak to moderate, medium, prismatic. Reaction is moderately alkaline to very strongly alkaline, and the B2t horizon ranges from 6 to 11 inches in thickness.

In the Cca and C horizons, hue is 10YR, 2.5Y, and 5Y; value is 6 to 8 when the soils are dry and ranges from 5 to 7 when they are moist; and chroma is 1 or 2. Textures are silty clay loam, clay loam, silt loam, very fine sandy loam, and loam. Reaction is moderately alkaline to strongly alkaline.

Arave silty clay loam (AV).—This soil is on low lake plains and low lake terraces, mainly along the edge of salt playas of the Great Salt Lake. Slopes are 0 to 1 percent and generally are slightly concave. Runoff is slow to ponded, and the hazard of erosion is only slight.

Included with this soil in mapping are small areas of Etil loamy sand, 1 to 6 percent slopes, and Saltair silty clay loam.

This soil is used chiefly for range. A small area is irrigated and produces mainly tall wheatgrass. Capability unit VIIw-28, nonirrigated; Salt Meadow range site.

Bickmore Series

The Bickmore series consists of well-drained soils. These soils are on north-facing mountains south of Mantua. They formed in residuum and colluvium derived from limestone. Slopes range from 50 to 70 percent. Vegetation consists mainly of Douglas-fir and alpine fir, and there is an understory of snowberry, Oregon grape, lupine, and horsemint. Mean annual air temperature ranges from 37° to 40° F. Average annual precipitation ranges from 24 to 28 inches, and the frost-free period is 45 to 60 days. Elevations range from 6,800 to 8,100 feet.

In a representative profile, the surface layer is dark-brown loam about 10 inches thick. The subsoil is yellowish-brown gravelly silty clay loam about 12 inches thick. The substratum is pale-brown very gravelly loam that is about 17 inches thick over limestone bedrock. The profile is neutral throughout.

Permeability is moderate to a depth of 22 inches but is moderately rapid below that depth. The rate of water intake is rapid. Available water holding capacity is 4 to 6 inches to bedrock. The water-supplying capacity ranges from 11 to 13 inches before moisture is depleted. Roots penetrate to bedrock.

Bickmore soils are used for woodland, wildlife habitat, and watershed.

Representative profile of Bickmore loam, 50 to 70 percent slopes, in woodland, 1,000 feet east and 400 feet north of the southwest corner of section 10, T. 8 N., R. 1 W., on Block Mountain south of Mantua:

- O1—2 inches to 0, matted decaying needles and twigs from conifers.
- A1—0 to 10 inches, dark-brown (10YR 3/3) loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable, slightly sticky and plastic; common fine and medium roots and few coarse roots; 15 percent gravel; neutral (pH 6.6); clear, wavy boundary.
- B2t—10 to 22 inches, yellowish-brown (10YR 5/4) gravelly silty clay loam, dark brown (10YR 3/3) when moist; moderate, medium and fine, subangular blocky structure; hard, friable, slightly sticky and plastic; common fine and medium roots; many very fine pores; common thin clay films on ped faces; 40 percent gravel and cobblestones; neutral (pH 6.6); diffuse, wavy boundary.
- Cca—22 to 39 inches, pale-brown (10YR 6/3) very gravelly loam, dark yellowish brown (10YR 4/4) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; few fine roots; many very fine pores; 70 percent gravel and cobblestones; slightly calcareous

in top of horizon to strongly calcareous at the bottom; neutral (pH 6.8); abrupt, wavy boundary.
R—39 inches, fractured limestone bedrock.

The solum ranges from 20 to 31 inches in thickness. Depth to bedrock ranges from 35 to 40 inches. Coarse fragments are gravel and cobblestones, and their content ranges from 10 to 25 percent in the A1 horizon, from 35 to 40 percent in the B2t horizon, and from 60 to 80 percent in the Cca horizon. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for about 50 to 60 consecutive days in summer.

In the A1 horizon, chroma is 2 or 3. Texture is loam or gravelly loam. The A1 horizon ranges from 10 to 16 inches in thickness. In the B2t horizon, chroma is 3 or 4. Texture in the B2t horizon is gravelly silty clay loam or cobbly silty clay loam. Clay films range from thin to moderately thick on ped faces. Thickness of the B2t horizon ranges from 10 to 15 inches. The horizon of carbonate accumulation may begin in the bottom of the B2t horizon but is most commonly in the Cca horizon. In the Cca horizon, chroma is 3 or 4. Texture of the Cca horizon is very gravelly loam or very cobbly loam. This horizon is slightly to strongly calcareous and is neutral to mildly alkaline.

Bickmore loam, 50 to 70 percent slopes (BCG).—This soil is on north-facing mountain slopes. Runoff is very rapid, and the hazard of erosion is very high.

Included with this soil in mapping are small areas of Agassiz very stony loam, 30 to 70 percent slopes, and a dark-colored soil that formed in material derived from quartzite and contains many coarse fragments.

This Bickmore soil is used for woodland, watershed, and wildlife habitat. Sawtimber is harvested from some areas. Use of equipment for timber harvesting is limited by steep slopes. Capability unit VIIe-HC, nonirrigated; range site not assigned.

Bingham Series

The Bingham series consists of well-drained soils. These soils are on intermediate and high lake terraces and alluvial fans. They formed in mixed lake sediments and very gravelly alluvium derived mainly from quartzite, sandstone, and limestone. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas is big sagebrush, bluebunch wheatgrass, Great Basin wildrye, and Sandberg bluegrass. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 110 to 140 days. Elevations range from 4,500 to 5,200 feet.

In a representative profile, the surface layer is dark grayish-brown gravelly loam about 7 inches thick. The subsoil is dark grayish-brown and grayish-brown gravelly light clay loam about 14 inches thick. The substratum is light brownish-gray very gravelly light loam between depths of 21 to 31 inches and then is pale-brown very gravelly loamy sand that extends to a depth of 60 inches. The surface layer and subsoil are moderately alkaline and noncalcareous, and the substratum is strongly alkaline and strongly calcareous.

Permeability is rapid, and the rate of water intake is rapid. Most roots are concentrated in the upper 30 inches of soil and only a few penetrate into the very gravelly loamy sand material.

These soils are used for nonirrigated crops.

Representative profile of Bingham gravelly loam, 6 to 10 percent slopes, in a cultivated field, 625 feet north and 550

feet west of the south quarter corner of section 10, T. 12 N., R. 3 W., about 1½ miles west of the town of Riverside:

- A1—0 to 7 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 20 percent gravel; moderately alkaline (pH 8.0); clear, smooth boundary.
- B21t—7 to 14 inches, dark grayish-brown (10YR 4/2) gravelly light clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine roots; common thin clay films on ped faces; 25 percent gravel; moderately alkaline (pH 8.0); clear, smooth boundary.
- B22t—14 to 21 inches, grayish-brown (10YR 5/2) gravelly light clay loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and slightly plastic; common fine and very fine roots; common fine and few medium pores; many thin clay films on ped faces; 40 percent gravel; moderately alkaline (pH 8.0); clear, smooth boundary.
- C1ca—21 to 31 inches, light brownish-gray (10YR 6/2) very gravelly light loam, dark grayish brown (10YR 4/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 65 percent gravel and cobblestones; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.
- IIC2ca—31 to 60 inches, pale-brown (10YR 6/3) very gravelly loamy sand, brown (10YR 5/3) when moist; massive; slightly hard, very friable, slightly sticky and nonplastic; few fine and very fine roots; 75 percent gravel and cobblestones; strongly calcareous, lime is disseminated, weakly cemented in lower part; strongly alkaline (pH 8.8).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 16 to 26 inches. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. The A1 horizon is dominantly gravelly loam that contains 15 to 30 percent gravel, but in places it is loam that contains 5 to 15 percent gravel. Reaction is mildly alkaline to moderately alkaline.

In the B2t horizon, value ranges from 4 to 6 when the soils are dry and is 2 or 3 when they are moist; chroma is 2 or 3. The B2t horizon is gravelly light clay loam or gravelly heavy loam that contains 20 to 45 percent gravel. Clay films are few to many on ped faces. Reaction is mildly alkaline to moderately alkaline. Thickness of the B2t horizon ranges from 6 to 14 inches.

In the Cca horizon, value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; chroma is 2 or 3. The Cca horizon is very gravelly loam, very gravelly sandy loam, very gravelly loamy sand, or very gravelly sand that contains 50 to 80 percent gravel and cobblestones. This horizon is noncemented to weakly or strongly cemented, and the coarse fragments are well coated with lime.

Bingham loam, 1 to 6 percent slopes (BdB).—This soil is on alluvial fans and on intermediate to high lake terraces. Slopes are short to medium in length. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity is 4.5 to 5 inches to a depth of 5 feet. The water-supplying capacity is 8 to 9 inches before moisture is depleted.

Included with this soil in mapping are small areas of Bingham gravelly loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 1 to 6 percent slopes; and Parleys silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated wheat and alfalfa. Capability unit IVs-U4, nonirrigated; range site not assigned.

Bingham gravelly loam, 1 to 6 percent slopes (BeB).—This soil is on intermediate to high lake terraces and alluvial fans. Slopes are medium to long and slightly convex. Runoff is slow, and the hazard of erosion is slight. The available water holding capacity to a depth of 5 feet is 4 to 4.5 inches. The water-supplying capacity is 8 to 9 inches before moisture is depleted.

Included with this soil in mapping are small areas of Bingham loam, 1 to 6 percent slopes; DeJarnet gravelly silt loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 1 to 6 percent slopes; and Sterling gravelly loam, 1 to 6 percent slopes.

This soil is used for nonirrigated wheat and alfalfa. Capability unit IVs-U4, nonirrigated; range site not assigned.

Bingham gravelly loam, 6 to 10 percent slopes (BeD).—This soil is on intermediate to high lake terraces and alluvial fans. Slopes are short to medium in length and slightly convex. A profile of this soil is the one described as representative for the Bingham series. Runoff is medium, and the hazard of erosion is moderate. Available water holding capacity to a depth of 5 feet is 4 to 4.5 inches. The water-supplying capacity is 8 to 9 inches before moisture is depleted.

Included with this soil in mapping are small areas of Bingham gravelly loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 6 to 10 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used for nonirrigated wheat and alfalfa. Capability unit IVs-U4, nonirrigated; range site not assigned.

Blue Star Series

The Blue Star series consists of well-drained soils. These soils are on alluvial fans, lake terraces, and terrace escarpments on Fremont Island and in the southern part of the Promontory Mountain range. They formed in gravelly alluvium derived dominantly from quartzite, limestone, and argillite. Slopes range from 6 to 60 percent but most commonly are 6 to 20 percent. Vegetation consists mainly of big sagebrush, snakeweed, Sandberg bluegrass, three-awn, cheatgrass, and some juniper. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 110 to 140 days. Elevations range from 4,250 to 4,950 feet.

In a representative profile, the surface layer is brown gravelly loam about 10 inches thick. The subsoil is pale-brown gravelly heavy sandy loam about 12 inches thick. The substratum is pale-brown gravelly coarse sandy loam between depths of 22 and 37 inches and then is very pale brown gravelly coarse sand that extends to a depth of 60 inches. The surface layer is moderately alkaline and slightly calcareous, and the subsoil is strongly alkaline and slightly calcareous. A layer of strong lime accumulation is at a depth of 22 inches.

Permeability is moderately rapid above a depth of 37 inches but is rapid below that depth. The rate of water intake is rapid. Available water holding capacity is 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is about 7 to 9 inches before moisture is depleted. Only a few roots penetrate to a depth below 37 inches.

These soils are used for range.

Representative profile of Blue Star gravelly loam, 6 to 20 percent slopes, in range, 2,100 feet north and 300 feet east of the southwest corner of section 19, T. 6 N., R. 5 W.:

- A1—0 to 10 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; soft, friable, nonsticky and slightly plastic; many fine and medium roots and few coarse roots; 20 percent fine gravel; slightly calcareous, moderately alkaline (pH 8.4); clear, irregular boundary.
- B2—10 to 22 inches, pale-brown (10YR 6/3) gravelly heavy sandy loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few fine, medium, and coarse roots; common very fine tubular pores; 35 percent fine gravel; slightly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.
- C1ca—22 to 37 inches, pale-brown (10YR 6/3) gravelly coarse sandy loam, brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky and nonplastic; few fine and medium roots; common fine tubular pores; 30 percent fine gravel, coated with lime; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); abrupt, irregular boundary.
- C2—37 to 60 inches, very pale brown (10YR 8/3) gravelly coarse sand, pale brown (10YR 6/3) when moist; single grained; loose; 50 percent fine gravel; strongly calcareous, under side of gravel coated with lime; strongly alkaline (pH 8.5).

Between depths of 10 to 40 inches, the texture averages gravelly sandy loam and the content of coarse fragments ranges from 25 to 35 percent. The coarse fragments are mainly fine gravel-size quartzite, limestone, and argillite and range from $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter. The soils are usually dry in all parts between depths of 8 and 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is gravelly loam or light loam. The A1 horizon is generally non-calcareous but in places is slightly calcareous. It ranges from 7 to 12 inches in thickness.

In the B2 horizon, value is 5 or 6 when the soils are dry; chroma is 2 or 3. The B2 horizon is moderately alkaline to strongly alkaline.

In the Cca and C2 horizons, hue is 7.5YR or 10YR; value ranges from 6 to 8 when the soils are dry and from 3 to 6 when they are moist; and chroma is 2 or 3. The C horizons are gravelly loam, gravelly sandy loam, gravelly loamy sand, or gravelly coarse sand. They are 20 to 50 percent fine gravel. Reaction is moderately alkaline to strongly alkaline. In some places the Cca horizon is weakly cemented.

Blue Star gravelly loam, 6 to 20 percent slopes (BgE).—This soil is on alluvial fans, mainly in the southern part of the Promontory Mountain range. A profile of this soil is the one described as representative for the Blue Star series. Runoff is medium, and the hazard of erosion is moderate. A few shallow to deep gullies have been formed.

Included with this soil in mapping are small areas of Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes, and Sheeprock gravelly sandy loam, 6 to 10 percent slopes.

This soil is used mainly for range. A small area is used for nonirrigated small grains. Capability unit VIs-U, nonirrigated; Upland Stony Loam range site.

Blue Star association, steep (BLG).—This mapping unit is on Fremont Island. It consists of about 60 percent Blue Star gravelly loam, 30 to 60 percent slopes; 38 percent Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes; and 2 percent Rock outcrop.

These soils are intermingled. The Blue Star soil is on east- and north-facing side slopes on fans and lake-terrace

escarpments under a cover of cheatgrass and bunchgrass. Slopes are medium in length, are slightly convex, and most commonly are 30 to 40 percent. The Blue Star gravelly subsoil variant is on east- and north-facing side slopes on lake terraces and terrace escarpments under a cover of cheatgrass and bunchgrass. Slopes are short and convex. Rock outcrop is at the tops of ridges.

Runoff is rapid on the Blue Star soil, and the hazard of erosion is high. Runoff is medium on the Blue Star gravelly subsoil variant, and the hazard of erosion is moderate.

The soils of this association are used for range. Blue Star gravelly loam is in capability unit VIIIs-U, nonirrigated; Upland Stony Loam range site. Blue Star gravelly subsoil variant is in capability unit VIs-U, nonirrigated; Upland Sand range site.

Blue Star Series, Gravelly Subsoil Variant

The Blue Star series, gravelly subsoil variant, consists of somewhat excessively drained soils. These soils are on alluvial fans, narrow lake terraces, and terrace escarpments on Fremont Island. They formed in gravelly alluvium derived mainly from argillite and tillite but partly from limestone and quartzite. Slopes range from 6 to 10 percent. The vegetation is mainly cheatgrass, Sandberg bluegrass, snakeweed, and annuals. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 110 to 140 days. Elevations range from 4,250 to 4,950 feet.

In a representative profile, the surface layer is brown gravelly loam about 7 inches thick. The subsoil is brown gravelly loam about 12 inches thick. The substratum, extending to a depth of 60 inches, is grayish-brown very gravelly loamy coarse sand and very gravelly loamy fine sand. The surface layer and subsoil are mildly alkaline. The substratum is strongly alkaline and moderately to strongly calcareous. A layer of strong lime accumulation is at a depth of 19 inches.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 3.5 to 5.5 inches to a depth of 5 feet. The water-supplying capacity is 5 to 7 inches before moisture is depleted. Only a few roots penetrate to a depth below 24 inches.

Blue Star gravelly subsoil variant soils are used for range.

Representative profile of Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes, in range, 500 feet north and 600 feet east of the west quarter corner of section 17, T. 14 N., R. 4 W., on the east side of Fremont Island:

- O1—1 inch to 0, mulch, partially decomposed vegetation mixed with soil, area has been burned several times over the years; very dark grayish brown (10YR 3/2), very dark brown (10YR 2/2) when moist.
- A1—0 to 7 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; many very fine roots; 20 percent fine angular gravel, mainly from tillite and argillite; mildly alkaline (pH 7.6); clear, smooth boundary.
- B2—7 to 19 inches, brown (10YR 5/3) gravelly loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; 20 percent fine angular gravel, mainly from tillite and argillite; mildly alkaline (pH 7.8); gradual, wavy boundary.

C1ca—19 to 46 inches, grayish-brown (10YR 5/2) very gravelly loamy coarse sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose; 50 percent fine angular gravel, mainly from tillite and argillite; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.5); gradual, wavy boundary.

C2—46 to 60 inches, grayish-brown (10YR 5/2) very gravelly loamy fine sand, dark brown (10YR 3/3) when moist; single grained; loose; 60 percent fine angular gravel, mainly from tillite and argillite; moderately calcareous, lime is disseminated; strongly alkaline (pH 9.0).

In the foregoing profile, the dark color of the soil below a depth of 19 inches is from dark-colored minerals found in the tillite and argillite rocks.

Coarse fragments are mainly fine gravel (chiplike) from argillite, tillite, and limestone and are about $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter. Between depths of 10 to 40 inches, the texture averages gravelly loamy sand and the content of coarse fragments ranges from 20 to 50 percent. The soils are usually dry in all parts between depths of 8 to 24 inches.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture of this horizon is gravelly loam or gravelly light loam, and its content of coarse fragments is 10 to 30 percent. Reaction is mildly alkaline to moderately alkaline. The A1 horizon ranges from 7 to 12 inches in thickness.

In the B2 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Reaction is mildly alkaline to moderately alkaline. The B2 horizon is noncalcareous to slightly calcareous.

In the Cca and C horizon, hue is 7.5 or 10YR; value is 5 or 6 when the soils are dry and ranges from 2 to 6 when they are moist; and chroma is 2 or 3. In the Cca and C horizon, the dark color of the soil is from dark minerals found in the tillite and argillite rocks. These horizons are gravelly or very gravelly loamy fine sand or gravelly or very gravelly loamy coarse sand that contains 40 to 70 percent gravel. Reaction in the Cca and C horizon is moderately alkaline to strongly alkaline. The horizons are moderately calcareous to strongly calcareous.

Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes (BhD).—This soil is on alluvial fans and terrace escarpments on Fremont Island. Slopes are medium in length. Runoff is medium, and the hazard of erosion is moderate. A few shallow gullies have been formed.

Included with this soil in mapping are small areas of Blue Star gravelly loam, 6 to 20 percent slopes, and Sheeprock gravelly sandy loam, 6 to 10 percent slopes.

This soil is used for range. Capability unit VI_s-U, nonirrigated; Upland Sand range site.

Borrow Pits

Borrow pits (Bp) is a miscellaneous land type that occurs at many locations in the survey area. The pits are open excavations from which soil and underlying materials have been removed. The soil material from these areas has been used for the construction of dams, dikes, levees, and highways. The material remaining in the pits is cobbly, stony, or gravelly, and its texture ranges from clay loam to sand. The side slopes of these borrow pits are very steep and generally have been left in roughened condition. In the bottom of most pits, the surface is very rough and uneven, and this condition prohibits the use of common tillage implements. A shallow water table is present in the bottom of a few pits.

These areas are nearly barren but support a thin stand of Russian thistle, sunflower, gumweed, sweetclover, and a few willows.

Borrow pits generally are not suited to use as range but may have some value for wildlife habitat or industrial

uses. Capability unit VIII_s-4; nonirrigated; range site not assigned.

Bram Series

The Bram series consists of moderately well drained and well drained soils. These soils are on lake plains and lake terraces. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes range from 0 to 1 percent. The vegetation consists of shadscale, greasewood, annual mustard, squirreletail, cheatgrass, and winterfat. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,230 to 4,500 feet.

In a representative profile, the surface layer is light brownish-gray silt loam about 5 inches thick, the subsoil is very pale brown silt loam about 7 inches thick, and substratum is very pale brown and light-gray silt loam that extends to a depth of 64 inches. This soil is moderately calcareous and strongly alkaline to a depth of about 12 inches and strongly calcareous and strongly alkaline between depths of 12 and 64 inches.

Permeability is moderately slow, and the rate of water intake is moderate. The water-holding capacity is 9 to 12 inches to a depth of 5 feet, but the water available to plants is only about 4 to 7 inches because of the high salt content. The water-supplying capacity is 5.5 to 8 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most are in the upper 30 inches of the soil.

These soils are used mainly for range. Some areas are used for irrigated crops and wildlife habitat.

Representative profile of Bram silt loam, in range, 700 feet east and 100 feet north of the east quarter corner of section 23, T. 9 N., R. 8 W., about 9 miles southwest of Golden Spike National Monument:

A11—0 to 2 inches, light brownish-gray (2.5Y 6/2) silt loam, olive brown (2.5Y 4/3) when moist; weak, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine and fine vesicular pores; moderately calcareous; very strongly alkaline (pH 8.9); abrupt, smooth boundary.

A12—2 to 5 inches, light brownish-gray (10YR 6/2) silt loam, brown (10YR 4/3) when moist; weak, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.8); clear, smooth boundary.

B2—5 to 12 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) when moist; weak, thick, platy structure that parts to weak, fine and medium, subangular blocky; hard, friable, sticky and plastic; common fine and few medium roots; many very fine interstitial pores; moderately calcareous; strongly alkaline (pH 9.0); clear, smooth boundary.

C1ca—12 to 18 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; weak, medium, subangular blocky structure; very hard, friable, sticky and plastic; few fine and medium roots; many very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); gradual, smooth boundary.

C2ca—18 to 23 inches, very pale brown (10YR 7/3) heavy silt loam, brown (10YR 5/3) when moist; massive; very hard, friable, sticky and plastic; few fine and medium roots; common very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); gradual, smooth boundary.

- C3—23 to 36 inches, light-gray (2.5Y 7/2) heavy silt loam, light olive brown (2.5Y 5/3) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); gradual, smooth boundary.
- C4—36 to 64 inches, light-gray (2.5Y 7/2) heavy silt loam, light brownish gray (2.5Y 6/2) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine and medium interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0).

Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 15 to 18 percent. The soils are usually dry in all parts between depths of 4 to 12 inches. In some areas, faint to distinct mottles are at depths below 30 to 50 inches. These soils are moderately to strongly affected by salts and alkali. Depth to the water table in irrigated areas ranges 26 to 40 inches.

In the A1 horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and ranges from 3 to 5 when they are moist; and chroma is 2 or 3. Texture in the A1 horizon is dominantly silt loam but may be loam or very fine sandy loam. Reaction is moderately alkaline to very strongly alkaline. The A1 horizon ranges from 4 to 10 inches in thickness.

In the B2 horizon, hue is dominantly 10YR but ranges from 7.5YR to 2.5Y; value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam or very fine sandy loam. Reaction in the B2 horizon is strongly alkaline to very strongly alkaline. Thickness of the B2 horizon ranges from 4 to 10 inches.

In the Cca and C horizons, hue is 10YR, 2.5Y, 5Y, or 7.5YR; value ranges from 6 to 8 when the soils are dry and from 4 to 7 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam or very fine sandy loam. Reaction is strongly alkaline to very strongly alkaline. In the Cca horizons, the calcium carbonate equivalent ranges from 20 to 35 percent.

Bram silt loam (BR).—This soil is in broad lake plains and lake terraces. Slopes are generally 0 to 1 percent, but in small areas they range from 1 to 4 percent. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Palisade silt loam, 1 to 6 percent slopes; Harding silt loam; and Thiokol silt loam, low rainfall, 0 to 1 percent slopes.

This soil is used mainly for range. Very small areas are used for irrigated alfalfa, sugar beets, corn for silage, tomatoes, small grains, and irrigated pasture. Capability unit IIIw-28, irrigated; capability unit VIIs-S8, non-irrigated; Semidesert Alkali Flats range site.

Broad Series

The Broad series consists of well-drained soils. These soils are on north- and east-facing mountains surrounding the Howell-Blue Creek valley. They formed in residuum and colluvium derived from sandstone, limestone, and quartzite. Slopes range from 20 to 60 percent. The vegetation is dominantly bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, serviceberry, snowberry, and annual grass. Mean annual air temperature ranges from 42° to 44° F. Average annual precipitation ranges from 16 to 19 inches, and the frost-free period is 75 to 100 days. Elevations range from 5,300 to 7,000 feet.

In a representative profile, the surface layer is dark grayish-brown cobbly loam about 9 inches thick. The subsoil is brown gravelly and very gravelly clay loam about 19 inches thick. The substratum is very pale brown very gravelly loam that extends to sandstone bedrock at a depth of about 36 inches. The surface layer is neutral, the subsoil is mildly alkaline, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is about 4 to 5 inches to bedrock. The water-supplying capacity is about 6.5 to 8 inches before moisture is depleted. Roots extend to bedrock.

Broad soils are used for range, wildlife habitat, and water supply.

Representative profile of Broad cobbly loam, 30 to 60 percent slopes, in an area of the Broad-Middle association, steep, in range, 200 feet west and 400 feet south of the northeast corner of section 15, T. 13 N., R. 4 W., about 4 miles northeast of Whites Valley:

- A11—0 to 3 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, granular structure; soft, very friable, slightly sticky and slightly plastic; many fine and very fine roots; common very fine interstitial pores; 20 percent cobblestones and gravel; neutral (pH 7.2); clear, smooth boundary.
- A12—3 to 9 inches, dark grayish-brown (10YR 4/2) cobbly loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; common very fine interstitial pores; 20 percent cobblestones and gravel; neutral (pH 7.2); clear, smooth boundary.
- B1—9 to 12 inches, brown (10YR 4/3) gravelly clay loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, subangular blocky structure; hard, firm, slightly sticky and plastic; many fine and very fine roots; common very fine interstitial pores; 25 percent gravel and cobblestones; mildly alkaline (pH 7.4); clear, smooth boundary.
- B21t—12 to 22 inches, brown (10YR 5/3) gravelly clay loam, brown (7.5YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; common very fine roots; common very fine interstitial pores; many thin clay films on ped faces and in pores; 25 percent gravel and cobblestones; mildly alkaline (pH 7.8); gradual, wavy boundary.
- B22t—22 to 28 inches, brown (7.5YR 5/4) very gravelly clay loam, brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; common very fine roots; few very fine interstitial pores; many thin clay films on ped faces and in pores; 55 percent gravel and cobblestones; mildly alkaline (pH 7.8); gradual, wavy boundary.
- Cca—28 to 36 inches, very pale brown (10YR 8/3) very gravelly heavy loam, light yellowish brown (10YR 6/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; very fine interstitial pores; 65 percent gravel and cobblestones; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.0); abrupt, smooth boundary.
- R—36 inches, fractured sandstone bedrock.

Depth to the horizon of carbonate accumulation ranges from 23 to 36 inches. Depth to bedrock ranges from 30 to 40 inches. Coarse fragments are mostly cobblestones and gravel; their content ranges from 10 to 20 percent in the surface layer, 25 to 50 percent in the subsoil, and 50 to 80 percent in the substratum. From 25 to 35 percent of the surface is covered with gravel, cobblestones, and a few stones. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is generally cobbly loam or gravelly loam but is loam or silt loam in some places. It is neutral to mildly alkaline and ranges from 7 to 15 inches in thickness.

In the B2t horizon, hue is 10YR or 7.5YR; value ranges from 4 to 6 when the soils are dry and is 3 or 4 when they are moist; and chroma ranges from 2 to 4. This horizon is gravelly or very gravelly clay loam to cobbly or very cobbly clay loam. Reaction is mildly alkaline to moderately alkaline. The B2t horizon ranges from 7 to 19 inches in thickness. The horizon of

carbonate accumulation begins in the lower part of the B2t horizon in some profiles but generally is in the Cca horizon.

In the Cca horizon, hue is 10YR or 7.5YR; value ranges from 5 to 8 when the soils are dry and from 5 to 7 when they are moist; and chroma ranges from 2 to 4. This horizon is very gravelly loam, very gravelly clay loam, cobbly loam, or cobbly clay loam. Reaction is moderately alkaline to strongly alkaline.

Broad cobbly loam, 20 to 30 percent slopes (BSE).—This soil is on north- and east-facing mountains. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Middle cobbly silt loam, 10 to 30 percent slopes; Smarts loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 20 to 30 percent slopes.

This soil is used for range, wildlife habitat, and water supply. Capability unit VI_s-M, nonirrigated; Mountain Stony Loam range site.

Broad cobbly loam, 30 to 60 percent slopes (BSG).—This soil is on north- and east-facing mountains. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Manila loam, 25 to 60 percent slopes; Middle cobbly silt loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes.

This soil is used for range, wildlife habitat, and water supply. Capability unit VII_s-M, nonirrigated; Mountain Stony Loam range site.

Broad-Manila association, steep (BTG).—This mapping unit is on the mountain areas east of Blue Creek valley. It consists of about 60 percent Broad cobbly loam, 30 to 60 percent slopes, and 30 percent Manila loam, 25 to 60 percent slopes. Included with these soils in mapping are areas of Forsgren silt loam, 10 to 20 percent slopes; Smarts loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this association are intermingled. The Broad soil is on very steep, north- and east-facing mountains. The Manila soil also is on very steep, north- and east-facing slopes, but slopes are slightly concave. Both soils have a cover of bluebunch wheatgrass, big sagebrush, yellowbrush, Sandberg bluegrass, and serviceberry.

The soils in this association are used for range, wildlife habitat, and water supply. The Broad soil is in capability unit VII_s-M, nonirrigated; Mountain Stony Loam range site. The Manila soil is in capability unit VII_e-M, nonirrigated; Mountain Loam range site.

Broad-Middle association, steep (BUG).—This mapping unit is mostly on the mountains east of Blue Creek valley, but a small acreage is on the east-facing slopes of the Promontory Mountains. It consists of about 60 percent Broad cobbly loam, 30 to 60 percent slopes, and 30 percent Middle cobbly silt loam, 30 to 70 percent slopes. Included with these soils in mapping are areas of Manila loam, 25 to 60 percent slopes; Sandall cobbly silt loam, 30 to 60 percent slopes; Smarts loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes. These included soils make up about 10 percent of the total acreage.

The Broad soil is on very steep, mainly north- and east-facing mountains. The Middle soil is on very steep, mainly south- and west-facing mountains. Both soils have a cover of bluebunch wheatgrass, big sagebrush, yellowbrush, Sandberg bluegrass, serviceberry, and annual

grasses. The profile of this Broad soil is the one described as representative for the Broad series.

Runoff is medium, and the hazard of erosion is moderate.

The soils in this association are used for range, wildlife habitat and, to a limited extent, water supply. The Broad soil is in capability unit VII_s-M, nonirrigated; Mountain Stony Loam range site. The Middle soil is in capability unit VII_e-U, nonirrigated; Upland Loam range site.

Broad-Smarts association, steep (BVG).—This mapping unit is on very steep mountains. It consists of about 60 percent Broad cobbly loam, 30 to 60 percent slopes, and 30 percent Smarts loam, 30 to 70 percent slopes. Included with these soils in mapping are areas of Manila loam, 25 to 60 percent slopes; Middle cobbly silt loam, 30 to 70 percent slopes; Yeates Hollow cobbly clay loam, 30 to 60 percent slopes; and Rock outcrop. These included areas make up about 10 percent of the total acreage.

The Broad soil is on south- and east-facing mountain slopes under a cover of big sagebrush, bluebunch wheatgrass, serviceberry, cheatgrass, and yellowbrush. The Smarts soil is on north- and west-facing mountain slopes and mountain ravines. Its plant cover is an overstory of maple and chokecherry and an understory of grasses, shrubs, and annuals.

Runoff is medium, and the hazard of erosion is moderate.

The soils in this association are used for range, wildlife habitat, and, to a limited extent, water supply. The Broad soil is in capability unit VII_s-M, nonirrigated; Mountain Stony Loam range site. The Smarts soil is in capability unit VII_e-M, nonirrigated; Mountain Loam (Shrub) range site.

Collett Series

The Collett series consists of somewhat poorly drained soils. These soils are on low lake terraces and lake plains in the Bear River valley south and west of Tremonton. They formed in calcareous, fine-textured, mixed lake sediments derived dominantly from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is Kentucky bluegrass, Great Basin wildrye, saltgrass, foxtail, and sedges. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 13 to 15 inches, and the frost-free period is 130 to 145 days. Elevations range from 4,250 to 4,350 feet.

In a representative profile, the surface layer is grayish-brown silty clay loam about 14 inches thick. The subsoil is light brownish-gray silty clay about 9 inches thick. The substratum is white silty clay between depths of 23 and 30 inches and then is light-gray and pink silty clay loam that extends to a depth of 66 inches. The surface layer is strongly alkaline and slightly to moderately calcareous, the subsoil is strongly alkaline and strongly calcareous, and the substratum is very strongly alkaline and strongly calcareous. A layer of strong lime accumulation is at a depth of 23 inches.

Permeability is slow to a depth of 23 inches and is moderately slow below that depth. The rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. Roots extend to a depth of 60 inches or more where the soils are drained.

Collett soils are used for irrigated crops.

Representative profile of Collett silty clay loam, in a cultivated field, 400 feet south and 600 feet west of the northeast corner of section 12, T. 11 N., R. 4 W., about 3 miles west of Tremonton:

- Ap—0 to 7 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and fine, subangular blocky structure that parts to weak, medium and fine, granular; hard, firm, sticky and plastic; common very fine and fine roots; slightly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.
- A1—7 to 14 inches, grayish-brown (10YR 5/2) heavy silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, firm, very sticky and very plastic; common very fine and fine roots; many very fine and fine pores; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.
- B2—14 to 23 inches, light brownish-gray (10YR 6/2) silty clay, dark grayish brown (2.5Y 4/2) when moist; moderate, fine and medium, subangular blocky structure; very hard, very firm, very sticky and very plastic; few very fine roots; many fine and medium pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); clear, wavy boundary.
- C1ca—23 to 30 inches, white (10YR 8/2) silty clay, grayish brown (2.5Y 5/2) when moist; many, fine, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, firm, very sticky and plastic; few very fine roots; common fine and few medium pores; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, wavy boundary.
- C2ca—30 to 45 inches, light-gray (10YR 7/2) heavy silty clay loam, brown (10YR 5/3) when moist; many, coarse, prominent, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; many fine and few medium pores; strongly calcareous; lime is disseminated; strongly alkaline (pH 9.0); clear, wavy boundary.
- C3—45 to 66 inches, pink (7.5YR 7/4) heavy silty clay loam, brown (7.5YR 5/4) when moist; common, medium, prominent, olive-gray (5Y 5/2) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; few very fine pores; strongly calcareous, some lime veins; strongly alkaline (pH 8.5).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 17 to 30 inches. Between depths of 10 and 40 inches, the texture averages silty clay and the content of clay ranges from 35 to 44 percent. The soils are usually moist, and unlike most other soils in the survey area, in most years they are not dry in all parts between depths of 4 to 12 inches for as much as 60 consecutive days in summer.

In the A1 horizon, hue is 10YR or 2.5Y and chroma is 1 or 2. Texture is heavy silty clay loam or heavy silt loam. The A1 horizon is moderately alkaline to strongly alkaline and is slightly calcareous to moderately calcareous.

In the B2 horizon, hue is 10YR or 2.5Y and value is 4 or 5 when the soils are moist. Texture is silty clay or heavy silty clay loam. The B2 horizon is moderately calcareous to strongly calcareous and is moderately alkaline to strongly alkaline.

In the Cca and C horizons hue is 7.5YR, 10YR, 2.5Y, or 5Y; value ranges from 6 to 8 when the soils are dry and is 5 to 6 when they are moist; and chroma ranges from 2 to 4. Reaction is strongly alkaline to very strongly alkaline. In the Cca horizon, calcium carbonate equivalents range from 25 to 50 percent. Stratified lake-laid sediments are at a depth below 29 to 45 inches; the texture is mainly silty clay loam or silty clay, but there are layers of very fine sandy loam $\frac{1}{4}$ inch to 2 inches thick. Depth to the water table ranges from 30 to 40 inches where the soils are not drained and from 40 to 60 inches where they are drained. Distinct mottles are at a depth below 22 to 32 inches; they range from few to many and are fine to medium.

Collett silty clay loam (Co).—This soil is on broad, low lake terraces and lake plains in the Bear River valley south and west of Tremonton. Slopes most commonly are less than 1 percent but range from 0 to 2 percent. Run-

off is slow, and the hazard of erosion is slight. Most areas of this soil have been leveled and tile drained. Where the soil is not drained, the water table is at a depth of 40 to 60 inches or more.

Included with this soil in mapping are small areas of Greenson silt loam, strongly alkali, and Honeyville silty clay loam.

This Collett soil is used for irrigated alfalfa, small grains, corn for silage, sugar beets, and irrigated pasture. Capability unit IIIw-25, irrigated; Wet Meadow range site.

Collinston Series

The Collinston series consists of well-drained soils. These soils are on high lake terraces and terrace escarpments near the communities of Collinston and Beaver Dam. They formed in calcareous alluvium, conglomerate of the Salt Lake geologic formation, and mixed lake sediments derived from light-colored, tuffaceous sandstone and limestone. Slopes range from 6 to 30 percent. Vegetation is mainly bluebunch wheatgrass, slender wheatgrass, Great Basin wildrye, balsamroot, and buckwheat. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation is 15 to 16 inches, and the frost-free period is 120 to 130 days. Elevations range from 4,700 to 5,400 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 14 inches thick. The next layer, about 11 inches thick, is white silt loam that has an accumulation of lime. This is underlain by white silt loam that extends to a depth of 60 inches or more. The surface layer is moderately and strongly alkaline and is slightly and moderately calcareous, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 10 to 12 inches for plant growth before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

These soils are used for nonirrigated crops and range.

Representative profile of Collinston silt loam, 10 to 30 percent slopes, in an area of Wheelon-Collinston silt loams, 10 to 30 percent slopes, in a cultivated field, 1,000 feet east and 300 feet north of the southwest corner of section 12, T. 12 N., R. 2 W., southeast of Beaver Dam:

- Ap—0 to 8 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; slightly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.
- A1—8 to 14 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; moderately calcareous; strongly alkaline (pH 8.6); abrupt, wavy boundary.
- C1ca—14 to 25 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous; strongly alkaline (pH 8.8); diffuse, smooth boundary.
- C2—25 to 44 inches, white (2.5Y 8/2) silt loam, light olive gray (5Y 6/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine and very fine and few medium

pores; strongly calcareous; strongly alkaline (pH 8.8); diffuse, smooth boundary.

C3—44 to 72 inches, white (2.5Y 8/2) silt loam, light olive gray (5Y 6/2) when moist; common, fine, distinct, yellowish-brown (10YR 5/8) mottles; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous; strongly alkaline (pH 8.8).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 8 to 17 inches. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 20 to 24 percent. The soils are usually moist but are dry in all parts between depths of 4 to 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist; chroma is 1 or 2. The A1 horizon is mildly alkaline to strongly alkaline and slightly calcareous to moderately calcareous. In the Cca horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soil is dry and from 4 to 6 when moist. Texture is mainly silt loam but may be silty clay loam. The Cca horizon is strongly alkaline to very strongly alkaline. In the C horizons hue is 2.5Y or 5Y.

In Box Elder County, Eastern Part, the Collinston soils are mapped only in complexes with the Wheelon soils. Soils of the two series are so closely intermingled that they cannot be separated at the scale used in mapping. To conserve these soils where they are used for crops, they must be treated with conservation measures required for the most restrictive soil.

Collinston-Wheelon silt loams, 6 to 10 percent slopes (CwD).—This mapping unit is in rolling topography on lake terraces having all aspects. It consists of about 55 percent Collinston silt loam, 6 to 10 percent slopes, and 35 percent Wheelon silt loam, 6 to 10 percent slopes. Included with these soils in mapping are small areas of Mendon silt loam, 6 to 10 percent slopes. This included soil makes up about 10 percent of the total acreage.

Soils of this complex are closely intermingled in rolling areas. The Collinston soil has slightly concave slopes, and the Wheelon soil has short, convex slopes and is on knolls and ridges. The plant cover on both soils consists mainly of bluebunch wheatgrass, slender wheatgrass, Great Basin wildrye, balsamroot, buckwheat, big sagebrush, and annual grasses.

Runoff is medium, and the hazard of erosion is moderate.

These soils are used for range and nonirrigated small grains. The Wheelon soil is the more erodible of the two soils. If the complex is used for crops, the Wheelon soil should determine the conservation measures needed for both soils. Capability unit VIe-U, nonirrigated; Upland Shallow Loam range site.

Cudahy Series

The Cudahy series consists of poorly drained soils that have a hardpan of indurated lime. These soils are on low lake terraces and lake plains in the area immediately west of Brigham City and Perry. They formed in very strongly calcareous, mixed lake sediments derived dominantly from limestone and sandstone. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas consists mainly of wiregrass, sedges, Kentucky bluegrass, saltgrass, and foxtail. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 15 to 17 inches, and the frost-free period is 140 to 155 days. Elevation ranges from 4,225 to 4,320 feet.

In a representative profile, the surface layer is gray silt loam about 10 inches thick. The next layer is light-gray silt loam 19 inches thick. This is underlain by a hardpan of white, indurated lime about 15 inches thick.

Below the hardpan is light-gray silty clay loam that extends to a depth of 60 inches. The surface layer is moderately alkaline and strongly calcareous, and the underlying layers are moderately alkaline and very strongly calcareous.

Permeability is moderate above the hardpan but is very slow in the hardpan. The rate of water intake is slow. Available water holding capacity is about 5 to 6 inches above the hardpan. Roots penetrate to the hardpan.

These soils are used mainly for native pasture, but some areas are used for irrigated crops.

Representative profile of Cudahy silt loam, in pasture, 1,120 feet east and 135 feet north of the west quarter corner of section 23, T. 9 N., R. 2 W., about three-fourths of a mile west of Box Elder High School, near Brigham City:

O1—1 inch to 0, decaying leaves, stems, and similar organic materials.

A1—0 to 10 inches, gray (10YR 5/1) silt loam, black (10YR 2/1) when moist; weak, medium and coarse, sub-angular blocky structure that parts to moderate, fine, granular; hard, friable, nonsticky and slightly plastic; many fine and very fine roots; strongly calcareous; moderately alkaline (pH 8.0); clear, wavy boundary.

C1ca—10 to 23 inches, light-gray (10YR 6/1) silt loam, dark gray (10YR 4/1) when moist; weak, medium, sub-angular blocky structure; hard, friable, nonsticky and slightly plastic; many fine and very fine roots; many very fine pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); gradual, irregular boundary.

C2ca—23 to 29 inches, light-gray (10YR 7/1) silt loam, grayish brown (10YR 5/2) when moist; massive; extremely hard, extremely firm, nonsticky and nonplastic; many very fine pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); gradual, irregular boundary.

C3cam—29 to 44 inches, white (10YR 8/2), indurated lime hardpan, light brownish gray (10YR 6/2) when moist; few, fine, faint, yellowish-brown (10YR 5/4) mottles; very strongly calcareous; moderately alkaline (pH 8.4).

C4g—44 to 60 inches, light-gray (5Y 7/1) light silty clay loam, gray (5Y 5/1) when moist; many, medium, distinct, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, firm, sticky and plastic; few fine pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Depth to the hardpan ranges from 23 to 40 inches. Average texture between a depth of 10 inches and the hardpan is silt loam. The soils are usually moist, and in most years they are not dry in all parts of the 4- to 12-inch depth for as long as 60 consecutive days in summer. Depth to the water table fluctuates with the season but is mainly 20 to 30 inches unless the soils are drained.

In the A1 horizon, value is 2 or 3 when the soils are moist; chroma is 1 or less. The A1 horizon ranges from 8 to 12 inches in thickness. In the Cca and C horizons, hue is 10YR, 2.5Y, or 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma is 1 or 2. Texture below the hardpan is light silty clay loam or light silty clay. Mottles below the hardpan are distinct, range from few to many, and are fine to medium.

Cudahy silt loam (Cy).—This soil is in small areas on west-facing low terraces and lake plains west of Brigham City and Perry. Slopes are slightly concave and most commonly are less than 1 percent, but they range from 0 to 3 percent. Runoff is slow to ponded, and the hazard of erosion is none to slight.

Included with this soil in mapping are small areas of Roshe Springs silt loam.

This Cudahy soil is used mainly for native pasture that is occasionally mowed for hay. A small area of this soil has been drained and is used for irrigated alfalfa, small grains, sugar beets, corn for silage, and irrigated pasture. Capability unit IVw-28, irrigated; Wet Meadow range site.

Dagor Series

The Dagor series consists of well-drained soils. These soils are on broad alluvial fans between the cities of Perry and Willard. They formed in alluvium derived from quartzite, sandstone, gneiss, and schist. Slopes range from 3 to 6 percent. The vegetation in noncultivated areas consists of big sagebrush, bluebunch wheatgrass, yellowbrush, yarrow, and annual grasses. Mean annual air temperature ranges from 49° to 51° F. Average annual precipitation is 15 to 16 inches, and the frost-free period is 100 to 160 days. Elevation ranges from 4,300 to 4,400 feet.

In a representative profile, the surface layer is dark grayish-brown loam about 21 inches thick. The underlying layers, extending to a depth of 60 inches, are light brownish-gray loam. The surface layer is mildly alkaline and noncalcareous to slightly calcareous. The next layers are moderately alkaline and slightly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 11 inches to a depth of 5 feet. The water-supplying capacity is 11 to 12 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

These soils are used for irrigated crops.

Representative profile of Dagor loam, 3 to 6 percent slopes, in a cultivated field, 2,350 feet south and 300 feet west of the north quarter corner of section 14, T. 8 N., R. 2 W., about 1½ miles north of Willard:

- Ap—0 to 9 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; hard, friable, nonsticky and slightly plastic; common fine and very fine roots; 5 percent gravel; noncalcareous to slightly calcareous; mildly alkaline (pH 7.4); abrupt, smooth boundary.
- A1—9 to 21 inches, dark grayish-brown (10YR 4/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, nonsticky and slightly plastic; few fine and very fine roots; common fine and very fine pores; 5 percent gravel; noncalcareous to slightly calcareous; mildly alkaline (pH 7.6); clear, smooth boundary.
- C1—21 to 31 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (2.5Y 4/2) when moist; massive; hard, friable, nonsticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; slightly calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.
- C2—31 to 60 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many fine and very fine pores; slightly calcareous; moderately alkaline (pH 8.4).

The texture averages loam between depths of 10 and 40 inches. The content of gravel is as much as 10 percent throughout the profile. These soils are generally noncalcareous but may be slightly calcareous if they are recharged by irrigation water. The soils are usually moist but in most years are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist, and they are noncalcareous to slightly calcareous. The A1 horizon ranges from 20 to 24 inches in thickness. In the C horizon, hue is 2.5Y or 10YR. The C horizon is noncalcareous to slightly calcareous.

Dagor loam, 3 to 6 percent slopes (DaB).—This soil is on short, west-facing alluvial fans. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Draper loam, 0 to 3 percent slopes, and Wasatch gravelly sandy loam, 3 to 10 percent slopes.

This soil is used for irrigated stone fruits, apples, tomatoes, corn, peas, melons, alfalfa, small grains, and irrigated pasture. Capability unit IIe-1, irrigated; range site not assigned.

DeJarnet Series

The DeJarnet series consists of well-drained soils. These soils are on intermediate and high lake terraces and offshore bars. They formed in very gravelly alluvium or reworked lake sediment that was derived dominantly from quartzite and sandstone rocks but was slightly influenced by limestone. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of big sagebrush, bluebunch wheatgrass, Sandberg bluegrass, yellowbrush, cheatgrass, and annual weeds. Mean annual air temperature is 47° to 50° F. Average annual precipitation is 15 to 18 inches, and the frost-free period is 110 to 140 days. Elevations range from 4,700 to 5,200 feet.

In a representative profile (fig. 2), the surface layer is dark grayish-brown gravelly silt loam about 10 inches thick. The subsoil is about 24 inches thick. It is dark grayish-brown gravelly silt loam in the upper part and brown very gravelly loam in the lower part. The substratum is pale-brown very gravelly loam that extends to a depth of 60 inches. The surface layer is mildly alkaline, the subsoil is mildly and moderately alkaline, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 5.5 to 7 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 9 to 11 inches. Roots penetrate to a depth of more than 60 inches, but most of them are at a depth of 20 to 30 inches.

These soils are used for nonirrigated crops.

Representative profile of DeJarnet gravelly silt loam, 1 to 6 percent slopes, in a cultivated field, 1,050 feet west and 240 feet south of the east quarter corner of section 11, T. 14 N., R. 6 W., about 8 miles north and 2 miles west from the Valley turnoff on Interstate Highway I-80:

- Ap1—0 to 4 inches, dark grayish-brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; 25 percent gravel; mildly alkaline (pH 7.8); clear, smooth boundary.
- Ap2—4 to 10 inches, dark grayish-brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few very fine pores; 25 percent gravel; mildly alkaline (pH 7.8); gradual, smooth boundary.
- B21—10 to 20 inches, dark grayish-brown (10YR 4/2) gravelly silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, firm, slightly sticky and plastic; few fine roots; many very fine pores; 50 percent gravel; mildly alkaline (pH 7.8); gradual, wavy boundary.

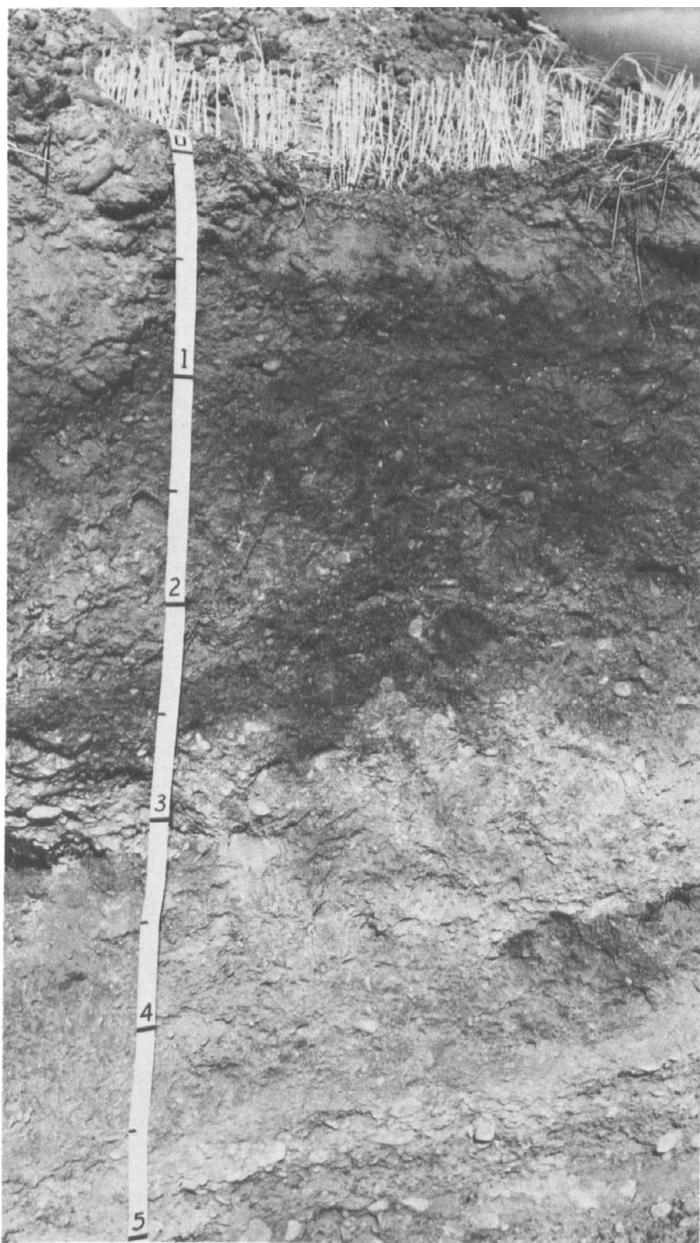


Figure 2.—Profile of DeJarnet gravelly silt loam, 1 to 6 percent slopes.

- B22—20 to 28 inches, brown (10YR 4/3) very gravelly loam, dark brown (10YR 3/3) when moist; moderate, fine, subangular blocky structure; hard, firm, slightly sticky and plastic; few fine roots; many very fine pores; common thin clay films on ped faces; 55 percent gravel; moderately alkaline (pH 7.9); gradual, wavy boundary.
- B23—28 to 34 inches, brown (10YR 5/3) very gravelly loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; few thin clay films on ped faces; 70 percent gravel and cobblestones; moderately alkaline (pH 8.0); gradual, wavy boundary.
- Cca—34 to 60 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) when moist; massive; hard, very friable, nonsticky and nonplastic; few fine roots; common very fine pores; 80 percent gravel and cob-

blestones; strongly calcareous, weakly cemented in places; strongly alkaline (pH 8.5).

The depth to very gravelly material ranges from 14 to 20 inches. Coarse fragments are mainly gravel $\frac{1}{2}$ to $1\frac{1}{2}$ inches in diameter, but there are some cobblestone-size fragments of quartzite, sandstone, and limestone. Between depths of 10 and 40 inches, the texture averages very gravelly loam, content of clay ranges from 18 to 22 percent, and content of coarse fragments ranges from 40 to 70 percent. Depth to the horizon of carbonate accumulation ranges from 20 to 36 inches. The soils are usually moist but in most years are dry in all parts between depths 4 and 12 inches for more than 60 consecutive days in summer.

In the A horizon value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is gravelly silt loam or gravelly heavy silt loam, and content of gravel is 20 to 35 percent. Reaction is neutral to moderately alkaline. The A1 horizon ranges from 7 to 14 inches in thickness.

In the B2 horizon, value is 4 or 5 when the soils are dry and 2 and 3 when they are moist; chroma is 2 or 3. Texture is very gravelly loam or gravelly silt loam, and the content of gravel and cobblestones is 40 to 60 percent. Clay films range from none or few to common and are in pores or on ped faces. Reaction is neutral to moderately alkaline. The B2 horizon ranges from 13 to 24 inches in thickness.

In the Cca horizon, hue is 10YR or 7.5YR; value ranges from 6 to 8 when the soils are dry and from 3 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is very gravelly loam, very gravelly sandy loam, or gravelly loam. The content of coarse fragments is 40 to 90 percent. Reaction is moderately alkaline to strongly alkaline. The Cca horizon is moderately calcareous to strongly calcareous and weakly cemented in some places.

DeJarnet gravelly silt loam, 1 to 6 percent slopes (DgB).—This soil is on offshore bars and intermediate and high lake terraces. Slopes are slightly convex and short in length. A profile of this soil is the one described as representative for the DeJarnet series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Bingham gravelly loam, 1 to 6 percent slopes, and Hupp gravelly silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated wheat. Capability unit IVs-U4, nonirrigated; range site not assigned.

DeJarnet gravelly silt loam, 6 to 10 percent slopes (DgD).—This soil is on offshore bars and intermediate and high lake terraces. Slopes are slightly convex and short to medium in length. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Bingham gravelly loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 1 to 6 percent slopes; Sterling gravelly loam, 6 to 20 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated wheat. Some areas are used for range. Capability unit IVs-U4, nonirrigated; range site not assigned.

Draper Series

The Draper series consists of somewhat poorly drained soils. These soils are on alluvial fans in the area west of Brigham City and Perry. They formed in noncalcareous, mixed alluvium derived dominantly from quartzite, gneiss, schist, and granite. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas is mainly sedges, wiregrass, and Kentucky bluegrass. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 15 to 17 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,225 to 4,360 feet.

In a representative profile, the surface layer is dark-gray and gray loam about 26 inches thick. The underlying layers are gray and light-gray heavy loam that extends to a depth of 60 inches. These soils are moderately alkaline and slightly calcareous throughout.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. Roots penetrate easily to the water table.

These soils are used for irrigated crops.

Representative profile of Draper loam, 0 to 3 percent slopes, in range, 450 feet south and 300 feet east of the west quarter corner of section 14, T. 8 N., R. 2 W., about 1½ miles northwest of Willard:

- Ap—0 to 8 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) when moist; weak, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.
- A11—8 to 15 inches, dark-gray (10YR 4/1) heavy loam, black (10YR 2/1) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.4); gradual, wavy boundary.
- A12—15 to 26 inches, gray (10YR 5/1) heavy loam, very dark gray (10YR 3/1) when moist; few, fine, faint, dark-brown (7.5YR 3/3) mottles; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.
- C1—26 to 35 inches, gray (10YR 6/1) heavy loam, very dark grayish brown (10YR 3/2) when moist; common, fine, distinct, reddish-yellow (7.5YR 6/8) mottles; massive; very hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.
- C2—35 to 44 inches, light-gray (10YR 7/2) heavy loam, very dark grayish brown (10YR 3/2) when moist; many, fine, distinct, reddish-yellow (7.5YR 6/8) mottles; massive; very hard, firm, slightly sticky and slightly plastic; many very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.2); gradual, irregular boundary.
- C3—44 to 60 inches, light-gray (2.5Y 7/2) heavy loam, olive brown (2.5Y 4/3) when moist; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; very hard, friable, slightly sticky and slightly plastic; common very fine tubular pores; slightly calcareous; moderately alkaline (pH 8.4).

In places the entire profile is 5 to 15 percent fine gravel. Between depths of 10 and 40 inches, the texture averages heavy loam and the content of clay ranges from 22 to 27 percent. The soils are usually moist, and in most years they are not dry in all parts at depths between 4 to 12 inches for as much as 60 consecutive days in summer. Depth to the water table ranges from 30 to 42 inches unless the soils are drained.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist. Texture is loam or heavy loam. The A1 horizon is noncalcareous to slightly calcareous and ranges from 24 to 30 inches in thickness.

In the C horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 1 to 3. Texture is heavy loam or loam. The C horizon is noncalcareous to slightly calcareous. Distinct mottles are below a depth of 26 inches and are common to many and fine to medium.

Draper loam, 0 to 3 percent slopes (DrA).—This soil is in small areas on west-facing alluvial fans west of Brigham City and Perry. Slopes are short. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Dagor loam, 3 to 6 percent slopes, James Canyon loam, 0 to 3 percent slopes, and Roshe Springs silt loam.

This Draper soil is used for irrigated small grains, corn for silage, alfalfa, sugar beets, irrigated pasture, tomatoes, and truck crops. Capability unit IIw-2, irrigated; range site not assigned.

Drum Series

The Drum series consists of well-drained soils. These soils are on lake plains and low lake terraces in the extreme southwestern part of the survey area. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 1 percent. Vegetation consists of greasewood, shadscale, pickleweed, kochia, rubber rabbitbrush, annual mustard, cheatgrass, and some big sagebrush. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 6 to 8 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,230 to 4,450 feet.

In a representative profile, the surface layer is light-gray silt loam about 5 inches thick. The subsoil is very pale brown silt loam about 7 inches thick. The substratum is very pale brown and white silt loam in the upper part and, in the lower part, is light-gray silty clay loam that extends to a depth of 60 inches. The surface layer and subsoil are very strongly alkaline, and the substratum is strongly alkaline. These soils are strongly calcareous throughout. A layer of strong lime accumulation is at a depth of 12 inches.

Permeability is moderate, and the rate of water intake is moderate. Because of the high salt content, the water available to plants is only about 3 to 7 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 11 inches to that depth. Roots penetrate to a depth of more than 60 inches, but most of them are in the top 18 inches of the soil.

These soils are used for range.

Representative profile of Drum silt loam, in range, 100 feet north and 1,600 feet east of the southeast corner of section 28, T. 12 N., R. 9 W., about 2 miles northeast of Locomotive Springs Wildlife Refuge headquarters:

- A1—0 to 5 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium, platy structure; soft, friable, slightly sticky and slightly plastic; common fine and very fine roots; many fine and very fine vesicular pores; strongly calcareous; very strongly alkaline (pH 9.1); abrupt, smooth boundary.
- B2—5 to 12 inches, very pale brown (10YR 7/4) silt loam, brown (7.5YR 5/4) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine vesicular pores; strongly calcareous; very strongly alkaline (pH 9.2); clear, smooth boundary.
- C1ca—12 to 18 inches, very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) when moist; massive; hard, very friable, slightly sticky and slightly plastic; few very fine roots; many fine and very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); clear, wavy boundary.

- C2ca—18 to 24 inches, white (2.5Y 8/2) silt loam, light brownish gray (10YR 6/2) when moist; massive; hard, very friable, slightly sticky and slightly plastic; many fine and very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); diffuse, smooth boundary.
- C3—24 to 36 inches, white (5Y 8/2) heavy silt loam, light olive gray (5Y 6/2) when moist; massive; hard, friable, slightly sticky and plastic; many fine and very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.
- C4—36 to 46 inches, very pale brown (10YR 7/3) light silty clay loam, yellowish brown (10YR 5/4) when moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; common fine and very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); gradual, wavy boundary.
- C5—46 to 60 inches, light-gray (2.5Y 7/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; many, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; common fine and very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 10 to 16 inches. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 18 to 25 percent. In places there are common to many distinct mottles at a depth below 36 inches. The salt content is as much as 1.25 percent in places. These soils are slightly to strongly affected by salts and moderately to strongly affected by alkali.

In the A1 horizon, value is 4 or 5 when the soils are moist, and chroma is 2 or 3. Texture ranges from silt loam to loam. Reaction is strongly alkaline or very strongly alkaline. The A1 horizon is moderately calcareous and is 4 to 7 inches thick.

In the B2 horizon, hue is 10YR or 7.5YR, value is 6 or 7 when the soils are dry, and chroma is 3 or 4. Reaction is strongly alkaline or very strongly alkaline. The B2 horizon is moderately calcareous to strongly calcareous and ranges from 6 to 9 inches in thickness.

In the Cca and C horizons, hue is 10YR, 2.5Y, or 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silty clay loam, silt loam, or very fine sandy loam. Reaction is strongly alkaline or very strongly alkaline. The Cca and C horizons are moderately calcareous to strongly calcareous.

Drum silt loam (DU).—This soil is on broad lake plains and low lake terraces in the extreme southwestern part of the survey area. Slopes are most commonly less than 1 percent but range from 0 to 4 percent. Runoff is medium, and the hazard of erosion is moderate. Shallow gullies and sheet and rill erosion are common.

Included with this soil in mapping are small areas of Uffens silt loam.

This Drum soil is used for range. Capability unit VIIIs-D8, nonirrigated; Desert Flats range site.

Eccles Series

The Eccles series consists of well-drained soils. These soils are on intermediate lake terraces. They formed in strongly calcareous, mixed lake sediments derived dominantly from limestone and sandstone rocks. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, big sagebrush, three-awn, Indian ricegrass, cheatgrass, annuals, and juniper. Crested wheatgrass has been planted in some areas (fig. 3). Mean annual air temperature is 47° to 50° F. Average annual precipitation ranges from 11 to 14 inches;

and the frost-free period is 110 to 130 days. Elevation ranges from 4,550 to 4,900 feet.

In a representative profile, the surface layer is pale-brown fine sandy loam about 11 inches thick, and the subsoil is pale-brown fine sandy loam about 7 inches thick. The substratum is light-gray fine sandy loam and very fine sandy loam that extends to a depth of 62 inches. These soils are strongly calcareous. The surface layer and subsoil are moderately alkaline, and the substratum is strongly alkaline and very strongly alkaline.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 7.5 to 8.5 inches to a depth of 5 feet. The water-supplying capacity is 8 to 10 inches before moisture is depleted. Roots extend to depth of more than 60 inches, but most of them are in the upper 30 inches of soil.

These soils are used mainly for nonirrigated crops.

Representative profile of Eccles fine sandy loam, 1 to 6 percent slopes, in a cultivated field, 2,000 feet east and 1,700 feet north of the southwest corner of section 27, T. 13 N., R. 8 W., in Hansel Valley, about one-half mile north of Bill Peterson ranch headquarters:

- Ap—0 to 6 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine and medium, granular; soft, friable, non-sticky and nonplastic; common fine and very fine roots; strongly calcareous; moderately alkaline (pH 8.0); abrupt, smooth boundary.
- A1—6 to 11 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure, but structure in the upper 2 inches of this horizon is thick platy; soft, friable, nonsticky and nonplastic; common fine roots; common very fine pores, strongly calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.
- B2—11 to 18 inches, pale-brown (10YR 6/3) fine sandy loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, non-sticky and slightly plastic; common fine and very fine roots; many very fine pores; strongly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.
- C1ca—18 to 28 inches, light-gray (2.5Y 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.
- C2ca—28 to 45 inches, light-gray (2.5Y 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, nonsticky and nonplastic; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.
- C3—45 to 62 inches, light-gray (2.5Y 7/2) light very fine sandy loam, light brownish gray (2.5Y 6/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; soft, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 10 to 24 inches. Between depths of 10 and 40 inches, the texture averages fine sandy loam and the content of clay ranges from 15 to 18 percent. In places a small amount of gravel, $\frac{1}{4}$ to $\frac{3}{4}$ inch in diameter, is on the surface and throughout the profile. Many, thin-crust, soft marine shells, $\frac{1}{4}$ to $\frac{1}{2}$ inch in size, are found in places throughout the profile. The soils are usually dry in all parts between depths of 8 and 30 inches.

In the A1 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Texture is fine sandy loam or light loam. The A1 horizon is moderately or strongly calcareous and is 5 to 11 inches thick.

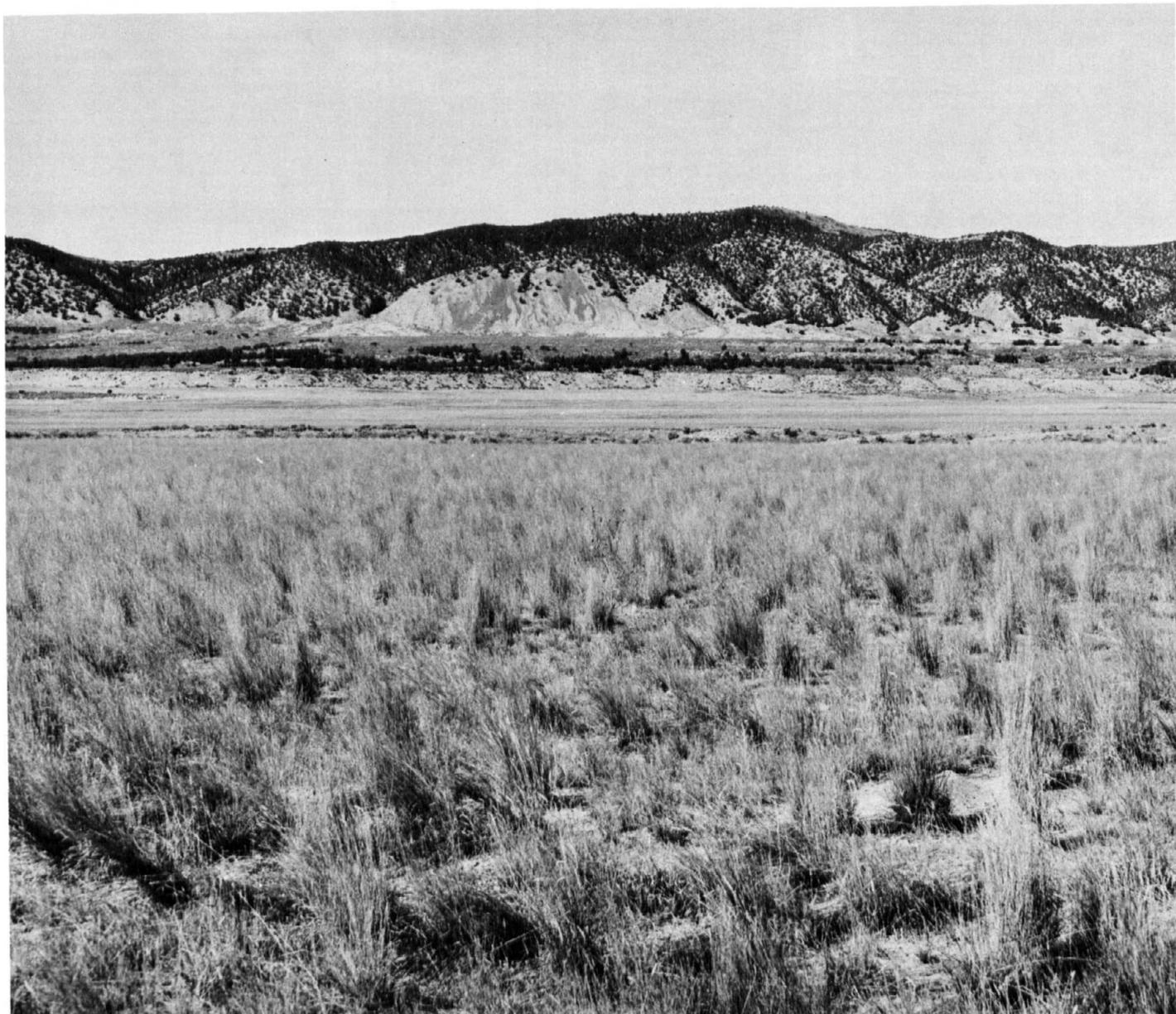


Figure 3.—Crested wheatgrass growing on Eccles fine sandy loam, 1 to 6 percent slopes, in foreground. Juniper growing on Sandall cobbly silt loam, 30 to 60 percent slopes, on the mountains in the background. The soil on the sloping fans between the mountains and the lower lake terraces is mainly Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes.

In the B₂ horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. Texture is very fine sandy loam, fine sandy loam, or sandy loam. In the B₂ horizon, reaction is moderately alkaline or strongly alkaline and the soil is moderately or strongly calcareous. In some profiles, carbonate accumulation begins in the lower part of the B₂ horizon. Thickness of the B_{2t} horizon ranges from 5 to 14 inches.

In the C_{ca} and C horizons, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and is 5 or 6 when they are moist; and chroma is 2 or 3. Texture is very fine sandy loam, sandy loam, or loamy sand. The C_{ca} and C horizons are strongly alkaline or very strongly alkaline.

Eccles fine sandy loam, 0 to 1 percent slopes (EcA).—This soil is on south- and west-facing slopes on intermediate lake terraces. Slopes are medium in length. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 1 to 6 percent slopes; Stingal loam, 1 to 6 percent slopes; and Thiokol silt loam, 0 to 1 percent slopes.

This soil is used mainly for nonirrigated small grains and alfalfa. Some areas are used for wildlife habitat. Capability unit IVc-U, nonirrigated; range site not assigned.

Eccles fine sandy loam, 1 to 6 percent slopes (EcB).—This soil is on south- and west-facing slopes on intermediate lake terraces. Slopes are long and slightly convex. A profile of this soil is the one described as representative for the Eccles series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 0 to 1 percent slopes; Stingal loam, 1 to 6 percent slopes; and Thiokol silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains and alfalfa. Some areas are used for wildlife habitat. Capability unit IVE-UZ, nonirrigated; range site not assigned.

Eccles fine sandy loam, 6 to 10 percent slopes (EcD).—This soil is on south- and west-facing slopes on intermediate lake terraces. Slopes are medium in length and slightly convex. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 1 to 6 percent slopes; Stingal loam, 6 to 10 percent slopes; and Windmill gravelly loam, 6 to 10 percent slopes.

This soil is used chiefly for nonirrigated small grains. Some areas are used for wildlife habitat. Capability unit IVE-UZ, nonirrigated; range site not assigned.

Eccles Series, Sandy Variant

The Eccles series, sandy variant, consists of well-drained soils. These soils are on intermediate lake terraces. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone and partly from shore deposits that have been reworked by wind. Slopes range from 1 to 10 percent. The vegetation in non-cultivated areas consists of big sagebrush, Indian ricegrass, bluebunch wheatgrass, cheatgrass, and annuals. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 110 to 130 days. Elevations range from 4,550 to 4,850 feet.

In a representative profile, the surface layer is pale-brown loamy sand about 8 inches thick, and the subsoil is pale-brown sandy loam about 18 inches thick. The substratum is very pale brown loamy very fine sand, loamy fine sand, and loamy sand that extends to a depth of 64 inches. The surface layer and subsoil are moderately alkaline and moderately calcareous. The substratum is moderately alkaline or strongly alkaline and strongly calcareous.

Permeability is rapid, and the rate of water intake is rapid. Available water holding capacity is 5 to 6 inches to a depth of 5 feet. The water-supplying capacity is 7 to 8 inches before moisture is depleted. Roots may extend to a depth of more than 60 inches, but most roots are in the upper 36 inches of the soil.

These soils are used mainly for nonirrigated crops. Some areas are used for range and wildlife habitat.

Representative profile of Eccles loamy sand, sandy variant, 1 to 6 percent slopes, in a cultivated field, 2,200 feet east and 1,500 feet north of the southwest corner of section 18, T. 13 N., R. 5 W., about 3 miles northwest of Howell Post Office:

Ap—0 to 8 inches, pale-brown (10YR 6/3) loamy sand, brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; soft, very friable; common very fine roots; moderately calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.

B21—8 to 16 inches, pale-brown (10YR 6/3) sandy loam, brown (10YR 4/3) when moist; weak, medium and coarse, subangular blocky structure; soft, very friable, non-sticky and nonplastic; few very fine roots; few fine

tubular pores; moderately calcareous; moderately alkaline (pH 8.4); gradual, wavy boundary.

B22—16 to 26 inches, pale-brown (10YR 6/3) light sandy loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few very fine roots; few fine tubular pores; moderately calcareous; moderately alkaline (pH 8.4); gradual, wavy boundary.

Clca—26 to 37 inches, very pale brown (10YR 7/3) loamy very fine sand, pale brown (10YR 6/3) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few fine tubular pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); gradual, wavy boundary.

C2ca—37 to 49 inches, very pale brown (10YR 7/3) loamy fine sand, pale brown (10YR 6/3) when moist; massive; soft, very friable; few fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.5); gradual, wavy boundary.

C3—49 to 64 inches, very pale brown (10YR 7/3) loamy sand, pale brown (10YR 6/3) when moist; massive; soft, very friable; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6).

Depth to the horizon of carbonate accumulation ranges from 18 to 26 inches. Texture averages light sandy loam between depths of 10 to 40 inches. In places, few, thin-crusts, soft marine shells that range from 1/4 to 1/2 inch in diameter are found throughout the profile. The soils are usually dry in all parts between depths of 8 to 24 inches.

In the A1 horizon, chroma is 2 or 3. This horizon is loamy sand or light sandy loam and ranges from 6 to 8 inches in thickness. In the B2 horizon, value is 4 or 5 when the soils are moist. Texture is sandy loam or light sandy loam. The B2 horizon is 13 to 18 inches thick. In the Cca and C horizons, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 5 or 6 when they are moist; and chroma is 2 or 3. Texture is loamy very fine sand or loamy sand. Reaction is moderately alkaline to very strongly alkaline.

Eccles loamy sand, sandy variant, 1 to 6 percent slopes (E1B).—This soil is on east-facing slopes on intermediate lake terraces and has been reworked by wind action. Slopes are short. Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 1 to 6 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Thiokol silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for wildlife habitat. Capability unit IVs-UZ, nonirrigated; range site not assigned.

Elzinga Series

The Elzinga series consists of well-drained soils. These soils are on mountain slopes and alluvial fans. They formed in colluvium and alluvium derived mainly from sandstone and quartzite. Slopes range from 25 to 70 percent. Vegetation consists of maple, chokecherry, snowberry, western coneflower, mountain brome, and bearded wheatgrass. Mean annual air temperature ranges from 40° to 45° F. Average annual precipitation ranges from 20 to 26 inches, and the frost-free period is 70 to 100 days. Elevations range from 5,200 to 7,500 feet.

In a representative profile, the surface layer is very dark gray silt loam and loam about 24 inches thick. The subsurface layer is pale-brown very gravelly silt loam about 29 inches thick. The subsoil is light-brown gravelly clay loam that extends to a depth of more than 60 inches. These soils are slightly acid throughout.

Permeability is moderate, and the rate of water intake is rapid. Available water holding capacity is 7 to 9 inches

to a depth of 5 feet. The water-supplying capacity is 13 to 18 inches before moisture is depleted. Roots extend to a depth of 60 inches or more.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Elzinga silt loam, 50 to 70 percent slopes, in an area of Foxol-Elzinga association, steep, in range, 1,100 feet west and 450 feet south of the northeast corner of section 32, T. 9 N., R. 1 W., east of Brigham City:

O1—1 inch to 0, decomposing leaves and twigs.

A11—0 to 10 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many fine and very fine roots and few coarse roots; 10 percent gravel; slightly acid (pH 6.4); gradual, smooth boundary.

A12—10 to 24 inches, very dark gray (10YR 3/1) heavy loam, black (10YR 2/1) when moist; weak, medium and coarse, subangular blocky structure that parts to moderate, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots and few coarse roots; common very fine and micro pores; 10 percent gravel; slightly acid (pH 6.3); gradual, irregular boundary.

A2—24 to 53 inches, pale-brown (10YR 6/3) very gravelly silt loam, brown (10YR 4/3) when moist; weak, medium and fine, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine and medium roots; few fine pores; 55 percent gravel and cobblestones; slightly acid (pH 6.2); diffuse, irregular boundary. Tongues from this horizon extend as much as 6 inches into the B2t horizon.

B2t—53 to 64 inches, light-brown (7.5YR 6/3) gravelly clay loam, brown (7.5YR 4/4) when moist; strong, coarse, subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine roots; common fine and very fine pores; many moderately thick clay films on ped faces; 35 percent gravel; common fine manganese concretions; slightly acid (pH 6.2).

The solum ranges from 48 to more than 60 inches in thickness. Content of gravel in the A1 horizon ranges from 10 to 20 percent. Content of gravel and cobblestones in the A2 horizon ranges from 55 to 70 percent, and content of gravel and cobblestones in the B2t horizon ranges from 35 to 70 percent. The soils are usually moist at depths between 4 and 12 inches, but are dry for 60 to 90 consecutive days in the summer in most years.

In the A1 horizon, value is 2 or 3 when the soils are moist; chroma is 1 or 2. Texture is silt loam or gravelly silt loam. The A1 horizon is slightly acid or medium acid and is 24 to 30 inches thick. In the A2 horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry and is 3 or 4 when they are moist; and chroma is 3 or 4. Texture is very gravelly silt loam or very cobbly light silty clay loam. Reaction is medium or slightly acid, and thickness of the A2 horizon ranges from 13 to 30 inches.

In the B2t horizon, hue is 7.5YR or 5Y; value is 3 or 4 when the soils are moist; and chroma is 3 or 4. Texture is gravelly clay loam or very gravelly clay loam. Reaction is medium acid or slightly acid. Clay films in the B2t horizon range from thin to thick on ped faces.

Elzinga-Agassiz association, steep (EMF).—This mapping unit is on the mountains near Mantua. It consists of about 50 percent Elzinga silt loam, 25 to 50 percent slopes, and 40 percent Agassiz very stony loam, 30 to 70 percent slopes. Included with these soils in mapping are areas of Maughan silt loam, 25 to 50 percent slopes, and Picayune gravelly loam, 40 to 70 percent slopes. These included soils make up about 10 percent of the total acreage.

The Elzinga soil is in pockets and draws under maple and grasses. Slopes are concave. The Agassiz soils are on

mountain slopes and ridgetops under bluebunch wheatgrass and big sagebrush. Slopes are convex.

Runoff is medium on these soils, and the hazard of erosion is moderate. Elevations range from 5,500 to 7,500 feet.

The soils of this association are used for range, wildlife habitat, and water supply. Elzinga loam is in capability unit VIIe-M, nonirrigated; Mountain Loam (Shrub) range site. Agassiz loam is in capability unit VIIs-M, nonirrigated; Mountain Shallow Loam range site.

Elzinga-Maughan complex, 25 to 50 percent slopes (ENF).—This complex is on the mountains northwest of Mantua. It consists of about 45 percent Elzinga silt loam, 25 to 50 percent slopes, and 35 percent Maughan silt loam, 25 to 50 percent slopes. Included with these soils in mapping are areas of Elzinga silt loam, 60 to 70 percent slopes; Goring clay loam, 25 to 40 percent slopes; and Agassiz very stony loam, 35 to 70 percent slopes. These included soils make up about 20 percent of the total acreage.

The Elzinga soils are on east- and west-facing mountain slopes and alluvial fans under maple and grasses. The Maughan soil is on north-facing mountain slopes under a dense cover of maple.

Runoff is medium on these soils, and the hazard of erosion is moderate.

The soils of this complex are used for range, wildlife habitat, and water supply. Capability unit VIIe-M, nonirrigated; Mountain Loam (Shrub) range site.

Etil Series

The Etil series consists of moderately well drained soils. These soils are on low lake terraces and in narrow, slightly elevated, beachline areas on the edge of salt playas bordering the Great Salt Lake. They formed in very strongly calcareous oolitic sand material. Slopes range from 1 to 6 percent. Vegetation consists of alkali sacaton, Indian ricegrass, greasewood, shadscale, big sagebrush, and cheatgrass. Mean annual air temperature ranges from 48° to 52° F. Average annual precipitation ranges from 8 to 10 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,210 to 4,230 feet.

In a representative profile, the surface layer is light brownish-gray loamy sand about 5 inches thick, and the underlying layers are light brownish-gray and light-gray sand and coarse sand that extend to a depth of about 60 inches. These soils are very strongly calcareous throughout. They are moderately alkaline in the surface layer and moderately alkaline to very strongly alkaline in the underlying layers.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 3.5 to 5 inches to a depth of 5 feet. The water-supplying capacity is about 4 to 5.5 inches before moisture is depleted. Roots extend to a depth of more than 60 inches in the soil.

These soils are used for range.

Representative profile of Etil loamy sand, 1 to 6 percent slopes, in range, 11 miles southwest of the Golden Spike National Monument, about 1,050 feet south and 600 feet east of the northwest corner of section 9, T. 8 N., R. 6 W.:

A1—0 to 5 inches, light brownish-gray (10YR 6/2) loamy sand, dark grayish brown (10YR 4/2) when moist; single grained; loose; common fine roots; 3 to 5 percent fine gravel; very strongly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.

- C1—5 to 11 inches, light brownish-gray (10YR 6/2) sand, grayish brown (10YR 5/2) when moist; single grained; loose; common fine roots; 3 to 5 percent fine gravel; very strongly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.
- C2—11 to 20 inches, light-gray (10YR 7/2) sand, light brownish gray (10YR 6/2) when moist; single grained; loose; few fine roots; 15 percent fine gravel; very strongly calcareous; strongly alkaline (pH 8.6); gradual, smooth boundary.
- C3—20 to 32 inches, light-gray (10YR 7/2) sand, light brownish gray (10YR 6/2) when moist; single grained; loose; few fine roots; very strongly calcareous; very strongly alkaline (pH 9.2); diffuse, wavy boundary.
- C4—32 to 60 inches, light-gray (10YR 7/2) coarse sand, light brownish gray (10YR 6/2) when moist; single grained; loose; few fine roots; very strongly calcareous; very strongly alkaline (pH 9.2).

Texture averages sand between depths of 10 to 40 inches. These soils are made up almost entirely of oolitic sand. They are usually moist but are dry in all parts between depths of 12 and 35 inches for more than 60 consecutive days in summer. Cemented oolitic aggregates, $\frac{1}{4}$ inch to $1\frac{1}{2}$ inches in diameter, may be in any horizon and range from 1 to 15 percent by volume. Depth to the water table ranges from 24 to 60 inches or more, depending on nearness to and elevation of areas above the salt playas.

In the A1 horizon, value is 4 or 5 when the soils are moist; chroma is 2 or 3. Texture is loamy sand or loamy fine sand. This horizon is moderately alkaline or strongly alkaline and ranges from 5 to 7 inches in thickness.

In the C horizon, value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; chroma is 2 or 3. Texture is fine sand to sand. The C horizons are moderately alkaline to very strongly alkaline.

Etil loamy sand, 1 to 6 percent slopes (ETB).—This soil is mainly on rounded or long, narrow mounds. This soil occupies the beachline on the edge of the salt playas that border the Great Salt Lake. Slopes are convex, short, and abrupt and most commonly are 1 to 3 percent. Run-off is slow, and the hazard of erosion is slight. Soil blowing and deposition are common.

Included with this soil in mapping are small areas of Arave silty clay loam, Bram silt loam, and Palisade silt loam, 1 to 6 percent slopes.

This soil is used for range. Capability unit VII-S, non-irrigated; Semidesert Sand range site.

Fielding Series

The Fielding series consists of well-drained soils. These soils are on broad valley plains and alluvial fans adjacent to the valley plain in the Bear River valley. They formed in mixed lake sediments and local alluvium derived mainly from limestone, sandstone, and quartzite. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, Great Basin wildrye, big sagebrush, western wheatgrass, and annual grasses. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 125 to 155 days. Elevations range from 4,250 to 4,450 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 10 inches thick. The subsoil is pale-brown silt loam about 9 inches thick. The substratum is light-gray loam in the upper 6 inches, very pale brown and white silt loam in the middle 33 inches, and pink silty clay loam in the lower part, which extends to a depth of 60 inches or more. Below a depth of 34 inches, the substratum has thin strata of very fine sandy loam. The surface layer

is moderately alkaline and slightly calcareous, and the subsoil is moderately alkaline and moderately calcareous or strongly calcareous. The substratum is strongly alkaline and strongly calcareous. A layer of strong lime accumulation is in the upper part of the substratum.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. Roots penetrate to a depth of 60 inches or more.

These soils are used for irrigated crops.

Representative profile of Fielding silt loam, in a cultivated field, 800 feet north and 850 feet west of the south quarter corner of section 31, T. 13 N., R. 2 W., one-eighth mile northwest of the Fielding school near Fielding:

- Ap1—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.2); clear, smooth boundary.
- Ap2—6 to 10 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; slightly calcareous; moderately alkaline (pH 8.2); clear, smooth boundary.
- B21—10 to 15 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, fine, subangular blocky structure; very hard, friable, sticky and plastic; few fine and very fine roots; few fine and medium interstitial pores; moderately calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.
- B22—15 to 19 inches, pale-brown (10YR 6/3) silt loam, grayish brown (10YR 5/2) when moist; weak, fine and medium, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine and very fine interstitial pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); abrupt, wavy boundary.
- C1ca—19 to 25 inches, light-gray (10YR 7/2) loam, grayish brown (10YR 5/2) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine and very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.
- C2ca—25 to 34 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine and micro interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); abrupt, wavy boundary.
- C3—34 to 52 inches, white (10YR 8/2) silt loam, stratified with $\frac{1}{16}$ - to $\frac{1}{4}$ -inch layers of very fine sandy loam, grayish brown (2.5Y 5/2) when moist; few, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few very fine roots; common very fine interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); clear, wavy boundary.
- C4—52 to 66 inches, pink (7.5YR 7/4) silty clay loam, stratified with $\frac{1}{8}$ - to 2-inch layers of very fine sandy loam, yellowish brown (10YR 5/4) when moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles; massive; very hard, very firm, sticky and plastic; few very fine roots; common very fine interstitial pores; strongly calcareous; strongly alkaline (pH 9.0).

Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 20 to 25 percent. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in

summer. In places the soil below a depth of 32 inches is silt loam or silty clay loam that is stratified with $\frac{1}{16}$ - to 2-inch layers of very fine sandy loam. Depth to the water table ranges from 45 to 60 inches or more. In places distinct mottles are within 30 inches of the surface.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is silt loam or heavy silt loam. The A1 horizon is mildly alkaline to strongly alkaline and is 7 to 12 inches thick.

In the B2 horizon, value ranges from 4 to 6 when the soils are dry and from 3 to 5 when they are moist; chroma is 2 or 3. Texture in the B2 horizon is silt loam, loam, heavy silt loam, or heavy loam. The B2 horizon is mildly alkaline to very strongly alkaline, is slightly calcareous to strongly calcareous, and is 5 to 14 inches thick. The Cca and C horizons are strongly alkaline or very strongly alkaline.

Fielding silt loam (Fd).—This soil is on broad valley plains in the Bear River Valley north of Garland. A profile of this soil is the one described as representative for the Fielding series. Slopes range from 0 to 3 percent but most commonly are less than 1 percent. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 125 to 140 days.

Included with this soil in mapping are small areas of Parleys silt loam, 0 to 1 percent slopes.

This Fielding soil is used for irrigated sugar beets, corn for silage, alfalfa, potatoes, small grains, and irrigated pasture. Capability unit IIc-2, irrigated; range site not assigned.

Fielding silt loam, warm (Fe).—This soil is on broad valley plains and alluvial fans adjacent to the valley plain. It is in the Bear River valley south of Garland. Slopes are 0 to 3 percent. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 140 to 155 days.

Included with this soil in mapping are small areas of Fridlo silt loam; Honeyville silty clay loam; and Timpanogos loam, 0 to 3 percent slopes. Also included are small areas of well drained to moderately well drained silt loam soils having slopes of 3 to 6 percent.

This soil is used for irrigated tomatoes, sugar beets, alfalfa, small grains, corn for silage, irrigated pasture, and truck crops. Capability unit I-1, irrigated; range site not assigned.

Forsgren Series

The Forsgren series consists of well-drained soils. These soils are on mountain foot slopes and colluvial fans in Whites Valley and the northern part of Blue Creek valley. They formed in alluvium and colluvium derived from sandstone, quartzite, and some limestone rocks. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, Great Basin wildrye, Sandberg bluegrass, yellowbrush, yarrow, big sagebrush, and serviceberry. Mean annual air temperature ranges from 46° to 50° F. Average annual precipitation is 17 to 18 inches, and the frost-free period is 100 to 120 days. Elevations range from 5,175 to 5,500 feet.

In a representative profile, the surface layer is dark grayish-brown heavy silt loam about 8 inches thick. The subsoil is brown and light-brown silty clay and silty clay loam about 44 inches thick. The substratum is light-brown silt loam that extends to a depth of about 66 inches. The surface layer is mildly alkaline, and the subsoil is mildly alkaline to moderately alkaline. The lower part of the subsoil is slightly calcareous, and the substratum is strongly alkaline and moderately calcareous.

Permeability is slow, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 13 to 14 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

These soils are used for nonirrigated crops and range.

Representative profile of Forsgren silt loam, 10 to 20 percent slopes, in a cultivated field, 850 feet east of the west quarter corner of section 10, T. 14 N., R. 5 W., about 8 miles north and 1 mile east of the turnoff from Interstate 80N to Pocatello Valley:

- Ap—0 to 5 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; slightly hard, friable, non-sticky and slightly plastic; common fine roots; few fine interstitial pores; mildly alkaline (pH 7.4); clear, smooth boundary.
- A1—5 to 8 inches, dark grayish-brown (10YR 4/2) heavy silt loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; few fine interstitial pores; mildly alkaline (pH 7.4); gradual, wavy boundary.
- B21t—8 to 16 inches, brown (10YR 4/3) silty clay loam, dark brown (7.5YR 3/2) when moist; weak, medium, prismatic structure that parts to moderate, medium and fine, subangular blocky; very hard, firm, sticky and plastic; few fine roots; common fine interstitial pores; many thin clay films on ped faces; mildly alkaline (pH 7.4); gradual, wavy boundary.
- B22t—16 to 34 inches, brown (7.5YR 5/4) light silty clay, brown (7.5YR 4/4) when moist; moderate, coarse, prismatic structure that parts to strong, medium and coarse, angular blocky; very hard, firm, sticky and very plastic; few fine roots; few fine interstitial pores; continuous thick clay films on ped faces; mildly alkaline (pH 7.8); gradual, wavy boundary.
- B23t—34 to 38 inches, brown (7.5YR 5/4) heavy silty clay loam, brown (7.5YR 4/4) when moist; moderate, coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and very plastic; few very fine roots; few fine interstitial pores; slightly calcareous, moderately alkaline (pH 8.2); gradual, wavy boundary.
- B3t—38 to 52 inches, light-brown (7.5YR 6/4) silty clay loam, brown (7.5YR 4/4) when moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky and very plastic; few very fine roots; few fine interstitial pores; many thin clay films on ped faces; slightly calcareous, lime is veined; moderately alkaline (pH 8.4); gradual, wavy boundary.
- C—52 to 66 inches, light-brown (7.5YR 6/4) silt loam, brown (7.5YR 5/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; moderately calcareous, lime is veined; strongly alkaline (pH 8.9).

Thickness of the solum ranges from 40 to 55 inches. A few angular pebbles, $\frac{1}{4}$ to $\frac{3}{4}$ inch in diameter, are on the surface and throughout the profile. These soils have cracks, $\frac{1}{2}$ to $1\frac{1}{2}$ inches wide, that extend to a depth of more than 20 inches in summer when they are dry. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist. Reaction is neutral or mildly alkaline. The A1 horizon ranges from 5 to 11 inches in thickness.

In the B2t horizon, hue is 7.5YR or 10YR; value is 4 or 5 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. In the upper 6 to 10 inches of the B2t horizon only, the hue is 10YR and value is 4 when dry and 3 when moist. Texture is clay, silty clay, or heavy silty clay loam. Structure ranges from weak to strong and is medium to coarse prismatic. Clay films range from common to continuous and thin to thick on ped faces. Reaction ranges from neutral to strongly alkaline. Thickness of B2t horizon ranges from 20 to 40 inches.

In the C horizon, hue is 7.5YR or 10YR; value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; and chroma is 3 or 4. Texture is silt loam, silty clay loam, or silty clay. Reaction is moderately alkaline or strongly alkaline. The C horizon is slightly calcareous to strongly calcareous below a depth of 40 inches.

Forsgren silt loam, 1 to 6 percent slopes (FgB).—This soil is on mountain foot slopes and colluvial fans in Whites Valley and Blue Creek valley. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Forsgren silt loam, 6 to 10 percent slopes, and Hendricks silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated crops, and wheat is the main crop grown. Capability unit IIIe-U, nonirrigated; range site not assigned.

Forsgren silt loam, 6 to 10 percent slopes (FgD).—This soil is on north- and east-facing slopes on colluvial fans and mountain foot slopes in Whites Valley and Hansel Valley. Slopes are medium in length and slightly concave. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Forsgren silt loam, 1 to 6 percent slopes; Hendricks silt loam, 6 to 10 percent slopes; and Parleys silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe-U, nonirrigated; range site not assigned.

Forsgren silt loam, 10 to 20 percent slopes (FgE).—This soil is on north- and east-facing slopes on colluvial fans and mountain foot slopes in Blue Creek valley and Whites Valley. Slopes are short to medium in length and slightly concave. A profile of this soil is the one described as representative for the Forsgren series. Runoff is rapid, and the hazard of erosion is high. Moderate rill erosion is common, and shallow gullies have been formed in places.

Included with this soil in mapping are small areas of a deep, well-drained soil having a clay subsoil with prismatic structure and having slopes of 20 to 30 percent. Also included are small areas of Hendricks silt loam, 10 to 20 percent slopes, and Parleys silt loam, 10 to 20 percent slopes.

This Forsgren soil is used for nonirrigated crops. Wheat and alfalfa are the main crops grown. Capability unit IVe-U, nonirrigated; Upland Loam range site.

Foxol Series

The Foxol series consists of somewhat excessively drained soils. These soils occur on south- and west-facing mountain slopes near Brigham City. They formed in residuum and colluvium derived mainly from quartzite. Slopes range from 50 to 70 percent. Vegetation is mainly bluebunch wheatgrass, low sagebrush, buckwheat, and annual weeds. Mean annual air temperature ranges from 40° to 44° F. Average annual precipitation ranges from 18 to 26 inches, and the frost-free period is 75 to 100 days. Elevations range from 5,200 to 8,000 feet.

In a representative profile, the surface layer is brown gravelly light loam about 7 inches thick, the subsoil is brown gravelly loam about 6 inches thick, and the substratum is pale-brown very gravelly loam that overlies quartzite bedrock at a depth of about 17 inches. These soils are slightly acid throughout.

Permeability is moderate, and the rate of water intake is slow. Available water holding capacity is about 2 inches. The water-supplying capacity is about 5 to 7 inches before moisture is depleted. Roots extend to bedrock.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of a Foxol gravelly loam, 50 to 70 percent slopes, in an area of Foxol-Rock outcrop complex, 50 to 70 percent slopes, in range, 1,700 feet east and 1,800 feet north of the southwest corner of section 8, T. 9 N., R. 1 W., east of Brigham City:

A1—0 to 7 inches, brown (10YR 5/3) gravelly light loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; soft, very friable, non-sticky and nonplastic; common fine and very fine roots; 35 percent fine gravel; slightly acid (pH 6.4); clear, wavy boundary.

B2—7 to 13 inches, brown (10YR 5/3) gravelly loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 35 percent gravel; slightly acid (pH 6.2); clear, irregular boundary.

C—13 to 17 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 90 percent gravel and cobblestones; slightly acid (pH 6.2); abrupt, irregular boundary.

R—17 inches, fractured quartzite rock.

Depth to bedrock ranges from 14 to 20 inches. The soils are usually moist but between depths of 4 and 12 inches are dry for 60 to 90 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist; chroma is 2 or 3. Texture of the A1 horizon is gravelly light loam or cobbly loam that is 35 to 50 percent gravel and cobblestones. Thickness of the A1 horizon ranges from 5 to 7 inches.

In the B2 horizon, value is 4 or 5 when the soils are dry and 3 or 4 when they are moist. The B2 horizon is gravelly loam or very cobbly heavy loam that is 35 to 70 percent gravel and cobblestones. It ranges from 6 to 7 inches in thickness.

In the C horizon, value is 3 or 4 when the soils are moist. The C horizon is very gravelly loam or very cobbly loam that is 80 to 90 percent gravel and cobblestones. Thickness ranges from 0 to 8 inches.

Foxol-Elzinga association, steep (FHG).—This mapping unit is on mountains southeast of Brigham City. It consists of about 45 percent Foxol gravelly loam, 50 to 70 percent slopes, and 35 percent Elzinga silt loam, 50 to 70 percent slopes. Included with these soils in mapping are small areas of a deep, well-drained, gravelly clay loam soil. This included soil makes up about 20 percent of the total acreage.

The Foxol soil is on east-, south-, and west-facing mountain slopes under a cover of bluebunch wheatgrass, low sagebrush, and buckwheat. The Elzinga soil is on east- and north-facing mountain slopes under a cover of maple, grasses, and annual weeds. A profile of the Elzinga soil is the one described as representative for the series.

Runoff is medium, and the hazard of erosion is moderate.

The soils in this association are used for range, wildlife habitat, and water supply. Foxol loam is in capability unit VIIs-M, nonirrigated; Mountain Shallow Loam range site. Elzinga loam is in capability unit VIIe-M, nonirrigated; Mountain Loam (Shrub) range site.

Foxol-Rock outcrop complex, 50 to 70 percent slopes (FRG).—This mapping unit is on the mountain slopes

east of Brigham City. It consists of about 60 percent Foxol gravelly loam, 50 to 70 percent slopes, and 40 percent Rock outcrop.

The Foxol soil and Rock outcrop are intermingled. The Foxol soil is generally on slightly concave, south- and west-facing mountain slopes. It has a plant cover of blue-bunch wheatgrass, low sagebrush, and buckwheat. A profile of the Foxol soil is the one described as representative for the series. Runoff is medium, and the hazard of erosion is moderate.

Rock outcrop is on south- and west-facing mountain slopes. It consists mainly of quartzite. Slopes are slightly convex.

This complex is used for range, wildlife habitat, and water supply. Capability unit VIIs-M, nonirrigated; Mountain Shallow Loam range site.

Francis Series

The Francis series consists of somewhat excessively drained soils. These soils are on low and intermediate lake terraces on the foot slopes of the Wasatch Mountains south of Willard. They formed in noncalcareous, wind-reworked, mixed lake sediments derived dominantly from quartzite, gneiss, schist, sandstone, and granite. Slopes range from 3 to 6 percent. The vegetation is noncultivated areas in sand dropseed, Indian ricegrass, three-awn grass, big sagebrush, rubber rabbitbrush, cheatgrass, and annual weeds. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,280 to 4,800 feet.

In a representative profile, the surface layer is brown loamy fine sand and loamy sand about 20 inches thick. The underlying layers are brown loamy sand that extends to a depth of 60 inches or more. The surface layer is moderately alkaline or mildly alkaline, and the underlying layers are mildly alkaline.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 4 to 5 inches to a depth of 5 feet. Roots penetrate easily to a depth of 60 inches.

These soils are used for irrigated crops and urban development.

Representative profile of Francis loamy fine sand, 3 to 6 percent slopes in an orchard, 2,350 feet west and 350 feet south of the northeast corner of section 11, T. 7 N., R. 2 W., about 3 miles south of Willard:

- Ap—0 to 7 inches, brown (10YR 5/3) loamy fine sand, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, very friable; few fine and medium roots; moderately alkaline (pH 8.1); abrupt, smooth boundary.
- A1—7 to 20 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine pores; mildly alkaline (pH 7.6); gradual, wavy boundary.
- C1—20 to 27 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) when moist; weak, medium to coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine roots; few fine pores; mildly alkaline (pH 7.6); gradual, wavy boundary.
- C2—27 to 60 inches, brown (10YR 5/3) loamy sand, dark brown (10YR 3/3) when moist; weak, massive; soft, very friable, nonsticky and nonplastic; mildly alkaline (pH 7.6).

Texture averages loamy sand between depths of 10 to 40 inches. In places a small amount of gravel, ¼ to ¾ inch in diameter, is on the surface and throughout the profile. The soils are usually moist, but in most years they are dry in all parts between depths of 12 and 35 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, chroma is 2 or 3. The A1 horizon ranges from 13 to 20 inches in thickness. In the C horizon, hue is 7.5YR or 10YR; value is 3 or 4 when the soils are moist; and chroma is 3 or 4. Texture is loamy sand or fine sand. In places clean gravel and sand are below a depth of 48 inches. Reaction is neutral or mildly alkaline. The C horizon is non-calcareous but in places is slightly calcareous to moderately calcareous below a depth of 60 inches.

Francis loamy fine sand, 3 to 6 percent slopes (FsB).— This soil is on long, west-facing slopes on low and intermediate lake terraces south of Willard. Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is high.

Included with this soil in mapping are small areas of Dagor loam, 3 to 6 percent slopes, and Wasatch gravelly sandy loam, 3 to 10 percent slopes.

This soil is used for irrigated crops and urban development. The main crops grown are peaches, apricots, apples, cherries, melons, alfalfa, corn for silage, tomatoes, and small grains. Capability unit IIIe-16, irrigated; range site not assigned.

Fresh Water Marsh

Fresh water marsh (FT) is a miscellaneous land type that occurs in natural depressions and manmade ponded areas. These marsh areas are on nearly level valley plains and along stream flood plains, where seasonal runoff accumulates and no surface drainage outlet is available. These areas are covered by fresh water most of the year, but when they are not covered they have a water table within 12 inches of the surface. A few areas of shallow open water about 10 to 50 feet in width are included. Texture of the soil material is silty clay loam to fine sandy loam. In some places there are layers of peat as much as 12 inches thick on the surface. Vegetation is dominantly sedges, cattails, and bulrushes.

Fresh water marsh is well suited to use as wildlife habitat. Many of the areas are being managed for use by migratory waterfowl and the trapping of muskrats. Some areas are used as range for cattle in winter. Capability unit VIIIw-2, nonirrigated; range site not assigned.

Fridlo Series

The Fridlo series consists of moderately well drained soils that are affected by alkali. These soils are on lake terraces and alluvial fans. They formed in reworked lake sediments and alluvium derived from many kinds of parent rocks. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas is saltgrass, greasewood, alkali sacaton, annual mustard, and annual grasses. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 130 to 150 days. Elevations range from 4,220 to 4,600 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 9 inches thick. The subsoil is brown silt loam in the upper 6 inches, pale-brown silty clay in the middle 6 inches, and very pale brown silt loam in the

lower 8 inches. The substratum, extending to a depth of 60 inches, is light-gray or white silty clay loam. The surface layer and upper part of the subsoil are alkaline. The lower part of the subsoil and the substratum are very strongly alkaline. The soil varies from noncalcareous in part of the surface layer to strongly calcareous in the lower part of the subsoil and in the substratum.

Most roots are within a depth of 40 inches, although roots may extend to a depth of more than 60 inches.

These soils are used mainly for irrigated and non-irrigated crops.

Representative profile of Fridlo silt loam, in a cultivated field, 400 feet north and 1,050 feet west of the southeast corner of section 7, T. 12 N., R. 5 W., southwest of Howell:

- Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; few coarse roots and many fine roots; few fine pores; slightly calcareous; moderately alkaline (pH 8.2); clear, smooth boundary.
- A1—6 to 9 inches, grayish-brown (10YR 5/2) heavy silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few coarse roots and many fine roots; few fine pores; noncalcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.
- B21t—9 to 15 inches, brown (10YR 5/3) heavy silt loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, slightly sticky and plastic; few coarse roots and many fine roots; common fine pores; many moderately thick clay films on ped faces; noncalcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.
- B22t—15 to 21 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and plastic; few coarse roots and few medium roots; few medium and fine pores; many moderately thick clay films on ped faces; slightly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.
- B3ca—21 to 29 inches, very pale brown (10YR 7/3) silt loam, yellowish brown (10YR 5/4) when moist; weak, medium, subangular blocky structure; extremely hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few fine pores; few thin clay films on ped faces; occasional patches of organic staining on ped faces; strongly calcareous; very strongly alkaline (pH 9.2); abrupt, smooth boundary.
- C1ca—29 to 43 inches, light-gray (10YR 7/2) light silty clay loam, brown (10YR 5/3) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous; very strongly alkaline (pH 9.3); clear, wavy boundary.
- C2—43 to 60 inches, white (10YR 8/2) silty clay loam, light gray (2.5Y 7/1) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 20 to 35 inches. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist; chroma ranges from 1 to 3. Texture is silt loam or heavy silt loam. Reaction is mildly alkaline to strongly alkaline, and the horizon is noncalcareous to slightly calcareous. Thickness of the A1 horizon ranges from 6 to 15 inches.

In the B2t horizon, value is 5 or 6 when the soils are dry and ranges from 2 to 5 when they are moist; chroma is 2 or 3. Texture is silty clay loam or heavy silt loam, and the content of clay ranges from 24 to 32 percent. Reaction is moderately

alkaline to very strongly alkaline, and the horizon is noncalcareous to strongly calcareous. Thickness ranges from 5 to 21 inches.

In the B2tca or B3ca horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; and chroma ranges from 1 to 4. Texture is silt loam or silty clay loam. In the Cca and C horizons, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 7 when they are moist; and chroma is 1 to 3. Texture is silty clay loam, silt loam, very fine sandy loam, or fine sandy loam. Reaction is strongly alkaline or very strongly alkaline. Depth to the water table ranges from 30 to 50 inches where the soils are not drained.

Fridlo silt loam (Fu).—This soil is on lake terraces and alluvial fans along Blue Creek and the Malad River. A profile of this soil is the one described as representative for the Fridlo series. Slopes are 0 to 3 percent. Because of the salt content, the water available to plants is only about 6 to 8 inches to a depth of 5 feet. If the soil is reclaimed, however, the available water holding capacity is 8 to 11 inches to that depth. Permeability is slow, and the rate of water intake is slow. Runoff is slow, and the hazard of erosion is slight. This soil is slightly to moderately affected by salts and moderately to strongly affected by alkali.

Included with this soil in mapping are small areas of Kearns silt loam, 1 to 3 percent slopes, and Lasil silt loam.

This Fridlo soil is used for irrigated alfalfa, small grains, corn for silage, sugar beets, and irrigated pasture. It also is used for nonirrigated small grains and alfalfa. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Fridlo silt loam, moderately alkali (Fv).—This soil is on lake terraces in the lower part of the Bear River valley. It is similar to the soil that has the profile described as representative for the Fridlo series, but its slopes are 0 to 1 percent (fig. 4). In addition, the main part of the subsoil is heavy silt loam or light silty clay loam, and the subsoil and substratum contain less exchangeable sodium. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. Permeability is moderately slow, and the rate of water intake is moderate. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation is 13 to 14 inches, and the frost-free period is 140 to 159 days. This soil is slightly to moderately affected by alkali.

Included with this soil in mapping are small areas of Lasil silt loam, moderately alkali; Lasil silt loam; Airport silt loam; Warm Springs fine sandy loam; and Lewiston fine sandy loam.

This Fridlo soil is used mainly for irrigated alfalfa, corn for silage, sugar beets, tomatoes, small grains, and irrigated pasture. Some areas are used for nonirrigated small grains and alfalfa. Capability unit IIIw-28, irrigated; Alkali Bottom range site.

Gemson Series

The Gemson series consists of well-drained soils. These soils are on foothill slopes in the northern part of Hansel Valley. They formed in alluvium and colluvium derived mainly from basalt rocks but partly from limestone and sandstone. Slopes range from 6 to 20 percent. The vegetation in noncultivated areas is dominantly bluebunch wheatgrass as well as some Sandberg bluegrass, big sagebrush, yellowbrush, balsamroot, and annuals. Mean annual air temperature ranges from 46° to 50° F. Average annual precipitation ranges from 14 to 17 inches,

and the frost-free period is 110 to 130 days. Elevations range from 5,150 to 5,600 feet.

In a representative profile, the surface layer is grayish-brown silty clay loam about 8 inches thick. The subsoil is brown and pale-brown silty clay and silty clay loam that extends to a depth of 64 inches. The substratum, to a depth of 74 inches, is white silty clay loam. The surface layer and subsoil are mildly alkaline to strongly alkaline. The surface layer and the upper part of the subsoil are generally noncalcareous, and the lower part of the subsoil is moderately calcareous. The substratum is very strongly alkaline and very strongly calcareous.

Permeability is slow, and the rate of water intake is moderate. Available water holding capacity is 10 to 14 inches before moisture is depleted. Roots penetrate to a depth of 60 inches.

These soils are used for range and nonirrigated crops.

Representative profile of Gemson silty clay loam, 10 to 20 percent slopes, in a cultivated field, 1,600 feet west and

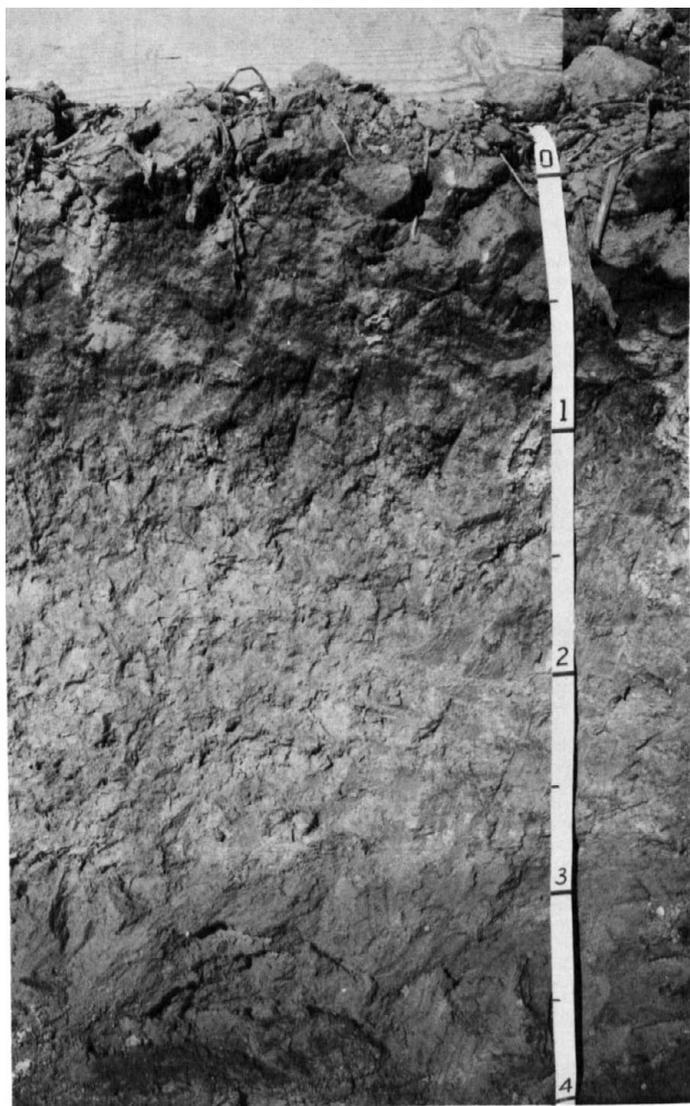


Figure 4.—Profile of Fridlo silt loam, moderately alkali.

100 feet south of the east quarter corner of section 16, T. 13 N., R. 6 W.

Ap1—0 to 4 inches, grayish-brown (10YR 5/2) silty clay loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; few medium pores; slightly calcareous; mildly alkaline (pH 7.8); clear, smooth boundary.

Ap2—4 to 8 inches, grayish-brown (10YR 5/2) silty clay loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; many very fine roots; few very fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.

B21t—8 to 12 inches, brown (10YR 5/3) silty clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; common very fine pores; common thin clay films on ped faces; mildly alkaline (pH 7.9); clear, smooth boundary.

B22t—12 to 16 inches, brown (10YR 5/3) silty clay, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; common very fine pores; common thin clay films on ped faces; slightly calcareous, lime is veined; mildly alkaline (pH 7.8); clear, wavy boundary.

B23t—16 to 21 inches, brown (10YR 5/3) heavy clay loam; brown (10YR 4/3) when moist; strong, coarse, prismatic structure that parts to moderate, medium and coarse, subangular blocky; very hard, very firm, sticky and plastic; common fine and very fine pores; many moderately thick clay films on ped faces; moderately calcareous, lime is veined; moderately alkaline (pH 8.2); gradual, wavy boundary.

B24tca—21 to 51 inches, pale-brown (10YR 6/3) silty clay loam; brown (10YR 4/3) when moist; strong, medium, prismatic structure that parts to moderate, medium and coarse, subangular blocky; very hard, firm, sticky and plastic; few very fine roots; few very fine pores; common thin clay films on ped faces; moderately calcareous; lime is veined, the soil matrix is noncalcareous, moderately alkaline (pH 8.4); gradual, irregular boundary.

B3tca—51 to 64 inches, pale-brown (10YR 6/3) silty clay loam, brown (7.5YR 4/3) when moist; weak, coarse, subangular blocky structure; hard, firm, sticky and plastic; common fine and very fine pores; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

Cca—64 to 74 inches, white (10YR 8/2) silty clay loam, very pale brown (10YR 8/3) when moist; massive; firm, slightly sticky and slightly plastic; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

A few fine pebbles, $\frac{1}{4}$ to $\frac{3}{4}$ inch in diameter, are on the surface and throughout the profile, and a few stones of basalt are on the surface. The soils are usually moist but in most years are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist. The A1 horizon is silty clay loam or heavy silt loam. It is neutral to moderately alkaline and ranges from 6 to 8 inches in thickness.

In the B2t horizon, hue is 7.5YR or 10YR; value is 5 or 6 when the soils are dry and 2 to 4 when they are moist; values of 6 dry and 4 moist occur below depths of 12 to 16 inches; and chroma ranges from 2 to 4. The B2t horizon is mainly silty clay or silty clay loam but may be clay or heavy clay loam. Content of clay ranges from 35 to 45 percent, and clay films range from common to continuous and thin to thick on ped faces. Reaction is mildly alkaline to strongly alkaline. The horizon of carbonate accumulation begins in the lower part of the B2t horizon. The lime is in veins, but the soil matrix is noncalcareous in the B2t horizon.

In the Cca horizon, hue is 10YR or 7.5YR; value ranges from 5 to 8 when the soils are dry and from 4 to 8 when they are moist; and chroma ranges from 2 to 4. The Cca horizon is

silty clay loam or silty clay. Reaction is moderately alkaline to very strongly alkaline.

Gemson silty clay loam, 6 to 10 percent slopes (GcD).—This soil is on foothill slopes in northern Hansel Valley. Slopes are medium in length and slightly concave. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Gemson silty clay loam, 10 to 20 percent slopes; Parleys silt loam, 6 to 10 percent slopes; and Snowville gravelly silt loam, 6 to 20 percent slopes.

This soil is used mainly for range, and it also is used for nonirrigated small grain. If the soil were not closely intermingled with Rock land, more areas of it would be used for nonirrigated crops. Capability unit IIIe-U, nonirrigated; Upland Loam range site.

Gemson silty clay loam, 10 to 20 percent slopes (GcE).—This soil is on northwest- and northeast-facing foothill slopes in the northern part of Hansel Valley. Slopes are medium in length and slightly concave. A profile of this soil is the one described as representative for the series. Runoff is rapid, and the hazard of erosion is high. Moderate rill erosion is common, and shallow gullies have been formed in places.

Included with this soil in mapping are small areas of Gemson silty clay loam, 6 to 10 percent slopes; Parleys silt loam, 10 to 20 percent slopes; and Snowville gravelly silt loam, 6 to 20 percent slopes.

This soil is used for range and nonirrigated crops. If the soil were not closely intermingled with Rock land, more areas of it would be used for nonirrigated crops. Capability unit IVe-U, nonirrigated; Upland Loam range site.

Gemson-Rock land association, moderately steep (GEE).—This mapping unit is on foothills in the northern part of Hansel Valley. Slopes are medium in length. The association consists of about 50 percent Gemson silty clay loam, 10 to 20 percent slopes; 20 percent Middle cobbly silt loam, 10 to 30 percent slopes; and 20 percent Rock land. Included with these soils in mapping are areas of Parleys silt loam, 10 to 20 percent slopes, and Snowville gravelly silt loam, 6 to 20 percent slopes. These included soils make up about 10 percent of the total acreage.

These soils and Rock land are intermingled. The Gemson soil is in slightly concave areas that are under a cover of bluebunch wheatgrass and some Sandberg bluegrass and yellowbrush. The Middle soil is on ridges and supports bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, and annuals. Rock land is on knobs and ridges and supports a good stand of bluebunch wheatgrass between the large stones of basalt.

Runoff is rapid, and the hazard of erosion is high.

This association is used for range. The Gemson soil is in capability unit IVe-U, nonirrigated; Upland Loam range site. The Middle soil is in capability unit VIe-U, nonirrigated; Upland Loam range site. Rock land is in capability unit VIII-X, nonirrigated; range site not assigned.

Gooch Series

The Gooch series consists of poorly drained soils. These soils are on broad lake plains and low lake terraces at the lower elevations in Bear River valley and Howell Valley. They formed in mixed lake sediments. Slopes are

0 to 1 percent. Vegetation consists of saltgrass, alkali sacaton, foxtail, and greasewood. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation ranges from 12 to 16 inches, and the frost-free period is 110 to 150 days. Elevations range from 4,220 to 4,500 feet.

In a representative profile, the surface layer is about 9 inches thick. It is light brownish-gray silt loam in the upper part and light brownish-gray loam in the lower part. The underlying layer extends to a depth of 60 inches or more. It is light-gray loam and light brownish-gray silt loam in the upper part, and it is white silty clay loam and light olive-gray fine sandy loam in the lower part. These soils are strongly alkaline to very strongly alkaline throughout. Lime has accumulated at the bottom of the surface layer or immediately below it. The surface layer is slightly calcareous, but the underlying layer is moderately or strongly calcareous.

Permeability is slow, and the rate of water intake is moderate. The water-holding capacity is 10 to 12 inches to a depth of 5 feet, but the water-supplying capacity for plant growth is only about 6 to 8 inches because of the high salt content. Roots penetrate to the water table, which is at a depth of less than 20 inches, but if the soils are drained, the roots extend to a depth of 60 inches.

These soils are used mainly for range, and some areas are used for improved pastures.

Representative profile of Gooch silt loam, in pasture, 1,500 feet south and 700 feet west of the northeast corner of section 22, T. 9 N., R. 2 W., about 2 miles west of Brigham City:

A11—0 to 3 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, granular structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; few fine pores; slightly calcareous; very strongly alkaline (pH 9.6); abrupt, smooth boundary.

A12—3 to 9 inches, light brownish-gray (10YR 6/2) loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine roots; few fine pores; slightly calcareous; very strongly alkaline (pH 9.6); abrupt, smooth boundary.

C1ca—9 to 18 inches, light-gray (10YR 7/2) loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine roots; common fine pores; many, large, distinct, light olive-brown (2.5Y 5/6) mottles; strongly calcareous; strongly alkaline (pH 9.0); abrupt, smooth boundary.

C2cag—18 to 30 inches, light brownish-gray (2.5Y 6/2) silt loam, grayish-brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and nonplastic; few fine roots; common fine pores; many, large, distinct, light olive-brown (2.5Y 5/6) mottles; strongly calcareous; strongly alkaline (pH 9.0); abrupt, smooth boundary.

IIC3cag—30 to 48 inches, white (N 8/0) silty clay loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; very few fine roots; few fine and medium pores; many, large, distinct, olive-yellow (2.5Y 6/6) mottles; strongly calcareous; strongly alkaline (pH 8.8); abrupt, smooth boundary.

IIIC4g—48 to 56 inches, light olive-gray (5Y 6/2) fine sandy loam, gray (5Y 5/1) when moist; massive; soft, very friable, nonsticky and nonplastic; common, medium, distinct, light olive-brown (2.5Y 5/4) mottles; moderately calcareous; strongly alkaline (pH 8.8); abrupt, smooth boundary.

IVC5g—56 to 65 inches, white (N 8/0) silty clay loam, gray (2.5Y 5/1) when moist; massive; hard, firm, very sticky and slightly plastic; many, large, distinct, light olive-brown (2.5Y 5/4) mottles; strongly calcareous; strongly alkaline (pH 8.8).

Depth to the horizon of carbonate accumulation ranges from 9 to 14 inches. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 25 to 27 percent. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer unless they are irrigated.

In the A1 horizon, hue is 10YR or 2.5Y, value is 3 or 4 when the soils are moist, and chroma is 1 or 2. The horizon is slightly calcareous to strongly calcareous. It ranges from 4 to 9 inches in thickness.

In the Cca, Ccag, Cg, and C horizons, hue is 10YR to 5Y or neutral; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 0 to 2. These horizons are silty clay, silt loam, loam, or fine sandy loam. Structure is weak to moderate, subangular blocky in the upper part, but the lower part is structureless (massive). These soils are moderately to strongly affected by salts and alkali. Depth to the water table is generally less than 20 inches.

Gooch silt loam (Gh).—This soil is on low lake terraces and lake plains. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Warm Springs fine sandy loam, Roshe Springs silt loam, and Cudahy silt loam.

This Gooch soil is used mainly for range. Some areas of it are flood-irrigated and are used for improved pasture. Capability unit VIIw-28, nonirrigated; Salt Meadow range site.

Goring Series

The Goring series consists of well-drained soils. These soils are on mountain slopes and alluvial fans near Mantua. They formed in colluvium and alluvium derived from quartzite and sandstone. Slopes range from 10 to 40 percent. Vegetation consists of slender wheatgrass, Great Basin wildrye, native bluegrass, and big sagebrush. Mean annual air temperature ranges from 41° to 44° F. Average annual precipitation ranges from 20 to 25 inches, and the frost-free period is 80 to 100 days. Elevations range from 5,200 to 7,000 feet.

In a representative profile, the surface layer is dark grayish-brown light clay loam about 7 inches thick. The subsoil is dark grayish-brown clay loam in the upper 11 inches, brown and yellowish-red clay and gravelly clay in the next 30 inches, and yellowish-red gravelly clay to a depth of 60 inches or more. The entire profile is slightly acid.

Permeability is slow, and the rate of water intake is slow. Available water holding capacity is 11 to 12 inches to a depth of 5 feet. The water-supplying capacity is 16 to 18 inches before moisture is depleted. Roots extend to a depth of more than 60 inches.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Goring clay loam, 10 to 25 percent slopes, in an area of Goring-Yeates Hollow association, moderately steep, in range, 1,000 feet west and 600 feet north of the south quarter corner of section 9, T. 9 N., R. 1 W., north of Mantua:

A1—0 to 7 inches, dark grayish-brown (10YR 4/2) light clay loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard,

friable, slightly sticky and slightly plastic; common fine and medium roots and few coarse roots; slightly acid (pH 6.4); clear, smooth boundary.

B1—7 to 18 inches, dark grayish-brown (10YR 4/2) heavy clay loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, subangular blocky structure; very hard, firm, sticky and very plastic; few fine, medium, and large roots; few fine and medium pores; few thin clay films on ped faces and in pores; slightly acid (pH 6.4); gradual, smooth boundary.

B21t—18 to 28 inches, brown (7.5YR 5/3) light clay, dark brown (7.5YR 3/3) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; extremely hard, very firm, very sticky and very plastic; few fine roots; many micro and very fine pores; many thin clay films on ped faces and in pores; slightly acid (pH 6.2); gradual, wavy boundary.

B22t—28 to 37 inches, brown (7.5YR 5/4) clay, brown (7.5YR 4/4) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; extremely hard, very firm, very sticky and very plastic; few fine roots; many very fine pores; continuous moderately thick clay films on ped faces; slightly acid (pH 6.2); diffuse, wavy boundary.

B23t—37 to 48 inches, yellowish-red (5YR 5/6) clay, brown (7.5YR 5/4) when moist; strong, coarse, angular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few fine roots; few very fine and fine pores; continuous thick clay films on ped faces; slightly acid (pH 6.2); gradual, irregular boundary.

B3—48 to 60 inches, yellowish-red (5YR 5/6) gravelly clay, brown (7.5YR 5/4) when moist; weak, coarse, subangular blocky structure; extremely hard, extremely firm, very sticky and very plastic; few very fine and fine roots; many moderately thick clay films on ped faces; 25 percent gravel; slightly acid (pH 6.3).

The solum ranges from 48 inches to more than 60 inches in thickness. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer.

In the A1 horizon, hue is 10YR or 7.5YR; value is 2 or 3 when the soils are moist; and chroma is 2 or 3. The A1 horizon is generally clay loam but may be loam. Reaction is medium acid or slightly acid. The A1 horizon ranges from 7 to 15 inches in thickness.

In the B1 horizon, hue is 10YR or 7.5YR. The horizon ranges from 0 to 11 inches in thickness. In the B2t and B3 horizons, hue is 7.5YR or 5YR; value is 4 or 5 when the soils are dry and ranges from 3 to 5 when they are moist; and chroma ranges from 3 to 6. The upper B2t horizon has a value of 3 and a chroma of 3. Texture of the B2t horizon is clay or silty clay. Structure is weak, medium and coarse, prismatic. Clay films range from many to continuous and from thin to thick on ped faces. Reaction of the B2t and B3 horizons is medium acid or slightly acid. The B2t horizon ranges from 30 to 33 inches in thickness. In the B3 horizon, content of coarse fragments ranges from 25 to 50 percent. The fragments are gravel and cobbles.

Goring-Yeates Hollow association, moderately steep (GLE).—This mapping unit is on the mountains north of Mantua. It consists of about 60 percent Goring clay loam, 10 to 25 percent slopes, and 30 percent Yeates Hollow stony loam, 10 to 25 percent slopes. Included with these soils in mapping are areas of Obray clay, 10 to 25 percent slopes; Goring clay loam, 25 to 40 percent slopes; and Yeates Hollow stony loam, 25 to 40 percent slopes. These included soils make up about 10 percent of the total acreage.

The Goring and Yeates Hollow soils generally are on south- and west-facing mountain slopes and alluvial fans, but in places there are short slopes that are north and east facing. Both soils occur on all aspects. The vegetation consists of mulesear dock, bluebunch wheatgrass, slender

wheatgrass, bluegrass, Great Basin wildrye, and big sagebrush.

A profile of the Goring soil in this association is the one described as representative for the Goring series. The Yeates Hollow soil has a profile similar to the one described for that series, but the surface layer is stony loam.

Runoff is medium on these soils, and the hazard of erosion is moderate. The water-supplying capacity is 10 to 11 inches for plant growth before moisture is depleted.

The soils of this association are used for range, wildlife habitat, and water supply. The Goring soil is in capability unit VIe-M, nonirrigated; Mountain Loam range site. The Yeates Hollow soil is in capability unit VIi-M, nonirrigated; Mountain Stony Loam range site.

Goring Series, Brown Subsoil Variant

The Goring series, brown subsoil variant, consists of well-drained soils. These soils are on small plains in mountain valleys southeast of Mantua. They formed in mixed alluvium and valley fill derived from many kinds of parent rocks. Slopes are from 0 to 1 percent. Vegetation consists of bluegrass, bearded wheatgrass, Great Basin wildrye, and some big sagebrush. Mean annual air temperature ranges from 40° to 42° F. Average annual precipitation ranges from 22 to 26 inches, and the frost-free period is 75 to 90 days. Elevation is about 6,600 feet.

In a representative profile, the surface layer is dark-gray loam about 21 inches thick, and the subsurface layer is light brownish-gray loam about 1 inch thick. The subsoil is light yellowish-brown and pale-brown silty clay in the upper 32 inches and is light-gray clay loam in the lower 7 inches. Between depths of 61 and 68 inches is light-gray loam. The surface layer is slightly acid or neutral. The subsurface layer, subsoil, and substratum are neutral. The subsoil and substratum contain many small concentrations of manganese.

Permeability is slow, and the rate of water intake is slow. Available water holding capacity is 11 to 12 inches to a depth of 5 feet. The water-supplying capacity is 17 to 22 inches for plant growth before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

Goring soils, brown subsoil variant, are used for range, wildlife habitat, and water supply. In the past, native hay was cut from some areas of these soils.

Representative profile of Goring loam, brown subsoil variant, in range, 1,300 feet west of the east quarter corner of section 1, T. 8 N., R. 1 W. about 5 miles southeast of Mantua:

- A11—0 to 7 inches, dark-gray (10YR 4/1) heavy loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, subangular blocky structure; very hard, friable, slightly sticky and plastic; common very fine and medium roots; few very fine pores; neutral (pH 6.6); gradual, smooth boundary.
- A12—7 to 21 inches, dark-gray (10YR 4/1) light clay loam, very dark brown (10YR 2/2) when moist; very hard, friable, sticky and plastic; common very fine and medium roots; few very fine pores; slightly acid (pH 6.2); gradual, wavy boundary.
- A2—21 to 22 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine pores; neutral (pH 6.6); gradual, wavy boundary.
- B21t—22 to 31 inches, light yellowish-brown (10YR 6/4) silty clay, yellowish brown (10YR 5/4) when moist;

moderate, medium, prismatic structure that parts to strong, medium, angular and subangular blocky; extremely hard, firm, sticky and very plastic; few fine and very fine roots; many very fine pores; thin continuous clay films on ped faces and in pores; neutral (pH 7.0); gradual, wavy boundary.

B22t—31 to 54 inches, pale-brown (10YR 6/3) silty clay, brown (10YR 5/3) when moist; weak, medium, prismatic structure that parts to strong, medium, angular and subangular blocky; extremely hard, firm, sticky and very plastic; many very fine pores; thin continuous clay films on ped faces and in pores; neutral (pH 7.0); clear, wavy boundary.

B3—54 to 61 inches, light-gray (2.5Y 7/2) light clay loam, brown (10YR 4/3) when moist; strong, medium and coarse, angular blocky structure; very hard, friable, slightly sticky and slightly plastic; many very fine pores; common thin clay films on ped faces; neutral (pH 7.2); abrupt, smooth boundary.

C—61 to 68 inches, light-gray (2.5Y 7/2) heavy loam, dark yellowish brown (10YR 4/4) when moist; common, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; very hard, friable, slightly sticky and slightly plastic; neutral (pH 7.2).

In the foregoing profile, many small manganese shot, 1 millimeter or less in diameter, are between depths of 20 and 60 inches or more.

The solum ranges from 48 to 61 inches in thickness. The soils are usually moist, but between depths of 4 and 12 inches, they are dry for 60 to 90 consecutive days in summer in most years.

In the A1 horizon, chroma is 1 or 2. Texture is loam at the surface and light clay loam at the bottom of the A1 horizon. Reaction is slightly acid or neutral in this horizon and thickness ranges from 20 to 24 inches. The A2 horizon is not continuous and is 0 to 4 inches thick. In the B2t horizon, chroma is 3 or 4. Structure is moderate to weak, medium, prismatic. Thickness of the B2t horizon ranges from 28 to 36 inches. In the B3 horizon, hue is 10YR to 2.5Y and chroma is 2 or 3.

Goring loam, brown subsoil variant (GM).—This soil is on small mountain valley plains. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Orbay clay, 10 to 25 percent slopes.

This Goring variant is now used for range, wildlife habitat, and water supply. Part of the acreage yielded native hay in the past. Capability unit VIe-M, nonirrigated; Mountain Loam range site.

Gravel Pits

Gravel pits (Gp) is a miscellaneous land type that occurs at scattered locations in the survey area. These pits are open excavations from which gravel, sand, and cobblestones have been removed. Most of the material has been used in building construction, for road grades and surfacing, and for railroad grades. Some of the pits are used as a commercial source of high-quality sand and gravel for making concrete. Most of the pits are on steep terrace escarpments or off-shore bars that were associated with prehistoric Lake Bonneville. Gravel pits have no value for crops or grazing, but some are valuable for industrial use. Capability unit VIIIi-4, nonirrigated; range site not assigned.

Greenson Series

The Greenson series consists of somewhat poorly drained soils. These soils are on broad, low lake terraces and lake plains in the Bear River valley south and west of Tremonton. They formed in fine textured and moderately fine textured, mixed lake sediments derived dominantly

from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is mainly saltgrass, alkali sacaton, greasewood, alkali bluegrass, and some foxtail and sedges. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation is 13 to 14 inches, and the frost-free period is 135 to 145 days. Elevations range from 4,250 to 4,325 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 12 inches thick. The subsoil is pale-brown heavy silt loam about 7 inches thick. The substratum is very pale brown and light-gray silt loam, about 20 inches thick, over stratified, pink silty clay and light-gray fine sandy loam that extends to a depth of 60 inches or more. The surface layer and subsoil are moderately alkaline and slightly calcareous. A layer of strong lime accumulation is at a depth of 19 inches. The substratum is strongly calcareous and very strongly alkaline.

Roots penetrate easily to a depth of about 40 inches and can extend to a depth of more than 60 inches. Permeability is moderate above the silty clay substratum but is slow in the silty clay.

Greenon soils are used for irrigated crops and native pasture.

Representative profile of Greenon silt loam, clay substratum, in a cultivated field, 700 feet south and 950 feet west of the northeast corner of section 33, T. 11 N., R. 3 W., about 5 miles southwest of Tremonton:

- Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, very friable, slightly sticky and slightly plastic; slightly calcareous; moderately alkaline (pH 8.0); clear, smooth boundary.
- A1—6 to 12 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, subangular blocky structure; soft, very friable, slightly sticky and slightly plastic; few fine roots; common fine and medium pores; slightly calcareous; moderately alkaline (pH 8.0); abrupt, smooth boundary.
- B2—12 to 19 inches, pale-brown (10YR 6/3) heavy silt loam, dark grayish brown (10YR 4/2) when moist; moderate, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common very fine tubular pores; numerous worm casts; slightly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.
- C1ca—19 to 27 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; weak, medium and coarse, subangular blocky structure; very hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.1); clear, smooth boundary.
- C2ca—27 to 30 inches, light-gray (2.5Y 7/2) heavy silt loam, pale olive (5Y 6/3) when moist; common, fine, distinct, strong-brown (7.5Y 5/6) mottles; weak, medium and coarse, subangular blocky structure; very hard, friable, slightly sticky and plastic; few very fine roots; many very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); abrupt, smooth boundary.
- C3ca—30 to 39 inches, very pale brown (10YR 7/3) light loam, pale brown (10YR 6/3) when moist; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; hard, very friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); clear, smooth boundary.
- C4—39 to 51 inches, pink (7.5YR 7/4) silty clay, brown (7.5YR 5/4) when moist; few, fine, faint, strong-brown (7.5YR 5/6) mottles; massive; extremely hard, very

firm, sticky and very plastic; common very fine pores; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); clear, smooth boundary.

C5—51 to 54 inches, light-gray (2.5Y 7/2) fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; soft, very friable; strongly calcareous; very strongly alkaline (pH 9.1); clear, smooth boundary.

C6—54 to 64 inches, pink (7.5YR 7/4) silty clay, brown (7.5YR 5/4) when moist; few, medium, faint, yellowish-brown (10YR 5/4) mottles; massive; extremely hard, very firm, sticky and very plastic; common very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 16 to 19 inches. Between depths of 10 and 40 inches, the texture averages silt loam, and the content of clay ranges from 18 to 22 percent. The soils are usually moist, and in most years they are not dry in all parts between depths of 4 and 12 inches for as much as 60 consecutive days in the summer.

In the A1 horizon, texture is silt loam or loam. The A1 horizon is slightly to moderately calcareous, and ranges from 7 to 13 inches in thickness. In the B2 horizon, chroma is 2 or 3. Reaction is moderately alkaline to very strongly alkaline. The B2 horizon is slightly to strongly calcareous and ranges from 3 to 7 inches in thickness.

In the Cca and C horizons, hue ranges from 7.5YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 7 when they are moist; an chroma ranges from 1 to 4. The C horizons are silty clay or silty clay loam and have layers, 1/16 to 3 inches thick, of very fine sandy loam or fine sandy loam. The Cca and C horizons are strongly calcareous to very strongly calcareous, and reaction is strongly alkaline or very strongly alkaline. Most areas have been drained, and depth to the water table is 48 to 60 inches or more, but where the soils are not drained, the water table is at a depth of 30 to 48 inches.

Distinct or faint mottles are at a depth of 26 to 36 inches and range from few to many and fine to medium.

Greenon silt loam, clay substratum (Gr).—This soil is on broad, low lake terraces and lake plains in the Bear River valley south and west of Tremonton. A profile of this soil is the one described as representative for the Greenon series. Slopes are 0 to 1 percent. The rate of water intake is moderate. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is 10 to 12 inches to a depth of 5 feet.

Included with this soil in mapping are small areas of Collett silty clay loam; Fielding silt loam, warm; Greenon silt loam, strongly alkali; and Honeyville silt clay loam.

This soil is used for irrigated tomatoes, sugar beets, alfalfa, small grains, irrigated pasture, and corn for silage. Capability unit IIIw-25, irrigated; range site not assigned.

Greenon silt loam, strongly alkali (Gs).—This soil is on low lake terraces and lake plains about 3 miles southwest of Tremonton. Slopes are 0 to 1 percent. The surface is very uneven where the soil has not been leveled. The rate of water intake is slow. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is about 10 to 12 inches to a depth of 5 feet, but the water available to plants is about 3 to 8 inches because of the high salt content. This soil is moderately to strongly affected by salts and alkali.

Included with this soil in mapping are small areas of Collett silty clay loam and Greenon silt loam, clay substratum.

This soil is used for irrigated alfalfa, sugar beets, small grains, corn for silage, and unimproved pasture. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Gullied Land

Gullied land (GU) is a miscellaneous land type that occurs on lake terraces and foothills in the western part of the survey area. It is characterized by an intricate network of gullies, some blowout areas, and few soil dunes. Gullied land is in areas of very silty soils that formed in mixed lake sediments and in loamy sand residuum on steep foothills. The gullies range from about 1 to 10 feet in depth. Gully banks, unprotected by vegetation, have been subjected to soil blowing and water erosion, and areas as large as 5 to 10 acres have been denuded of the original surface layer and, in some places, some of the subsoil. The small dunes are from 1 to 6 feet high and have a surface layer of silt loam or fine sandy loam. The vegetation consists of juniper, thorny hopsage, Indian ricegrass, and snakeweed in the foothills and greasewood, shadscale, big sagebrush, and squirreltail on the lake terraces. In the foothills, outcrops of rock are common.

Gullied land has some value for wildlife habitat. Capability unit VIIIe-E, nonirrigated; range site not assigned.

Hansel Series

The Hansel series consists of well-drained soils on lake terraces. These soils formed in mixed lake sediments derived from limestone, sandstone, and quartzite. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas consists of big sagebrush and bunchgrasses. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,400 to 5,000 feet.

In a representative profile (fig. 5), the surface layer is light brownish-gray silt loam about 10 inches thick. The subsoil is light-gray silty clay loam about 8 inches thick. The substratum, extending to a depth of 60 inches or more, is white and light-gray silty clay loam. The surface layer and subsoil are moderately alkaline and noncalcareous. The substratum is strongly alkaline to very strongly alkaline and strongly calcareous.

Permeability is moderately slow, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 9 to 10.5 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most are between depths of 20 and 30 inches.

These soils are used mainly for nonirrigated crops. Some areas are used for irrigated crops and wildlife habitat.

Representative profile of Hansel silt loam, 1 to 6 percent slopes, in a cultivated field, 800 feet north and 750 feet west of the east quarter corner of section 30, T. 13 N., R. 5 W., about 2¼ miles north and ½ mile west of Howell Post Office:

A11—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; common fine and medium pores; moderately alkaline (pH 8.2); clear, smooth boundary.

A12—6 to 10 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots;



Figure 5.—Profile of Hansel silt loam, 1 to 6 percent slopes.

common fine and medium pores; moderately alkaline (pH 8.2); clear, smooth boundary.

B21t—10 to 14 inches, light-gray (10YR 7/2) silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, medium, prismatic structure; slightly hard, firm, sticky and plastic; few very fine roots; common very fine pores; common thin clay films on ped faces; moderately alkaline (pH 8.2); clear, smooth boundary.

B22t—14 to 18 inches, light-gray (10YR 7/2) silty clay loam, brown (10YR 4/3) when moist; moderate, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; common medium pores; few thin clay films on ped faces; moderately alkaline (pH 8.4); gradual, wavy boundary.

C1ca—18 to 23 inches, white (10YR 8/2) light silty clay loam, pale brown (10YR 6/3) when moist; moderate, fine and medium, subangular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine roots; common medium pores; strongly calcareous; strongly alkaline (pH 8.6); gradual, wavy boundary.

C2ca—23 to 33 inches, white (10YR 8/2) light silty clay loam, light brownish gray (2.5YR 6/2) when moist; weak, fine and medium, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common medium pores; strongly calcareous, lime is nonindurated and disseminated; very strongly alkaline (pH 9.2); gradual, smooth boundary.

C3—33 to 45 inches, light-gray (2.5YR 7/2) silty clay loam, brown (10YR 5/3) when moist; massive; hard, firm, slightly sticky and slightly plastic; common medium pores; strongly calcareous, lime is nonindurated and veined; very strongly alkaline (pH 9.4); gradual, smooth boundary.

C4—45 to 62 inches, light-gray (2.5YR 7/2) silty clay loam, brown (10YR 5/3) when moist; massive; hard, firm, sticky and plastic; strongly calcareous, lime is nonindurated and veined; very strongly alkaline (pH 9.6).

These soils are usually dry at all depths between 4 and 12 inches. Depth to the horizon of carbonate accumulation ranges from 10 to 22 inches. In the A1 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Texture is mainly silt loam, but in places it is loam or heavy silt loam. The A1 horizon ranges from 4 to 15 inches in thickness, is mildly alkaline to strongly alkaline, and is noncalcareous or slightly calcareous.

In the B2t horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and ranges from 3 to 5 when they are moist; and chroma ranges from 2 to 4. This horizon is silty clay loam or heavy silt loam and ranges from 7 to 17 inches in thickness. Content of clay is dominantly 28 to 32 percent. Clay films are thin and range from few to common on ped faces. This horizon is neutral to strongly alkaline and noncalcareous to moderately calcareous.

The Cca horizon in most places begins at the lower boundary of the B2t horizon. The Cca and C horizons have a hue of 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; and chroma ranges from 2 to 4. These horizons are silty clay loam or silt loam. They are strongly alkaline or very strongly alkaline.

Hansel silt loam, 0 to 1 percent slopes (HaA).—This soil is on lake terraces. Slopes are medium to long. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Hansel silt loam, 1 to 6 percent slopes, and Thiokol silt loam, 0 to 1 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for wildlife habitat, and a small area is used for irrigated alfalfa, corn for silage, sugar beets, and small grains. Capability unit IIc-2, irrigated; capability unit IVc-U, nonirrigated; range site not assigned.

Hansel silt loam, 1 to 6 percent slopes (HaB).—This soil is on lake terraces. Slopes are medium in length and slightly convex. A profile of this soil is the one described as representative for the Hansel series. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Kearns silt loam, 3 to 6 percent slopes; Parleys silt loam, 1 to 6 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Thiokol silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated crops. Some areas are used for wildlife habitat. Capability unit IVe-UZ, nonirrigated; range site not assigned.

Hansel silt loam, 6 to 10 percent slopes (HaD).—This soil is generally on north- and east-facing slopes and is on lake terraces. Slopes are short to medium in length and are slightly convex. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes; Parleys silt loam, 6 to 10 percent slopes; and Pomat silt loam, 6 to 10 percent slopes.

This soil is used mainly for nonirrigated crops. Some areas are used for wildlife habitat. Capability unit IVe-UZ, nonirrigated; range site not assigned.

Harding Series

The Harding series consists of well-drained soils that are affected by alkali. These soils are in slightly depressed areas on lake terraces. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation consists of greasewood, shadscale, annual mustard, foxtail, cheatgrass, and annual weeds. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,230 to 4,500 feet.

In a representative profile, the surface layer is very pale brown silt loam about 5 inches thick. The subsoil is very pale brown silty clay about 14 inches thick. The substratum, extending to a depth of 60 inches is light-gray and pale-yellow silt loam and very fine sandy loam. The soils are strongly calcareous or moderately calcareous throughout and strongly alkaline to very strongly alkaline.

Permeability is slow above a depth of 19 inches but is moderate below that depth. The rate of water intake is slow. The water holding capacity is 10 to 12 inches to a depth of 5 feet, but the water available to plants is only about 3 to 6 inches because of the high salt content. Roots penetrate to depths below 60 inches, but most are less than 25 inches deep.

These soils are used for range and, to a limited extent, for wildlife habitat.

Representative profile of Harding silt loam, in range, 1,500 feet north and 1,200 feet east of the southwest corner of section 1, T. 9 N., R. 8 W., about 9 miles southwest of Golden Spike National Monument:

A11—0 to 2 inches, very pale brown (10YR 7/3) silt loam, olive brown (2.5YR 4/3) when moist; weak, medium, platy structure; slightly sticky and slightly plastic; common very fine and fine roots; many very fine and fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); clear, smooth boundary.

A12—2 to 5 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, thin, platy structure; soft, friable, sticky and slightly plastic; common very fine and fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.9); clear, smooth boundary.

B2t—5 to 12 inches, very pale brown (10YR 7/3) silty clay, yellowish brown (10YR 5/4) crushed, and brown (10YR 4/3) aggregate when moist; moderate, fine and medium, columnar structure; extremely hard, very firm, very sticky and very plastic; few very fine and fine roots; many very fine interstitial pores; continuous moderately thick clay films on ped faces; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); clear, smooth boundary.

B3tca—12 to 19 inches, very pale brown (10YR 7/3) silty clay, yellowish brown (10YR 5/4) when moist; weak, fine and medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, wavy boundary.

C1ca—19 to 25 inches, light-gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4) when moist; weak, medium, subangular blocky structure; very hard, firm, sticky and plastic; few very fine roots; many very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, smooth boundary.

C2ca—25 to 42 inches, light-gray (2.5Y 7/2) silt loam, light olive brown (2.5Y 5/4) when moist; massive; hard, friable, slightly sticky and slightly plastic; many very

fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); diffuse, wavy boundary.

C3—42 to 57 inches, light-gray (2.5Y 7/2) very fine sandy loam, light olive brown (2.5Y 5/4) when moist; few, fine, faint, light yellowish-brown (2.5Y 6/4) mottles; massive; soft, friable, nonsticky and nonplastic; moderately calcareous; very strongly alkaline (pH 9.2); gradual, wavy boundary.

C4—57 to 64 inches, pale-yellow (5Y 7/3) silt loam, olive (5Y 5/3) when moist; few, fine, faint, light yellowish-brown (2.5Y 6/4) mottles; massive; soft, very friable, nonsticky and nonplastic; moderately calcareous; strongly alkaline (pH 8.6).

The solum ranges from 18 to 21 inches in thickness. The soils are usually dry in all parts between depths of 4 and 12 inches.

In the A1 horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry. Structure is weak to moderate and very thin to medium platy. Reaction is strongly alkaline to very strongly alkaline. Thickness of the A1 horizon ranges from 4 to 5 inches.

In the B2t horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; and chroma is 3 or 4. This horizon is silty clay or heavy silty clay loam; content of clay ranges from 37 to 50 percent. Clay films range from thin to moderately thick and from many to continuous.

The Cca horizon in most places begins as the lower part of the B2t horizon. Hue ranges from 10YR to 5Y; value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; and chroma ranges from 2 to 4. This horizon is light silty clay loam, silt loam, or very fine sandy loam. Reaction is strongly alkaline to very strongly alkaline. Faint to distinct mottles are at depths of 25 to 45 inches. These soils are moderately to strongly affected by salts and alkali.

Harding silt loam (HD).—This soil is on lake terraces. Slopes are slightly concave and medium in length. Runoff is medium, and the hazard of erosion is moderate. In places many shallow to moderately deep gullies have been formed. Sheet erosion is common.

Included with this soil in mapping are small areas of Mellor silt loam, 1 to 6 percent slopes; Bram silt loam; and Palisade silt loam, 1 to 6 percent slopes.

This soil is used for range and, to a limited extent, for wildlife habitat. Capability unit VII_s-S8, nonirrigated; Semidesert Alkali Flats range site.

Hendricks Series

The Hendricks series consists of well-drained soils. These soils are on alluvial fans and foothill slopes in areas that are slightly above the highest lake terraces. They formed in alluvium and residuum derived mainly from sandstone and quartzite. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas consists mainly of bluebunch wheatgrass, slender wheatgrass, big sagebrush, balsamroot, yarrow, and annual grasses. Mean annual air temperature ranges from 45° to 49° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 110 to 130 days. Elevations range from 5,150 to 5,600 feet.

In a representative profile, the surface layer is dark grayish-brown silt loam about 6 inches thick. The subsoil is dominantly brown silty clay loam that extends to a depth of 67 inches or more. These soils are noncalcareous, except in the lower part of the subsoil. The surface layer is neutral, and the subsoil is neutral to moderately alkaline.

Permeability is moderately slow, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying

capacity is 14 to 16 inches before moisture is depleted. Roots penetrate to a depth of 60 inches.

Hendricks soils are used for nonirrigated crops.

Representative profile of Hendricks silt loam, 10 to 20 percent slopes, in a cultivated field, 250 feet west and 550 feet south of east quarter corner of section 9, T. 14 N., R. 5 W., in Pocatello Valley:

Ap—0 to 6 inches, dark grayish-brown (10YR 4/2) silt loam, very dark brown (10YR 2/2) when moist; weak, coarse, subangular blocky structure that parts to weak, medium, granular; soft, friable, nonsticky and slightly plastic; few fine roots; few fine interstitial pores; neutral (pH 7.1); abrupt, smooth boundary.

B1—6 to 11 inches, grayish-brown (10YR 5/2) light silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky; hard, firm, slightly sticky and plastic; few fine roots; common fine and a few medium interstitial pores; few thin clay films on ped faces; neutral (pH 7.3); gradual, wavy boundary.

B2t—11 to 21 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, slightly sticky and plastic; few very fine roots; few fine and medium interstitial pores; many moderately thick clay films on ped faces; mildly alkaline (pH 7.6); gradual, wavy boundary.

B22t—21 to 38 inches, light yellowish-brown (10YR 6/4) light silty clay loam, brown (7.5YR 4/4) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, slightly sticky and slightly plastic; few very fine roots; few medium interstitial pores; many thin clay films on ped faces; mildly alkaline (pH 7.6); gradual, wavy boundary.

B23t—38 to 56 inches, brown (10YR 5/3) light silty clay loam, dark brown (7.5YR 4/3) when moist; weak, coarse, subangular blocky structure that parts to weak, fine and medium, subangular blocky; very hard, firm, slightly sticky and slightly plastic; few very fine roots; few fine and common medium interstitial pores; many thin clay films on ped faces; mildly alkaline (pH 7.8); gradual, wavy boundary.

B24tca—56 to 67 inches, brown (7.5YR 5/4) silty clay loam, dark yellowish brown (10YR 4/4) when moist; moderate, fine and coarse, subangular blocky structure; very hard, firm, slightly sticky and plastic; few medium pores; many moderately thick clay films on ped faces; slightly calcareous, lime is veined; moderately alkaline (pH 8.0).

The solum ranges from 48 to 60 inches or more in thickness. Lime accumulation is at depths below 48 inches in places. The content of gravel is 5 to 10 percent throughout the profile in some places. The soils are usually moist, but they are dry in all parts between depths of 4 to 12 inches for more than 60 consecutive days in summer.

In the A horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is neutral or mildly alkaline and ranges from 6 to 12 inches in thickness.

The B1 horizon is 4 to 6 inches thick. In the B2t horizon, hue is 10YR or 7.5Y; value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. This horizon is silty clay loam or clay loam. Structure is weak to moderate and prismatic or subangular blocky. Reaction is mildly alkaline to moderately alkaline. Clay films are thin to moderately thick and common to continuous on ped faces.

In the C horizon, hue is 10YR or 7.5Y; value is 5 or 6 when the soils are dry; and chroma is 3 or 4. This horizon is light silty clay loam or heavy loam.

Hendricks silt loam, 1 to 6 percent slopes (HeB).—This soil is on alluvial fans in Pocatello Valley and Whites Valley. Slopes are medium in length. A profile of this soil is similar to that described as representative for the

Hendricks series, but the surface layer averages about 12 inches in thickness. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Forsgren silt loam, 1 to 6 percent slopes; Parleys silt loam, 1 to 6 percent slopes; and Red Rock silt loam, high rainfall, 0 to 3 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIe-M, nonirrigated; range site not assigned.

Hendricks silt loam, 6 to 10 percent slopes (HeD).— This soil generally is on north- or east-facing slopes on alluvial fans in Pocatello Valley and Whites Valley. Slopes are medium in length. A profile of this soil is similar to that described as representative for the Hendricks series, but the surface layer averages about 7 inches in thickness. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Forsgren silt loam, 6 to 10 percent slopes; Parleys silt loam, 6 to 10 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe-M, nonirrigated; range site not assigned.

Hendricks silt loam, 10 to 20 percent slopes (HeE).— This soil is on generally north- or east-facing slopes, which are short to medium in length, and on alluvial fans and foothill slopes that are slightly above the highest lake terraces. A profile of this soil is the one described as representative for the Hendricks series. Runoff is rapid, and the hazard of erosion is high. Moderate sheet and rill erosion is common in some areas.

Included with this soil in mapping are small areas of Forsgren silt loam, 10 to 20 percent slopes; Hendricks silt loam, 6 to 10 percent slopes; Parleys silt loam, 10 to 20 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IVe-M, nonirrigated; range site not assigned.

Hendricks complex, 6 to 10 percent slopes (HkD).— This complex is on medium-length foothill slopes and alluvial fans just above the highest lake terraces in Pocatello Valley. It consists of about 60 percent Hendricks silt loam, 6 to 10 percent slopes, and 30 percent Kearns silt loam, high lime variant, 6 to 10 percent slopes. Included with these soils in mapping are areas of Forsgren silt loam, 6 to 10 percent slopes; Munk gravelly silt loam, 10 to 20 percent slopes; and Parleys silt loam, 6 to 10 percent slopes. These included soils make up about 10 percent of the total acreage.

The Hendricks soil is on slightly concave, north- and east-facing slopes of the drainageways and in the flat area between drainageways. The Kearns high lime variant is on slightly steeper slopes that extend into the drainageways and is on convex knolls. It is calcareous throughout and has a layer of lime accumulation at a depth of 12 inches.

Runoff is medium on these soils, and the hazard of erosion is moderate.

The soils of this complex are used for nonirrigated small grains. Capability unit IIIe-M, nonirrigated; range site not assigned.

Honeyville Series

The Honeyville series consists of moderately well drained soils. These soils are on broad, low lake terraces and lake plains in the Bear River valley south and west of Garland. They formed in calcareous, fine textured and moderately fine textured, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation in noncultivated areas consists of western wheatgrass, Great Basin wildrye, big sagebrush, and annual weeds. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 130 to 150 days. Elevations range from 4,260 to 4,355 feet.

In a representative profile, the surface layer is grayish-brown silty clay loam about 13 inches thick. The subsoil is brown and pale-brown silty clay loam about 19 inches thick. The substratum is pale-brown and pinkish-gray silty clay loam that extends to a depth of 64 inches. The surface layer is moderately calcareous and moderately alkaline to strongly alkaline; the subsoil is moderately calcareous and strongly alkaline; and the substratum is strongly calcareous and strongly alkaline to very strongly alkaline. A layer of strong lime accumulation is at a depth of 32 inches.

Permeability is slow, and the rate of water intake is moderate. Available water holding capacity is 10.5 to 12 inches to a depth of 5 feet. Roots are mainly above the water table, but where the soils are drained, roots penetrate to a depth of 48 inches or more.

Honeyville soils are used for irrigated crops.

Representative profile of Honeyville silty clay loam, in a cultivated area, 900 feet north and 1,800 feet west of the northeast corner of section 22, T. 11 N., R. 3 W., about 2 miles south of Tremonton:

- Ap—0 to 8 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine and medium pores; moderately calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.
- A1—8 to 13 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; hard, firm, sticky and plastic; few fine roots; many fine, medium, and coarse pores; moderately calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.
- B21—13 to 19 inches, brown (10YR 5/3) heavy silty clay loam, dark brown (10YR 3/3) when moist; weak, coarse, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, sticky and plastic; few fine roots; many fine and medium pores; few thin clay films on ped faces; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, smooth boundary.
- B22—19 to 32 inches, pale-brown (10YR 6/3) heavy silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to weak, coarse, subangular blocky; very hard, very firm, very sticky and plastic; few fine and very fine roots; common fine pores and few medium pores; few thin clay films on ped faces; moderately calcareous; strongly alkaline (pH 8.5); clear, wavy boundary.
- C1ca—32 to 40 inches, pale-brown (10YR 6/3) heavy silty clay loam, brown (10YR 5/3) when moist; common, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, very sticky and very plastic; few very fine roots; many fine and few medium pores; strongly calcareous, some lime veins; very strongly alkaline (pH 9.2); clear, wavy boundary.

C2ca—40 to 64 inches, pinkish-gray (7.5YR 6/2) heavy silty clay loam, brown (10YR 5/3) when moist; common, fine, prominent, strong-brown (7.5YR 5/6) mottles; massive; very hard, very firm, sticky and very plastic; common very fine and few large pores; strongly calcareous, some laminar lime veins; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 19 to 36 inches. Between depths of 10 and 40 inches, the texture averages heavy silty clay loam and the content of clay ranges from 35 to 40 percent. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, chroma is 2 or 3. Texture is silty clay loam or heavy silty clay loam. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is slightly or moderately calcareous and ranges from 7 to 15 inches in thickness.

In the B2 horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. Texture is heavy silty clay loam or light silty clay. Reaction is moderately alkaline to strongly alkaline. The B2 horizon is moderately to strongly calcareous.

In the Cca horizon, hue is 7.5YR or 10YR; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Mottles are at a depth below 30 inches and are few to common, fine to medium, and faint to prominent. This horizon is silty clay or silty clay loam. It is strongly alkaline to very strongly alkaline and moderately calcareous to strongly calcareous. Most of the acreage of these soils has been drained, and the depth to the water table is 44 inches to more than 60 inches. Where the soils are not drained, the water table is at a depth of 30 to 44 inches.

Honeyville silty clay loam (Ho).—This soil is on broad, low lake terraces and lake plains in Bear River Valley south and west of Garland. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight. Most areas of this soil have been leveled and tile drained.

Included with this soil in mapping are small areas of Collett silty clay loam; Fielding silt loam, warm; and Greenson silt loam, clay substratum.

This soil is used for irrigated alfalfa, small grains, sugar beets, corn for silage, tomatoes, and irrigated pasture. Capability unit IIIw-25, irrigated; range site not assigned.

Hupp Series

The Hupp series consists of well-drained soils. These soils are on alluvial fans, mainly in the northern and central parts of the survey area. They formed in very gravely and cobbly alluvium derived mainly from limestone, sandstone, and quartzite parent rocks. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas mainly consists of big sagebrush, yellowbrush, bluebunch wheatgrass, Sandberg bluegrass, cheatgrass, and annual weeds. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation is 13 to 14 inches, and the frost-free period is 100 to 140 days. Elevations range from 4,300 to 5,300 feet.

In a representative profile (fig. 6), the surface layer is grayish-brown and brown gravelly silt loam about 18 inches thick. The subsoil is pale-brown very gravelly silt loam about 14 inches thick. The substratum is pale-brown very gravelly silt loam that extends to a depth of 60 inches or more. The surface layer is mildly alkaline and slightly calcareous in the lower part. The subsoil and substratum are moderately alkaline and moderately calcareous. A layer of strong lime accumulation is at a depth of 32 inches.

Permeability is moderately rapid. Roots penetrate to a depth of more than 60 inches, but most roots are concentrated in the upper 30 inches of soil.

These soils are used about equally for range and non-irrigated crops. Some areas are used for wildlife habitat.

Representative profile of Hupp gravelly silt loam, 6 to 10 percent slopes, in range, 2,100 feet east and 1,300 feet north of the southwest corner of section 20, T. 13 N., R. 6 W., in the southeast area of Hansel Valley:

A11—0 to 6 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when



Figure 6.—Profile of Hupp gravelly silt loam, 6 to 10 percent slopes.

moist; weak, fine, subangular blocky structure that parts to weak, fine, granular; soft, friable, slightly sticky and nonplastic; common fine roots and few medium roots; about 20 percent gravel; mildly alkaline (pH 7.6); clear, smooth boundary.

- A12—6 to 13 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; soft, friable, slightly sticky and slightly plastic; few fine and very fine roots; few, fine, discontinuous pores; about 25 percent gravel; mildly alkaline (pH 7.6); clear, smooth boundary.
- A13—13 to 18 inches, brown (10YR 5/3) gravelly silt loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure that parts to weak, medium, granular; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few, very fine, discontinuous pores; slightly calcareous; about 35 percent gravel; mildly alkaline (pH 7.8); clear, smooth boundary.
- B2—18 to 32 inches, pale-brown (10YR 6/3) very gravelly silt loam, brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; hard, firm, slightly sticky and plastic; few very fine roots; common very fine tubular pores; about 50 percent gravel and cobblestones; few thin clay films on ped faces; moderately calcareous, lime is in laminar veins; moderately alkaline (pH 8.0); gradual, wavy boundary.
- Cca—32 to 60 inches, pale-brown (10YR 6/3) very gravelly silt loam, brown (10YR 5/3) moist; weak, fine and medium, subangular blocky structure; hard, friable slightly sticky and slightly plastic; many, very fine discontinuous pores; about 50 percent gravel and cobblestones; moderately calcareous, lime is in veins; moderately alkaline (pH 8.4).

The solum ranges from 17 to 32 inches in thickness. Between depths of 10 and 40 inches, the texture averages very gravelly or very cobbly silt loam or very gravelly or very cobbly loam and the content of coarse fragments averages more than 50 percent. The coarse fragments are mainly gravel and cobblestone-sized angular fragments of limestone and sandstone. The content of coarse fragments ranges from 5 to 50 percent in the A1 horizon but is mainly 20 to 35 percent; 30 to 80 percent in the B2 horizon; and 50 to 90 percent in the C horizon. The soils are usually moist but are dry between depths of 8 and 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is silt loam, gravelly silt loam, very gravelly silt loam, gravelly loam, or very gravelly loam, and it ranges from 7 to 18 inches in thickness. The horizon is neutral to moderately alkaline and is generally noncalcareous, but it may be slightly calcareous in the lower part.

In the B2 horizon, value is 3 or 4 when the soils are moist; chroma ranges from 2 to 4. This horizon is very gravelly silt loam, very gravelly loam, or very cobbly loam. It is moderately or strongly alkaline and is noncalcareous to moderately calcareous, but mainly is moderately calcareous. A few clay films are on ped faces in places.

In the Cca horizon, value is 5 or 6 when the soils are dry and ranges from 3 to 5 when they are moist; chroma ranges from 2 to 4. Texture is very gravelly silt loam, very cobbly silt loam, very gravelly loam, very cobbly loam, very gravelly sandy loam, very gravelly loamy sand, or very cobbly loamy sand. Reaction is moderately alkaline to very strongly alkaline. The Cca horizon is moderately calcareous to strongly calcareous; gravel and cobblestones have thin coatings of lime on the bottom surfaces.

Hupp gravelly silt loam, 1 to 6 percent slopes (HpB).—This soil is on alluvial fans. Slopes are slightly convex and medium in length. Runoff is slow, and the hazard of erosion is slight. The rate of water intake is rapid. Available water holding capacity is 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is about 8 to 9 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of DeJarnet gravelly silt loam, 1 to 6 percent slopes; Kearns silt loam, 3 to 6 percent slopes; and Sterling gravelly loam, 1 to 6 percent slopes.

This soil is used about equally for range and nonirrigated small grains. It is also used for wildlife habitat. Capability unit IVs-UZ, nonirrigated; Upland Stony Loam range site.

Hupp gravelly silt loam, 6 to 10 percent slopes (HpD).—This soil is mainly on east- and west-facing slopes on alluvial fans. Slopes are slightly convex and are medium in length to long. A profile of this soil is the one described as representative for the Hupp series. Runoff is medium and the hazard of erosion is moderate. The rate of water intake is rapid. Available water holding capacity is 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is about 8 to 9 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Abela gravelly loam, 10 to 20 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Sterling gravelly loam 6 to 20 percent slopes.

This soil is used mainly for range and nonirrigated small grains. It is also used for wildlife habitat. Capability unit IVs-UZ, nonirrigated; Upland Stony Loam range site.

Hupp silt loam, 3 to 6 percent slopes (HuC).—This soil is on east- and south-facing slopes on alluvial fans, mainly in Howell Valley. Slopes are medium in length. A profile of this soil is similar to that described as representative for the Hupp series, but in the upper 9 to 16 inches the content of coarse fragments is only 5 to 15 percent. Runoff is medium, and the hazard of erosion is moderate. The rate of water intake is moderate. Available water holding capacity is 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is about 8 to 9 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 3 to 6 percent slopes; and Sterling gravelly loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for wildlife habitat, and a very small area is used for range. Capability unit IVs-UZ, nonirrigated; range site not assigned.

Hupp silt loam, 6 to 10 percent slopes (HuD).—This soil is on east- and south-facing slopes on alluvial fans, mainly in Howell Valley. Slopes are medium in length. A profile of this soil is similar to that described as representative for the series, but in the upper 9 to 16 inches the content of coarse fragments is only 5 to 15 percent. Runoff is medium, and the hazard of erosion is moderate. The rate of water intake is moderate. Available water holding capacity is about 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is about 8 to 9 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used mainly for nonirrigated small grains and alfalfa. Some areas are used for wildlife habitat, and a very small area is used for range. Capability unit IVs-UZ, nonirrigated; range site not assigned.

James Canyon Series

The James Canyon series consists of somewhat poorly drained soils. These soils are on alluvial fans in the vicinity of Brigham City and Willard. They formed in alluvium derived mainly from quartzite and sandstone. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas consists of bluegrass, wiregrass, sedges, foxtail, and clover. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 150 to 160 days. Elevations range from 4,250 to 4,300 feet.

In a representative profile, the surface layer is very dark gray and dark-gray loam about 35 inches thick. The underlying layers, extending to a depth of about 60 inches, are gray gravelly loam and gravelly sandy loam. The soils are neutral throughout.

Permeability and the rate of water intake are both moderate. Available water holding capacity is 7 to 10 inches to a depth of 5 feet. Most roots are in the top 36 inches but may extend to a depth of 60 inches.

James Canyon soils are used for irrigated crops and native pasture.

Representative profile of James Canyon loam, 0 to 3 percent slopes, in a cultivated area, 120 feet north and 480 feet west of the south quarter corner of section 12, T. 9 N., R. 2 W., one-half mile north of the Brigham City Golf Course:

- Ap—0 to 8 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) when moist; weak, fine, granular structure; slightly hard, friable, nonsticky and nonplastic; many very fine, fine, and medium roots; neutral (pH 7.3); abrupt, smooth boundary.
- A11—8 to 15 inches, very dark gray (10YR 3/1) loam, black (10YR 2/1) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; many very fine, fine, and medium roots; many very fine pores; neutral (pH 7.2); gradual, wavy boundary.
- A12—15 to 35 inches, dark-gray (10YR 4/1) loam, black (10YR 2/1) when moist; massive; slightly hard, friable, nonsticky and slightly plastic; common fine roots; few fine pores; neutral (pH 7.2); gradual, wavy boundary.
- C1—35 to 40 inches, gray (10YR 5/1) gravelly loam, very dark gray (10YR 3/1) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few fine and very fine roots; 35 percent gravel; neutral; gradual, irregular boundary.
- C2—40 to 60 inches, gray (10YR 5/1) gravelly sandy loam, very dark gray (10YR 3/1) when moist; massive; slightly hard, friable, nonsticky and nonplastic; 40 percent gravel; neutral (pH 7.3).

Texture between depths of 10 and 40 inches averages loam. Depth to the water table usually ranges from 20 to 40 inches, but if the soils are drained, the water table is at a depth below 40 inches.

In the A1 horizon, value is 3 or 4 when the soils are dry. Texture is loam or light loam, and content of gravel ranges from 5 to 20 percent. Reaction is neutral to moderately alkaline. The A1 horizon ranges from 26 to 36 inches in thickness.

In the C horizon, hue is 10YR or 2.5Y; value ranges from 4 to 6 when the soils are dry and from 2 to 4 when they are moist; and chroma is 1 or 2. Texture is gravelly loam, gravelly sandy loam, or very gravelly sandy loam, and content of gravel ranges from 20 to 70 percent. Reaction is neutral to moderately alkaline.

James Canyon loam, 0 to 3 percent slopes (JaA).—This soil is on alluvial fans in the vicinity of Brigham City and Willard. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Wasatch gravelly sandy loam, 3 to 10 percent slopes; Roshe Springs silt loam; and Draper loam, 0 to 3 percent slopes.

Where the water table is controlled by subsurface tile drainage or by diverting water that would normally enter the profile, this soil is used for irrigated crops. Common crops are alfalfa, tomatoes, sugar beets, melons, corn for silage, irrigated pastures, and small grains. Where the water table is not controlled, this soil supports a pasture of bluegrass, sedges, wiregrass, meadow foxtail, and clover that can be mowed for hay. Capability unit IIw-2, irrigated; Semiwet Meadow range site.

Kapod Series

The Kapod series consists of well-drained soils. These soils are on lake terraces and foot slopes west of Garland. They formed in very cobbly and stony alluvium and mixed lake sediments derived mainly from sandstone and limestone. Slopes range from 6 to 20 percent. The vegetation consists of bluebunch wheatgrass, Great Basin wildrye, western wheatgrass, big sagebrush, snakeweed, cheatgrass, and annual weeds. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation is 15 to 16 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,500 to 5,000 feet.

In a representative profile, the surface layer is dark-brown very cobbly loam about 13 inches thick. Content of stones is about 5 percent (fig. 7). The subsoil is brown very cobbly sandy clay loam and pale-brown very cobbly loam about 18 inches thick. Content of stones is about 5 percent. The substratum is very pale brown very gravelly loam that extends to a depth of about 66 inches. The surface layer is moderately alkaline, the subsoil is moderately alkaline and slightly calcareous or moderately calcareous, and the substratum is strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is about 6 to 7 inches before moisture is depleted. Roots penetrate to a depth of more than 60 inches.

These soils are used for range and wildlife habitat.

Representative profile of Kapod stony loam, 6 to 20 percent slopes, in range, 1,600 feet south and 160 feet west of the north quarter corner of section 29, T. 12 N., R. 3 W., on foothills west of Garland:

- A11—0 to 6 inches, dark-brown (10YR 3/3) very cobbly loam, very dark brown (10YR 2/2) when moist; weak, thick, platy and medium, subangular blocky structure that parts to moderate, fine, granular; soft, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; about 50 percent cobblestones and gravel and 5 percent stones; moderately alkaline (pH 8.0); clear, smooth boundary.
- A12—6 to 13 inches, dark-brown (10YR 3/3) very cobbly loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure that parts to moderate, fine, granular; soft, friable, slightly sticky and slightly plastic; common fine roots and few medium roots; about 60 percent cobblestones and gravel and 5 percent stones; moderately alkaline (pH 8.2); clear, smooth boundary.
- B21t—13 to 18 inches, brown (10YR 4/3), very cobbly sandy clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium and coarse, subangular blocky structure; slightly hard, firm, sticky and plas-



Figure 7.—Profile of Kapod stony loam, 6 to 20 percent slopes.

tic; few fine and very fine roots; few fine and very fine pores; many thin clay films on ped faces; slightly calcareous; 70 percent cobbles and gravel and 5 percent stones; moderately alkaline (pH 8.2); clear, wavy boundary.

B22t—18 to 31 inches, pale-brown (10YR 6/3) very cobbly loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; few fine pores; common thin clay films on ped faces; moderately calcareous; about 70 percent cobbles and gravel and 5 percent stones; moderately alkaline (pH 8.2); abrupt, wavy boundary.

C1ca—31 to 52 inches, very pale brown (10YR 7/3) very gravelly loam, pale brown (10YR 6/3) when moist; massive; hard, firm, sticky and slightly plastic; few fine roots; few fine pores; about 70 percent gravel; strongly calcareous, lime is in veins; strongly alkaline (pH 8.7); clear, wavy boundary.

C2—52 to 66 inches, very pale brown (10YR 7/3) very gravelly loam, light yellowish brown (10YR 6/4) when moist; massive; hard, firm, sticky and slightly plastic; about 50 percent gravel; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

The solum ranges from 20 to 33 inches in thickness. Coarse fragments are mainly subrounded sandstone and limestone. The soils are usually moist, but in most years they are dry in

all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value ranges from 3 to 5 when the soils are dry and is 2 or 3 when they are moist; chroma is 2 or 3. Texture is cobbly loam or very cobbly loam that is 40 to 60 percent cobbles and gravel and 5 to 10 percent stones. Reaction is neutral to moderately alkaline. Thickness of the A1 horizon ranges from 8 to 13 inches.

In the B2t horizon, value ranges from 4 to 6 when the soils are dry and is 3 or 4 when they are moist; chroma ranges from 2 to 4. Texture is very cobbly sandy clay loam or very cobbly loam, and the content of coarse fragments ranges from 50 to 80 percent cobbles and gravel and from 5 to 10 percent stones. Reaction is neutral to moderately alkaline. Clay films are common to continuous and thin to moderately thick on ped faces. This horizon is 10 to 18 inches thick.

In the Cca and C horizons, value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; chroma ranges from 2 to 4. Texture is very cobbly or very gravelly loam, very cobbly or very gravelly sandy loam, or very cobbly or very gravelly sand. Content of coarse fragments ranges from 50 to 85 percent gravel and cobbles and some stones. Reaction is moderately alkaline or strongly alkaline. The C horizon is moderately to strongly calcareous and in some places is weakly cemented.

Kapod stony loam, 6 to 20 percent slopes (KaE).—

This soil is on east- and south-facing slopes on lake terraces and foot slopes (fig. 8). It occurs as long, narrow, stony strips that are intermingled with areas of nonirrigated cropland. Most of the acreage is along the foothills west of Garland. Slopes are medium in length and slightly convex. A profile of this soil is the one described as representative for the series. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Bingham gravelly loam, 6 to 10 percent slopes; Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Middle cobbly silt loam, 10 to 30 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VIIs-U, nonirrigated; Upland Stony Loam range site.

Kearns Series

The Kearns series consists of well-drained soils. These soils are on alluvial fans and lake terraces and are widely distributed throughout the survey area. They formed in alluvium and mixed lake sediments derived mainly from limestone, sandstone, and quartzite. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas is mainly bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, cheatgrass, and annual weeds. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is 115 to 130 days. Elevations range from 4,350 to 5,250 feet.

In a representative profile, the surface layer is grayish-brown and brown silt loam about 9 inches thick. The subsoil is pale-brown silt loam about 6 inches thick. The substratum, between depths of 15 and 60 inches or more, is pale-brown silt loam and very pale brown silt loam and loam. The surface layer is moderately alkaline and slightly calcareous or noncalcareous; the subsoil is moderately alkaline and moderately calcareous; and the substratum is moderately alkaline to strongly alkaline and strongly calcareous or moderately calcareous. A layer of lime accumulation is at a depth of about 15 inches.

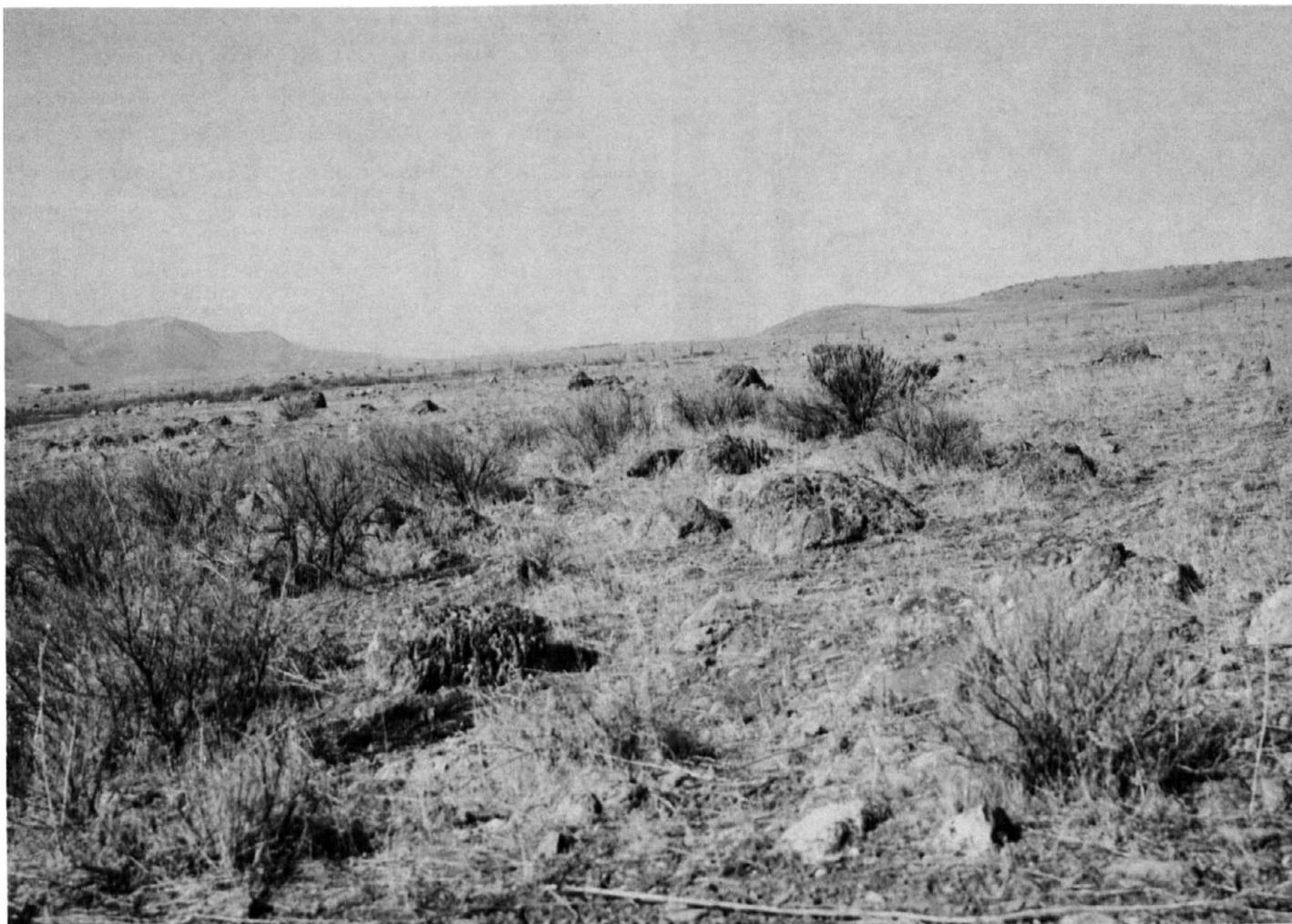


Figure 8.—Kapod stony loam, 6 to 20 percent slopes, on south-facing lake terraces.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. The water-supplying capacity is 10 to 12 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches or more.

These soils are used mainly for nonirrigated crops and wildlife habitat. Small areas are used for irrigated crops.

Representative profile of Kearns silt loam, 3 to 6 percent slopes, in a cultivated area, 660 feet west and 660 feet south of the north quarter corner of section 31, T. 12 N., R. 5 W., about 4 miles south of the Howell post office:

- Ap—0 to 5 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine pores; slightly calcareous; moderately alkaline (pH 8.0); clear, smooth boundary.
- A1—5 to 9 inches, brown (10YR 5/3) silt loam, dark brown (10YR 3/3) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; few fine roots; many fine pores; noncalcareous; moderately alkaline (pH 8.2); clear, wavy boundary.
- B2—9 to 15 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; moderate, fine and medium,

subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.

- C1ca—15 to 20 inches, pale-brown (10YR 6/3) silt loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; strongly calcareous, lime is veined; moderately alkaline (pH 8.4); gradual, wavy boundary.

- C2ca—20 to 39 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; hard, very friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; moderately calcareous, lime is laminar and veined; strongly alkaline (pH 8.6); gradual, wavy boundary.

- IIC3ca—39 to 76 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; slightly hard, very friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 13 to 27 inches. In places a few pebbles are on the surface and throughout the profile. Texture between depths of 10 and 40 inches averages silt loam. The soils are

usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, chroma is 2 or 3. This horizon is silt loam or loam and ranges from 7 to 14 inches in thickness. Reaction is mildly alkaline or moderately alkaline.

In the B2 horizon, hue is 10YR or 2.5Y; value ranges from 5 to 7 when the soils are dry and is 3 or 4 when they are moist; and chroma is 2 or 3. This horizon is silt loam or heavy silt loam and is 5 to 16 inches thick. It is mildly alkaline to strongly alkaline and noncalcareous to moderately calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value ranges from 5 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam in the upper part but may be fine sandy loam, loam, or silt loam in the lower part. This horizon is strongly alkaline to very strongly alkaline.

Kearns silt loam, 1 to 3 percent slopes (KeB).—This soil is on alluvial fans and lake terraces. Slopes are slightly convex and medium in length. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Fridlo silt loam; Hansel silt loam, 1 to 6 percent slopes; Kearns silt loam, 3 to 6 percent slopes; and Thiokol silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for irrigated alfalfa, small grains, corn for silage, and sugar beets and also for wildlife habitat. Capability unit IIc-2, irrigated; capability unit IIIe-U, nonirrigated; range site not assigned.

Kearns silt loam, 3 to 6 percent slopes (KeC).—This soil is on terraces and broad, long alluvial fans. A profile of this soil is the one described as representative for the Kearns series. Runoff is slow, and the hazard of erosion is slight in nonirrigated areas and moderate in irrigated areas.

Included with this soil in mapping are small areas of Hansel silt loam, 1 to 6 percent slopes; Hupp gravelly silt loam, 1 to 6 percent slopes; Thiokol silt loam, 1 to 6 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. Small areas are used for irrigated alfalfa, small grains, and corn for silage and irrigated pasture and also for wildlife habitat. Capability unit IIe-2, irrigated; capability unit IIIe-U, nonirrigated; range site not assigned.

Kearns silt loam, 6 to 10 percent slopes (KeD).—This soil is on lake terraces and alluvial fans. Slopes are slightly convex and short to medium in length. Runoff is medium, and the hazard of erosion is moderate. Rill erosion is common, and there are a few shallow gullies.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 3 to 6 percent slopes; Thiokol silt loam, 6 to 10 percent slopes; and Timpanogos silt loam, 6 to 10 percent slopes.

This soil is used mainly for nonirrigated small grains and for wildlife habitat. Some areas are used for irrigated alfalfa and small grains. Capability unit IIIe-U, nonirrigated; range site not assigned.

Kearns silt loam, 10 to 20 percent slopes (KeE).—This soil is on alluvial fans. Slopes are convex and short. Runoff is rapid, and the hazard of erosion is high. Rill erosion is common, and there are a few shallow gullies.

Included with this soil in mapping are small areas of Abela gravelly loam, 10 to 20 percent slopes; Kearns silt

loam, 6 to 10 percent slopes; and Parleys silt loam, 10 to 20 percent slopes.

This soil is used for nonirrigated small grains and wildlife habitat. Capability unit IVe-U, nonirrigated; range site not assigned.

Kearns-Stingal complex, 6 to 10 percent slopes (KgD).—This complex is on intermediate and high lake terraces and alluvial fans in the south-central part of the survey area. It consists of about 50 percent Kearns silt loam, 6 to 10 percent slopes, and 40 percent Stingal silt loam, 6 to 10 percent slopes. Included with these soils in mapping are areas of Eccles fine sandy loam, 6 to 10 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes. These included areas make up about 10 percent of the total acreage.

These soils are intermingled. The Stingal soil is on convex knolls and ridges, and the Kearns soil is in slightly concave areas between the knolls and ridges. Average annual precipitation is 13 to 14 inches. Runoff is medium, and the hazard of erosion is moderate for these soils.

This complex is in capability unit IVe-UZ, nonirrigated; range site not assigned.

Kearns Series, High Lime Variant

The Kearns series, high lime variant, consists of well-drained soils. These soils are in Pocatello Valley and are on alluvial fans and foothill slopes that are slightly above the highest lake terraces. They formed in alluvium and colluvium derived mainly from limestone and sandstone. Slopes range from 6 to 20 percent. The vegetation in noncultivated areas is dominantly bluebunch wheatgrass, slender wheatgrass, big sagebrush, and annual grasses. Mean annual air temperature ranges from 45° to 49° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 110 to 130 days. Elevations range from 5,175 to 5,500 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 8 inches thick. The subsoil is pale-brown light clay loam about 4 inches thick. The substratum, extending to a depth of about 60 inches, is very pale brown clay loam in the upper part and sandy clay loam in the lower part. The surface layer is moderately alkaline and slightly calcareous, the subsoil is moderately alkaline and strongly or very strongly calcareous, and the substratum is strongly alkaline and strongly or very strongly calcareous. A layer of lime accumulation is at a depth of about 12 inches and is weakly cemented below a depth of 18 inches.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. The water-supplying capacity is 12 to 13 inches before moisture is depleted. Roots are mainly in the upper 30 inches of the soil but may penetrate to a depth of more than 60 inches.

These soils are used for nonirrigated crops.

Representative profile of Kearns silt loam, high lime variant, 10 to 20 percent slopes, in a cultivated area, 1,700 feet west and 50 feet south of the southeast corner of section 15, T. 14 N., R. 6 W., northern Blue Creek Valley:

Ap-0 to 8 inches, grayish-brown (10YR 5/2) silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few very fine roots; slightly

- calcareous; moderately alkaline (pH 8.2); abrupt, smooth boundary.
- B2—8 to 12 inches, pale-brown (10YR 6/2) light clay loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common very fine pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.
- C1ca—12 to 18 inches, very pale brown (10YR 8/3) clay loam, very pale brown (10YR 7/3) when moist; massive; hard, firm, sticky and slightly plastic; few fine and very fine roots; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.
- C2ca—18 to 29 inches, very pale brown (10YR 8/3) light clay loam, very pale brown (10YR 7/3) when moist; massive; hard, firm, slightly sticky and slightly plastic; few very fine roots; many very fine pores; very strongly calcareous, weakly cemented, lime is disseminated, many lime nodules; strongly alkaline (pH 8.8); clear, wavy boundary.
- C3ca—29 to 60 inches, very pale brown (10YR 8/3) light sandy clay loam, very pale brown (10YR 7/3) when moist; massive; extremely hard, friable, nonsticky and nonplastic; common very fine pores; 10 percent gravel; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Depth to the horizon of carbonate accumulation ranges from 12 to 16 inches. Between depths of 10 and 40 inches, the texture averages clay loam and the content of clay ranges from 20 to 32 percent. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, chroma is 2 or 3. This horizon is slightly or moderately calcareous and ranges from 7 to 10 inches in thickness. In the B2 horizon, chroma is 2 or 3. This horizon is mainly clay loam but may be heavy silt loam. It is moderately calcareous or strongly calcareous and ranges from 4 to 6 inches in thickness.

In the Cca horizon, hue is 10YR or 7.5YR; value is 7 or 8 when the soils are dry and ranges from 5 to 7 when they are moist; and chroma is 3 to 4. Texture is clay loam or heavy silt loam in the upper part and sandy clay loam, loam, or sandy loam in the lower part. In places, this horizon is weakly to strongly cemented and contains few to many lime nodules.

Kearns silt loam, high lime variant, 10 to 20 percent slopes (KhE).—This mapping unit is on alluvial fans and foothill slopes in Pocatello Valley in areas that are slightly above the highest lake terraces. It consists of about 60 percent Kearns silt loam, high lime variant, 10 to 20 percent slopes, and 30 percent Hendricks silt loam, 10 to 20 percent slopes. Included with these soils in mapping are areas of Munk gravelly silt loam, 10 to 20 percent slopes; Parleys silt loam, 10 to 20 percent slopes; and Pomat silt loam, 10 to 30 percent slopes. These included soils make up about 10 percent of the total acreage.

The soils in this mapping unit are intermingled. The Kearns variant is on convex knolls and short, generally south-facing slopes. The Hendricks soil is on north- and east-facing slopes that are slightly concave.

Runoff is rapid, and the hazard of erosion is high. Sheet and rill erosion is moderate, and a few shallow gullies have been formed.

These soils are used for nonirrigated small grains. Capability unit IVE-U, nonirrigated; range site not assigned.

Kidman Series

The Kidman series consists of well-drained soils. These soils are on broad lake terraces and are widely distributed throughout the survey area. They formed in mixed lake

sediments derived mainly from sandstone, limestone, and quartzite and from shore deposits that have been reworked by wind. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas is sagebrush, bluebunch wheatgrass, western wheatgrass, cheatgrass, and annual weeds. Mean annual air temperature ranges from 46° to 51° F. Average annual precipitation ranges from 13 to 17 inches, and the frost-free period is 115 to 155 days. Elevations range from 4,250 to 5,150 feet.

In a representative profile, the surface layer is brown fine sandy loam about 14 inches thick. The subsoil is brown fine sandy loam about 15 inches thick. The substratum is light-gray, pinkish-gray, and very pale brown fine sandy loam that extends to a depth of about 60 inches. A layer of strong lime accumulation is at a depth of 29 inches. The surface layer and subsoil are moderately alkaline. The substratum is moderately alkaline to strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 7.5 to 9 inches to a depth of 5 feet. The water-supplying capacity is 10 to 11 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches or more.

These soils are used for irrigated and nonirrigated crops.

Representative profile of Kidman fine sandy loam, 0 to 2 percent slopes, in a cultivated area, at a point 590 feet east and 205 feet north of the south quarter corner of section 1, T. 11 N., R. 3 W., about 1½ miles east of Tremonton:

- Ap—0 to 6 inches, brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, coarse, granular structure; soft, friable, nonsticky and nonplastic; common fine and very fine roots; moderately alkaline (pH 8.2); abrupt, smooth boundary.
- A1—6 to 14 inches, brown (10YR 4/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, fine and medium, subangular blocky structure; soft, friable, nonsticky and nonplastic; common fine and very fine roots; moderately alkaline (pH 8.2); gradual, smooth boundary.
- B2—14 to 29 inches, brown (10YR 5/3) fine sandy loam, brown (10YR 4/3) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine and fine roots; common fine and very fine tubular pores; few thin clay films as coatings on sand grains; few krotovinas one-half inch in diameter; moderately alkaline (pH 8.2); clear, wavy boundary.
- C1ca—29 to 41 inches, light-gray (10YR 7/2) fine sandy loam, pale brown (10YR 6/3) when moist; weak, coarse, subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine roots; common very fine tubular pores; strongly calcareous, lime is disseminated and nodular; moderately alkaline (pH 8.4); abrupt, wavy boundary.
- C2ca—41 to 50 inches, pinkish-gray (7.5YR 6/2) fine sandy loam, brown (10YR 5/3) when moist; common, medium, faint, dark yellowish-brown (10YR 4/4) mottles; massive; hard, friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.
- C3—50 to 60 inches, very pale brown (10YR 7/3) light fine sandy loam, brown (10YR 5/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6).

Depth to the horizon of carbonate accumulation ranges from 20 to 37 inches but is dominantly more than 28 inches. In places, a few pebbles are scattered on the surface and throughout the profile. Where the soils are irrigated, the depth to the water table ranges from 50 inches to 60 inches or more,

and common, fine to medium, faint mottles are below a depth of 40 inches. The soils are usually moist, but they are dry in all parts between depths of 8 to 24 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is fine sandy loam or light loam and ranges from 8 to 15 inches in thickness. It is mildly or moderately alkaline and generally noncalcareous, but in places it is slightly calcareous.

In the B2 horizon, value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; chroma is 2 or 3. This horizon is mainly fine sandy loam but may be loam. It is mildly alkaline to strongly alkaline and generally noncalcareous, but it is moderately calcareous in the lower part.

In the C horizon, hue is 7.5YR, 10YR, or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam, loam, fine sandy loam, or loamy fine sand but is dominantly fine sandy loam. Reaction is moderately alkaline to very strongly alkaline.

Kidman fine sandy loam, 0 to 2 percent slopes (K1A).—This soil is on broad, low lake terraces in the Bear River Valley. A profile of this soil is the one described as representative for the Kidman series. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 140 to 155 days.

Included with this soil in mapping are small areas of Fielding silt loam, warm; Lewiston fine sandy loam; and Timpanogos loam, 0 to 3 percent slopes. Also included are some moderately well drained areas.

This soil is used for irrigated tomatoes, sugar beets, small grains, corn for silage, irrigated pasture, alfalfa, apples, stone fruits, and some truck crops. Capability unit I-1, irrigated; range site not assigned.

Kidman fine sandy loam, 2 to 4 percent slopes (K1B).—This soil is on medium-length, mainly west-facing slopes on low and intermediate lake terraces. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 140 to 155 days.

Included with this soil in mapping are small areas of Kidman fine sandy loam, 0 to 2 percent slopes, and Timpanogos loam, 0 to 3 percent slopes. Also included are areas of moderately well drained fine sandy loam having slopes of 2 to 10 percent.

This soil is used for irrigated tomatoes, sugar beets, alfalfa, small grains, corn for silage, cherries, apricots, peaches, apples, and irrigated pasture. Capability unit IIe-1, irrigated; range site not assigned.

Kidman loam, 0 to 1 percent slopes (KmA).—This soil is on broad, high lake terraces in Pocatello Valley. The profile of this soil is similar to the one described as representative for the series, but the surface layer is loam about 16 inches thick. Runoff is slow, and the erosion hazard is slight. Average annual precipitation is 16 to 17 inches. The frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Red Rock silt loam, 0 to 1 percent slopes, and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIc-U, nonirrigated; range site not assigned.

Kidman loam, 1 to 6 percent slopes (KmB).—This soil is on lake terraces. Slopes are medium in length and slightly convex. The profile of this soil is similar to that described as representative for the Kidman series, but it has a surface layer of loam about 16 inches thick. Runoff is slow, and the hazard of erosion is slight. Average

annual precipitation is 14 to 15 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 3 to 6 percent slopes; Stingal loam, 1 to 6 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe-U, nonirrigated; range site not assigned.

Kidman loam, 6 to 10 percent slopes (KmD).—This soil is in small areas on lake terraces in the northwestern part of the survey area. The profile of this soil is similar to that described as representative for the Kidman series, but it has a surface layer of loam about 16 inches thick. Runoff is medium, and the hazard of erosion is moderate. Average annual precipitation is 14 to 15 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes, and Timpanogos silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe-U, nonirrigated; range site not assigned.

Kidman loam, 10 to 20 percent slopes (KmE).—This soil is on somewhat dissected, intermediate and high lake terraces. Slopes are slightly convex and short to medium in length. The profile of this soil is similar to that described as representative for the Kidman series, but it has a surface layer of loam about 16 inches thick. Runoff is rapid, and the hazard of erosion is high. Average annual precipitation is 14 to 15 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kidman loam, 6 to 10 percent slopes; Pomat silt loam, 10 to 30 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes.

This soil is used mainly for nonirrigated small grains, but a small area is used for range. Capability unit IVe-U, nonirrigated; Upland Loam range site.

Kilburn Series

The Kilburn series consists of somewhat excessively drained soils. These soils are on lake terraces, benches, and alluvial fans along the mountain front south of Brigham City and Mantua. They formed in alluvium derived from quartzite, gneiss, and schist. Slopes range from 1 to 60 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, big sagebrush, sand dropseed, western wheatgrass, annual grass, and annual weeds. Mean annual air temperature is 49° to 50° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 130 to 160 days. Elevations range from 4,275 to 5,150 feet.

In a representative profile, the surface layer is dark grayish-brown and brown gravelly sandy loam about 14 inches thick. The subsoil is brown gravelly loam about 8 inches thick. The substratum is brown very gravelly sandy loam and brown very gravelly loamy sand that extends to a depth of more than 60 inches. The surface layer is neutral, and the subsoil and substratum are mildly alkaline.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is 7.5 to 8 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

Kilburn soils are used for irrigated crops, range, and wildlife habitat.

Representative profile of Kilburn gravelly sandy loam, 10 to 20 percent slopes, in range, at a point one-fourth mile south of the north quarter corner of section 1, T. 8 N., R. 2 W., south of Brigham City:

- A11—0 to 8 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, dark brown (7.5YR 3/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; many very fine and few medium roots; 20 percent gravel; neutral (pH 7.2); clear, wavy boundary.
- A12—8 to 14 inches, brown (10YR 4/3) gravelly sandy loam, dark brown (7.5YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, nonsticky and slightly plastic; many fine and very fine and few medium roots; many very fine tubular pores; 20 percent gravel; neutral (pH 7.2); clear, wavy boundary.
- B2—14 to 22 inches, brown (7.5YR 5/4) gravelly light loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and slightly plastic; common fine and very fine and few medium roots; many very fine tubular pores; 30 percent gravel; few thin clay films line pores; mildly alkaline (pH 7.4); gradual, wavy boundary.
- C1—22 to 35 inches, brown (7.5YR 5/4) very gravelly light sandy loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; soft, very friable; few very fine roots; 60 percent gravel; mildly alkaline (pH 7.6); gradual, wavy boundary.
- C2—35 to 60 inches, brown (7.5YR 5/3) very gravelly loamy sand, brown (7.5YR 4/3) when moist; single grained; loose; few very fine roots; 55 percent gravel; mildly alkaline (pH 7.6).

The solum ranges from 21 to 32 inches in thickness. Coarse fragments are mostly rounded gravel, and their content ranges from 20 to 40 percent in the A1 horizon; 25 to 60 percent in the B2 horizon; and 40 to 80 percent in the C horizon. The soils are dry in all parts between depths of 12 and 35 inches for more than 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is generally gravelly sandy loam but is loam in some areas. Reaction is neutral or mildly alkaline. Thickness of the A1 horizon ranges from 10 to 18 inches.

In the B2 horizon, hue is 10YR or 7.5YR; value ranges from 4 to 6 when the soils are dry and is 3 or 4 when they are moist; and chroma ranges from 2 to 4. Texture is gravelly loam or gravelly sandy loam. Reaction is neutral or mildly alkaline. Thickness of the B2 horizon ranges from 7 to 14 inches.

In the C horizon, hue is 10YR or 7.5YR; value ranges from 4 to 6 when the soils are dry and from 3 to 5 when they are moist. Texture is gravelly loam, very gravelly loam, gravelly sandy loam, very gravelly sandy loam, or very gravelly loamy sand. Reaction is neutral or mildly alkaline.

Kilburn gravelly sandy loam, 3 to 6 percent slopes (KnC).—This soil is on west- and north-facing alluvial fans at the base of mountains. The profile of this soil is similar to that described as representative for the Kilburn series, but the subsoil is 14 inches thick. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 140 to 160 days. A very small acreage of this soil is in Mantua Valley where slightly cooler weather prevails.

Included with this soil in mapping are small areas of Kilburn gravelly loam, 1 to 3 percent slopes.

This soil is used for irrigated apricots, peaches, cherries, apples, alfalfa, melons, tomatoes, corn for silage, small grains, and irrigated pasture. Capability unit IIIe-16, irrigated; range site not assigned.

Kilburn gravelly sandy loam, 6 to 10 percent slopes (KnD).—This soil is on west-facing alluvial fans at the

base of mountains. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 3 to 6 percent slopes, and Kilburn gravelly sandy loam, 20 to 30 percent slopes.

This soil is used mainly for irrigated apricots, peaches, cherries, apples, alfalfa, melons, tomatoes, corn for silage, and small grains. Some areas are used for range. Capability unit IVe-16, irrigated; range site not assigned.

Kilburn gravelly sandy loam, 10 to 20 percent slopes (KnE).—This soil is on west-facing alluvial fans and lake terraces and benches at the base of mountains. A profile of this soil is the one described as representative for the Kilburn series. Runoff is medium, and the hazard of erosion is moderate. The frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 6 to 10 percent slopes; Kilburn gravelly sandy loam, 20 to 30 percent slopes; and Stony alluvial land.

This soil is used mainly for irrigated apricots, peaches, cherries, apples, grapes, and alfalfa. It is also used for range and wildlife habitat. Capability unit IVe-16, irrigated; capability unit VIe-U, nonirrigated; Upland Stony Loam range site.

Kilburn gravelly sandy loam, 20 to 30 percent slopes (KnF).—This soil is on west-facing lake-terrace escarpments and alluvial fans at the base of mountains. Runoff is medium, and the hazard of erosion is moderate. The frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 10 to 20 percent slopes; Kilburn gravelly sandy loam, 30 to 60 percent slopes; Wasatch gravelly sandy loam, 10 to 25 percent slopes; and Stony alluvial land.

This soil is used for range and wildlife habitat. Capability unit VIe-U, nonirrigated; Upland Stony Loam range site.

Kilburn gravelly sandy loam, 30 to 60 percent slopes (KnG).—This soil is on west-facing lake-terrace escarpments at the base of mountains. The profile of this soil is similar to that described as representative for the Kilburn series, but the surface layer ranges from 10 to 14 inches in thickness. Runoff is rapid, and the hazard of erosion is high. Elevations range from 4,700 to 5,150 feet. The frost-free period is from 130 to 150 days.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 20 to 30 percent slopes, and Stony alluvial land.

This soil is used for range and wildlife habitat. Capability unit VIIe-U, nonirrigated; Upland Stony Loam range site.

Kilburn gravelly loam, 1 to 3 percent slopes (KoB).—This soil is on west-facing alluvial fans at the base of mountains. The profile of this soil is similar to that described as representative for the Kilburn series, but the surface layer is generally gravelly loam and the subsoil is 12 to 14 inches thick. Runoff is slow, and the hazard of erosion is slight. The frost-free period is 140 to 160 days. A very small acreage of this soil is in Mantua Valley where slightly cooler weather prevails.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 3 to 6 percent slopes, and Wasatch gravelly sandy loam, 3 to 10 percent slopes.

This soil is used for irrigated apricots, peaches, cherries, apples, alfalfa, melons, tomatoes, corn for silage, small grains, and irrigated pasture. Capability unit IIIs-16, irrigated; range site not assigned.

Kirkham Series

The Kirkham series consists of somewhat poorly drained soils. These soils are on flood plains and low river terraces along the Malad River and Bear River in the eastern part of the survey area. They formed in mixed, calcareous, stratified alluvium derived dominantly from limestone, sandstone, and quartzite. Slopes range from 0 to 2 percent. The vegetation in noncultivated areas is mainly saltgrass, foxtail, wiregrass, Great Basin wildrye, greasewood, sour dock, alkali mallow, povertyweed, and cheatgrass. Mean annual air temperature ranges from 48° to 52° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,215 to 4,400 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 10 inches thick. The underlying layer, extending to a depth of 60 inches or more, is highly stratified material; it is light brownish-gray loam in the upper part and grayish-brown and light brownish-gray silty clay loam in the lower part. These soils are strongly calcareous throughout. The upper 5 inches of the surface layer is moderately alkaline. Between depths of 5 and 60 inches or more, the soils are strongly to very strongly alkaline.

Permeability is moderately slow, and the rate of water intake is moderate. Because of the salt content, the water available to plants is only about 7 to 10 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 12 inches to that depth. Roots penetrate to a depth of 60 inches.

Kirkham soils are used for native pasture and irrigated crops.

Representative profile of Kirkham silt loam, in range, 775 feet east and 1,475 feet south of the north quarter corner of section 10, T. 11 N., R. 3 W., about one-fourth mile southeast of Tremonton:

- A11—0 to 5 inches, grayish-brown (2.5Y 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine and medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); abrupt, smooth boundary.
- A12—5 to 10 inches, grayish-brown (2.5Y 5/2) silt loam, very dark gray (10YR 3/1) when moist; weak, very coarse, granular structure that parts to weak, medium, granular; hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; few fine and medium interstitial pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); abrupt, wavy boundary.
- C1—10 to 16 inches, light brownish-gray (2.5Y 6/2) loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, nonsticky and slightly plastic; common fine and very fine roots; common fine and medium interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.1); abrupt, wavy boundary.
- A1b1—16 to 25 inches, grayish-brown (2.5YR 5/2) silty clay loam, very dark brown (10YR 2/2) when moist; weak, fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; common fine and very fine interstitial pores; few snail shells; strongly calcareous, lime is

disseminated; strongly alkaline (pH 8.8); clear, smooth boundary.

- C2g—25 to 36 inches, light brownish-gray (2.5Y 6/2) silty clay loam, very dark gray (10YR 3/1) when moist; weak, medium and fine, subangular blocky structure; hard, firm, slightly sticky and plastic; few fine and very fine roots; many fine and medium interstitial pores; few snail shells; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); clear, smooth boundary.

- A1b2g—36 to 44 inches, grayish-brown (2.5Y 5/2) heavy silty clay, very dark gray (10YR 3/1) when moist; weak, fine and medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine and very fine roots; many fine and medium interstitial pores; few snail shells; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, wavy boundary.

- C3g—44 to 54 inches, grayish-brown (2.5Y 5/2) silty clay loam, dark gray (5Y 4/1) when moist; massive; very hard, firm, slightly sticky and plastic; few fine and very fine roots; common fine and medium interstitial pores; few snail shells; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

- C4g—54 to 68 inches, gray (5Y 6/1) silty clay loam, dark gray (5Y 4/1) when moist; massive; very hard, firm, sticky and plastic; few fine and very fine roots; common fine and medium interstitial pores; few snail shells; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6).

The solum ranges from 10 to 18 inches in thickness. Between depths of 10 and 40 inches, the texture averages silty clay loam and the content of clay ranges from 27 to 35 percent. Few marine or snail shells are found in places throughout the profile. These soils commonly have recent deposition on the surface that ranges from 4 to 8 inches in thickness.

In the A1 horizon, hue is 10YR or 2.5Y; value is 2 or 3 when the soils are moist; and chroma is 1 or 2. Texture is silt loam, heavy silt loam, or light silty clay loam. Reaction is moderately alkaline to very strongly alkaline. A dark-colored, buried A1 horizon is at a depth below 15 inches. Content of organic matter decreases irregularly with increasing depth.

In the C horizon, hue is 10YR, 2.5Y, or 5Y; value ranges from 5 to 7 when the soils are dry and from 2 to 5 when they are moist; and chroma is 1 or 2. This horizon is silty clay loam, silt loam, or loam and is stratified with thin layers of very fine sandy loam. The water table fluctuates with the season but is at a depth ranging from 20 to 50 inches. In spring the water table is at or near the surface for many weeks. Faint to distinct mottles or chromas of 1 are at depths between 20 and 40 inches. Reaction is strongly alkaline to very strongly alkaline. These soils are slightly to moderately affected by salts and alkali.

Kirkham silt loam (Kr).—This soil is on flood plains and low river terraces along the Malad River and the Bear River. Slopes are 0 to 2 percent. The surface is quite uneven where the soil has not been leveled. Runoff is slow, and the hazard of erosion is slight. This soil is subject to overflow or flooding in spring. Streambanks have been cut in places.

Included with this soil in mapping are small areas of Fresh water marsh, Logan silty clay loam, Martini fine sandy loam, and Sunset silt loam.

This soil is used for native pasture and irrigated crops. Where flooding is controlled and the soil drained, it is used for irrigated small grains, corn for silage, alfalfa, and improved pasture. A small area of this soil is used for nonirrigated small grains. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Lakeshore Series

The Lakeshore series consists of poorly drained soils that have stratified layers with an average texture of

loam or fine sandy loam. These soils are on broad stream flood plains southwest of Honeyville. They formed in alluvium deposited over mixed lake sediments. Slopes are less than 1 percent. Vegetation consists of a sparse cover of saltgrass and pickleweed. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 12 to 15 inches, and the frost-free period is 130 to 140 days. Elevations range from 4,220 to 4,240 feet.

In a representative profile, the soil has stratified layers of gray, light-gray, and white fine sandy loam, loam, silt loam, and light silty clay loam. These layers extend from the surface to a depth of more than 60 inches, and buried surface layers are common. These soils are very strongly saline throughout and are strongly to moderately alkaline. Commonly, platy crusts of salt are on the surface and are underlain by layers of soft, granular material.

Permeability is slow, and the rate of water intake is slow. Because of the high salt content, the water available to plants is only 3 to 5 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 11 inches to that depth. Roots may penetrate to a depth of 60 inches or more.

These soils are used for range and for wildlife habitat.

Representative profile of Lakeshore fine sandy loam, in range, 750 feet east and 400 feet south of north quarter corner of section 21, T. 10 N., R. 2 W., south of the town of Honeyville:

- C1sa—0 to 2 inches, light-gray (2.5Y 7/2) fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, thin, platy structure; slightly hard, very friable, nonsticky and slightly plastic; many fine and very fine pores; strongly calcareous; very strongly saline; strongly alkaline (pH 8.6); abrupt, smooth boundary.
- C2sa—2 to 6 inches, light-gray (2.5Y 7/2) fine sandy loam, dark grayish brown (2.5Y 4/2) when moist; common, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; many fine and very fine pores; strongly calcareous; very strongly saline; strongly alkaline (pH 8.6); abrupt, smooth boundary.
- C3sa—6 to 17 inches, light-gray (2.5Y 7/2) loam, dark gray (2.5Y 4/1) when moist; few, fine, distinct, strong-brown (7.5YR 5/6) mottles; weak, medium, subangular blocky structure; slightly hard, very friable, nonsticky and slightly plastic; many fine and very fine pores; moderately calcareous; very strongly saline; strongly alkaline (pH 8.8); abrupt, smooth boundary.
- A1bl—17 to 18 inches, gray (10YR 5/1) heavy silt loam, black (10YR 2/1) when moist; massive; hard, friable, sticky and plastic; many fine and very fine pores; moderately calcareous; very strongly saline; strongly alkaline (pH 8.8); gradual, smooth boundary.
- C4sa—18 to 25 inches, light-gray (2.5Y 7/2) fine sandy loam, grayish brown (10YR 5/2) when moist; single grained; loose; many fine and very fine pores; strongly calcareous; very strongly saline; strongly alkaline (pH 8.8); gradual, smooth boundary.
- A1b2—25 to 32 inches, gray (10YR 5/1) silt loam, black (10YR 2/1) when moist; massive; hard, friable, sticky and plastic; many fine and very fine pores; slightly calcareous; very strongly saline; moderately alkaline (pH 8.2); abrupt, smooth boundary.
- C5sa—32 to 39 inches, white (2.5Y 8/2) loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, nonsticky and slightly plastic; many fine and very fine pores; moderately calcareous; very strongly saline; moderately alkaline (pH 8.4); clear, smooth boundary.
- C6sa—39 to 48 inches, light-gray (10YR 7/1) light silty clay loam, very dark grayish brown (10YR 3/2) when moist; massive; very hard, friable, sticky and plastic;

many fine and very fine pores; moderately calcareous; very strongly saline; moderately alkaline (pH 8.4); clear, smooth boundary.

C7sa—48 to 53 inches, light-gray (10YR 7/1) loam, very dark gray (2.5Y 3/1) when moist; massive; hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; moderately calcareous; very strongly saline; moderately alkaline (pH 8.4); abrupt, smooth boundary.

C8sa—53 to 64 inches, light-gray (10YR 7/1) heavy loam, very dark gray (10YR 3/1) when moist; massive; hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; moderately calcareous; very strongly saline; moderately alkaline (pH 8.4).

The soils are usually moist, and the water table is at or near the surface all the time. Between depths of 10 and 40 inches, the texture is light silt loam or fine sandy loam and the content of clay averages less than 18 percent. In the Csa horizon, hue is 10YR or 2.5Y; value ranges from 5 to 8 when the soils are dry and from 3 to 6 when they are moist; and chroma is 1 or 2. Content of salt averages more than 2 percent to a depth of more than 4 feet.

Lakeshore fine sandy loam (LA).—This soil is on broad flood plains of streams. Slopes most commonly are less than 1 percent. Runoff is very slow, and there is no erosion hazard.

Included with this soil in mapping are small areas of Syracuse fine sandy loam and Playas.

This soil is used for range and for wildlife habitat. In some areas, fresh water has been spread on the surface and has washed or leached out some of the salts. In these areas, a good stand of saltgrass has been established. Capability unit VIIw-28, nonirrigated; Salt Meadow range site.

Lasil Series

The Lasil series consists of somewhat poorly drained soils that are affected by alkali. These soils are on valley plains and low lake terraces. They formed in mixed lake sediments. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is saltgrass, greasewood, alkali sacaton, annual weeds, and grasses. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation is 11 to 14 inches, and the frost-free period is 100 to 150 days. Elevations range from 4,220 to 4,525 feet.

In a representative profile, the surface layer is light brownish-gray and pale-brown silt loam about 9 inches thick. The subsoil is pale-brown, light-gray, and very pale brown silty clay loam about 14 inches thick. The substratum, extending to a depth of 60 inches, is very pale brown and white silty clay loam. The surface layer is noncalcareous and moderately alkaline. The subsoil and substratum are mostly moderately calcareous or strongly calcareous and moderately alkaline or strongly alkaline.

Permeability is slow, and the rate of water intake is slow. Roots penetrate easily to a depth of 60 inches, but most of them are at a depth within 24 inches.

These soils are used for irrigated and nonirrigated crops and for range.

Representative profile of Lasil silt loam, in a cultivated field, 1,320 feet south and 400 feet east of the northwest corner of section 20, T. 12 N., R. 5 W., about 1 mile south of Howell:

- Ap1—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; few very fine, fine, and medium

- roots; many very fine pores; moderately alkaline (pH 8.0); clear, smooth boundary.
- Ap2—6 to 9 inches, pale-brown (10YR 6/3) silt loam, dark brown (10YR 3/3) when moist; weak, very fine, subangular blocky structure; soft, friable, slightly sticky and plastic; few very fine, fine, and medium roots; many very fine pores; moderately alkaline (pH 8.0); clear, wavy boundary.
- B21t—9 to 13 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, fine and very fine, angular blocky; very hard, firm, sticky and plastic; few very fine, fine, and medium roots; many very fine pores; common, thin to moderately thick clay films on ped faces; moderately alkaline (pH 8.0); clear, wavy boundary.
- B22tca—13 to 19 inches, light-gray (10YR 7/2) silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to weak, fine and very fine, angular blocky; very hard, very firm, sticky and plastic; few very fine, fine, and medium roots; common very fine pores; moderately calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.
- B3ca—19 to 23 inches, very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) when moist; weak and moderate, fine, subangular blocky structure; hard, firm, sticky and plastic; few very fine and medium roots; common very fine pores; strongly calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.
- C1ca—23 to 36 inches, very pale brown (10YR 8/3) silty clay loam, pale brown (10YR 6/3) when moist; common, medium, distinct, brown (10YR 5/3) mottles in lower half of horizon; weak, medium, subangular blocky structure; hard, friable, sticky and slightly plastic; few fine roots; many very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.
- C2—36 to 44 inches, very pale brown (10YR 8/3) silty clay loam, brown (10YR 5/3) when moist; common, medium, distinct, brown (10YR 4/3) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine and few fine pores; strongly calcareous; strongly alkaline (pH 8.8); gradual, irregular boundary.
- C3—44 to 60 inches, white (10YR 8/2) silty clay loam, grayish brown (2.5Y 5/2) when moist; common, medium, distinct, brown (10YR 5/3) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; many very fine pores; strongly calcareous, lime is veined; strongly alkaline (pH 9.0).

Depth to the horizon of carbonate accumulation ranges from 10 to 18 inches. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for as much as 60 consecutive days in summer. Depth to the water table is 20 to 40 inches unless the soils are drained.

In the A1 horizon, hue ranges from 10YR to 2.5Y; chroma is 2 or 3. This horizon is silt loam or loam and ranges from 5 to 11 inches in thickness. It is mildly alkaline to very strongly alkaline and noncalcareous to moderately calcareous.

In the B2t horizon, hue is generally 10YR or 2.5Y but is 7.5YR in some places near Portage; value ranges from 6 to 8 when the soils are dry and from 3 to 5 when they are moist; and chroma is 2 or 3. This horizon is silty clay loam or heavy loam and is 3 to 10 inches thick. It has weak to strong, medium to coarse, prismatic structure, is moderately alkaline to very strongly alkaline, and is noncalcareous to strongly calcareous. Clay films in the B21t subhorizon are common to continuous and thin to thick on ped faces.

In the B3ca horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when the soils are moist; and chroma ranges from 2 to 4. This horizon is silty clay loam or heavy loam and is 0 to 10 inches thick. It is strongly alkaline to very strongly alkaline and is moderately calcareous to strongly calcareous.

In the C horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when the soils are moist; and chroma ranges from 2 to 4. Texture is silty clay loam, silt loam, or very fine sandy loam. Reaction is strongly alkaline or very strongly alkaline.

Lasil silt loam (Lc).—This soil is on valley plains and low lake terraces. A profile of this soil is the one described as representative for the Lasil series. The subsoil and substratum are silty clay loam, and the exchangeable sodium percentage ranges from 25 to 60 percent. Slopes most commonly are less than 1 percent. Runoff is slow, and the hazard of erosion is slight. This soil is strongly affected by salts and alkali. Its water-holding capacity is 11 to 12 inches to a depth of 5 feet, but the water available to plants is only 4 to 8 inches because the salt content is so high. The frost-free period is 100 to 130 days.

Included with this soil in mapping are small areas of Fridlo silt loam and Payson silt loam.

This soil is used mainly for range. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Lasil silt loam, moderately alkali (Ld).—This soil is on valley plains and low lake terraces. The profile of this soil is similar to that described as representative for the Lasil series. The subsoil and substratum are silty clay loam, light clay loam, heavy silt loam, or heavy loam. Exchangeable sodium percentage ranges from 15 to 25 percent in the subsoil and substratum. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight. This soil is slightly to moderately affected by salts and alkali. Its water-holding capacity is 11 to 12 inches to a depth of 5 feet, but the water available to plants is only 7 to 9 inches because of the salt content. The frost-free period is from 140 to 150 days.

Included with this soil in mapping are small areas of Fridlo silt loam, moderately alkali; Airport silt loam; Warm Springs fine sandy loam; and Lewiston fine sandy loam.

This soil is used for irrigated crops and pasture. Under irrigation, the soil grows alfalfa, small grains, sugar beets, tomatoes, and corn for silage. Native pastures are mostly saltgrass, alkali sacaton, and greasewood. Improved pastures grow heavy stands of tall wheatgrass. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Lasil-Airport silt loams (Lr).—This complex is on the valley plain near the Malad River in the vicinity of Portage. It consists of about 45 percent Lasil silt loam and 45 percent Airport silt loam, strongly alkali. Included with these soils in mapping are areas of Fridlo silt loam, Kirkham silt loam, and Airport silt loam. These included areas make up about 10 percent of the total acreage.

These soils are intermingled and have a microrelief difference of 12 to 24 inches in elevation. The Lasil soil is in higher, slightly convex positions, and the Airport soil is in lower, slightly concave positions. Both soils formed under a cover of saltgrass, alkali sacaton, and greasewood.

Lasil silt loam in this complex has a profile similar to that described as representative for the Lasil series, but the subsoil has a hue of 10YR or 7.5YR and a texture of silty clay loam or clay loam. Exchangeable sodium percentage ranges from 25 to 50 percent. Airport silt loam, strongly alkali, has a profile similar to that described as representative for the Airport series, but the surface layer is 8 to 11 inches thick, the soil is very strongly alkali, and the frost-free period is 110 to 130 days.

The soils of this complex are used for range. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Lewiston Series

The Lewiston series consists of somewhat poorly drained soils. These soils are on low lake terraces, lake plains, and river flood plains in the area near Corinne. They formed in moderately coarse textured lake sediments and mixed alluvium derived dominantly from limestone, sandstone, and quartzite. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is Great Basin wildrye, saltgrass, foxtail, alkali sacaton, and annual weeds. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 13 to 15 inches, and the frost-free period is 140 to 155 days. Elevations range from 4,225 to 4,250 feet.

In a representative profile, the surface layer is grayish-brown and brown fine sandy loam about 15 inches thick. Below this is a layer of white fine sandy loam about 14 inches thick. The next layer, extending to a depth of 60 inches or more, is very pale brown fine sandy loam in the upper part and loamy fine sand in the lower part. The surface layer is slightly calcareous, and the underlying layers are strongly calcareous or moderately calcareous. A layer of strong lime accumulation is at depth of 15 inches. The soil is moderately alkaline to strongly alkaline.

Permeability is moderate, and the rate of water intake is rapid. Available water holding capacity is 6.5 to 8.5 inches to a depth of 5 feet. Roots penetrate easily to the water table and, if the soils are drained, may extend to a depth of 60 inches or more.

Lewiston soils are used for irrigated crops.

Representative profile of Lewiston fine sandy loam, in a cultivated field, 225 feet east and 170 feet north of the southwest corner of section 28, T. 10 N., R. 2 W., about 2 miles northeast of Corinne:

- Ap—0 to 10 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; slightly calcareous; moderately alkaline (pH 8.2); abrupt, smooth boundary.
- A12—10 to 15 inches, brown (10YR 5/3) fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; soft, very friable, nonsticky and nonplastic; many very fine pores; slightly calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.
- C1ca—15 to 29 inches, white (10YR 8/2) fine sandy loam, pale brown (10YR 6/3) when moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles; moderate, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and nonplastic; few fine and very fine roots; many very fine pores; many krotovinas ½ to 1 inch in diameter; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.
- C2—29 to 40 inches, very pale brown (10YR 7/3) fine sandy loam, brown (10YR 5/3) when moist; many, medium, faint, yellowish-brown (10YR 5/6) mottles; massive; soft, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); diffuse, wavy boundary.
- C3—40 to 70 inches, very pale brown (10YR 7/3) loamy fine sand, brown (10YR 5/3) when moist; many, medium, faint, yellowish-brown (10YR 5/6) mottles; single grained; loose; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Depth to the horizon of carbonate accumulation is 14 to 15 inches. Texture between depths of 10 and 40 inches averages fine sandy loam. Depth to the water table ranges from 26 to 40 inches where the soils have not been drained. Most of the areas have been drained, however, and depth to the water table in these areas is 40 to 60 inches or more. Faint mottles are at

a depth of 14 to 16 inches, and distinct or faint mottles are at a depth below 29 inches. They range from few to many. These soils are slightly affected by salts and alkali.

In the A1 horizon, value is 2 to 3 when the soils are moist; chroma is 2 or 3. Texture is fine sandy loam or heavy fine sandy loam. The A1 horizon is slightly to moderately calcareous and is 14 to 15 inches thick.

In the C horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is light loam, fine sandy loam, or loamy fine sand. Reaction is moderately alkaline to strongly alkaline.

Lewiston fine sandy loam (Ls).—This soil is on low lake terraces, lake plains, and river flood plains in the vicinity of Corinne. Slopes are 0 to 1 percent. Most areas of this soil have been leveled and tile drained. Runoff is slow, and the hazard of erosion is slight. The hazard of soil blowing is moderate where the soil is left unprotected.

Included with this soil in mapping are small areas of Fridlo silt loam, moderately alkali, and Warm Springs fine sandy loam.

This Lewiston soil is used for irrigated tomatoes, sugar beets, corn for silage, alfalfa, small grains, and irrigated pasture. Capability unit IIw-2, irrigated; range site not assigned.

Logan Series

The Logan series consists of poorly drained soils. These soils are on low lake terraces, stream flood plains, and lake plains along the Bear River and along the edge of Great Salt Lake. They formed in alluvium and mixed lake sediments. Slopes range from 0 to 3 percent. Vegetation consists of wiregrass, sedges, bluegrass, foxtail, and saltgrass. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 110 to 150 days. Elevations range from 4,205 to 4,300 feet.

In a representative profile, the surface layer is dark-gray silty clay loam about 11 inches thick. The next layer is light-gray and white silty clay loam about 36 inches thick. Below this, and extending to a depth of about 60 inches, is mixed pinkish-gray and white silty clay loam. The surface layer is strongly alkaline and slightly calcareous, and the underlying layers are moderately alkaline and very strongly calcareous.

Permeability is slow, and the rate of water intake is slow. Depth of rooting is limited by the water table. Where the soils are drained, roots may penetrate to a depth of 60 inches or more.

Logan soils are used for range and wildlife habitat.

Representative profile of Logan silty clay loam, in range, 650 feet north and 100 feet west of the north quarter corner of section 26, T. 9 N., R. 2 W., southwest of Brigham City:

- A1—0 to 11 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; weak, medium, granular structure; very hard, firm, slightly sticky and plastic; many very fine, fine, and medium roots; slightly calcareous; strongly alkaline (pH 8.6); gradual, wavy boundary.
- C1cag—11 to 23 inches, light-gray (10YR 6/1) silty clay loam, light gray (10YR 6/1) when moist; weak, fine, subangular blocky structure; hard, friable, nonsticky and slightly plastic; many very fine, fine, and medium roots; many fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.

C2cag—23 to 47 inches, white (10YR 8/1) heavy silty clay loam, light gray (10YR 7/1) when moist; common, coarse, distinct, reddish-yellow (7.5YR 6/8) mottles; massive; extremely hard, very firm, sticky and very plastic; common fine and medium roots; many fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); diffuse, irregular boundary.

C3—47 to 60 inches, 50 percent pinkish-gray (7.5YR 6/2) and 50 percent white (10YR 8/1) heavy silty clay loam, pinkish gray (7.5YR 6/2) and light gray (10YR 7/1), respectively, when moist; many, medium, distinct, yellowish-red (5YR 5/6) mottles; stratified lake sediments; extremely hard, very firm, sticky and very plastic; few fine and medium roots; many fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2).

Depth to the horizon of calcium carbonate accumulation ranges from 10 to 15 inches. Between depths of 10 and 40 inches, the texture averages silty clay loam or heavy silt loam and the content of clay ranges from 27 to 35 percent. The soils are usually moist and are saturated throughout for many weeks in winter and spring. The water table is normally between depths of 15 and 36 inches but is at or near the surface for many weeks in winter and spring. These soils are generally free of salts and alkali, but in the area near the Great Salt Lake, they are moderately to strongly affected by salts and alkali.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist. This horizon is mainly silty clay loam but ranges to heavy silt loam, and it ranges from 10 to 15 inches in thickness.

In the Cca horizon, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist. Thickness ranges from 26 to 36 inches. In Cg horizon, hue ranges from 7.5YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; and chroma is 1 or 2. The horizons are mainly mixed lake sediments. Texture is silty clay loam or heavy silt loam stratified with layers of fine sandy loam that are 1/8 to 2 inches thick.

In this survey area the moderately saline phase of the Logan series is mapped as the smaller component of the Saltair-Logan association. A description of this association is given under the heading "Saltair series."

Logan silty clay loam (Lt).—This soil is on low lake terraces and stream flood plains. Slopes are 0 to 3 percent. Elevations range from 4,220 to 4,300 feet, and the frost-free period is 130 to 150 days. Runoff is very slow, and the hazard of erosion is none to slight. This soil is free of harmful salts and alkali. Available water holding capacity is 11 to 12 inches to a depth of 5 feet.

Included with this soil in mapping are small areas of Roshe Springs silt loam, Cudahy silt loam, and Airport silt loam.

This Logan soil is used mainly for range. It also has value as wildlife habitat. Native hay has been harvested in a few areas. Where the soil is drained and irrigated, alfalfa, small grains, corn for silage, sugar beets, and improved pastures are grown. Capability unit IIIw-25, irrigated; Wet Meadow range site.

Lucky Star Series

The Lucky Star series consists of well-drained soils. These soils are on north-facing mountains south of Mantua. They formed in residuum and colluvium derived from sandstone, quartzite, and conglomerate. Slopes range from 25 to 40 percent. The vegetation is an overstory of aspen and an understory of chokecherry, bearded wheatgrass, western coneflower, goldenrod, and mountain brome. Mean annual air temperature ranges from 37° to 41° F. Average annual precipitation ranges from 22 to

28 inches, and the frost-free period is 70 to 80 days. Elevations range from 6,500 to 7,500 feet.

In a representative profile, the surface layer is very dark gray silt loam about 20 inches thick. The subsurface layer is brown gravelly loam about 13 inches thick. The subsoil is brown gravelly clay loam that extends to a depth of 50 inches. The next layer is brown very gravelly loam and extends to a depth of more than 60 inches. These soils are slightly acid to a depth of 50 inches and are medium acid below that depth.

Permeability is moderate, and the rate of water intake is rapid. Available water holding capacity is 7 to 9 inches to a depth of 5 feet. The water-supplying capacity is 13 to 19 inches before moisture is depleted. Roots of aspen penetrate to a depth of more than 60 inches.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Lucky Star loam, 25 to 40 percent slopes, in an area of Lucky Star-Elzinga association, steep, in range, 1,150 feet west and 500 feet north of the southeast corner of section 10, T. 8 N., R. 1 W., south of Mantua:

O1—1 inch to 0, matted decaying leaves and twigs.

A11—0 to 11 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; 18 percent gravel; slightly acid (pH 6.3); clear, smooth boundary.

A12—11 to 20 inches, very dark gray (10YR 3/1) silt loam, black (10YR 2/1) when moist; weak, medium and fine, subangular blocky structure that parts to weak, fine, granular; soft, very friable, slightly sticky and slightly plastic; common very fine, fine, medium, and coarse roots; 18 percent gravel; slightly acid (pH 6.3); clear, wavy boundary.

A2—20 to 33 inches, brown (7.5YR 5/4) gravelly loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine and fine pores; 40 percent gravel and cobblestones; slightly acid (pH 6.2); gradual, irregular boundary.

B21t—33 to 40 inches, brown (7.5YR 5/4) gravelly clay loam, brown (7.5YR 4/4) when moist; weak, medium, subangular blocky structure; extremely hard, firm, sticky and very plastic; few fine and very fine roots; common very fine and fine pores; common thin clay films on ped faces; 35 percent gravel; slightly acid (pH 6.1); diffuse, irregular boundary.

B22t—40 to 50 inches, brown (7.5YR 5/4) gravelly clay loam, brown (7.5YR 4/4) when moist; moderate, medium, subangular blocky structure; extremely hard, firm, very sticky and very plastic; few fine and very fine roots; many very fine and fine pores; many thin clay films on ped faces; 30 percent gravel; slightly acid (pH 6.1); gradual, wavy boundary.

B3—50 to 60 inches, brown (7.5YR 5/4) very gravelly heavy loam, brown (7.5YR 4/4) when moist; massive; hard, firm, slightly sticky and slightly plastic; few fine and very fine pores; few thin clay films on ped faces; 65 percent gravel; medium acid (pH 6.0).

The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer in most years.

In the A1 horizon, value is 3 or 4 when the soils are dry and chroma is 1 or 2. This horizon is silt loam or gravelly loam that is 15 to 20 percent gravel, and it ranges from 18 to 20 inches in thickness. In the A2 horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry; and chroma ranges from 2 to 4. This horizon is gravelly loam or cobbly loam that is 30 to 40 percent gravel and cobblestones, and it ranges 12 to 14 inches thick.

In the B2t horizon, hue is 7.5 YR or 5 YR. Texture is gravelly clay loam or cobbly clay loam that is 30 to 50 percent gravel and cobblestones. Clay films range from few to many on ped faces. Below the B2t horizon, the soil material is very gravelly and cobbly material to soft, weathered sandstone.

Lucky Star-Elzinga association, steep (LUE).—This mapping unit is on the mountains south of Mantua and west of Devils Gate Valley. It consists of about 40 percent Lucky Star silt loam, 25 to 40 percent slopes, and 40 percent Elzinga silt loam, 25 to 50 percent slopes. Included with these soils in mapping are areas of Goring clay loam, 25 to 40 percent slopes; Maughan silt loam, 25 to 50 percent slopes; Yeates Hollow stony loam, 25 to 40 percent slopes; and a deep soil that has a clay loam subsoil and is under a cover of oakbrush. These included soils make up about 20 percent of the total acreage.

The soils of this association are intermingled on broad, east-facing, stream-dissected side slopes of mountain valleys. The Lucky Star soil is on short, north-facing slopes along the stream channels under aspen trees. The Elzinga soil is on east-facing, even, and slightly concave ridges under maple trees.

Runoff is medium on these soils and the hazard of erosion is moderate.

The soils of this association are used for range, wildlife habitat, and water supply. The Lucky Star soil is in capability unit VIe-H, nonirrigated; High Mountain Loam (Aspen) range site. The Elzinga soil is in capability unit VIIe-M, nonirrigated; Mountain Loam (Shrub) range site.

Magna Series

The Magna series consists of poorly drained soils. These soils are on low lake terraces and lake plains in the western part of Bear River valley near Penrose. They formed in calcareous, fine textured and moderately fine textured, mixed lake sediments derived mainly from limestone and sandstone. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is Great Basin wildrye, saltgrass, foxtail, western wheatgrass, greasewood, and alkali sycamore. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation is 13 to 14 inches, and the frost-free period is 135 to 145 days. Elevations range from 4,250 to 4,300 feet.

In a representative profile, the surface layer is silty clay loam about 13 inches thick; it is grayish brown in the upper part and light brownish gray in the lower part. The underlying layers, extending to a depth of about 60 inches, are light-gray and white silty clay in the upper part and pinkish-gray and pink silty clay loam and silty clay in the lower part. The surface layer is slightly calcareous and moderately alkaline. A layer of strong lime accumulation is at a depth of 13 inches. Between depths of 13 inches and 60 inches, these soils are strongly calcareous or very strongly calcareous and strongly alkaline.

Permeability is slow, and rate of water intake is slow. The water-holding capacity is 11 to 12 inches to a depth of 5 feet, but the water available to plants is only about 9 to 10 inches because of the content of salt. Roots are mainly above the water table, but where the soils are drained, roots may extend to a depth of more than 60 inches.

Magna soils are used for irrigated crops and wet meadow pasture.

Representative profile of Magna silty clay loam, in a cultivated field, 2,050 feet west and 1,400 feet south of the northeast corner of section 23, T. 11 N., R. 4 W., about 1½ miles southeast of Thatcher church:

Ap—0 to 7 inches, grayish-brown (2.5 Y 5/2) light silty clay loam, very dark grayish brown (10 YR 3/2) when moist; moderate, coarse, granular structure; hard, friable, sticky and plastic; few fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.

A1—7 to 13 inches, light brownish-gray (2.5 Y 6/2) heavy silty clay loam, very dark grayish brown (10 YR 3/2) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; slightly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.

C1ca—13 to 19 inches, light-gray (2.5 Y 7/2) silty clay, olive gray (5 Y 5/2) when moist; weak, medium, subangular blocky structure; very hard, very firm, very sticky and very plastic; few fine and very fine roots; many krotovinas ⅜ to ¼ inch in diameter; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, irregular boundary.

C2ca—19 to 30 inches, white (5 Y 8/2) silty clay, light olive gray (5 Y 6/2) when moist; few, fine, distinct, yellowish-brown (10 YR 5/6) mottles; weak, fine, prismatic structure that parts to moderate, medium, angular and subangular blocky; extremely hard, very firm, very sticky and very plastic; few fine and very fine roots; organic stain, very dark grayish brown (2.5 Y 3/2) when moist, on prism faces; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); abrupt, irregular boundary.

C3cag—30 to 37 inches, white (5 Y 8/1) silty clay, light olive gray (5 Y 6/2) when moist; few, fine, distinct, yellowish-brown (10 YR 5/6) mottles; extremely hard, extremely firm, sticky and very plastic; organic stain of very dark grayish brown (2.5 Y 3/2) when moist; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.

C4—37 to 46 inches, pinkish-gray (7.5 YR 7/2) heavy silty clay loam, brown (7.5 YR 5/2) when moist; massive (stratified lake sediments); very hard, very firm, sticky and plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); clear, wavy boundary.

C5—46 to 60 inches, pink (7.5 YR 7/4) light silty clay, brown (7.5 YR 5/4) when moist; massive (stratified lake sediments); very hard, very firm, sticky and very plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Depth to the horizon of carbonate accumulation is 12 to 13 inches. Between depths of 10 and 40 inches, the texture averages silty clay and the content of clay ranges from 35 to 42 percent. Most of the acreage has been drained, and depth to the water table is about 30 to 60 inches. Where the soils are not drained, the depth to the water table is about 18 to 30 inches. These soils are slightly affected by salts and alkali. Distinct mottles are at depths below 19 inches and range from few to many.

In the A1 horizon, hue ranges from 10 YR to 5 Y; value is 5 or 6 when the soils are dry; and chroma is 1 or 2. This horizon is heavy silty clay loam or light silty clay loam, and it ranges from 12 to 13 inches in thickness. It is moderately alkaline to strongly alkaline.

In the C horizon, hue ranges from 7.5 YR to 5 Y; value ranges from 6 to 8 when the soils are dry and is 5 or 6 when they are moist; and chroma is generally 1 or 2 but may be 4 in some layers. This horizon is moderately alkaline to strongly alkaline and strongly calcareous or very strongly calcareous. Stratified lake sediments begin at a depth of 30 to 47 inches. These sediments are mainly silty clay loam or silty clay but include layers of very fine sandy loam ¼ inch to 2 inches thick.

Magna silty clay loam (Ma).—This soil is on broad, low lake terraces and lake plains in the extreme western part of Bear River valley near Penrose. Slopes are 0 to

1 percent. Runoff is slow, and the hazard of erosion is none to slight.

Included with this soil in mapping are small areas of Collett silty clay loam; Greenson silt loam, strongly alkali; and Stokes silt loam.

This soil is used for irrigated sugar beets, corn for silage, irrigated pasture, small grains, alfalfa, and wet meadow pastures. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Manila Series

The Manila series consists of well-drained soils. These soils are on mountain slopes and high lake terraces in the vicinity of Mantua and on the mountains between Blue Creek valley and the Malad River valley. They formed in colluvium, residuum, and alluvium derived mainly from sandstone, limestone, and quartzite. Slopes range from 6 to 60 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, big sagebrush, Great Basin wildrye, serviceberry, snowberry, annual grasses, and some bitterbrush. Mean annual air temperature ranges from 42° to 45° F. Average annual precipitation ranges from 16 to 21 inches, and the frost-free period is 85 to 100 days. Elevations range from 4,900 to 6,800 feet.

In a representative profile, the surface layer is dark grayish-brown loam about 13 inches thick. The subsoil is grayish-brown silty clay loam in the upper 7 inches, brown silty clay and light-brown clay in the next 12 inches, and grayish-brown silty clay in the lower 10 inches. The substratum is pale-brown very cobbly silt loam that extends to weathered sandstone and fractured limestone bedrock at a depth of 57 inches. The surface layer and upper part of the subsoil are mildly alkaline, the lower part of the subsoil is moderately alkaline, and the substratum is strongly alkaline and is strongly calcareous.

Permeability is slow, and the rate of water intake is moderate. Roots penetrate to the limestone and sandstone.

Manila soils are used mainly for range, nonirrigated crops, wildlife habitat, and water supply. Some areas are used for irrigated crops.

Representative profile of Manila loam, 25 to 60 percent slopes, in range, 2,300 feet north and 1,800 feet west of the southwest corner of section 35, T. 14 N., R. 5 W., about 4 miles northwest of Whites Valley:

- A11—0 to 5 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; few fine and very fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.
- A12—5 to 13 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; moderate, medium, granular structure; slightly hard, friable, slightly sticky and slightly plastic; many fine roots; few fine and very fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.
- B1—13 to 20 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, subangular blocky structure; hard, firm, sticky and plastic; common fine roots; few fine and very fine pores; mildly alkaline (pH 7.6); gradual, wavy boundary.
- B21t—20 to 25 inches, brown (10YR 5/3) silty clay, brown (7.5YR 4/4) when moist; moderate, medium, prismatic structure that parts to strong, medium, subangular blocky; very hard, very firm, very sticky and very

plastic; few fine roots; few very fine pores; many moderately thick clay films on ped faces; mildly alkaline (pH 7.8); gradual, wavy boundary.

B22t—25 to 32 inches, light-brown (7.5YR 6/4) clay, brown (7.5YR 4/4) when moist; strong, medium or coarse, prismatic structure that parts to strong, medium or coarse, subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine roots; few very fine pores; continuous moderately thick clay films on ped faces; moderately alkaline (pH 8.0); gradual, wavy boundary.

B23t—32 to 42 inches, grayish-brown (10YR 5/2) silty clay, dark brown (10YR 4/3) when moist; moderate, medium, subangular blocky structure; extremely hard, very firm, very sticky and plastic; few very fine roots; few very fine pores; common thin clay films on ped faces; moderately alkaline (pH 8.2); diffuse, wavy boundary.

IIC1ca—42 to 57 inches, pale-brown (10YR 6/3) very cobbly silt loam, yellowish brown (10YR 5/4) when moist; massive; hard, firm, sticky and plastic; contains 50 percent cobbles and gravel; strongly calcareous, lime is bedded; strongly alkaline (pH 8.6); abrupt, irregular boundary.

IICR—57 inches, weathered sandstone and fractured limestone.

The solum ranges from 40 to 60 inches or more in thickness. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in most summers. In the A1 horizon, value is 3 or 4 when the soils are dry. This horizon is loam or silt loam and ranges from 6 to 13 inches in thickness. It is slightly acid to moderately alkaline. The B1 horizon is 4 to 7 inches thick.

In the B2t horizon, hue is 10YR or 7.5YR; value ranges from 4 to 6 when the soils are dry and is 3 or 4 when the soils are moist; and chroma is 2 to 4. The B2t horizon is clay or silty clay, and its content of gravel or cobbles ranges from 0 to 20 percent. The horizon ranges from 22 to 50 inches in thickness. Clay films are common to continuous and thin to thick.

Below the B2t horizon are the B3, B3ca, C, or Cca horizons. Hue is 10YR or 7.5YR; value ranges from 5 to 7 when the soils are dry and from 4 to 7 when they are moist; and chroma is 3 or 4. These horizons are clay, silty clay, silty clay loam, clay loam, or silt loam and are noncobbly to very cobbly. They are mildly alkaline to strongly alkaline and noncalcareous to strongly calcareous. Depth to the parent rock (CR horizon) ranges from 50 to 60 inches or more.

Manila loam, 6 to 10 percent slopes (MbC).—This soil is on high lake terraces that have all aspects. The profile of this soil is similar to that described as representative for the Manila series, but the surface layer and subsoil combined are 5 or more feet thick and contain no gravel or cobbles. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is about 11 to 13 inches to a depth of 5 feet. The water-supplying capacity is about 12 to 14 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Yeates Hollow cobbly clay loam, 20 to 30 percent slopes, and Goring clay loam, 10 to 25 percent slopes.

This soil is used for irrigated and nonirrigated alfalfa and small grains. Only a small acreage is irrigated. Capability unit IIIe-M, nonirrigated; range site not assigned.

Manila loam, 10 to 25 percent slopes (MbE).—This soil is on high lake terraces having all aspects and on north- and east-facing mountain slopes. Runoff is medium, and the hazard of erosion is moderate. Available water holding capacity is 11 to 12 inches to a depth of 5 feet. The water-supplying capacity is about 12 to 16 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Yeates Hollow cobbly clay loam, 20 to 30 percent slopes; Broad cobbly loam, 20 to 30 percent slopes; Forsgren silt

loam, 10 to 20 percent slopes; and Middle cobbly silt loam, 10 to 30 percent slopes.

This soil is used mainly for range. It also is used for nonirrigated small grains and alfalfa and for wildlife habitat and water supply. Capability unit IVE-M, nonirrigated; Mountain Loam range site.

Manila loam, 25 to 60 percent slopes (MCG).—This soil is on north- and east-facing mountain slopes. A profile of this soil is the one described as representative for the Manila series. Runoff is rapid, and the hazard of erosion is high. Available water holding capacity is about 11 to 12 inches. The water-supplying capacity is about 16 to 18 inches for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Broad cobbly loam, 30 to 60 percent slopes; Smarts loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes.

This soil is used mainly for range. It also is used for wildlife habitat and water supply. Capability unit VIIe-M, nonirrigated; Mountain Loam range site.

Manila-Smarts association, steep (MDG).—This mapping unit is on mountain slopes. It consists of about 60 percent Manila loam, 25 to 60 percent slopes, and 30 percent Smarts loam, 30 to 70 percent slopes. Included with these soils in mapping are areas of Broad cobbly loam, 30 to 60 percent slopes; Middle cobbly silt loam, 30 to 70 percent slopes; and Yeates Hollow cobbly clay loam, 30 to 60 percent slopes. These included soils make up about 10 percent of the total acreage.

The Manila soil is on very steep, north- and east-facing mountain slopes under a cover of bluebunch wheatgrass, big sagebrush, Great Basin wildrye, snowberry, and yellowbrush. The Smarts soil is in very steep, north- and east-facing ravines and canyons under a cover of maple, scrub aspen, and shrubs.

Runoff is rapid on the Manila soil, and the hazard of erosion is high. Available water holding capacity is about 11 to 12 inches. The water-supplying capacity is about 16 to 18 inches for plant growth before moisture is depleted.

This association is used for range, habitat for big-game animals, and water supply. Manila loam is in capability unit VIIe-M, nonirrigated; Mountain Loam range site. Smarts loam is in capability unit VIIe-M, nonirrigated; Mountain Loam (Shrub) range site.

Martini Series

The Martini series consists of moderately well drained soils. These soils are on low river terraces and flood plains along the Bear River in the east-central part of the survey area. They formed in mixed, moderately coarse textured, stratified alluvium derived mainly from limestone, sandstone, and quartzite. Slopes range from 0 to 2 percent. The vegetation in noncultivated areas is mainly boxelder, willow, rose, western wheatgrass, Great Basin wildrye, sagebrush, and cheatgrass. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is 125 to 145 days. Elevations range from 4,215 to 4,315 feet.

In a representative profile, the surface layer is grayish-brown fine sandy loam about 9 inches thick. The underlying layers, reaching to a depth of 60 inches or more, are stratified materials; they are brown and light brownish-gray very fine sandy loam, light brownish-gray fine sandy loam, light brownish-gray sandy loam, grayish-brown very

fine sandy loam, and light brownish-gray loam. These soils are moderately calcareous to a depth of 22 inches and strongly calcareous between depths of 22 inches and 60 inches or more. They are mostly moderately alkaline throughout.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is 8.5 to 10.5 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

Martini soils are used for irrigated and nonirrigated crops and range.

Representative profile of Martini fine sandy loam, in a cultivated field, 1,100 feet north and 1,750 feet west of the southeast corner of section 18, T. 12 N., R. 2 W., along the Bear River about 1 mile west of Collinston:

- Ap—0 to 9 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; single grained; loose; common fine and medium roots; moderately calcareous; moderately alkaline; abrupt, smooth boundary.
- C1—9 to 15 inches, brown (10YR 5/3) very fine sandy loam, dark brown (10YR 3/3) when moist; massive; slightly hard, very friable; few fine roots; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, wavy boundary.
- C2—15 to 22 inches, light brownish-gray (10YR 6/2) very fine sandy loam, brown (10YR 4/3) when moist; massive; soft, very friable; few fine roots; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, wavy boundary.
- C3—22 to 30 inches, light brownish-gray (10YR 6/2) fine sandy loam, dark brown (10YR 3/3) when moist; single grained; loose; few fine roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, wavy boundary.
- C4—30 to 45 inches, light brownish-gray (10YR 6/2) sandy loam, brown (10YR 4/3) when moist; single grained; loose; few fine roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); abrupt, smooth boundary.
- A1b—45 to 52 inches, grayish-brown (10YR 5/2) very fine sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, irregular boundary.
- C5—52 to 63 inches, light brownish-gray (10YR 6/2) loam, dark grayish-brown (10YR 4/2) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Between depths of 10 and 40 inches, the texture averages fine sandy loam and content of clay ranges from 10 to 15 percent. The 10- to 40-inch depth is stratified with thin layers of loam or loamy fine sand. The soils are usually moist, but in most years they are dry in all parts between depths of 8 and 24 inches for more than 60 consecutive days in summer. Distinct mottles may be at depths below 30 to 48 inches and range from few to common and from fine to medium. Depth to the water table ranges from 36 to 48 inches. In places these soils are slightly to moderately affected by salts and alkali.

In the A1 horizon, value is 4 or 5 when the soils are dry; chroma is 2 or 3. This horizon is fine sandy loam or light loam, and it ranges from 9 to 18 inches in thickness. A dark-colored, buried A1 horizon is at depths between 20 and 60 inches. Content of organic matter decreases irregularly with depth.

In the C horizon, value ranges from 5 to 7 when the soils are dry and from 3 to 5 when they are moist; chroma is 2 or 3. The C horizon is moderately calcareous to strongly calcareous and moderately alkaline to very strongly alkaline.

Martini fine sandy loam (Me).—This soil is on low river terraces and flood plains, mainly as small parcels on

the oxbows along the Bear River from Fielding to Corinne. Slopes are 0 to 2 percent. The surface is quite uneven where the soil has not been leveled. Runoff is slow, and the hazard of erosion is slight. This soil is subject to overflow or flooding early in spring in about 4 years out of 10.

Included with this soil in mapping are small areas of Kirkham silt loam and Sunset silt loam and small areas that are slightly to moderately affected by salt and alkali.

This soil is used mainly for irrigated crops. Some areas are used for nonirrigated small grains and for range. Irrigated crops are alfalfa, sugar beets, small grains, corn for silage, and improved pasture. Irrigation is mainly by direct diversion or pumping from the Bear River. Capability unit IIw-2, irrigated; Semiwet Meadow range site.

Maughan Series

The Maughan series consists of well-drained soils. These soils are on north-facing mountains near Mantua. They formed in colluvium and alluvium derived from sandstone and quartzite. Slopes range from 25 to 50 percent. The vegetation is a dense overstory of maple and oregongrape and an understory of bearded wheatgrass. Mean annual air temperature ranges from 38° to 43° F. Average annual precipitation ranges from 20 to 26 inches, and the frost-free period is 70 to 100 days. Elevations range from 5,200 to 7,500 feet.

In a representative profile, the surface layer is dark-gray silt loam about 24 inches thick. The subsurface layer is brown very cobbly loam about 11 inches thick. The subsoil, extending to a depth of 60 inches or more, is reddish-brown cobbly clay in the upper part and reddish-brown cobbly silty clay in the lower part. The soils are slightly acid to medium acid.

Permeability is moderate to a depth of 35 inches and is slow below that depth. The rate of water intake is slow. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 14 to 21 inches before moisture is depleted. Roots penetrate to a depth of more than 60 inches.

These soils are used for range and wildlife habitat.

Representative profile of Maughan silt loam, 25 to 50 percent slopes, in an area of Elzinga-Maughan complex, 25 to 50 percent slopes, in range, 1,400 feet east and 100 feet north of the west quarter corner of section 16, T. 9 N., R. 1 W., northwest of Mantua:

O1—3 inches to 0, matted, decaying leaves and twigs.

A1—0 to 24 inches, dark-gray (10YR 4/1) silt loam, black (10YR 2/1) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; many very fine and coarse roots; 15 percent cobbles; slightly acid (pH 6.4); clear, wavy boundary.

A2—24 to 35 inches, brown (10YR 5/3) very cobbly loam, brown (7.5YR 4/2) when moist; weak, medium and fine, subangular blocky structure; soft, friable, nonsticky and slightly plastic; common very fine and coarse roots; 55 percent cobbles; slightly acid (pH 6.2); gradual, irregular boundary.

B21t—35 to 51 inches, reddish-brown (5YR 5/4) cobbly clay, dark brown (7.5YR 4/4) when moist; moderate, medium, prismatic structure that parts to strong, medium and coarse, subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine and coarse roots; few very fine pores; many moderately thick clay films on ped faces; 20 percent cobbles; many small (about 1 millimeter in diameter) manganese concretions; medium acid (pH 6.0); diffuse, irregular boundary.

B22t—51 to 66 inches, reddish-brown (5YR 5/4) cobbly silty clay, dark brown (7.5YR 4/4) when moist; moderate, medium and coarse, subangular blocky structure; extremely hard, firm, very sticky and very plastic; few fine and very fine roots; few fine and very fine pores; common moderately thick clay films on ped faces; 35 percent weathered sandstone cobbles, surrounded by silt loam material; medium acid (pH 6.0).

The solum ranges from 54 to 70 inches or more in thickness. Content of coarse fragments, mostly cobbles, ranges from 10 to 15 percent in the A1 horizon, 20 to 55 percent in the A2 horizon, and 20 to 35 percent in the B2t horizon. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer in most years.

In the A1 horizon, value is 3 or 4 when the soils are dry; chroma is 1 or 2. This horizon ranges from 24 to 26 inches in thickness. In the A2 horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. This horizon is cobbly heavy loam or very cobbly loam, and it ranges from 9 to 14 inches thick.

In the B2t horizon, hue is 7.5YR or 5YR; value is 4 or 5 when the soils are dry and is 3 or 4 when they are moist. Texture is cobbly clay or cobbly silty clay, and reaction is slightly acid or medium acid.

In this survey area the Maughan soils are mapped only in a complex with the Elzinga soils. A description of this complex is given under the heading "Elzinga Series."

Mellor Series

The Mellor series consists of well-drained soils that are affected by alkali. These soils are on low lake terraces in Curlew Valley and Hansel Valley. They formed in strongly calcareous, mixed lake sediments derived mainly from limestone and sandstone. Slopes range from 1 to 6 percent but most commonly are 1 to 3 percent. The vegetation consists of shadscale, greasewood, squirreltail, kochia, annual mustard, and cheatgrass. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,260 to 4,600 feet.

In a representative profile, the surface layer is pale-brown and very pale brown silt loam about 6 inches thick. The subsoil is about 12 inches thick. It is light brownish-gray and light-gray silty clay loam in the upper part and light-gray silt loam in the lower part. The substratum, to a depth of 48 inches, is light-gray silt loam. Between depths of 48 and 62 inches the substratum is light-gray gravelly loamy fine sand. These soils are moderately calcareous to strongly calcareous and mostly strongly alkaline throughout.

Permeability is slow, and the rate of water intake is slow. Because of the salt content, the water available to plants is only 3 to 7 inches to a depth of 5 feet and the water-supplying capacity is about 5.5 to 8 inches before moisture is depleted. If the soils are reclaimed, however, the available water holding capacity is 10 to 12 inches to that depth. Roots penetrate to a depth of more than 60 inches, but most roots are in the top 18 inches of soil.

These soils are used for range.

Representative profile of Mellor silt loam, 1 to 6 percent slopes, in range, 2,900 feet north and 2,200 feet east of the southwest corner of section 16, T. 12 N., R. 7 W., about one-fourth mile north of Salt Wells in south Hansel Valley:

A11—0 to 3 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (2.5Y 4/2) when moist; moderate,

thick, platy structure that parts to moderate, thin, platy; soft, friable, nonsticky and slightly plastic; common fine and very fine and few medium roots; common very fine and few fine pores; moderately calcareous; strongly alkaline (pH 8.7); abrupt, smooth boundary.

- A12—3 to 6 inches, very pale brown (10YR 7/3) silt loam, dark grayish brown (10YR 4/2) when moist; strong, thick, platy structure that parts to moderate, thin, platy; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine and few medium roots; few fine pores; moderately calcareous; strongly alkaline (pH 8.7); abrupt, smooth boundary.
- B21t—6 to 10 inches, light brownish-gray (2.5YR 6/2) light silty clay loam, dark grayish brown (10YR 4/2) when moist; weak, coarse, prismatic structure that parts to moderate, fine, subangular blocky; hard, firm, sticky and slightly plastic; common very fine and few medium roots; common very fine and fine pores; many thin clay films on ped faces; moderately calcareous; strongly alkaline (pH 8.7); clear, smooth boundary.
- B22t—10 to 14 inches, light-gray (2.5Y 7/2) silty clay loam, grayish brown (10YR 5/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; hard, firm, sticky and slightly plastic; common fine and very fine and few medium roots; common very fine pores; continuous thin and common moderately thick clay films on ped faces; few krotovinas (2 to 5 millimeters in diameter); strongly calcareous; strongly alkaline (pH 8.9); clear, wavy boundary.
- B3tca—14 to 18 inches, light-gray (10YR 5/2) heavy silt loam, grayish brown (10YR 5/2) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; slightly hard, firm, slightly sticky and slightly plastic; common fine and very fine and few medium roots; few very fine pores; few thin clay films on ped faces; strongly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.
- C1ca—18 to 25 inches, light-gray (10YR 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, wavy boundary.
- C2—25 to 41 inches, light-gray (2.5Y 7/2) heavy silt loam, grayish brown (2.5Y 5/2) when moist; massive; slightly hard, friable, sticky and slightly plastic; few fine and very fine roots; many fine pores; some thin gypsum seams; 1 percent fine gravel; strongly calcareous, lime is filamentary; strongly alkaline (pH 8.9); abrupt, smooth boundary.
- C3—41 to 48 inches, light-gray (5Y 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few very fine roots; few very fine pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); abrupt, smooth boundary.
- IIC4—48 to 62 inches, light-gray (10YR 7/2) gravelly loamy fine sand, pale brown (10YR 6/3) when moist; single grained; strongly calcareous, lime is disseminated; loose, except weakly cemented between depths of 48 and 49 inches; strongly alkaline (pH 8.5).

The surface has a prominent polygonal pattern. Depth to the horizon of carbonate accumulation ranges from 11 to 21 inches. The soils are usually dry in all parts between depths of 4 and 12 inches.

In the A1 horizon, value is 6 to 7 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 2 to 4. Reaction is moderately alkaline to very strongly alkaline. Thickness of the A1 horizon ranges from 4 to 8 inches.

In the B2t horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is light silty clay loam or silty clay loam, and content of clay ranges from 28 to 35 percent. Clay films range from few to many and from thin to moderately thick on ped faces. This horizon is strongly alkaline to very strongly alkaline and is moderately calcareous to strongly calcareous. The B3ca horizon, where present, is similar

to the B2t horizon in color, texture, and reaction, but it is strongly calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value is 7 or 8 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is mainly silt loam but may be light silty clay loam or very fine sandy loam. This horizon is moderately to strongly affected by salts and alkali.

Mellor silt loam, 1 to 6 percent slopes (MFB).—

This soil is on low lake terraces. Slopes are slightly convex and medium in length and most commonly are 1 to 3 percent. A profile of this soil is the one described as representative for the Mellor series. Runoff is medium, and the hazard of erosion is moderate. Shallow gullies have been formed in places.

Included with this soil in mapping are small areas of Bram silt loam; Harding silt loam; Palisade silt loam, 1 to 6 percent slopes; and Thiokol silt loam, low rainfall, 1 to 3 percent slopes.

This soil is used for range. Capability unit VII_s-S8, nonirrigated; Semidesert Alkali Flats range site.

Mellor-Thiokol silt loams, 1 to 6 percent slopes (MGB).—

This mapping unit is on low lake terraces. Slopes are slightly convex and medium in length. The mapping unit consists of about 60 percent Mellor silt loam, 1 to 6 percent slopes, and 35 percent Thiokol silt loam, low rainfall, 1 to 6 percent slopes. Included with these soils in mapping are areas of Bram silt loam and Saxby extremely stony silt loam, 1 to 6 percent slopes. These included soils make up about 5 percent of the total acreage.

Soils of this complex are intermingled. The Mellor soil is in slightly convex, undulating areas under a cover of kochia, halogeton, annual mustard, and some shadscale. The Thiokol soil is in slightly raised positions along the shallow drainageways and supports a cover of sagebrush and squirreltail.

The profile of the Mellor soil in this complex is similar to that described as representative for the Mellor series. The Thiokol soil in this complex is similar to Thiokol silt loam, 1 to 6 percent slopes, but the frost-free period is 90 to 110 days and the average annual precipitation is 8 to 11 inches. Runoff is medium, and the hazard of erosion is moderate.

The soils of this complex are used mainly for range, but a very small area in Curlew Valley is used for irrigated small grains and alfalfa. Capability unit VII_s-S8, nonirrigated; Semidesert Alkali Flats range site.

Mendon Series

The Mendon series consists of well-drained soils. These soils are on intermediate and high lake terraces in the northeastern part of the survey area. They formed in alluvium and lake sediments derived from light-colored tufaceous sandstone, conglomerate, and limestone. Slopes range from 1 to 10 percent. The vegetation in noncultivated areas is mainly bluebunch wheatgrass, western wheatgrass, big sagebrush, and annual grasses. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 16 to 18 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,700 to 5,100 feet.

In a representative profile (fig. 9), the surface layer is dark-gray silt loam about 12 inches thick. The subsoil is grayish-brown silty clay loam about 19 inches thick. The substratum is white silt loam that reaches to a depth



Figure 9.—Profile of Mendon silt loam, 1 to 6 percent slopes.

of 60 inches or more. The surface layer and subsoil are mildly alkaline. The substratum is strongly alkaline and strongly calcareous. A layer of strong lime accumulation is at a depth of about 31 inches.

Permeability is moderately slow to a depth of 31 inches but is moderate below that depth, and the rate of water intake is moderate. Available water holding capacity is 11 to 12 inches to a depth of 5 feet. The water-supplying capacity is 14 to 16 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

These soils are used for nonirrigated crops.

Representative profile of Mendon silt loam, 1 to 6 percent slopes, in a nonirrigated crop area, 400 feet west of the southeast corner of section 15, T. 15 N., R. 2 W.:

Ap—0 to 7 inches, dark-gray (10YR 4/1) silt loam, very dark gray (10YR 3/1) when moist; moderate, medium and fine, granular structure; soft, friable, slightly sticky and slightly plastic; many fine and very fine roots; mildly alkaline (pH 7.4); clear, smooth boundary.

A1—7 to 12 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) when moist; moderate, medium and fine, subangular blocky structure; slightly hard,

friable, slightly sticky and plastic; many fine and very fine roots; common fine pores; mildly alkaline (pH 7.5); clear, smooth boundary.

B21t—12 to 23 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; moderate, medium, prismatic structure that parts to strong, medium, subangular blocky; very hard, firm, sticky and plastic; common fine and few medium roots; common very fine and fine pores; continuous moderately thick clay films on ped faces; mildly alkaline (pH 7.6); clear, wavy boundary.

B22t—23 to 31 inches, grayish-brown (10YR 5/2) silty clay loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, prismatic structure that parts to strong, medium, subangular blocky; very hard, firm, sticky and very plastic; many fine and very fine and few medium roots; common fine and few medium pores; continuous moderately thick clay films on ped faces; mildly alkaline (pH 7.6); abrupt, smooth boundary.

C1ca—31 to 42 inches, white (10YR 8/1) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many fine and very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, wavy boundary.

C2—42 to 62 inches, white (5Y 8/1) light silt loam, light olive gray (5Y 6/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; many fine and very fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7).

The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 1 to 1.5 in the upper part and ranges to 2 in the lower part. Thickness of the A1 horizon ranges from 10 to 13 inches.

In the B2t horizon, hue is 10YR to 5Y; value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; and chroma is 1 or 2. Texture is silty clay loam or heavy silt loam. Clay films are thin to moderately thick and few to continuous on ped faces. Reaction is mildly alkaline or moderately alkaline.

In the C horizon, hue is 10YR, 2.5Y, or 5Y; value is 7 or 8 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma is 1 or 2. Depth to the Cca horizon is most commonly 30 inches but may be as much as 40 inches. Texture in the C horizon is silt loam, silty clay loam, or silty clay. Reaction is mildly alkaline to strongly alkaline.

Mendon silt loam, 1 to 6 percent slopes (MhB).—This soil is on lake terraces in the northeastern part of the survey area near Plymouth and Collinston. Slopes are medium in length. A profile of this soil is the one described as representative for the Mendon series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Anty fine sandy loam, 1 to 6 percent slopes; Collinston silt loam, 6 to 10 percent slopes; and Mendon silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIe-M, nonirrigated; range site not assigned.

Mendon silt loam, 6 to 10 percent slopes (MhD).—This soil is on lake terraces in the northeastern part of the survey area between Plymouth and Collinston. Slopes are short and slightly convex. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Anty fine sandy loam, 6 to 10 percent slopes; Collinston silt loam, 6 to 10 percent slopes; and Mendon silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe-M, nonirrigated; range site not assigned.

Middle Series

The Middle series consists of well-drained soils on mountains. These soils formed in residuum and colluvium derived mainly from sandstone, limestone, quartzite, and basalt. A small area of this soil that formed in basaltic material is near Rattlesnake Pass. Slopes range from 10 to 70 percent. Vegetation is mainly bluebunch wheatgrass, sagebrush, bitterbrush, and cheatgrass. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 15 to 18 inches, and the frost-free period is 100 to 110 days. Elevations range from 4,800 to 6,600 feet.

In a representative profile, the surface layer is grayish-brown and brown cobbly silt loam about 7 inches thick. The subsoil is brown cobbly silt loam and very cobbly silt loam about 12 inches thick. The substratum is very pale brown very cobbly loam about 9 inches thick over limestone bedrock, which is at a depth of about 28 inches. The surface layer is mildly alkaline, the subsoil is moderately alkaline, and the substratum is moderately alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 2.5 to 4 inches above bedrock. The water-supplying capacity is about 8 or 9 inches before moisture is depleted. Roots are concentrated in the top 24 to 30 inches but can penetrate to bedrock.

Middle soils are used for range and wildlife habitat.

Representative profile of Middle cobbly silt loam, 30 to 70 percent slopes, in range, 2,400 feet east and 1,200 feet north of the southwest corner of section 16, T. 14 N., R. 4 W., about 4 miles southwest of Portage in Rough Canyon:

- A11—0 to 3 inches, grayish-brown (10YR 5/2) cobbly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; common very fine pores; 30 percent cobblestones and gravel; mildly alkaline (pH 7.8); clear, smooth boundary.
- A12—3 to 7 inches, brown (10YR 5/3) cobbly silt loam, dark brown (10YR 3/3) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine roots; common very fine pores; 35 percent cobblestones and gravel; mildly alkaline (pH 7.8); clear, smooth boundary.
- B21—7 to 12 inches, brown (10YR 5/3) cobbly silt loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine roots; many fine pores; 45 percent cobblestones and gravel; moderately alkaline (pH 8.0); gradual, wavy boundary.
- B22—12 to 19 inches, brown (10YR 5/3) very cobbly heavy silt loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; many fine pores; 55 percent cobblestones and gravel; slightly calcareous; moderately alkaline (pH 8.0); gradual, wavy boundary.
- Cca—19 to 28 inches, very pale brown (10YR 7/4) very cobbly loam, yellowish brown (10YR 5/4) when moist; massive; soft, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; 80 percent cobblestones and gravel, and also a few stones; strongly calcareous; moderately alkaline (pH 8.2); abrupt, irregular boundary.
- R—28 to 32 inches, fractured limestone bedrock.

The solum ranges from 13 to 24 inches in thickness. Depth to bedrock ranges from 24 to 38 inches. Coarse fragments are angular cobblestones and gravel. Their content ranges

from 25 to 50 percent in the A1 horizon and from 25 to 80 percent in the B2 and C horizons. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry; chroma is 2 or 3. This horizon is cobbly silt loam or gravelly loam and ranges from 5 to 17 inches in thickness. Reaction is mildly alkaline or moderately alkaline.

In the B2 horizon, value ranges from 5 to 7 when the soils are dry and is 4 or 5 when they are moist; and chroma is 2 or 3. Texture is gravelly, very gravelly, cobbly, or very cobbly silt loam, silty clay loam, or clay loam. The B2 horizon is mildly alkaline to moderately alkaline, is nonclacareous to moderately calcareous, and is 5 to 12 inches thick.

In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 3 to 5 when they are moist; chroma ranges from 2 to 4. Texture is very cobbly light loam or very cobbly heavy loam. Reaction is moderately alkaline to strongly alkaline.

Middle cobbly silt loam, 10 to 30 percent slopes (MIE).—This soil is mainly on north-facing mountain slopes. Elevations range from 5,300 to 5,800 feet. Runoff is medium, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Broad cobbly loam, 20 to 30 percent slopes, and Middle cobbly silt loam, 30 to 70 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VIe-U, nonirrigated; Upland Loam range site.

Middle cobbly silt loam, 30 to 70 percent slopes (MIG).—This soil is mainly on north-facing mountain slopes. A profile of this soil is the one described as representative for the Middle series. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Broad cobbly loam, 30 to 60 percent slopes, and Smarts loam, 30 to 70 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VIIe-U, nonirrigated; Upland Loam range site.

Middle-Broad association, steep (MJG).—This mapping unit is on the mountains surrounding Blue Creek valley and Howell Valley. It consists of about 65 percent Middle cobbly silt loam, 30 to 70 percent slopes, and 25 percent Broad cobbly loam, 30 to 60 percent slopes. Included with these soils in mapping are areas of Yeates Hollow cobbly clay loam, 30 to 60 percent slopes; Richmond very stony loam, 30 to 70 percent slopes; and Smarts loam, 30 to 70 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this association are intermingled. The Middle soil is on slightly concave, south- and west-facing mountain slopes. The Broad soil is on even or slightly concave, north- and east-facing mountain slopes. (fig. 10). Both soils have a cover of bluebunch wheatgrass, sagebrush, bitterbrush, yellowbrush, and annual grasses.

The profile of the Middle soil in this association is similar to that described as representative for the Middle series, but the surface layer ranges from 5 to 9 inches in thickness. Elevations range from 5,300 to 6,400 feet. Runoff is medium, and the hazard of erosion is moderate. The profile of the Broad soil is similar to that described as representative for the Broad series.

The soils in this association are used for range and wildlife habitat. The Middle soil is in capability unit VIIe-U, nonirrigated; Upland Loam range site. The Broad soil is in capability unit VIIs-M, nonirrigated; Mountain Stony Loam range site.

Middle-Rock outcrop complex, 10 to 30 percent slopes (MKE).—This mapping unit is on the mountains in the



Figure 10.—An area of Middle-Broad association, steep. The Middle soil is on the south-facing slopes where the snow has melted. The Broad soil is on the north-facing slopes that are covered by snow. Slopes are mainly 30 to 70 percent. The soil in the foreground is mainly Middle cobbly silt loam, 10 to 30 percent slopes.

northern part of Hansel Valley. It consists of about 50 percent Middle cobbly loam, 10 to 30 percent slopes, and 30 percent Rock outcrop. Included with this unit in mapping are areas of Rock land; Sandall cobbly silt loam, 10 to 30 percent slopes; Gemson silty clay loam, 10 to 20 percent slopes; and Snowville gravelly silt loam, 6 to 20 percent slopes. These included areas make up about 20 percent of the total acreage.

This complex is mainly on south- and west-facing slopes. The Middle soil is on slightly concave side slopes. Its plant cover is mostly sagebrush and bluebunch wheatgrass, but there is some yellowbrush, bitterbrush, juniper, and annual weeds and grass. Rock outcrop is mainly on ridgetops and knobs that are close enough together to hinder the movement of grazing animals. It also occurs in random areas throughout the complex. No usable vegetation grows on Rock outcrop.

The profile of the Middle soil in this complex is similar to that described as representative for the Middle series. This soil formed in residuum and colluvium derived from basalt; the surface layer is cobbly loam, and the subsoil

is gravelly heavy silt loam or gravelly silty clay loam. In the subsoil, value is 6 or 7 when the soil is dry and ranges from 3 to 5 when it is moist, and a few thin clay films are on ped faces in some places. Rock outcrop in this complex is mainly basalt. Runoff is medium, and the hazard of erosion is slight for this complex.

This complex is used for range and wildlife habitat. Capability unit VIe-U, nonirrigated; Upland Loam range site.

Middle-Rock outcrop complex, 30 to 60 percent slopes (MKG).—This mapping unit is on the mountains in the northern part of Hansel Valley. It consists of about 50 percent Middle cobbly loam, 30 to 60 percent slopes, and about 30 percent Rock outcrop. Included with this unit in mapping are areas of Rock land; Sandall cobbly silt loam, 30 to 70 percent slopes; and Gemson silty clay loam, 10 to 20 percent slopes. These included areas make up about 20 percent of the total acreage.

This complex is mainly on south- and west-facing slopes. The Middle soil has slightly concave slopes. Its plant cover is mostly sagebrush and bluebunch wheat-

grass, but there is some yellowbrush, bitterbrush, juniper and annual weeds and grasses. Rock outcrop is mainly on ridgetops and knobs that are close enough together to hinder the movement of grazing animals. It also is in random areas throughout the complex. No usable vegetation grows on Rock outcrop,

The profile of the Middle soil in this complex is similar to that described as representative for the Middle series. The soil formed in residuum and colluvium derived from basalt. The surface layer is cobbly loam, and the subsoil is gravelly heavy silt loam or gravelly or cobbly clay loam. In the subsoil, value is 6 or 7 when the soil is dry and ranges from 3 to 5 when it is moist. A few thin clay films are on ped faces in some places. Rock outcrop in this complex is mostly basalt.

This complex is used for range and wildlife habitat. Capability unit VIIe-U, nonirrigated; Upland Loam range site.

Millville Series

The Millville series consists of moderately well drained soils. These soils are on alluvial fans along the base of the Wellsville Mountains. They formed in alluvium derived mainly from dolomitic limestone. Slopes range from 0 to 4 percent. The vegetation in noncultivated areas is big sagebrush, bluebunch wheatgrass, bluegrass, buckwheat, annual grasses, and weeds. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,240 to 4,400 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 12 inches thick. The underlying layers, extending to a depth of 60 inches, are light brownish-gray, light-gray, and pale-brown silt loam. These soils are strongly alkaline throughout and are strongly calcareous or very strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. Roots penetrate to a depth of 60 inches.

Millville soils are used for irrigated crops.

Representative profile of Millville silt loam, 0 to 2 percent slopes, in a cultivated field, 1,700 feet north of the south quarter corner of section 15, T. 10 N., R. 2 W., 2 miles southeast of Honeyville:

- Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure that parts to weak, fine, granular; hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.
- A1—9 to 12 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; strongly calcareous; strongly alkaline (pH 8.8); clear, smooth boundary.
- C1—12 to 17 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine and very fine pores; very strongly calcareous; strongly alkaline (pH 9.0); clear, wavy boundary.
- C2—17 to 24 inches, light-gray (10YR 7/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic;

few fine roots; common fine and very fine pores; very strongly calcareous; strongly alkaline (pH 8.8); clear, wavy boundary.

- C3—24 to 41 inches, light-gray (10YR 7/2) silt loam, brown (10YR 5/3) when moist; massive; very hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; very strongly calcareous; strongly alkaline (pH 9.0); gradual, wavy boundary.
- C4—41 to 53 inches, light-gray (10YR 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; few, fine, faint, yellowish-brown (10YR 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; very strongly calcareous; strongly alkaline (pH 9.0); gradual, wavy boundary.
- C5—53 to 60 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; few, fine, faint, yellowish-brown (10YR 5/4) mottles; massive; hard, friable, slightly sticky and slightly plastic; many fine and very fine pores; very strongly calcareous; strongly alkaline (pH 9.0).

Between depths of 10 and 40 inches, the texture averages silt loam and the calcium carbonate equivalent ranges from 40 to 55 percent. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated. In places there is a fluctuating water table at depths between 30 and 50 inches.

The A1 horizon is moderately alkaline or strongly alkaline and moderately or strongly calcareous. Thickness of the A1 horizon ranges from 12 to 18 inches. In the C horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma is 2 or 3. Reaction is moderately alkaline or strongly alkaline.

Millville silt loam, 0 to 2 percent slopes (M1A).—This soil is on west-facing slopes on alluvial fans. Slopes are medium in length. A profile of this soil is the one described as representative for the Millville series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Millville silt loam, 2 to 4 percent slopes; Roshe Springs silt loam; and Honeyville silty clay loam.

This soil is used for irrigated alfalfa, corn for silage, sweet corn, small grains, tomatoes, sugar beets, and irrigated pasture. Capability unit I-1, irrigated; range site not assigned.

Millville silt loam, 2 to 4 percent slopes (M1B).—This soil is on west-facing slopes on alluvial fans. Slopes are short to medium in length. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Millville silt loam, 0 to 2 percent slopes; Millville silt loam, moderately deep water table, 2 to 4 percent slopes; Roshe Springs silt loam; and Honeyville silty clay loam.

This soil is used for irrigated alfalfa, corn for silage, sweet corn, small grains, tomatoes, and sugar beets. Capability unit IIe-1, irrigated; range site not assigned.

Millville silt loam, moderately deep water table, 2 to 4 percent slopes (MmB).—This soil is on alluvial fans. The profile of this soil is similar to that described as representative for the Millville series, but a fluctuating water table or other characteristics associated with wetness are between depths of 30 and 50 inches. Slopes are short and slightly concave. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Millville silt loam, 2 to 4 percent slopes; Roshe Springs silt loam; and Honeyville silty clay loam.

This Millville soil is used chiefly for irrigated alfalfa, corn for silage, small grains, sugar beets, tomatoes, and irrigated pasture. A small area is used for nonirrigated

alfalfa and small grains. Capability unit IIw-2, irrigated; range site not assigned.

Munk Series

The Munk series consists of well-drained soils. These soils are on foothills and high lake terraces. They formed in residuum and colluvium derived mainly from limestone, conglomerate, and tufaceous sandstone. Slopes range from 6 to 20 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, big sagebrush, balsamroot, yellowbrush, oregongrape, bitterbrush, and annual grasses. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 110 to 130 days. Elevations range from 4,800 to 5,575 feet.

In a representative profile, the surface layer is grayish-brown gravelly silt loam about 10 inches thick. The next layer is grayish-brown gravelly heavy loam about 7 inches thick. The underlying layer, between depths of 17 and about 32 inches, is light-gray very gravelly sandy clay loam that is underlain by fractured limestone bedrock. The surface layer is moderately alkaline or strongly alkaline and moderately calcareous. The substratum is strongly alkaline and strongly calcareous. A layer of strong lime accumulation is at a depth of about 17 inches.

Permeability is moderate, and the intake rate of water is rapid. Available water holding capacity is 2 to 4 inches to bedrock. The water-supplying capacity is 7.5 to 8.5 inches before moisture is depleted. Roots penetrate to bedrock.

These soils are used for nonirrigated crops, range, and wildlife habitat.

Representative profile of Munk gravelly silt loam, 10 to 20 percent slopes, in an area of Parleys-Munk complex, 10 to 20 percent slopes, in nonirrigated cropland, 1,300 feet east and 1,200 feet north of the southwest corner of section 27, T. 14 N., R. 6 W., in the northern part of Hansel Valley:

- Ap—0 to 6 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and very fine roots; 25 percent gravel and cobbles; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, smooth boundary.
- A1—6 to 10 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; 30 percent gravel and cobbles; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.
- AC—10 to 17 inches, grayish-brown (10YR 5/2) gravelly heavy loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few very fine pores; 35 percent gravel and cobbles; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.
- Cca—17 to 32 inches, light-gray (10YR 7/2) very gravelly sandy clay loam, pale brown (10YR 6/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; few fine and very fine pores; 60 percent gravel and cobbles; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.
- R—32 inches, fractured limestone bedrock.

Depth to the horizon of carbonate accumulation is about 17 inches. Texture between depths of 10 and 40 inches averages very gravelly light loam. Depth to bedrock ranges from 30 to 40 inches. Coarse fragments are mainly angular limestone and tufaceous sandstone of gravel and cobblestone size. The content of coarse fragments ranges from 20 to 50 percent in the A1 horizon and from 40 to 80 percent in the Cca horizon. The soils are usually moist but are dry in all parts between depths of 8 and 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry. This horizon is gravelly silt loam or gravelly loam and ranges from 7 to 12 inches in thickness. It is moderately alkaline to strongly alkaline and slightly calcareous to strongly calcareous.

In the Cca horizon, value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; chroma ranges from 2 to 4. Texture is very gravelly sandy clay loam or very gravelly sandy loam. In places the Cca horizon is weakly cemented.

Munk gravelly silt loam, 10 to 20 percent slopes (MuE).—This soil is on south- and west-facing foothills and high lake terraces. Slopes are slightly convex. Runoff is rapid, and the hazard of erosion is high. Moderate sheet and rill erosion is common, and a few shallow gullies have been formed.

Included with this soil in mapping are small areas of Forsgren silt loam, 10 to 20 percent slopes, and Pomat silt loam, 10 to 30 percent slopes.

This Munk soil is used for nonirrigated small grains. It is also used for range and wildlife habitat. Capability unit VI_s-U, nonirrigated; Upland Stony Loam range site.

Obray Series

The Obray series consists of well-drained soils. These soils are on alluvial fans and in mountain valleys east and south of Mantua. They formed in fine-textured alluvium and colluvium derived from sandstone, quartzite, and limestone. Slopes range from 10 to 25 percent. Vegetation consists of slender wheatgrass, mountain brome, bluegrass, mulesear dock, and low sagebrush. Mean annual air temperature ranges from 41° to 43° F. Average annual precipitation ranges from 18 to 25 inches, and the frost-free period is 80 to 100 days. Elevations range from 6,000 to 6,800 feet.

In a representative profile, the surface layer is grayish-brown clay loam and clay about 37 inches thick. The underlying layers are brown and pale-brown clay that extend to a depth of 60 inches. The soils are slightly acid or neutral throughout.

Permeability is very slow, and the rate of water intake is slow. Available water holding capacity is 11 to 13 inches to a depth of 5 feet. The water-supplying capacity is about 14 to 21 inches for plant growth before moisture is depleted. Roots easily penetrate to a depth of 60 inches.

Obray soils are used for range, wildlife habitat, and water supply.

Representative profile of Obray clay, 10 to 25 percent slopes, in range, 1,520 feet west and 560 feet south of the east quarter corner of section 25, T. 9 N., R. 1 W., in Clay Valley east of Mantua:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) clay loam, very dark brown (10YR 2/2) when moist; weak, medium and fine, subangular blocky structure; hard, firm, slightly sticky and slightly plastic; common fine and very fine roots; one-half inch of weak, medium, granular structure under clumps of grass; slightly acid; abrupt, smooth boundary.

A12—2 to 22 inches, grayish-brown (10YR 5/2) clay, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, prismatic structure that parts to strong, medium and coarse, subangular blocky; extremely hard, very firm, very sticky and very plastic; common fine and very fine roots in upper part of horizon decreasing to few very fine roots in the lower part; few very fine pores; common slickensides; black organic stains on vertical faces of peds; many manganese shot (less than 1 millimeter in diameter); slightly acid (pH 6.4); gradual, wavy boundary.

A1&C1—22 to 37 inches, the A1 part is grayish-brown (10YR 5/2) clay, dark brown (7.5YR 3/2) when moist; the C1 part is yellowish-brown (10YR 5/4) clay, brown (7.5YR 4/4) when moist; both the A1 and C1 parts have weak, medium and coarse, prismatic structure that parts to strong, coarse, subangular blocky; extremely hard, very firm, very sticky and very plastic; few very fine pores; many slickensides; many manganese shot (less than 1 millimeter in diameter); neutral (pH 6.6); gradual, irregular boundary.

C2—37 to 46 inches, brown (10YR 5/3) clay, brown (7.5YR 4/3) when moist; massive; extremely hard, very firm, very sticky and very plastic; few very fine pores; common slickensides; many manganese shot (less than 1 millimeter in diameter); slightly acid (pH 6.2); diffuse, wavy boundary.

C3—46 to 60 inches, pale-brown (10YR 6/3) clay, brown (10YR 4/3) when moist; massive; extremely hard, very firm, very sticky and very plastic; few slickensides; many manganese shot (less than 1 millimeter in diameter); slightly acid (pH 6.2).

In the foregoing profile, slickensides are on both vertical and horizontal faces but are strongest on faces at an angle of 10 to 30 degrees from horizontal.

Cracks in these soils range from ½ to 1 inch in width and extend to a depth of more than 40 inches. The surface has a gilgai microrrelief that amounts to about 6 inches difference in elevation. The soils are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 2 or 3 when the soils are moist. Texture is clay loam or silty clay loam in the top 2 inches, and structure is fine platy or fine to medium subangular blocky. Slickensides are common in the bottom part of the A1 horizon.

In the C horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry; and chroma is 2 or 3. Structure is weak to strong, medium to coarse, subangular blocky, or the soil is massive. Slickensides range from few to many. Reaction is slightly acid or neutral.

Obray clay, 10 to 25 percent slopes (OBE).—This soil is in mountain valleys and on alluvial fans. Slopes are slightly convex and short to medium in length. Runoff is rapid, and the hazard of erosion is high. Sheet erosion is common, and a few shallow gullies have been formed.

Included with this soil in mapping are areas of Goring clay loam, 10 to 25 percent slopes, and Yeates Hollow cobbly clay loam, 20 to 30 percent slopes. One area of Obray clay in the north end of Devils Gate Valley has a browner surface layer than is allowed for the Obray series. This area represents about one-third of the total acreage of this soil.

This soil is used mainly for range but is also used for wildlife habitat and water supply. Capability unit VIe-M, nonirrigated; Mountain Clay range site.

Palisade Series

The Palisade series consists of well-drained soils on lake terraces. These soils formed in strongly calcareous, mixed lake sediments derived dominantly from limestone and sandstone. Slopes range from 1 to 10 percent. Vegetation consists of big sagebrush, cheatgrass, annual mustard, Russian-thistle, and some greasewood. Mean annual air

temperature ranges from 48° to 52° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 90 to 130 days. Elevations range from 4,300 to 4,840 feet.

In a representative profile, the surface layer is pale-brown silt loam about 6 inches thick. The subsoil is very pale brown silt loam about 6 inches thick. The substratum is very pale brown silt loam and light-gray loam between depths of 12 and 30 inches, and it is pale-brown very fine sandy loam that extends to a depth of 60 inches or more. These soils are moderately alkaline or strongly alkaline to a depth of 19 inches and very strongly alkaline between depths of 19 and 60 inches. They are moderately calcareous to strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Generally, the available water holding capacity is 8 to 9 inches to a depth of 5 feet. In some places, however, the soils contain enough salts below a depth of 20 inches to reduce the water available for plants to about 4 to 8 inches. In these places the water-supplying capacity is 6 to 8 inches before moisture is depleted. Most roots are in the top 24 inches of soil, but roots may penetrate to a depth of 60 inches.

These soils are used mainly for range. Very small areas are used for irrigated crops, and there is limited use by wildlife.

Representative profile of Palisade silt loam, 1 to 6 percent slopes, in range, 400 feet north and 700 feet east of the south quarter corner of section 11, T. 9 N., R. 7 W., about 7 miles southwest of Golden Spike Monument:

A1—0 to 6 inches, pale-brown (10YR 6/3) silt loam, dark grayish brown (10YR 4/2) when moist; weak, thin, platy structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; many fine and common medium pores; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, smooth boundary.

B2—6 to 12 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine vesicular pores; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.5); clear, smooth boundary.

C1ca—12 to 19 inches, very pale brown (10YR 7/3) light silt loam, brown (10YR 5/3) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); gradual, wavy boundary.

C2ca—19 to 30 inches, light-gray (10YR 7/2) light loam, brown (10YR 5/3) when moist; weak, medium and coarse, subangular blocky structure; very hard, friable, nonsticky and nonplastic; few very fine roots; many very fine vesicular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); gradual wavy boundary.

C3—30 to 43 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 5/3) when moist; massive; soft, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.1); gradual, wavy boundary.

C4—43 to 60 inches, pale-brown (10YR 6/3) very fine sandy loam, dark brown (10YR 4/3) when moist; massive; soft, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

The solum ranges from 10 to 19 inches in thickness. Between depths of 10 and 40 inches, the texture averages light silt loam and the content of clay ranges from 12 to 18 percent. Content of fine gravel is as much as 10 percent throughout. The soils

are usually dry in all parts between depths of 8 and 24 inches. These soils generally are not affected by a harmful content of salts and alkali, but in places they are slightly to strongly affected by salt and alkali.

In the A1 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is light silt loam or loam and ranges from 4 to 6 inches in thickness. It is moderately alkaline to very strongly alkaline.

In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is silt loam or loam and is 5 to 15 inches thick. It is strongly alkaline or very strongly alkaline and moderately calcareous or strongly calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value ranges from 5 to 8 when the soils are dry and is 4 or 5 when they are moist; and chroma ranges from 2 to 4. Texture is very fine, sandy loam, light loam, or light silt loam. In places, gravel is at a depth below 36 inches, but the content does not exceed 30 percent. Reaction is strongly alkaline or very strongly alkaline.

Palisade silt loam, 1 to 6 percent slopes (PAB).—This soil is on lake terraces. Slopes are long and slightly convex. A profile of this soil is the one described as representative for the Palisade series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Bram silt loam; Thiokol silt loam, low rainfall, 1 to 3 percent slopes; and Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes.

This soil is used chiefly for range and wildlife. Limited areas are used for irrigated small grains, alfalfa, corn for silage, and irrigated pasture. The small acreage of irrigated crops is in an area where the frost-free period does not exceed 100 days. Capability unit IIIe-3, irrigated; capability unit VIIe-S, nonirrigated; Semidesert Loam range site.

Palisade silt loam, 6 to 10 percent slopes (PAD).—This soil is on lake terraces. Slopes are slightly convex and medium in length. Runoff is medium, and the hazard of erosion is moderate. There are a few moderately deep gullies, and rill erosion is prominent in places.

Included with this soil in mapping are small areas of Palisade silt loam, 1 to 6 percent slopes; Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes; and Stingal loam, 6 to 10 percent slopes.

This soil is used for range and wildlife. Capability unit VIIe-S, nonirrigated; Semidesert Loam range site.

Parleys Series

The Parleys series consists of well drained and moderately well drained soils. These soils are on broad lake terraces, foothills, and alluvial fans. They formed in mixed lake sediments and alluvium derived mainly from sandstone, limestone, and quartzite. Slopes range from 0 to 20 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, western wheatgrass, big sagebrush, yellowbrush, phlox, balsamroot, and annual grasses. Mean annual air temperature ranges from 45° to 51° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 110 to 160 days. Elevations range from 4,220 to 5,575 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 11 inches thick. The subsoil is brown and pale-brown silty clay loam about 36 inches thick. The substratum is pale-brown loam that extends to a depth of 60 inches. The surface layer and subsoil are mildly alkaline and moderately alkaline. The substratum is

moderately alkaline to strongly alkaline and moderately calcareous. A layer of strong lime accumulation is at a depth of about 34 inches.

Permeability is moderately slow, and the rate of water intake is slow to moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 11 to 13 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

These soils are used for nonirrigated and irrigated crops. They are also used for wildlife habitat and urban development.

Representative profile of Parleys silt loam, 1 to 6 percent slopes, in a cultivated area, 200 feet south and 1,500 feet west of the east quarter corner of section 33, T. 14 N., R. 5 W., in northern Blue Creek valley:

Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and slightly plastic; few fine roots; few fine pores; mildly alkaline (pH 7.6); clear, smooth boundary.

A1—6 to 11 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; common fine pores; mildly alkaline (pH 7.4); abrupt, smooth boundary.

B2t—11 to 19 inches, brown (10YR 5/3) silty clay loam, dark brown (10YR 3/3) when moist; weak, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky; very hard, firm, sticky and plastic; few fine roots; few fine pores; common thin clay films on ped faces; mildly alkaline (pH 7.6); gradual, wavy boundary.

B22t—19 to 34 inches, pale-brown (10YR 6/3) silty clay loam, brown (10YR 4/3) when moist; weak, medium, prismatic structure that parts to moderate, fine and medium, subangular blocky; very hard, firm, sticky and plastic; few fine roots; few fine pores; many moderately thick clay films on ped faces; moderately alkaline (pH 8.0); gradual, wavy boundary.

B3ca—34 to 47 inches, pale-brown (10YR 6/3) light silty clay loam, dark yellowish brown (10YR 4/4) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few very fine roots; few fine pores; few thin clay films on ped faces; moderately calcareous, lime is in veins; moderately alkaline (pH 8.4); paste; gradual, wavy boundary.

Cca—47 to 60 inches, pale-brown (10YR 6/3) heavy loam, brown (7.5YR 4/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine pores; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6).

Depth to the horizon of carbonate accumulation ranges from 18 to 36 inches. In places, some gravel is on the surface and throughout the profile. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated. Depth to the water table ranges from 46 inches to 60 inches or more. In places, distinct mottles are at a depth below 42 inches.

In the A1 horizon, value is 4 to 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 to 3. This horizon is silt loam, loam, or light silty clay loam and ranges from 7 to 14 inches in thickness. It is mildly alkaline or moderately alkaline and generally is noncalcareous, but it may be slightly calcareous where the soil is irrigated.

In the B2t horizon, hue is 10YR and 7.5YR; value ranges from 4 to 6 when the soils are dry and from 3 to 5 when they are moist; and chroma ranges from 2 to 4. Texture is silty clay loam or light silty clay loam and the content of clay ranges from 28 to 35 percent. Structure is weak or moderate, prismatic or blocky. Clay films are few to continuous and thin to moderately thick on ped faces. Reaction is mildly alkaline to strongly alkaline. The B3ca horizon generally begins just below the B2t horizon.

In the Cca horizon, hue ranges from 7.5YR to 2.5Y; value ranges from 6 to 8 when the soils are dry; and chroma ranges

from 2 to 4. Texture is mainly silty clay loam, silt loam, or loam, but in places the horizon is stratified and has layers of very fine sandy loam $\frac{1}{8}$ to $\frac{1}{4}$ inch thick.

Parleys loam, 0 to 3 percent slopes (PbA).—This soil is on broad, low and intermediate lake terraces and alluvial fans in Bear River valley south of Garland and the benchlands south of Brigham City. Runoff is slow, and the hazard of erosion is slight. This soil is well drained. Average annual precipitation is 14 to 18 inches, and the frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Fielding silt loam, warm; Honeyville silty clay loam; Kilburn gravelly sandy loam, 3 to 6 percent slopes; and Timpanogos loam, 0 to 3 percent slopes. Also included are small areas of well drained to moderately well drained soils that have a subsoil of silty clay loam and slopes of 3 to 6 percent.

This Parleys soil is used for irrigated small grains, sugar beets, alfalfa, tomatoes, corn for silage, irrigated pasture, and orchards of apples, apricots, cherries, and peaches. It is also used for urban development and wildlife habitat. Capability unit I-1, irrigated; range site not assigned.

Parleys loam, cool, 0 to 3 percent slopes (PdA).—This soil is on broad, low lake terraces and alluvial fans adjacent to the valley floor in the Bear River valley area north of Garland. Runoff is slow, and the hazard of erosion is slight. This soil is moderately well drained. Average annual precipitation is 14 to 16 inches, and the frost-free period is 120 to 140 days.

Included with this soil in mapping are small areas of Fielding silt loam; Kearns silt loam, 1 to 3 percent slopes; and Timpanogos loam, cool, 0 to 3 percent slopes.

This soil is used for irrigated sugar beets, corn for silage, alfalfa, small grains, and pasture. Capability unit IIc-2, irrigated; range site not assigned.

Parleys silt loam, 0 to 1 percent slopes (PeA).—This soil is on broad lake terraces. Runoff is slow, and the hazard of erosion is slight. This soil is well drained. Average annual precipitation is 14 to 16 inches, and the frost-free period is 120 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 1 to 3 percent slopes, and Parleys silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains and for wildlife habitat. Capability unit IIIc-U, nonirrigated; range site not assigned.

Parleys silt loam, 1 to 6 percent slopes (PeB).—This soil is on broad lake terraces, uplands, and alluvial fans. A profile of this soil is the one described as representative for the Parleys series. Runoff is medium, and the hazard of erosion is moderate. This soil is well drained. Average annual precipitation is 15 to 18 inches, and the frost-free period is 110 to 130 days.

Included with this soil in mapping are small areas of DeJarnet gravelly silt loam, 1 to 6 percent slopes; Hendricks silt loam, 1 to 6 percent slopes; Kearns silt loam, 3 to 6 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. It is also used for wildlife habitat. Capability unit IIIe-U, nonirrigated; range site not assigned.

Parleys silt loam, 6 to 10 percent slopes (PeD).—This soil is on lake terraces, uplands, and alluvial fans. Slopes are slightly convex and medium in length. Runoff is

medium, and the hazard of erosion is moderate. This soil is well drained. Average annual precipitation is 15 to 18 inches, and the frost-free period is 110 to 130 days.

Included with this soil in mapping are small areas of Hendricks silt loam, 6 to 10 percent slopes; Sterling gravelly loam, 6 to 20 percent slopes; and Timpanogos silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains. It is also used for wildlife habitat. Capability unit IIIe-U, nonirrigated; Upland Loam range site.

Parleys silt loam, 10 to 20 percent slopes (PeE).—This soil is on high lake terraces, uplands, and alluvial fans. Slopes are short to medium in length and slightly convex. Runoff is rapid, and the hazard of erosion is high. Sheet and rill erosion is moderate, and shallow gullies are common. This soil is well drained. Average annual precipitation is 15 to 18 inches, and the frost-free period is 110 to 130 days.

Included with this soil in mapping are small areas of Forsgren silt loam, 10 to 20 percent slopes; Hendricks silt loam, 10 to 20 percent slopes; and Munk gravelly silt loam, 10 to 20 percent slopes.

This soil is used for nonirrigated small grains and for wildlife habitat. Capability unit IVe-U, nonirrigated; Upland Loam range site.

Parleys silty clay loam, 0 to 3 percent slopes (PIA).—This soil is on west-facing slopes on low lake terraces west of Willard. Slopes are medium in length and most commonly are less than 1 percent. The profile of this soil is similar to that described as representative for the Parleys series, but it is finer textured throughout. Runoff is slow, and the hazard of erosion is slight. This soil is well drained. Average annual precipitation is 14 to 17 inches, and the frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Parleys loam, 0 to 3 percent slopes.

This soil is used chiefly for irrigated small grains, alfalfa, sugar beets, corn for silage, and irrigated pasture. A small area is used for nonirrigated small grains. Capability unit I-1, irrigated; range site not assigned.

Parleys-Munk complex, 6 to 10 percent slopes (PmD).—This mapping unit is on uplands in the northern part of Blue Creek valley and Hansel Valley. It consists of about 60 percent Parleys silt loam, 6 to 10 percent slopes, and about 25 percent Munk gravelly silt loam, 6 to 10 percent slopes. Included with these soils in mapping are areas of Forsgren silt loam, 6 to 10 percent slopes; Hendricks silt loam, 6 to 10 percent slopes; and Pomat silt loam, 6 to 10 percent slopes. These included soils make up about 15 percent of the total acreage.

The soils of this complex are intermingled. The Parleys soil is between the knolls and ridges. Its slopes are medium in length and slightly concave. The Munk soil is on the knolls and ridges. Its slopes are short and convex.

The profile of the Parleys soil in this complex is similar to that described as representative for the series. This Parleys soil is well drained. The profile of the Munk soil in this complex is similar to that described as representative for the Munk series, but it has not been affected by moderate sheet and rill erosion. Runoff is medium on these soils, and the hazard of erosion is moderate.

The soils of this complex are used for nonirrigated small grains and for wildlife habitat. Capability unit IIIe-U, nonirrigated; range site not assigned.

Parleys-Munk complex, 10 to 20 percent slopes (PmE).—This mapping unit is on uplands in the northern part of Blue Creek valley and Hansel Valley. It consists of about 60 percent Parleys silt loam, 10 to 20 percent slopes, and 25 percent Munk gravelly silt loam, 10 to 20 percent slopes. Included with these soils in mapping are areas of Forsgren silt loam, 10 to 20 percent slopes, and Pomat silt loam, 10 to 30 percent slopes. These included soils make up about 15 percent of the total acreage.

Soils of this complex are closely intermingled. The Parleys soil is on north- and east-facing uplands. Its slopes are short to medium in length and are slightly concave. The Munk soil is on knolls and ridges. Its slopes are convex.

The profile of the Parleys soil in this complex is similar to that described as representative for the series. This Parleys soil is well drained. A profile of the Munk soil in this complex is the one described as representative for the Munk series. Runoff is rapid on these soils, and the hazard of erosion is high. Sheet and rill erosion is moderate, and a few shallow gullies have been formed.

The soils of this complex are used for nonirrigated small grains, range, and wildlife habitat. Capability unit IVe-U, nonirrigated; Upland loam range site.

Parleys-Pomat silt loams, 6 to 10 percent slopes (PnD).—This complex is on intermediate and high lake terraces and on uplands that are slightly above the highest lake terraces. It consists of about 50 percent Parleys silt loam, 6 to 10 percent slopes, and 35 percent Pomat silt loam, 6 to 10 percent slopes. Included with these soils in mapping are areas of Kearns silt loam, 6 to 10 percent slopes; Hendricks silt loam, 6 to 10 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes. These included soils make up about 15 percent of the total acreage.

The Parleys soil is in flat or slightly concave areas. The Pomat soil is on convex knolls and ridges and escarpments of terraces.

Runoff is medium on these soils. The hazard of erosion is slight to moderate on the Parleys soil and is moderate on the Pomat soil.

The soils of this complex are used for nonirrigated small grains and wildlife habitat. Capability unit IIIe-U, nonirrigated; range site not assigned.

Pass Canyon Series

The Pass Canyon series consists of well-drained soils. These soils are on mountain slopes at the southern end of the Promontory Mountains. They formed in residuum and colluvium derived from quartzite and sandstone. Slopes range from 6 to 30 percent. Vegetation consists of bluebunch wheatgrass, bluegrass, Indian ricegrass, big sagebrush, and yellowbrush. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 12 to 15 inches, and the frost-free period is 105 to 120 days. Elevations range from 4,300 to 5,240 feet.

In a representative profile, the surface layer is brown loam and silt loam about 11 inches thick. The subsoil is yellowish-brown cobbly light clay loam, about 9 inches thick, that is underlain by quartzite bedrock at a depth of 20 inches. The soil is neutral throughout.

Permeability is moderate, and the rate of water intake is moderately slow. Available water holding capacity is

2.5 to 3.5 inches to bedrock. The water-supplying capacity is 6.5 to 8 inches before moisture is depleted. Roots penetrate to bedrock.

These soils are used for range.

Representative profile of Pass Canyon loam, 6 to 30 percent slopes, in an area of Pass Canyon-Rock outcrop complex, 6 to 30 percent slopes, in range, 600 feet east and 450 feet south of the west quarter corner of section 21, T. 6 N., R. 5 W.:

A11—0 to 4 inches, brown (10YR 5/3) loam, dark brown (10YR 3/3) when moist; moderate, thick, platy structure that parts to moderate, thin, platy; hard, friable, slightly sticky and slightly plastic; many fine roots; neutral (pH 6.8); clear, wavy boundary.

A12—4 to 11 inches, brown (10YR 5/3) heavy silty loam, dark brown (10YR 3/3) when moist; strong, fine, granular structure; slightly hard, very friable, sticky and slightly plastic; common fine roots; neutral (pH 6.6); clear, wavy boundary.

B2t—11 to 20 inches, yellowish-brown (10YR 5/4) cobbly light clay loam, dark yellowish brown (10YR 4/4) when moist; weak, coarse, subangular blocky structure that parts to weak, fine, subangular blocky; slightly hard, firm slightly sticky and plastic; common fine roots; 30 percent cobblestones; thin continuous clay films on ped faces; neutral (pH 6.8); abrupt, irregular boundary.

R—20 inches, fractured quartzite bedrock.

Depth to fractured quartzite bedrock ranges from 14 to 20 inches. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer.

In the A1 horizon, texture is loam, silt loam, or heavy silt loam that is 0 to 15 percent gravel. Reaction is neutral or mildly alkaline. This horizon ranges from 11 to 13 inches in thickness. In the B2t horizon, value is 5 to 6 when the soils are dry. Texture is cobbly light clay loam or cobbly light silty clay loam, and reaction is neutral to mildly alkaline. The B2t horizon ranges from 7 to 9 inches in thickness.

Pass Canyon-Rock outcrop complex, 6 to 30 percent slopes (POE).—This mapping unit is on the southern end of the Promontory Mountains. It consists of about 75 percent Pass Canyon loam, 6 to 30 percent slopes, and 20 percent Rock outcrop. Included with this unit in mapping are areas of Hupp gravelly silt loam, 10 to 20 percent slopes. These included areas make up about 5 percent of the total acreage.

The Pass Canyon soil is on mountain slopes having all exposures and is under a cover of bluebunch wheatgrass and big sagebrush. A profile of this soil is the one described as representative for the series. Mainly, slopes are slightly convex and 6 to 15 percent. Runoff is medium, and the hazard of erosion is moderate.

Rock outcrop is in small areas, 5 to 50 feet across, throughout the mapping unit. The outcropping rock is mainly quartzite.

This complex is used for range. Capability unit VIIs-U, nonirrigated; Upland Shallow Loam range site.

Payson Series

The Payson series consists of somewhat poorly drained soils that are affected by alkali. These soils are on low lake terraces and lake plains. They formed in alluvium and mixed lake sediments derived from limestone, sandstone, and quartzite. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is greasewood, saltgrass, annual mustard, cheatgrass, and annual weeds. Mean annual air temperature ranges from 46° to 50° F. Average

annual precipitation ranges from 12 to 16 inches, and the frost-free period is 120 to 150 days. Elevations range from 4,215 feet to 4,350 feet.

In a representative profile, the surface layer is light brownish-gray and light-gray silt loam about 6 inches thick. The subsoil is grayish-brown clay about 8 inches thick. The substratum, which extends to a depth of 60 inches, is white clay loam and loam in the upper part and light-gray silt loam and very pale brown silty clay loam in the lower part. The surface layer is mildly alkaline and noncalcareous. The subsoil and substratum are strongly alkaline or very strongly alkaline and slightly calcareous to strongly calcareous. A layer of strong lime accumulation is at a depth of 14 inches.

Permeability is very slow in the subsoil but is moderately slow in the substratum. The rate of water intake is slow. Because of the salt content, the water available to plants is only about 4 to 8 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 10 to 11 inches to that depth. Most roots are in the upper 16 inches of soil, but roots of some plants may penetrate to a depth of more than 60 inches.

Payson soils are used for range and irrigated crops.

Representative profile of Payson silt loam, 1,900 feet south and 140 feet west of the north quarter corner of section 21, T. 9 N., R. 2 W., about 2 miles west of Box Elder High School near Brigham City:

- A2p—0 to 5 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, platy structure that parts to weak, fine, granular; soft, friable, nonsticky and nonplastic; few fine roots; many fine vesicular pores; mildly alkaline (pH 7.5); abrupt, smooth boundary.
- A2—5 to 6 inches, light-gray (10YR 7/2) silt loam, grayish brown (10YR 5/2) when moist; weak, moderately thin, platy structure; soft, friable, nonsticky and nonplastic; few fine roots; common fine vesicular pores; mildly alkaline (pH 7.5); abrupt, smooth boundary.
- B2t—6 to 14 inches, grayish-brown (10YR 5/2) clay, very dark grayish brown (2.5Y 3/2) when moist; strong, medium, columnar structure that parts to strong, fine and medium, subangular blocky; hard, extremely firm, sticky and plastic; few fine roots; few fine interstitial pores; continuous moderately thick clay films on ped faces; ped faces are noncalcareous, interiors are slightly calcareous; strongly alkaline (pH 8.9); abrupt, wavy boundary.
- C1ca—14 to 17 inches, white (2.5Y 8/2) clay loam, light yellowish brown (2.5Y 6/3) when moist; common, medium, distinct, light olive-brown (2.5Y 5/6) mottles; massive; very hard, firm, slightly sticky and slightly plastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.7); abrupt, smooth boundary.
- C2—17 to 24 inches, white (2.5Y 8/2) loam, olive (5Y 5/3) when moist; few, fine, distinct, light olive-brown (2.5Y 5/6) mottles; massive; hard, firm, slightly sticky and slightly plastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.7); clear, wavy boundary.
- C3—24 to 32 inches, light-gray (10YR 7/2) silt loam, grayish brown (2.5Y 5/2) when moist; few, fine, faint, light olive-brown (2.5Y 5/6) mottles; massive; slightly hard, friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.6); gradual, wavy boundary.
- C4—32 to 60 inches, very pale brown (10YR 7/3) silty clay loam, grayish brown (2.5Y 5/2) when moist; stratified with layers of very fine sandy loam $\frac{1}{8}$ to $\frac{1}{4}$ inch thick; common, fine, faint, light olive-brown (2.5Y 5/6) mottles; massive; hard, firm, sticky and plastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Depth to the horizon of carbonate accumulation ranges from 11 to 16 inches. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated. Depth to the water table ranges from 32 to 48 inches unless the soils are drained. Distinct mottles are below a depth of 14 inches and range from common to many and from fine to medium. These soils are severely affected by alkali and moderately affected by salts.

In the A2 horizon, value is 6 or 7 when the soils are dry and ranges from 3 to 5 when they are moist. This horizon is silt loam or loam and ranges from 4 to 7 inches in thickness. It is mildly alkaline or moderately alkaline.

In the B2t horizon, hue is 10YR or 2.5Y; value ranges from 5 to 7 when the soils are dry and from 3 to 5 when they are moist; and chroma is 2 or 3. This horizon is dominantly clay but may be heavy silty clay loam or silty clay. Structure ranges from medium to coarse and is columnar or prismatic. Clay films range from moderately thick to thick and from common to continuous on ped faces. Reaction is moderately alkaline to very strongly alkaline. Ped faces are mostly noncalcareous, but interiors range from slightly calcareous to strongly calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and is 5 or 6 when they are moist; and chroma is 2 or 3. This horizon is silty clay loam, clay loam, silt loam, or loam and in places is stratified with thin layers of fine sandy loam. It is strongly alkaline or very strongly alkaline and moderately calcareous to strongly calcareous.

Payson silt loam (Pr).—This soil is on low lake terraces and lake plains. Slopes are 0 to 1 percent. The surface is uneven where the soil has not been leveled. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Airport silt loam; Lasil silt loam; Saltair silty clay loam; and Playas.

This soil is used mainly for range, but a small area is used for irrigated small grains and alfalfa. Improved range is mostly in tall wheatgrass. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Peteetneet Series, Moderately Deep Variant

The Peteetneet series, moderately deep variant, consists of very poorly drained soils. These soils are on lake plains and in nearly level depressions on low lake terraces in an area southwest of Tremonton. They formed in fibrous peat and muck deposits and fine-textured mixed lake sediments. Slopes range from 0 to 3 percent. Vegetation consists of sedges, tules, wiregrass, rushes, and cattails. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 13 to 15 inches, and the frost-free period is 130 to 145 days. Elevations range from 4,225 to 4,260 feet.

In a representative profile, the surface layer is black peat about 7 inches thick. The subsurface layer is very dark grayish-brown and grayish-brown muck about 11 inches thick. The next layer extends to a depth of 60 inches or more. It is grayish-brown silt loam in the upper 6 inches and light greenish-gray, light-gray, and pink silty clay in the lower part. The organic layers are neutral to moderately alkaline and the mineral soil material is moderately alkaline to strongly alkaline and slightly calcareous to strongly calcareous.

Permeability is moderate to a depth of 24 inches but is slow below that depth. The rate of water intake is moderate. Available water holding capacity is 11 to 13 inches to a depth of 5 feet. Roots can penetrate to a depth of 60 inches.

These soils are used for wildlife and range.

Representative profile of Peteeetneet peat, moderately deep variant, in range, 1,775 feet east and 800 feet north of the southwest corner of section 24, T. 11 N., R. 4 W., about 5 miles southwest of Tremonton:

- Oa1—0 to 7 inches, black (5Y 2/1) peat, very dark brown (10YR 2/2) when moist; soft, friable, nonsticky and nonplastic; neutral (pH 7.3); abrupt, wavy boundary.
- Oa2—7 to 13 inches, very dark grayish-brown (10YR 3/2) muck and a few root fibers, black (10YR 2/1) when moist; slightly hard, friable, slightly sticky and slightly plastic; moderately alkaline (pH 8.5); clear, irregular boundary.
- Oa3—13 to 18 inches, grayish-brown (10YR 5/2) muck and a few root fibers, black (10YR 2/1) when moist; slightly hard, firm, slightly sticky and slightly plastic; slightly calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.
- A11g—18 to 24 inches, grayish-brown (10YR 5/2) heavy silt loam, black (10YR 2/1) when moist, ped faces gray (2.5Y 5/1) when dry; weak, medium, prismatic structure that parts to weak, medium, subangular blocky; slightly hard, friable, sticky and slightly plastic; moderately alkaline (pH 8.4); abrupt, wavy boundary.
- A12g—24 to 26 inches, grayish-brown (10YR 5/2) light silty clay, very dark gray (10YR 3/1) when moist, ped faces gray (5Y 5/1) when dry; weak, medium to fine, prismatic structure; hard, firm, slightly sticky and plastic; slightly calcareous; moderately alkaline (pH 8.4); abrupt, irregular boundary.
- C1cag—26 to 34 inches, light greenish-gray (5GY 7/1) silty clay, light olive gray (5Y 6/2) when moist, ped faces greenish gray (GY 5/1) when dry; weak, coarse, prismatic structure; extremely hard, very firm, very sticky and very plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, irregular boundary.
- C2cag—34 to 54 inches, light-gray (5Y 7/1) silty clay, light olive gray (5Y 6/2) when moist, ped faces greenish gray (5GY 6/1) when moist; few, fine, prominent, light olive-brown (2.5Y 5/6) mottles; massive; extremely hard, very firm, very sticky and very plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, wavy boundary.
- C3g—54 to 66 inches, light-gray (5Y 7/1) silty clay, gray (5Y 6/1) when moist; many, medium and coarse, prominent, light olive-brown (2.5Y 5/6) mottles; massive; extremely hard, very firm, very sticky and plastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, wavy boundary.
- C4—66 to 74 inches, pink (7.5YR 7/4) silty clay, brown (7.5YR 5/4) when moist; massive; extremely hard, extremely firm, very sticky and plastic; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Depth of peat and muck over mineral soil ranges from 18 to 36 inches. Generally, the water table is at or near the surface most of the time. In places, however, the overflow water is diverted and the depth to the water table is mainly between 20 and 48 inches.

The Oa1 horizon is dominantly coarse, fibrous, noncalcareous peat that is neutral or mildly alkaline and ranges from 7 to 11 inches in thickness. The Oa2 and Oa3 horizons are mainly muck with a few root fibers. They are noncalcareous to slightly calcareous and mildly alkaline or moderately alkaline. Thickness of the muck horizons ranges from 11 to 26 inches.

In the mineral soil material, hue ranges from 7.5YR to 5GY; value ranges from 5 to 7 when the soils are dry and from 2 to 6 when they are moist; and chroma is 1 or 2. Texture is mainly silty clay but is silty clay loam or heavy silt loam in parts. The C horizons are laminated lake sediments.

Peteetneet peat, moderately deep variant (Ps).—This soil is on lake plains and nearly level depressions or low lake terraces. Most of the acreage is in the Salt Creek Waterfowl Management Area about 5 miles southwest of Tremonton. Slopes most commonly are less than 1 percent

but range from 0 to 3 percent. Runoff is very slow, and the hazard of erosion is none.

Included with this soil in mapping are small areas of Airport silt loam and Fresh water marsh.

This soil is used for waterfowl habitat and native pasture. Capability unit VIIw-2, nonirrigated; Wet Meadow range site.

Picayune Series

The Picayune series consists of well-drained soils. These soils are on south- and west-facing slopes east of Mantua. They formed in colluvium derived from limestone. Slopes range from 40 to 70 percent. Vegetation consists of blue-bunch wheatgrass, slender wheatgrass, big sagebrush, and annual grasses. Mean annual air temperature ranges from 43° to 45° F. Average annual precipitation ranges from 18 to 24 inches, and the frost-free period is 70 to 100 days. Elevations range from 5,200 to 6,500 feet.

In a representative profile, the surface layer is dark grayish-brown gravelly loam about 14 inches thick. The subsoil is yellowish-brown gravelly loam about 13 inches thick. The substratum, reaching to a depth of 60 inches or more, is yellowish-brown gravelly loam in the upper part and pale-brown very gravelly loam in the lower part. The surface layer and subsoil are noncalcareous, and the substratum is strongly calcareous. The surface layer is mildly alkaline, and the subsoil and substratum are moderately alkaline.

Permeability is moderate, and the rate of water intake is rapid. Runoff is rapid, and the hazard of erosion is high. Available water holding capacity is 12 to 15 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

These soils are used for range and wildlife habitat.

Representative profile of Picayune gravelly loam, 40 to 70 percent slopes, in an area of Agassiz-Picayune association, very steep, in range, 300 feet west and 600 feet north of the south quarter corner of section 35, T. 9 N., R. 1 W., southeast of Mantua:

- A1—0 to 14 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and medium and few coarse roots; 25 percent gravel; mildly alkaline (pH 7.8); gradual, wavy boundary.
- B2—14 to 27 inches, yellowish-brown (10YR 5/4) gravelly loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine and very fine pores; 30 percent gravel; moderately alkaline (pH 8.0); gradual, wavy boundary.
- C1ca—27 to 40 inches, yellowish-brown (10YR 5/4) gravelly loam, brown (10YR 4/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common fine and very fine pores; 34 percent gravel; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); diffuse, wavy boundary.
- C2ca—40 to 60 inches, pale-brown (10YR 6/3) very gravelly loam, brown (10YR 4/3) when moist; massive; very hard, friable, slightly sticky and nonplastic; 60 percent gravel; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Depth to the horizon of carbonate accumulation ranges from 23 to 28 inches. Content of gravel ranges from 10 to 30 percent in the A1 horizon, 20 to 30 percent in the B2 horizon, and 20 to 80 percent in the Cca horizon. Between depths of 10 and 40 inches, the texture averages gravelly loam that is about 30

percent gravel. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer.

In the A1 horizon, chroma is 2 or 3. Texture is mainly gravelly loam but may be loam. Reaction is mildly alkaline or moderately alkaline. In the B2 horizon, value is 4 or 5 when the soils are dry and 3 or 4 when they are moist; chroma is 3 or 4. This horizon is mildly alkaline or moderately alkaline and is noncalcareous or slightly calcareous. In the Cea horizon, value is 5 or 6 when the soils are dry and 4 or 5 when they are moist; chroma is 3 or 4. Texture is gravelly loam or very gravelly loam. Reaction is moderately alkaline or strongly alkaline.

In this survey area the Picayune soils are mapped only in an association with the Agassiz soils. A description of this association is given under the heading "Agassiz Series."

Placeritos Series

The Placeritos series consists of somewhat poorly drained, stratified soils that are affected by salts and alkali. These soils are on broad river flood plains south of Corinne. They formed in mixed alluvium. Slopes range from 0 to 2 percent. Vegetation consists of saltgrass, alkali sacaton, and annual weeds and annual grasses. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 140 to 150 days. Elevations range from 4,220 to 4,240 feet.

In a representative profile, the surface layer is grayish-brown silt loam over light brownish-gray silty clay loam about 16 inches thick. Layers below the surface layer are stratified, gray silt loam, light-gray loam, light-gray very fine sandy loam, and pale-brown fine sandy loam and extend to a depth of 60 inches or more. These soils are moderately or strongly calcareous throughout and are moderately alkaline or strongly alkaline.

Permeability is moderately slow, and the rate of water intake is moderate. Because the salt content is high, the water available to plants is only about 3 to 5 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 8 to 11 inches to that depth. Depth of rooting is limited by the height of the water table, but rooting may be as deep as 60 inches where the soils are drained.

Placeritos soils are used for range and wildlife habitat.

Representative profile of Placeritos silt loam, in range, 1,400 feet east and 1,250 feet north of the southwest corner of section 19, T. 9 N., R. 2 W., 5 miles west of Brigham City:

- Ap—0 to 6 inches, grayish-brown (2.5Y 5/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, angular blocky structure; very hard, firm, slightly sticky and slightly plastic; few very fine, fine, and medium roots; common very fine tubular pores; strongly calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.
- A11—6 to 11 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (10YR 5/2) when moist; moderate, medium and coarse, subangular blocky structure; very hard, firm, slightly sticky and plastic; few very fine, fine, and medium roots, many very fine tubular pores; strongly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.
- A12—11 to 16 inches, light brownish-gray (2.5Y 6/2) silty clay loam, grayish brown (10YR 5/2) when moist; weak, medium and coarse, prismatic structure that parts to moderate, medium and coarse, subangular blocky; very hard, firm, sticky and plastic; few fine and very fine roots; many very fine tubular pores;

- many snail shell fragments; moderately calcareous; moderately alkaline (pH 8.4); abrupt, wavy boundary.
- A1b—16 to 22 inches, gray (10YR 5/1) silt loam, black (10YR 2/1) when moist; weak, medium and coarse, prismatic structure that parts to moderate, medium, subangular blocky; very hard, friable, slightly sticky and plastic; few fine and very fine roots; many very fine tubular pores; many snail shell fragments; moderately calcareous; strongly alkaline (pH 8.8); gradual, irregular boundary.
- C1—22 to 31 inches, light-gray (10YR 7/2) loam, dark grayish brown (10YR 4/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; many very fine tubular pores; few snail shell fragments; moderately calcareous strongly alkaline (pH 9.0); gradual, wavy boundary.
- C2—31 to 43 inches, light-gray (10YR 7/2) very fine sandy loam, grayish brown (2.5Y 5/2) when moist; common, medium, distinct, yellowish-brown (10YR 5/6) mottles; massive; slightly hard, very friable, non-sticky and nonplastic; few fine and very fine roots; many fine and very fine tubular pores; few snail shell fragments; moderately calcareous; strongly alkaline (pH 8.7); gradual, wavy boundary.
- C3—43 to 51 inches, light-gray (10YR 7/2) loam, grayish brown (2.5Y 5/2) when moist; many, medium, distinct, yellowish-brown (10YR 5/8) mottles; massive; slightly hard, very friable, slightly sticky and slightly plastic; many fine and very fine tubular pores; moderately calcareous; strongly alkaline (pH 8.8); gradual, wavy boundary.
- C4—51 to 62 inches, pale-brown (10YR 6/3) fine sandy loam, dark grayish brown (10YR 4/2) when moist; many, medium, distinct, yellowish-brown (10YR 6/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; strongly calcareous; strongly alkaline (pH 8.6).

The soils are saturated in all parts for 1 to 3 weeks in most years early in spring. Mottling or a chroma of 1 is at a depth of 6 to 22 inches. Mottles are few to many and faint to distinct. Depth to the water table is commonly 20 to 40 inches. These soils are moderately to very strongly affected by salts and alkali.

In the A1 horizon, hue is 10YR or 2.5Y; value is 5 or 6 when the soils are dry and 4 or 5 when they are moist. This horizon is silty clay loam, silt loam, loam, very fine sandy loam, or fine sandy loam, and it ranges from 6 to 16 inches in thickness. It is moderately alkaline to very strongly alkaline and moderately calcareous or strongly calcareous.

In the C horizon, and included A1b horizon, hue is 10YR or 2.5Y; value ranges from 5 to 7 when the soils are dry and from 2 to 5 when they are moist; and chroma ranges from 1 to 3. Texture is silty clay loam, silt loam, loam, very fine sandy loam, or fine sandy loam. This horizon is moderately alkaline to very strongly alkaline and moderately calcareous to strongly calcareous.

Placeritos silt loam (PT).—This soil is on broad river flood plains. Slopes are 0 to 2 percent. Runoff is slow, and the hazard of erosion is slight. This soil is subject to frequent overflow and flooding in spring.

Included with this soil in mapping are small areas of Saltair silty clay loam, Logan silty clay loam, and Fresh water marsh.

This soil is used chiefly for range. It also has value as wildlife habitat. A small acreage has been used for irrigated small grains and pasture in recent years. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Playas

Playas (PU) are a miscellaneous land type that consists of nearly level lake plains or basins that are subject to repeated inundation by salt water and salinization by evaporation of this accumulated water. These areas are

on lake plains that border the Great Salt Lake or basin areas in many locations throughout the survey area. A water table is commonly within 20 inches of the surface. The surface is smooth, crusted with salt, and patterned by cracks when dry. The soil materials are mainly strongly calcareous, mixed lake sediments of silty clay, silty clay loam, or silt loam texture.

The vegetation is sparse and includes scattered plants of pickleweed and samphire. The areas are at least 95 percent barren.

Playas are not suitable for range and have no value for farming. On the shores of Great Salt Lake, solar ponds and dikes have been constructed on Playas to impound the mineral-heavy water pumped from the lake. Valuable minerals are extracted through evaporation from the mineral-rich water of the lake. These minerals are processed by chemical plants located on the shores of the Great Salt Lake. Capability unit VIIIw-8, nonirrigated; range site not assigned.

Pogal Series

The Pogal series consists of well-drained soils. These soils occur mainly as small, isolated, rounded or long and narrow, wind-deposited mounds on lake plains. They are in the central part of the survey area on the north edge of Great Salt Lake. They formed in strongly calcareous, mixed lake sediments that were derived mainly from limestone and sandstone and have been piled into mounds by wind. These mounds are about 6 to 20 feet high and have short, abrupt side slopes of 6 to 20 percent. Slopes range from 1 to 3 percent on top of the mounds and in the areas adjoining the mounds. Vegetation consists mostly of greasewood, shadscale, Russian-thistle, and kochia, but there is also some big sagebrush and annual mustard. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 11 to 13 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,208 to 4,250 feet.

In a representative profile, these soils are very pale brown silt loam to a depth of 60 inches or more. They are strongly calcareous throughout. A layer of strong lime accumulation begins at a depth of 22 inches. The surface layer is moderately alkaline to strongly alkaline, and between depths of 13 and 60 inches or more, the soils are very strongly alkaline.

Permeability is moderate, and the rate of water intake is moderate. Because the salt content is high, the water available to plants is only about 4 to 6 inches to a depth of 5 feet. The water-supplying capacity is about 8.5 to 10.5 inches before moisture is depleted. If the soils are reclaimed, the available water holding capacity is 9 to 11 inches to a depth of 5 feet. Roots penetrate easily to a depth of 60 inches.

These soils are used for range and wildlife habitat for migratory birds.

Representative profile of Pogal silt loam, rolling, in range, 700 feet east and 400 feet north of the southwest corner of section 27, T. 10 N., R. 4 W., in Public Shooting Grounds:

A11—0 to 4 inches, very pale brown (10YR 7/3) silt loam, grayish brown (10YR 5/2) when moist; weak, thin, platy structure; soft, friable, slightly sticky and slightly plastic; common fine and very fine and few medium roots; common fine and very fine vesicular

- pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.3); abrupt, smooth boundary.
- A12—4 to 13 inches, very pale brown (10YR 7/3) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; soft, friable, slightly sticky and nonplastic; few very fine and medium roots; common very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.5); clear, wavy boundary.
- C1—13 to 22 inches, very pale brown (10YR 7/3) silt loam, brown (10YR 5/3) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and nonplastic; few very fine, fine, and medium roots; common very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.3); gradual, wavy boundary.
- C2ca—22 to 35 inches, very pale brown (10YR 7/3) silt loam, pale brown (10YR 6/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine, fine, and medium roots; common very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.3); clear, wavy boundary.
- C3—35 to 41 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few very fine, fine, and medium roots; few fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.3); clear, wavy boundary.
- C4—41 to 49 inches, very pale brown (10YR 8/3) silt loam, pale olive (5Y 6/3) when moist; massive; slightly hard, friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); gradual, wavy boundary.
- C5—49 to 60 inches, very pale brown (10YR 8/3) silt loam, pale brown (10YR 6/3) when moist; massive; soft, friable, nonsticky and nonplastic; few very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4).

Between depths of 10 to 40 inches the texture averages silt loam and the content of clay ranges from 11 to 15 percent. Depth to the horizon of carbonate accumulation ranges from 22 to 38 inches. The soils are usually dry in all parts between depths of 8 and 24 inches. In places mottles are below a depth of 30 inches; they range from fine to medium and from faint to prominent. These soils are moderately affected by salts and alkali.

In the A1 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is mainly silt loam but may be loam, and it ranges in thickness from 9 to 13 inches. It is moderately alkaline to very strongly alkaline and moderately calcareous or strongly calcareous.

In the C horizon, hue is 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is silt loam, very fine sandy loam, or fine sandy loam. Where present, the fine sandy loam is at depths below 40 inches. Reaction is strongly alkaline or very strongly alkaline.

Pogal silt loam, rolling (PVC).—This soil occurs mainly as small, isolated, rounded or long and narrow, wind-deposited mounds on lake plains on the north edge of Great Salt Lake in the central part of the survey area. These mounds are about 6 to 20 feet high and have short, abrupt side slopes of 6 to 20 percent. Slopes are 1 to 3 percent on top of the mounds and in the areas adjoining the mounds. Runoff is medium, and the hazard of erosion is moderate. Soil blowing is a moderate hazard, and accumulations of soil material are common.

Included with this soil in mapping are small areas of Bram silt loam; Eccles fine sandy loam, 1 to 6 percent slopes; and Stingal loam, 1 to 6 percent slopes.

This soil is used for range and wildlife habitat for migratory birds. Capability unit VIIs-S8, nonirrigated; Semi-desert Alkali Flats range site.

Pomat Series

The Pomat series consists of well-drained soils. These soils are on intermediate and high lake terraces, terrace escarpments, and uplands just above the highest lake terraces. They formed in mixed lake sediments and local alluvium derived mainly from limestone and sandstone. Slopes range from 6 to 40 percent. The vegetation in non-cultivated areas is dominantly bluebunch wheatgrass, big sagebrush, Sandberg bluegrass, Russian-thistle, and cheatgrass. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,600 to 5,350 feet.

In a representative profile, the surface layer is light brownish-gray silt loam about 10 inches thick. The underlying layer is white silt loam to a depth of 56 inches and is white fine sandy loam between depths of 56 and 60 inches or more. These soils are strongly calcareous to very strongly calcareous throughout. The surface layer is moderately alkaline, and the underlying layer is moderately alkaline or very strongly alkaline.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 9 to 11 inches to a depth of 5 feet. The water-supplying capacity is 9 to 10 inches before moisture is depleted. Most roots are at depths of 10 to 20 inches, but roots may penetrate to a depth of 60 inches or more.

These soils are used for nonirrigated crops, range, and wildlife habitat.

Representative profile of Pomat silt loam, 10 to 30 percent slopes, in a cultivated field, 1,000 feet south and 600 feet east of the northwest corner of section 18, T. 13 N., R. 5 W., in Howell Valley:

- Ap—0 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; few fine pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, smooth boundary.
- A1—5 to 10 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine and medium pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, irregular boundary.
- C1—10 to 25 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine pores; strongly calcareous, lime is disseminated and some is nodular; moderately alkaline (pH 8.4); gradual, wavy boundary.
- C2—25 to 56 inches, white (2.5Y 8/2) silt loam, light yellowish brown (2.5Y 6/3) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine pores; strongly calcareous, lime is disseminated and some is nodular; very strongly alkaline (pH 9.2); clear, wavy boundary.
- C3—56 to 65 inches, white (10YR 8/2) fine sandy loam, pale brown (10YR 6/3) when moist; massive; soft, very friable, nonsticky and nonplastic; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Between depths of 10 to 40 inches, the texture averages silt loam and the content of clay ranges from 12 to 17 percent. The soils are usually dry in all parts between depths of 4 and 12 inches.

In the A1 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is silt loam or loam, and it ranges from 5 to 13 inches in thickness. It is moderately alkaline or strongly alkaline and is slightly calcareous to strongly calcareous.

In the C horizon, hue ranges from 10YR to 5Y; value is 7 or 8 when the soils are dry and ranges from 5 to 7 when they are moist; and chroma ranges from 2 to 4. Reaction is moderately alkaline to very strongly alkaline.

Pomat silt loam, 6 to 10 percent slopes (PwD).—This soil is on intermediate and high lake terraces. Slopes are slightly convex and medium in length. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet and rill erosion is common, and a few shallow gullies have been formed.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes; Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes; and Thiokol silt loam, 6 to 10 percent slopes. Also included are areas in which the content of gravel and cobblestones is as much as 10 percent throughout the profile.

This soil is used for nonirrigated small grains. It is also used for wildlife habitat. Capability unit IVe-UZ, nonirrigated; range site not assigned.

Pomat silt loam, 10 to 30 percent slopes (PwE).—This soil is on intermediate and high lake terraces, escarpments, and slopes into drainageways. A profile of this soil is the one described as representative for the Pomat series. Slopes are slightly convex and short to medium in length. Runoff is rapid, and the hazard of erosion is high. Moderate sheet and rill erosion is common, and there are a few shallow and deep gullies.

Included with this soil in mapping are small areas of Kearns silt loam, 10 to 20 percent slopes; Munk gravelly silt loam, 10 to 20 percent slopes; and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes. Also included are areas in which the content of gravel and cobblestones is as much as 10 percent throughout the profile.

This soil is used for nonirrigated small grains and range. It is also used for wildlife habitat. Capability unit VIe-U, nonirrigated; Upland Loam range site.

Pomat silt loam, 30 to 40 percent slopes, eroded (PwG2).—This soil is on intermediate and high lake-terrace escarpments and side slopes into drainageways. Runoff is very rapid, and the hazard of erosion is very high. Severe sheet and rill erosion is common, and there are a few deep gullies and many shallow gullies.

Included with this soil in mapping are small areas of Pomat silt loam, 10 to 30 percent slopes, and Sanpete gravelly silt loam, high rainfall, 30 to 50 percent slopes; a few areas of Rock outcrop; and areas in which the content of gravel and cobblestones is 0 to 10 percent in the profile.

This soil is used for range and wildlife habitat. Capability unit VIIe-U, nonirrigated; Upland Loam range site.

Pomat-Kearns silt loams, 10 to 30 percent slopes (PxE).—This complex is on dissected, intermediate and high lake terraces and escarpments. It consists of about 50 percent Pomat silt loam, 10 to 30 percent slopes, and 40 percent Kearns silt loam, 10 to 20 percent slopes. Included with these soils in mapping are areas of Kearns silt loam, 6 to 10 percent slopes; Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes; and Thiokol silt loam, 6 to 10 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this complex are closely intermingled. The Pomat soil is on the tops and on south and west sides of knolls and ridges. The Kearns soil is on the north and east sides of the knolls and ridges. Its slopes are slightly concave.

Runoff is rapid, and the hazard of erosion is high on these soils.

The soils of this complex are used for nonirrigated small grains and wildlife habitat. Capability unit VIe-U, nonirrigated; Upland Loam range site.

Pomat-Parleys silt loams, 10 to 30 percent slopes (PyE).—This complex is on dissected, intermediate and high lake terraces, escarpments of terraces, and uplands that are above the highest lake terraces. It consists of about 50 percent Pomat silt loam, 10 to 30 percent slopes, and 30 percent Parleys silt loam, 10 to 20 percent slopes. Included with these soils in mapping are areas of Kearns silt loam, 10 to 20 percent slopes; Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes; and Sterling gravelly loam, 6 to 20 percent slopes. These included soils make up about 20 percent of the total acreage.

Soils of this complex are intermingled. The Pomat soil is on south- and west-facing slopes, and the Parleys soil is in slightly concave areas on north- and east-facing slopes. Runoff is rapid, and the hazard of erosion is high. Sheet and rill erosion is moderate, and there are a few shallow gullies.

The soils of this complex are used for nonirrigated small grains and wildlife habitat. Capability unit VIe-U, nonirrigated; Upland Loam range site.

Promo Series

The Promo series consists of somewhat excessively drained soils. These soils are on mountains or mountain foot slopes, mainly in the Promontory and Hansel Mountains. They formed in very gravelly and cobbly, medium-textured colluvium and residuum derived dominantly from limestone rocks. Slopes range from 30 to 60 percent. Vegetation consists of juniper, bitterbush, big sagebrush, bluebunch wheatgrass, cheatgrass, and annual weeds and grasses. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 2 to 14 inches, and the frost-free period is 100 to 130 days. Elevations range from 5,200 to 6,500 feet.

In a representative profile, the surface layer is pale-brown cobbly silt loam about 7 inches thick. The underlying layer is pale-brown cobbly loam that is about 7 inches thick over limestone bedrock. The surface layer is moderately alkaline or strongly alkaline and moderately calcareous. The underlying layer is strongly alkaline and strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is slow. Available water holding capacity is 2 to 3 inches above bedrock, and the soils can furnish about 4 to 5 inches of water for plant growth before moisture is depleted. Roots penetrate to bedrock.

These soils are used for range and wildlife.

Representative profile of Promo cobbly silt loam, 30 to 60 percent slopes, in an area of Sandall-Promo association, steep, in range, 650 feet west and 850 feet south of the north quarter corner of section 35, T. 8 N., R. 6 W., about 14 miles south of Golden Spike National Monument:

A11—0 to 4 inches, pale-brown (10YR 6/3) cobbly silt loam, brown (10YR 4/3) when moist; weak, medium and

thin, platy structure; soft, friable, slightly sticky and slightly plastic; few fine roots; many very fine and fine pores; 35 percent cobbles and gravel; moderately calcareous; moderately alkaline (pH 8.4); clear, wavy boundary.

A12—4 to 7 inches, pale-brown (10YR 6/3) cobbly silt loam, brown (10YR 4/3) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few very fine pores; 35 percent gravel and cobbles; moderately calcareous, lime is disseminated and occurs as thin coatings on underside of some pebbles; strongly alkaline (pH 8.6); gradual, wavy boundary.

C—7 to 14 inches, pale-brown (10YR 6/3) cobbly loam, brown (10YR 4/3) when moist; weak, fine and medium, angular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; 40 percent gravel and cobbles; strongly calcareous, lime is disseminated and occurs as coatings on the coarse fragments; strongly alkaline (pH 8.6); abrupt, irregular boundary.

R—14 inches, limestone bedrock.

Depth to bedrock ranges from 12 to 20 inches. The soils contain 30 to 80 percent angular gravel and cobbles and a few stones throughout the profile. The soils are usually dry above the bedrock.

In the A1 horizon, value is 4 when the soils are moist; chroma ranges from 2 to 4. This horizon is gravelly and cobbly silt loam or loam or very cobbly silt loam or very cobbly loam, and it ranges from 7 to 15 inches in thickness. It is moderately alkaline or strongly alkaline and slightly calcareous to strongly calcareous.

In the C horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. Texture is very cobbly loam to very gravelly silt loam that consists of 35 to 80 percent cobbles, gravel, and a few stones.

In this survey area the Promo soils are mapped only in an association with the Sandall soils. A description of this association is given under the heading "Sandall Series."

Red Rock Series

The Red Rock series consists of well-drained soils. These soils are on alluvial fans, on lake terraces, and in depression areas or basin areas. They formed in mixed alluvium and reworked lake sediments derived mainly from limestone and sandstone. Slopes range from 0 to 6 percent but most commonly are 0 to 3 percent. The vegetation in noncultivated areas consists of big sagebrush, Great Basin wildrye, bluebunch wheatgrass, giant ragweed, and cheatgrass. Mean annual air temperature is 50° to 53° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 100 to 140 days. Elevations range from 4,350 to 5,400 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 17 inches thick. The subsoil is grayish-brown heavy silt loam about 20 inches thick. The substratum, extending to a depth of 60 inches or more, is light brownish-gray silt loam. The surface layer and subsoil are moderately alkaline and noncalcareous, and the substratum is moderately alkaline or strongly alkaline and slightly calcareous or moderately calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. The water-supplying capacity is 11 to 16 inches before moisture is depleted. Roots penetrate to a depth of 60 inches or more.

These soils are used mainly for nonirrigated crops. Some areas are used for irrigated crops.

Representative profile of Red Rock silt loam, 0 to 1 percent slopes, in a cultivated field, 1,500 feet north and

1,300 feet west of the southeast corner of section 1, T. 13 N., R. 6 W., in Blue Creek valley:

- Ap—0 to 9 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; soft, friable, nonsticky and slightly plastic; common fine roots; many fine pores; moderately alkaline (pH 8.2); abrupt, smooth boundary.
- A1—9 to 17 inches, grayish-brown (10YR 5/2) silt loam, very dark brown (10YR 2/2) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; common fine pores; moderately alkaline (pH 8.2); clear, smooth boundary.
- B1—17 to 25 inches, grayish-brown (10YR 5/2) heavy silt loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine pores; moderately alkaline (pH 8.2); clear, smooth boundary.
- B2—25 to 37 inches, grayish-brown (10YR 5/2) heavy silt loam, dark brown (10YR 3/3) when moist; moderate, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine roots; common fine and medium pores; moderately alkaline (pH 8.2); gradual, wavy boundary.
- C1—37 to 48 inches, light brownish-gray (10YR 6/2) silt loam, dark brown (10YR 3/3) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine and medium pores; slightly calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.
- C2—48 to 66 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores; moderately calcareous, lime is laminar and veined; strongly alkaline (pH 8.6); gradual, wavy boundary.
- C3—66 to 84 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; moderately calcareous, lime is disseminated; strongly alkaline (pH 8.6).

Between depths of 10 to 40 inches, the texture averages silt loam and the content of clay ranges from 24 to 27 percent. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for more than 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is dominantly silt loam but may be loam, and it ranges from 17 to 34 inches in thickness. It is neutral to moderately alkaline and is mainly noncalcareous, though in places it is slightly calcareous.

The B1 horizon is 6 to 8 inches thick. In the B2 horizon, value is 5 or 6 when the soils are dry and ranges from 2 to 4 when they are moist; chroma is 2 or 3. This horizon is heavy silt loam or light silty clay loam, and it ranges from 11 to 38 inches in thickness. It is neutral to moderately alkaline.

In the C horizon, hue is 10YR or 2.5Y; value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam, loam, very fine sandy loam, or fine sandy loam. The soils are commonly stratified below a depth of 36 inches. The C horizon is mildly alkaline to strongly alkaline and slightly calcareous to moderately calcareous.

Red Rock silt loam, high rainfall, 0 to 3 percent slopes (RdA).—This soil is on alluvial fans, on lake terraces, and in broad depression or basin areas that receive runoff from adjacent areas. Slopes most commonly are less than 1 percent. Runoff is slow, and the hazard of erosion is slight. Elevations range from 5,000 to 5,400 feet. Average annual precipitation ranges from 16 to 18 inches, and the water-supplying capacity is 14 to 16 inches before moisture is depleted.

Included with this soil in mapping are small areas of Forsgren silt loam, 1 to 6 percent slopes, and Hendricks silt loam, 1 to 6 percent slopes.

This Red Rock soil is used for nonirrigated small grains. Capability unit IIe-M, nonirrigated; range site not assigned.

Red Rock silt loam, 0 to 1 percent slopes (ReA).—This soil is on broad lake terraces and alluvial fans and in swalelike areas. A profile of this soil is the one described as representative for Red Rock series. Runoff is slow, and the hazard of erosion is slight. This soil is mainly in swalelike areas that receive runoff from adjacent areas. Elevations range from 4,700 feet to 5,400 feet. Average annual precipitation ranges from 14 to 16 inches, and the water-supplying capacity is 11 to 14 inches before moisture is depleted.

Included with this soil in mapping are small areas of Kearns silt loam, 1 to 3 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This Red Rock soil is used mainly for nonirrigated small grains. A small acreage is irrigated in Blue Creek valley, where sugar beets, alfalfa, and small grains are grown. Capability unit IIc-2, irrigated; capability unit IIIc-U, nonirrigated; range site not assigned.

Red Rock silt loam, 1 to 6 percent slopes (ReB).—This soil is on alluvial fans and lake terraces. Slopes are slightly concave. Runoff is medium, and the hazard of erosion is moderate. In places a few gullies have been formed in channelways. Elevations range from 4,350 to 5,400 feet. Average annual precipitation ranges from 14 to 16 inches, and the water-supplying capacity is 11 to 14 inches before moisture is depleted.

Included with this soil in mapping are small areas of Forsgren silt loam, 1 to 6 percent slopes; Kearns silt loam, 3 to 6 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Timpanogos silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains. Capability unit IIIe-U, nonirrigated; range site not assigned.

Refuge Series

The Refuge series consists of somewhat poorly drained soils. These soils are on flood plains south and west of the Willard Bay Reservoir. They formed in highly stratified, calcareous, mixed alluvium derived mainly from limestone, sandstone, and quartzite. Slopes are 0 to 1 percent. Vegetation consists of saltgrass, alkali sacaton, annual mustard, foxtail, and annual weeds. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 12 to 16 inches, and the frost-free period is 130 to 150 days. Elevations range from 4,207 to 4,215 feet.

In a representative profile, the surface layer is grayish-brown loam about 7 inches thick. Between depths of 7 and 41 inches is pale-brown, stratified loam and very fine sandy loam, and between depths of 41 and 60 inches is light-gray silty clay loam. These soils are strongly alkaline throughout and are slightly calcareous to moderately calcareous.

Permeability is moderate, and the rate of water intake is moderate. Because the salt content is high, the water available to plants is only 3 to 5 inches to a depth of 5

feet. If the soils are reclaimed, however, the available water holding capacity is 9 to 11 inches to that depth. Roots penetrate to a depth of more than 60 inches if the soils are drained, but most roots are in the uppermost 19 inches.

Refuge soils are used for range and waterfowl habitat.

Representative profile of Refuge loam, in an area of Saltair-Refuge complex, in range, 55 feet east and 750 feet north of the southwest corner of section 17, T. 7 N., R. 2 W., one-eighth mile south of Willard Bay Reservoir:

- A11—0 to 3 inches, grayish-brown (10YR 5/2) loam, dark brown (10YR 3/3) when moist; weak, thin, platy structure that parts to weak, fine, granular; slightly hard, friable, nonsticky and slightly plastic; common fine and few medium roots; slightly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.
- A12—3 to 7 inches, grayish-brown (10YR 5/2) light loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; soft, very friable, nonsticky and nonplastic; common fine and few medium roots; slightly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.
- C1—7 to 12 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) when moist; common, medium, distinct, strong-brown (7.5YR 4/6) mottles; weak, coarse, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few fine and medium roots; common very fine interstitial pores; moderately calcareous; strongly alkaline (pH 9.0); clear, smooth boundary.
- C2—12 to 19 inches, pale-brown (10YR 6/3) light loam, brown (10YR 4/3) when moist; few, medium, distinct, strong-brown (7.5YR 4/6) mottles; slightly hard, very friable, nonsticky and slightly plastic; few fine and medium roots; common very fine and few fine interstitial pores; moderately calcareous; strongly alkaline (pH 9.0); clear, smooth boundary.
- C3sa—19 to 25 inches, pale-brown (10YR 6/3) very fine sandy loam, brown (10YR 4/3) when moist; many, medium, distinct, strong-brown (7.5YR 4/6) mottles; massive; soft, very friable, nonsticky and nonplastic; few fine roots; common very fine and few fine interstitial pores; moderately calcareous; strongly alkaline (pH 9.0); clear, smooth boundary.
- C4sa—25 to 33 inches, pale-brown (10YR 6/3) light loam, brown (10YR 4/3) when moist; many, medium, distinct, strong-brown (7.5YR 4/6) mottles; massive; slightly hard, very friable, nonsticky and slightly plastic; few fine roots; common very fine and few fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.8); gradual, smooth boundary.
- C5sa—33 to 41 inches, pale-brown (10YR 6/3) heavy loam, brown (10YR 4/3) when moist; many, coarse, prominent, strong-brown (7.5YR 4/6) mottles; massive; hard, friable, slightly sticky and slightly plastic; few fine roots; common very fine and few fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.
- C6g—41 to 60 inches, light-gray (10YR 7/1) light silty clay loam, gray (10YR 5/1) when moist; many, coarse, prominent, strong-brown (7.5YR 4/6) mottles; massive; hard, friable, slightly sticky and plastic; common very fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.8).

Texture averages light loam between depths of 10 and 40 inches. Few to common, medium to coarse, distinct mottles are at a depth of 20 inches or less. The water table fluctuates with the season and most commonly is at a depth of 22 to 40 inches, but in some years it is less than 20 inches from the surface early in spring.

In the A1 horizon, chroma is 2 or 3. Texture is loam or light loam. The A1 horizon is slightly calcareous or moderately calcareous and is 7 to 9 inches thick. In the C horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is mainly 2 or 3, but in places chroma is 1 below a depth of 40 inches. Texture is light silty clay loam, silt loam, or very fine sandy loam. The Csa subhorizon is very strongly

saline and has its upper boundary at a depth of 19 to 25 inches.

Refuge loam (Rf).—This soil is on flood plains south and west of the Willard Bay Reservoir. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight. Recent deposition on the surface is common.

Included with this soil in mapping are small areas of Saltair silty clay loam and Playas.

This Refuge soil is used chiefly for range, but it has been diked and ponded in some areas and used as habitat for migratory waterfowl. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Richmond Series

The Richmond series consists of excessively drained soils. These soils are on the west slopes of the Wellsville Mountains. They formed in residuum and colluvium derived from limestone. Slopes range from 30 to 70 percent. Vegetation is mainly bluebunch wheatgrass, big sagebrush, scattered juniper, and annual grasses and weeds. Mean annual air temperature ranges from 45° to 47° F. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 100 to 200 days. Elevations range from 5,150 to 6,500 feet.

In a representative profile, the surface layer is light brownish-gray gravelly loam about 4 inches thick. The first underlying layer is light brownish-gray very gravelly loam about 5 inches thick. The next underlying layer is pale-brown very gravelly sandy loam that is about 7 inches thick and overlies limestone bedrock at a depth of about 16 inches. This layer is about 80 percent coarse fragments. The soil is strongly alkaline and strongly calcareous throughout.

Permeability is moderately rapid, and the rate of water intake is slow. Available water holding capacity is 1 to 2 inches to bedrock. These soils can furnish about 4 to 5 inches of water for plant growth before moisture is depleted. Roots extend to bedrock.

Richmond soils are used for range and wildlife habitat.

Representative profile of Richmond very stony loam, 30 to 70 percent slopes, eroded, in an area of Richmond-Middle complex, 30 to 70 percent slopes, eroded, in range, 1,200 feet south and 300 feet east of the north quarter corner of section 27, T. 11 N., R. 2 W., northeast of Honeyville:

- A1—0 to 4 inches, light brownish-gray (10YR 6/2) gravelly loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure that parts to moderate, medium, granular; slightly hard, friable, slightly sticky and slightly plastic; common medium and fine roots; 40 percent angular gravel and cobbles; strongly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.
- C1—4 to 9 inches, light brownish-gray (10YR 6/2) very gravelly loam, brown (10YR 4/3) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; common medium and fine roots; 60 percent angular gravel and cobbles; very strongly calcareous; strongly alkaline (pH 8.6); gradual, irregular boundary.
- C2—9 to 16 inches, pale-brown (10YR 6/3) very gravelly sandy loam, brown (10YR 4/3) when moist; single grained; loose; few fine roots; 80 percent angular fragments of fractured limestone; very strongly calcareous; strongly alkaline (pH 8.5); abrupt, irregular boundary.
- R—16 inches, limestone bedrock.

Depth to bedrock ranges from 11 to 19 inches. About 25 percent of the surface is covered by cobblestones and stones. The soils are usually moist but are dry above bedrock for more than 60 consecutive days in the summer.

The A1 horizon is gravelly loam or gravelly light loam; content of gravel and cobblestones ranges from 30 to 40 percent. Reaction is mildly alkaline to strongly alkaline. This horizon ranges from 3 to 7 inches in thickness.

In the C horizon, chroma is 2 or 3. The C horizon is very gravelly loam or very gravelly sandy loam that is 50 to 80 percent gravel and cobblestones. The lime content in this horizon is more than 40 percent.

Richmond-Middle complex, 30 to 70 percent slopes, eroded (RMG2).—This mapping unit is on the western slopes of the Wellsville Mountains. It consists of about 40 percent Richmond very stony loam, 30 to 70 percent slopes, eroded; 30 percent Middle cobbly silt loam, 30 to 70 percent slopes; and 20 percent Rock outcrop. Included with these soils in mapping are areas of Rock land that make up about 10 percent of the total acreage.

Soils of this complex are closely intermingled. The Richmond soil is mainly on south- and west-facing mountain slopes under a cover of bluebunch wheatgrass, sagebrush, juniper, yellowbrush, and cheatgrass. The Middle soil is mainly on short, north-facing mountain slopes under a cover of bluebunch wheatgrass, sagebrush, bitterbrush, and cheatgrass. Rock outcrop is mostly on ridgetops.

A profile of the Richmond soil in this complex is the one described as representative for the Richmond series. Runoff is rapid, and the hazard of erosion is high. Moderate sheet erosion is common, and in places many shallow gullies have been formed.

The soils of this complex are used for range and wildlife. Capability unit VIIs-U, nonirrigated; Upland Shallow Loam range site.

Ridd Series

The Ridd series consists of well-drained soils. These soils are on mountain slopes and alluvial fans along the Wasatch Mountains south of Willard. They formed in colluvium and alluvium derived from quartzite, gneiss, and schist. Slopes range from 10 to 70 percent. Vegetation consists of bluebunch wheatgrass, lupine, scattered oakbrush, and big sagebrush. Mean annual air temperature ranges from 45° to 47° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 110 to 140 days. Elevations range from 5,000 to 6,500 feet.

In a representative profile, the surface layer is brown gravelly sandy loam about 11 inches thick. The subsoil is brown gravelly sandy loam about 13 inches thick. Bedrock is at a depth of about 24 inches. The soils are neutral throughout.

Permeability is moderate, and the rate of water intake is rapid. Available water holding capacity is 2 to 3 inches for the soil above bedrock, and the soils can furnish 7 to 9 inches of water for plant growth before moisture is depleted. Roots extend to bedrock.

Ridd soils are used for range and wildlife habitat.

Representative profile of Ridd stony sandy loam, 30 to 70 percent slopes, in an area of Ridd-Rock outcrop complex, 30 to 70 percent slopes, in range, 100 feet south

of the north quarter corner of section 7, T. 7 N., R. 1 E., southeast of Willard:

O1—1 inch to 0, decaying leaves, and twigs.

A1—0 to 11 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, fine, granular structure; soft, very friable; many fine and very fine and few medium and large roots; 3 percent stones and 30 percent gravel; neutral (pH 7.1); gradual, wavy boundary.

B2t—11 to 24 inches, brown (10YR 5/3) gravelly heavy sandy loam, dark brown (10YR 3/3) when moist; weak, fine and medium, subangular blocky structure; soft, very friable; common fine and very fine roots; 3 percent stones and 40 percent gravel; neutral (pH 6.8); abrupt, irregular boundary.

R—24 inches, fractured, weathered quartzite bedrock.

The solum ranges from 24 to 36 inches in thickness. Depth to bedrock ranges from 24 to 40 inches. From 10 to 60 percent of the surface is covered with cobblestones, stones, and boulders. Content of coarse fragments ranges from 30 to 50 percent in the A1 and B2t horizons and from 50 to 70 percent in the C horizon where this horizon is present. The soils are usually moist but in most years are dry in all parts between the depths of 8 and 24 inches for more than 60 consecutive days in the summer.

In the A1 horizon, value ranges from 2 or 3 when the soils are moist and from 4 or 5 when they are dry. This horizon is 7 to 12 inches thick.

In the B2t horizon, value ranges from 3 to 4 when the soils are moist; chroma is 3 or 4. Texture is gravelly heavy sandy loam or gravelly sandy loam. This horizon ranges from 13 to 18 inches in thickness. In the C horizon, where present, chroma ranges from 4 to 6.

Ridd-Rock outcrop complex, 10 to 30 percent slopes (RrE).—This mapping unit is on mountain slopes and alluvial fans near the Hot Springs Resort located on the Box Elder-Weber County line. It consists of about 75 percent Ridd stony sandy loam, 10 to 30 percent slopes, and 15 percent Rock outcrop. Included in mapping are areas of Wasatch cobbly sandy loam, gravelly subsoil variant, 10 to 20 percent slopes, and Stony alluvial land. These included soils make up about 10 percent of the total acreage.

The Ridd soil is in areas closely intermingled with Rock outcrop. Its plant cover is bluebunch wheatgrass, lupine, sagebrush, and balsamroot. Elevations range from 5,000 to 5,600 feet. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet and rill erosion has occurred on the Ridd soil, and there are a few shallow gullies. Rock outcrop consists mainly of quartzite rock.

This complex is used for range and wildlife habitat. Capability unit VIIs-U, nonirrigated; Upland Stony Loam range site.

Ridd-Rock outcrop complex, 30 to 70 percent slopes (RrG).—This mapping unit is on mountain slopes southeast of Willard. It consists of about 75 percent Ridd stony sandy loam, 30 to 70 percent slopes, and 20 percent Rock outcrop. Included in mapping are areas of Stony alluvial land that make up about 5 percent of the total acreage.

The Ridd soil is in areas intermingled with Rock outcrop. It is under a cover of bluebunch wheatgrass, balsamroot, lupine, big sagebrush, and scattered oakbrush. A profile of the Ridd soil is the one described as representative for the series. Elevations range from 5,200 to 6,500 feet. Runoff is rapid, and the hazard of erosion is high. Sheet and gully erosion is moderate on this soil, and a few shallow and deep gullies have been formed.

Rock outcrop is mainly quartzite. It occupies ridgetops and also occurs randomly in other places.

This complex is used for range and wildlife habitat. Capability unit VIIIs-U, nonirrigated; Upland Stony Loam range site.

Rock Land

Rock land (RS) is a miscellaneous land type that consists of rock outcrop, rock rubble, talus materials, extremely stony land, and very shallow soils. Rock outcrops generally occupy from 25 to 90 percent of the areas. The mapping unit is on very steep mountain slopes, ridges, and canyon walls. The rocks are mainly limestone and quartzite but include some sandstone, basalt, and conglomerate. The vegetation is variable but is mainly bitterbrush, big sagebrush, bluebunch wheatgrass, maple, aspen, and some juniper.

Rock land is generally considered unsuitable for range because it is too steep and rocky. It has some value for wildlife habitat. The adjacent soils provide food and cover for wildlife. In places, Rock land is used to furnish fill material for roads and embankments. Capability unit VIIIs-X, nonirrigated; range site not assigned.

Rock Outcrop

Rock outcrop (RT) is a miscellaneous land type that consists of exposures of bare bedrock. It is on mountain slopes, in areas of cliffs and ridges, and on canyon walls. The rock is mainly quartzite, limestone, and sandstone, but there is some basalt. Rock outcrop is mostly barren, though small depressional areas, crevices, and cracks have collected enough soil material to support some grass and a few trees and shrubs. Runoff is very rapid and has been the source of water for numerous destructive floods.

Rock outcrop has no value for range, but it has some value as habitat for wildlife. Capability unit VIIIs-X, nonirrigated; range site not assigned.

Roshe Springs Series

The Roshe Springs series consists of poorly drained soils. These soils are on low lake terraces and flood plains in Bear River valley. They formed in alluvium or mixed lake sediments. Slopes range from 0 to 3 percent. Vegetation is mainly wiregrass, sedges, saltgrass, and foptail. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation ranges from 12 to 15 inches, and the frost-free period is 140 to 150 days. Elevations range from 4,225 to 4,245 feet.

In a representative profile, the surface layer is dark-gray and gray silt loam about 20 inches thick. The underlying layer is light-gray silt loam that extends to a depth of 60 inches or more. The soils are moderately alkaline throughout, and below a depth of 10 inches, they are very strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is about 10 to 12 inches to a depth of 5 feet. Depth to the water table is commonly less than 20 inches. Root penetration is limited by the water table. If the soils were drained, roots could penetrate to a depth of more than 60 inches.

Roshe Springs soils are used for irrigated crops and for range.

Representative profile of Roshe Springs silt loam, in a cultivated field, 1,200 feet west and 500 feet south of the northeast corner of section 35, T. 9 N., R. 2 W., southwest of Brigham City:

Ap—0 to 10 inches, dark-gray (10YR 4/1) silt loam, very dark brown (10YR 2/2) when moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and few medium roots; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, smooth boundary.

A1—10 to 20 inches, gray (10YR 5/1) silt loam, very dark gray (10YR 3/1) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); clear, wavy boundary.

Clcag—20 to 27 inches, light-gray (2.5Y 7/1) silt loam, gray (2.5Y 5/1) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and plastic; few very fine roots; many very fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.

C2g—27 to 60 inches, light-gray (2.5Y 7/2) silt loam, grayish-brown (2.5Y 5/2) when moist; many, medium, distinct, strong-brown (7.5YR 5/6) mottles; massive; hard, friable, slightly sticky and plastic; few very fine roots; many very fine tubular pores; very strongly calcareous, lime is disseminated; moderately alkaline (pH 8.4).

Accumulations of calcium carbonate are at a depth of 7 to 15 inches, and the calcium carbonate equivalent is 40 to 80 percent. The water table fluctuates between the surface and a depth of 20 inches unless the soils are drained. Texture averages silt loam between depths of 10 and 40 inches.

In the A1 horizon, value is 3 or 4 when the soils are dry; chroma is 1 or 2. Thickness ranges from 12 to 20 inches. This horizon is moderately alkaline to very strongly alkaline and is very strongly calcareous.

In the Cca horizon, hue is 10YR or 2.5Y; value ranges from 6 to 8 when the soils are dry and from 3 to 7 when they are moist. Reaction is moderately alkaline or strongly alkaline. Thin, weakly cemented layers are in the C horizon.

Roshe Springs silt loam (Ru).—This soil is on low lake terraces and flood plains that receive runoff from adjacent areas. Slopes range from 0 to 3 percent but most commonly are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Logan silty clay loam, Cudahy silt loam, and a soil that is similar to this Roshe Springs soil but has a lower content of carbonates.

This Roshe Springs soil is used for range and irrigated crops. Irrigated crops are corn for silage, small grains, alfalfa, sugar beets, and improved pasture. Capability unit IIIw-2, irrigated; Wet Meadow range site.

Rough Broken Land

Rough broken land (Rv) is a miscellaneous land type that consists of very steep escarpmentlike breaks into river bottom land. It also is on very steep drainageways or V-shaped tributaries. Geologic erosion is active, and runoff is very rapid. Soil slipping is common, and the steep slopes have a succession of short, vertical exposures. In places a mantle of silt loam or very fine sandy loam or small patches of gravel cover the surface. Drainage water from higher, irrigated areas commonly causes seeps and wet spots along these escarpmentlike breaks. The vege-

tation consists of willows, rose, Great Basin wildrye, Russian-olive, boxelder, and cottonwood.

Rough broken land is used for wildlife habitat and limited grazing. It has little or no value for farming. Capability unit VIIe-U, nonirrigated; Upland Loam range site.

Rozlee Series

The Rozlee series consists of well-drained soils. These soils are on mountain slopes and mountain foot slopes. They formed in residuum and colluvium derived mainly from limestone but also from sandstone and quartzite. Slopes range from 30 to 70 percent. Vegetation is dominantly bluebunch wheatgrass, big sagebrush, bitterbrush, juniper, cheatgrass, and annual weeds and grasses. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 13 to 15 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,600 to 6,000 feet.

In a representative profile, the surface layer is grayish-brown cobbly silt loam about 8 inches thick. The subsoil is brown cobbly silt loam about 10 inches thick. The substratum is pale-brown very cobbly silt loam that is about 12 inches thick over limestone bedrock. A layer of lime accumulation is at a depth of 18 inches. The soils are strongly alkaline throughout. The surface layer is slightly calcareous, the subsoil is moderately calcareous, and the substratum is strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is moderate. Available water holding capacity is 2 to 3 inches to bedrock. The water-supplying capacity is about 5 to 7 inches for plant growth before moisture is depleted. Roots penetrate to bedrock.

These soils are used for range and wildlife habitat.

Representative profile of Rozlee cobbly silt loam, 30 to 70 percent slopes, in an area of Sandall-Rozlee association, steep, in range, 800 feet east and 800 feet north of the southwest corner of section 27, T. 8 N., R. 6 W.:

- A1—0 to 8 inches, grayish-brown (10YR 5/2) cobbly silt loam, very dark grayish brown (10YR 3/2) when moist; moderate, fine, granular structure; soft, friable, slightly sticky and slightly plastic; common fine and few medium roots; 35 percent cobblestones and gravel; slightly calcareous; strongly alkaline (pH 8.5); gradual, smooth boundary.
- B2—8 to 18 inches, brown (10YR 5/3) cobbly silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; common fine roots; 45 percent cobblestones and gravel; moderately calcareous; strongly alkaline (pH 8.5); gradual, irregular boundary.
- Cca—18 to 30 inches, pale-brown (10YR 6/3) very cobbly silt loam, brown (10YR 5/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; 55 percent cobblestones and gravel; strongly calcareous; strongly alkaline (pH 8.5); abrupt, irregular boundary.
- R—30 inches, fractured limestone bedrock; lime accumulations in the cracks.

Depth to limestone bedrock ranges from 24 to 38 inches. Coarse fragments are angular cobblestones, gravel, and a few stones that are mainly limestone but are partly sandstone and quartzite. Content of coarse fragments ranges from 20 to 35 percent in the A1 horizon, 40 to 70 percent in the B2 horizon, and 50 to 80 percent in the Cca horizon. Most of the coarse fragments are more than 2 inches in diameter. Depth to the horizon of carbonate accumulation ranges from 11 to 23 inches.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. This horizon is cobbly silt loam, cobbly loam, gravelly silt loam, or gravelly loam, and it ranges from 7 to 16 inches in thickness. It is mildly alkaline to strongly alkaline and slightly calcareous to moderately calcareous.

In the B2 horizon, value is 5 or 6 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 2 to 4. This horizon is cobbly or very cobbly silt loam or loam, or very gravelly or gravelly silt loam or loam, and it ranges from 5 to 12 inches in thickness. It is moderately alkaline or strongly alkaline and slightly calcareous to moderately calcareous.

In the Cca horizon, values range from 5 to 7 when the soils are dry and from 4 to 6 when they are moist; chroma ranges from 2 to 4. Texture is very cobbly silt loam, very gravelly silt loam, very cobbly loam, or very gravelly loam. Reaction is moderately alkaline or strongly alkaline.

Rozlee-Rock outcrop complex, 30 to 70 percent slopes (RWG).—This mapping unit is on mountains and mountain foot slopes. It consists of about 85 percent Rozlee cobbly silt loam, 30 to 70 percent slopes, and 10 percent Rock outcrop. Included with this unit in mapping are areas of Sandall cobbly silt loam, 30 to 60 percent slopes, that make up 5 percent of the total acreage.

The Rozlee soil is on generally east-facing mountain slopes and supports a cover of bluebunch wheatgrass, sagebrush, snakeweed, annual grasses, and juniper. Slopes are medium in length. Runoff is rapid, and the hazard of erosion is high.

Rock outcrop is in irregularly scattered areas on ridges and in prominently raised positions. The outcropping rock is mainly limestone.

This complex is used for range and wildlife habitat. Capability unit VIIs-U, nonirrigated; Upland Stony Hills (Juniper) range site.

Saltair Series

The Saltair series consists of poorly drained, very strongly saline soils. These soils are on broad plains surrounding Great Salt Lake. They formed in mixed lake sediments and are nearly barren of vegetation. Slopes are less than 1 percent. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 12 to 15 inches, and the frost-free period is 110 to 150 days. Elevations range from 4,205 and 4,225 feet.

In a representative profile, the surface layer is gray silty clay loam about 7 inches thick. Between depths of 7 and 30 inches are layers of stratified, light-gray silty clay loam and heavy silt loam. Below this, and reaching to a depth of 60 inches or more, is light-gray silty clay loam. These soils are strongly calcareous and moderately alkaline throughout.

Permeability is slow, and the rate of water intake is slow. These soils are usually saturated with water, but the water available for plant growth is only 2 to 4 inches because of the very high salt content. Plants that grow on Saltair soils normally have a shallow rooting system.

In most places the Saltair soils are barren wasteland, but they have value as wildlife habitat.

Representative profile of Saltair silty clay loam in an area of Saltair-Logan association, in range, 1,900 feet west and 1,750 feet north of the southeast corner of section 4, T. 8 N., R. 2 W., southwest of Perry:

- A1sa—0 to 7 inches, gray (10YR 6/1) silty clay loam, very dark gray (10YR 3/1) when moist; massive (puddled); hard, friable, slightly sticky and plastic; many very

fine pores; strongly calcareous; very strongly saline; moderately alkaline (pH 8.4); abrupt, irregular boundary.

- C1sa—7 to 20 inches, light-gray (10YR 7/2) silty clay loam, dark grayish brown (2.5Y 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine pores; very strongly saline; strongly calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.
- C2sa—20 to 30 inches, light-gray (2.5Y 7/2) heavy silt loam, grayish brown (2.5Y 5/2) when moist; massive; hard, friable, slightly sticky and plastic; very strongly saline; strongly calcareous; moderately alkaline (pH 8.2); gradual, wavy boundary.
- C3—30 to 60 inches, light-gray (2.5Y 7/2) heavy silty clay loam, olive gray (5Y 5/2) when moist; massive; very hard, firm, sticky and very plastic; strongly calcareous; moderately alkaline (pH 8.2).

Between depths of 10 and 40 inches, the texture averages silty clay loam and the content of clay ranges from 28 to 32 percent. The soils are usually moist because the water table is at or near the surface most of the year.

In the A1sa horizon, hue is 10YR or 2.5Y; value is 3 or 4 when the soils are moist; and chroma is 1 or 2. This horizon has weak, thin, platy structure or is massive but parts to coarse, polygonal-shaped peds if the top few inches become dry. Thickness of the A1sa horizon ranges from 5 to 8 inches.

In the Csa horizon, hue ranges from 1 to 4. Texture is heavy silt loam or silty clay loam. This horizon is very strongly saline and moderately alkaline or strongly alkaline.

Saltair silty clay loam (SA).—This soil is on broad plains surrounding the Great Salt Lake. The profile of this soil is similar to that described as representative for the Saltair series, but the surface layer is 8 inches thick. Hue is 2.5Y; value is 4 when the soil is moist; and chroma is 2. The substratum has hues that range from 7.5YR to 2.5Y, and its texture is as fine as silty clay. Runoff is very slow or ponded, and there is no hazard of erosion.

Included with this soil in mapping are small areas of Logan silty clay loam, moderately saline; Playas; and Fresh water marsh.

This Saltair soil is most commonly barren wasteland, but it has been diked and ponded in some areas and used as habitat for migratory waterfowl. Capability unit VIIIw-8, nonirrigated; range site not assigned.

Saltair-Fresh water marsh association (SB).—This mapping unit is on broad plains surrounding the Great Salt Lake where streams empty into the lake. It consists of about 40 percent Saltair silty clay loam and 35 percent Fresh water marsh. Included with this unit in mapping are areas of Logan silty clay loam, moderately saline, and Playas. These included soils make up about 25 percent of the total acreage.

The Saltair soil is on nearly level lake plains. Generally, it is nearly bare but supports scattered plants of pickleweed and a few patches of saltgrass. Fresh water marsh is in slightly concave areas where water from streams stands for long periods of time. Its plant cover is mainly cattails and bulrushes. The Logan soil is in areas that have been flooded with fresh water for several years and have a thick cover of saltgrass.

Runoff is very slow or ponded, and there is no hazard of erosion.

Although the Saltair soil is mostly barren wasteland, some areas have been diked and ponded and used as waterfowl habitat. Fresh water marsh is better suited to wildlife habitat than to most other uses. Many areas are managed for use by migratory waterfowl and the trapping of muskrats. Saltair soil is in capability unit VIIIw-8, nonirrigated; range site not assigned. Fresh water marsh

is in capability unit VIIIw-2, nonirrigated; range site not assigned.

Saltair-Logan association (SC).—This mapping unit is on broad plains surrounding the Great Salt Lake. It consists of about 55 percent Saltair silty clay loam and 35 percent Logan silty clay loam, moderately saline. Included with these soils in mapping are areas of Playas and Fresh water marsh. These included areas make up about 10 percent of the total acreage.

Both of these soils are nearly level and are on saltwater lake plains. The Saltair soil is nearly barren; it supports only scattered plants of pickleweed and a few patches of saltgrass. The Logan soil is in areas that have been flooded with fresh water for several years and have a thick cover of saltgrass.

A profile of Saltair soil in this association is the one described as representative for the Saltair series. The profile of the Logan soil is similar to that described as representative for the Logan series, but it is moderately saline. Slopes are generally less than 1 percent. Because of the salt content, the water available to plants is only about 7 to 9 inches to a depth of 5 feet. If the soils are reclaimed, however, the available water holding capacity is 11 to 12 inches to that depth. Runoff is very slow, and the hazard of erosion is slight. Elevations range from 4,205 to 4,220 feet, and the frost-free period is 110 to 140 days.

The Saltair soil in this association is mainly barren wasteland, but some areas have been diked and ponded and used for wildlife habitat. The Logan soil is used for range and wildlife habitat. The Saltair soil is in capability unit VIIIw-8, nonirrigated; range site not assigned. The Logan soil is in capability unit VIIw-28, nonirrigated; Salt Meadow range site.

Saltair-Refuge complex (Sd).—This mapping unit is on broad plains surrounding Great Salt Lake. It consists of about 60 percent Saltair silty clay loam and 40 percent Refuge loam.

These soils are intermingled and have a difference in microrelief of only 6 to 18 inches. The Saltair soil is in low positions and is nearly bare; it has only a thin stand of pickleweed and a few patches of saltgrass. The Refuge soil is in slightly higher areas under a cover of saltgrass, alkali sacaton, annual mustard, and cheatgrass.

A profile of the Saltair soil in this mapping unit is similar to that described as representative for the Saltair series. A profile of the Refuge soil is the one described as representative for the Refuge series. Runoff is very slow, and the hazard of erosion is slight.

The soils in this complex are used mostly for wildlife habitat, including waterfowl habitat. Capability unit VIIw-28, nonirrigated; Alkali Bottom range site.

Sandall Series

The Sandall series consists of somewhat excessively drained soils. These soils are on mountain slopes, mountain foot slopes, and terraces. Generally they formed in gravelly and cobbly colluvium and residuum derived mostly from limestone rocks that have some sandstone and quartzite. At the lower elevations, however, the soils formed in mixed lake sediments. Slopes range from 3 to 70 percent but most commonly are 30 to 60 percent. The vegetation is mainly juniper but includes bluebunch wheatgrass, Sandberg bluegrass, big sagebrush, bitterbrush, cheatgrass, and annual weeds. Mean annual air

temperature ranges from 48° to 52° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,350 to 6,800 feet.

In a representative profile, the surface layer is brown and pale-brown cobbly silt loam about 7 inches thick. The subsoil is very pale brown gravelly heavy loam about 9 inches thick. The substratum is light yellowish-brown and white very cobbly loam that is about 19 inches thick and extends to limestone bedrock. The surface layer is moderately calcareous and moderately alkaline, and the subsoil and substratum are strongly calcareous or very strongly calcareous and strongly alkaline to very strongly alkaline.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 3 to 4 inches above bedrock. The water-supplying capacity is about 5 to 8 inches before moisture is depleted. Most roots are concentrated in the top 20 to 30 inches of soil, but roots can penetrate to bedrock.

These soils are used for range and wildlife habitat.

Representative profile of Sandall cobbly silt loam, 30 to 60 percent slopes, in range, 1,900 feet west and 100 feet south of the northeast corner of section 13, T. 13 N., R. 8 W., about 8 miles southwest of the town of Snowville:

O1—1/2 inch to 0, pinon pine needles.

A11—0 to 2 inches, brown (10YR 5/3) cobbly silt loam, dark grayish brown (10YR 4/2) when moist; weak, very fine, granular structure; soft, very friable, slightly sticky and slightly plastic; few fine roots; 20 percent gravel and cobblestones; moderately calcareous; moderately alkaline (pH 8.2); abrupt, smooth boundary.

A12—2 to 7 inches, pale-brown (10YR 6/3) cobbly heavy silt loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure that parts to granular; slightly hard, friable, slightly sticky and slightly plastic; common fine, medium, and large roots; common very fine pores; 25 percent gravel and cobblestones; moderately calcareous; moderately alkaline (pH 8.2); clear, wavy boundary.

B2—7 to 16 inches, very pale brown (10YR 7/4) gravelly heavy loam, yellowish brown (10YR 5/4) when moist; moderate, fine and medium, subangular blocky structure; hard, friable, sticky and slightly plastic; common fine, medium, and large roots; common, very fine, discontinuous pores; 30 percent gravel and cobblestones; cicada holes one-half inch in diameter; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.9); clear, wavy boundary.

C1ca—16 to 24 inches, light yellowish-brown (10YR 6/4) very cobbly heavy loam, brown (10YR 5/3) when moist; weak, fine and medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; common fine, medium, and large roots; common, very fine, discontinuous pores; 60 percent cobblestones, gravel, and some stones; strongly calcareous, some lime coatings on coarse fragments; strongly alkaline (pH 9.0); abrupt, irregular boundary.

C2ca—24 to 35 inches, white (10YR 8/2) very cobbly loam, light gray (10YR 7/2) when moist; massive; common, very fine, discontinuous pores; 60 percent cobblestones and partially weathered limestone; very strongly calcareous, lime is strongly cemented on coarse fragments; strongly alkaline (pH 9.1); abrupt, smooth boundary.

R—35 inches, limestone bedrock.

Angular cobblestones, gravel, and a few stones cover about 25 to 40 percent of the surface. Most of the coarse fragments are more than 2 inches in diameter and are dominantly limestone and sandstone rocks. Depth to the top of the Cca horizon ranges from 10 to 19 inches. Between depths of 10 and 40 inches, the texture averages very gravelly or very cobbly loam that is 40 to 80 percent coarse fragments. Depth to limestone

bedrock ranges from 22 to 40 inches. The soils are usually dry in all parts between depths of 4 and 12 inches.

In the A1 horizon, value is 5 or 6 when the soils are dry and ranges from 3 to 5 when they are moist; and chroma is 2 or 3. The part of the A1 horizon having a value of 5 when dry and of 3 when moist is less than 6 inches thick. This horizon is gravelly loam, cobbly loam, gravelly silt loam, or cobbly silt loam, and its content of gravel and cobblestones is 20 to 35 percent. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is moderately calcareous or strongly calcareous and ranges from 4 to 10 inches in thickness.

In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 2 to 4. Texture is gravelly silt loam, very gravelly loam, or very gravelly silt loam. The B2 horizon is moderately alkaline or strongly alkaline and moderately calcareous or strongly calcareous.

In the Cca and C horizons, hue ranges from 7.5YR to 2.5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is very cobbly loam, very gravelly loam, very cobbly fine sandy loam, or very gravelly fine sandy loam that is 35 to 90 percent cobblestones and gravel. Reaction is strongly alkaline or very strongly alkaline. The Cca and C horizons are strongly calcareous to very strongly calcareous and in places are weakly cemented.

Sandall cobbly silt loam, 10 to 30 percent slopes (SEE).—This soil is on generally south- and west-facing mountains or mountain foot slopes. Slopes are slightly convex and range from 10 to 30 percent but most commonly are 20 to 30 percent. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet erosion is common, and a few shallow gullies have been formed.

Included with this soil in mapping are small areas of Abela gravelly loam, 10 to 20 percent slopes; Rozlee cobbly silt loam, 30 to 70 percent slopes; Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes; a light-colored cobbly silt loam soil that is moderately deep over bedrock and has slopes of 20 to 30 percent; and Rock outcrop and rockslides.

This Sandall soil is used for range and wildlife habitat. Capability unit VI_s-U, nonirrigated; Upland Stony Hills (Juniper) range site.

Sandall cobbly silt loam, 30 to 60 percent slopes (SEG).—This soil is on generally south- and west-facing mountains or mountain foot slopes in the Promontory and Hansel Mountains. Slopes are medium in length and slightly convex. A profile of this soil is the one described as representative for the Sandall series. Runoff is rapid, and the hazard of erosion is high. Moderate sheet erosion is common, and many shallow gullies and a few deep ones have been formed in places.

Included with this soil in mapping are small areas of Promo cobbly silt loam, 30 to 60 percent slopes; Rozlee cobbly silt loam, 30 to 70 percent slopes; and Rock outcrop and rockslides.

This Sandall soil is used for range and wildlife habitat. Capability unit VII_s-U, nonirrigated; Upland Stony Hills (Juniper) range site.

Sandall-Broad association, steep (SFG).—This mapping unit is on mountains and mountain foot slopes. It consists of about 65 percent Sandall cobbly silt loam, 30 to 60 percent slopes, and 25 percent Broad cobbly loam, 30 to 60 percent slopes. Included with these soils in mapping are areas of Promo cobbly silt loam, 30 to 60 percent slopes; Rozlee cobbly silt loam, 30 to 70 percent slopes; and Rock outcrop and rockslides. These included areas make up about 10 percent of the total acreage.

Soils of this association are intermingled but are in a predictable pattern. The Sandall soil has very steep,

south- and northwest-facing slopes and is under a cover of juniper, bluebunch wheatgrass, cheatgrass, and annual weeds. Its slopes are slightly convex. The Broad soil has very steep, north- and east-facing slopes and is under a cover of bluebunch wheatgrass, Sandberg bluegrass, and the juniper trees that have invaded areas of this soil. Its slopes are slightly concave.

Runoff is rapid, and the hazard of erosion is high on these soils.

The soils of this association are used for range and wildlife habitat. The Sandall soil is in capability unit VII_s-U, nonirrigated; Upland Stony Hills (Juniper) range site. The Broad soil is in capability unit VII_s-M, nonirrigated; Mountain Stony Loam range site.

Sandall-Promo association, steep (SGG).—This mapping unit is on the mountains and mountain foot slopes in the Hansel and Promontory Mountains. It consists of about 45 percent Sandall cobbly silt loam, 30 to 60 percent slopes, and 40 percent Promo cobbly silt loam, 30 to 60 percent slopes. Included with these soils in mapping are areas of Rozlee cobbly silt loam, 30 to 70 percent slopes, and Rock outcrop and rockslides. These included areas make up about 15 percent of the total acreage.

Soils of this association are intermingled. The Sandall soil on side slopes having all aspects and is under a cover of juniper, big sagebrush, bluebunch wheatgrass, cheatgrass, and annual weeds. Slopes are very steep and slightly convex. The Promo soil is on south- and west-facing slopes and is under a cover of juniper, big sagebrush, bitterbrush, bluebunch wheatgrass, cheatgrass, and annual weeds. Slopes are medium in length and slightly convex.

Runoff is rapid, and the hazard of erosion is high on these soils. Moderate sheet and rill erosion is common.

The soils of this association are used for range and wildlife habitat. Capability unit VII_s-U, nonirrigated; Upland Stony Hills (Juniper) range site.

Sandall-Rock outcrop complex, 3 to 30 percent slopes (SHE).—This mapping unit is on slightly convex, mainly south- and west-facing mountain foot slopes and terraces. It consists of about 80 percent Sandall cobbly silt loam, 3 to 30 percent slopes, and 15 percent Rock outcrop. Included with this unit in mapping are areas of Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes, and Windmill gravelly loam, 10 to 20 percent slopes. These included soils make up about 5 percent of the total acreage.

The Sandall soil is gently sloping to steep and has slightly convex slopes that are short to medium in length. Its plant cover is cheatgrass, annual weeds, and some big sagebrush and bluebunch wheatgrass. This soil is similar to the soil having the profile described as representative for the series, but it is at much lower elevations and formed in mixed lake sediments. Runoff is medium, and the hazard of erosion is moderate.

Rock outcrop is on ridges and in slightly raised positions. The outcropping rock is mainly limestone.

This complex is used for range and wildlife habitat. Capability unit VII_s-U, nonirrigated; Upland Stony Loam range site.

Sandall-Rozlee association, steep (SJG).—This mapping unit is on mountains and mountain foot slopes. It consists of about 50 percent Sandall cobbly silt loam, 30 to 60 percent slopes, and 45 percent Rozlee cobbly silt loam, 30 to 70 percent slopes. Included with these soils in

mapping are areas of Promo cobbly silt loam, 30 to 60 percent slopes; a well-drained very cobbly silt loam that is moderately deep over bedrock and has slopes of 20 to 30 percent; and Rock outcrop and rockslides. These included areas make up about 5 percent of the total acreage.

Soils of this association are intermingled. The Sandall soil is on south- and west-facing mountain slopes that are very steep and slightly convex. The Rozlee soil is on generally north- and east-facing mountain slopes that are very steep and slightly concave. A profile of this soil is the one described as representative for the Rozlee series. Both soils support a cover of juniper, sagebrush, bitterbrush, bluebunch wheatgrass, and annual weeds and grasses.

Runoff is rapid on these soils, and the hazard of erosion is high. Sheet and rill erosion is common, and in places many shallow gullies have been formed.

The soils of this association are used for range and wildlife habitat. Capability unit VII_s-U, nonirrigated; Upland Stony Hills (Juniper) range site.

Sanpete Series

The Sanpete series consists of somewhat excessively drained soils. These soils are on lake terraces, escarpments, steep sides of drainageways, and foothills. They are widely distributed throughout the survey area. They formed in mixed lake sediments and very gravelly and cobbly alluvium and colluvium materials derived mainly from limestone. Slopes range from 1 to 50 percent but most commonly are 6 to 30 percent. The vegetation in noncultivated areas is mainly big sagebrush, bluebunch wheatgrass, snakeweed, sand dropseed, three-awn, cheatgrass, annual weeds, and some juniper. Mean annual air temperature ranges from 46° to 51° F. Average annual precipitation ranges from 8 to 14 inches, and the frost-free period is 100 to 140 days. Elevations range from 4,350 to 5,300 feet.

In a representative profile, the surface layer is pale-brown gravelly silt loam about 10 inches thick. The subsoil is pale-brown gravelly loam about 9 inches thick. The substratum, extending to a depth of 60 inches or more, is light-gray very gravelly sandy loam in the upper part and very pale brown very gravelly silt loam and very gravelly loam in the lower part. These soils are strongly calcareous below a depth of 5 inches. The surface layer is moderately alkaline, and the subsoil and substratum are strongly alkaline to very strongly alkaline.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 4 to 5.5 inches to a depth of 5 feet. The water-supplying capacity is about 4 to 9 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most roots are in the top 30 inches of the soil.

The Sanpete soils are used for range, nonirrigated crops, and industrial development.

Representative profile of Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes, in range, 2,100 feet north and 1,700 feet east of the southwest corner of section 6, T. 10 N., R. 7 W., about 4 miles southwest of Cedar Spring:

Ap—0 to 5 inches, pale-brown (10YR 6/3) gravelly silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, nonsticky and slightly plastic; common very fine roots; 20

- percent gravel; moderately calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.
- A1—5 to 10 inches, pale-brown (10YR 6/3) gravelly silt loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure that parts to weak, fine, subangular blocky; very few fine roots; common fine and very fine vesicular pores: 25 percent gravel; strongly calcareous; moderately alkaline (pH 8.4) clear, smooth boundary.
- B2—10 to 19 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 5/3) when moist; moderate, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine and very fine tubular pores; 40 percent gravel; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); abrupt, wavy boundary.
- C1ca—19 to 31 inches, light-gray (10YR 7/2) very gravelly heavy sandy loam, pale brown (10YR 6/3) when moist; massive; hard, friable, nonsticky and nonplastic; few very fine roots; few fine and medium tubular pores; 75 percent gravel; very strongly calcareous, weakly cemented; strongly alkaline (pH 8.9); abrupt, wavy boundary.
- C2ca—31 to 41 inches, very pale brown (10YR 7/3) very gravelly silt loam, light yellowish brown (10YR 6/4) when moist; massive; hard, friable, nonsticky and nonplastic; few fine and very fine tubular pores; 80 percent gravel; very strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); diffuse, wavy boundary.
- C3—41 to 56 inches, very pale brown (10YR 7/3) very gravelly silt loam, pale brown (10YR 6/3) when moist; massive; hard, friable, nonsticky and nonplastic; 80 percent gravel; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); diffuse, irregular boundary.
- C4—56 to 65 inches, very pale brown (10YR 7/3) very gravelly light loam, light yellowish brown (10YR 6/4) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; 70 percent gravel; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4).

Depth to the horizon of carbonate accumulation ranges from 12 to 21 inches. Coarse fragments are dominantly rounded limestone of gravel size. About 20 to 50 percent of the surface is covered with gravel and some cobbles. Between depths of 10 and 40 inches, the texture averages very gravelly light loam and the content of gravel and cobbles ranges from 40 to 80 percent. The soils are usually dry in all parts between depths of 8 to 24 inches.

In the A1 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is gravelly silt loam or gravelly fine sandy loam, and the content of gravel and cobbles ranges from 20 to 50 percent. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is slightly calcareous to strongly calcareous and is 6 to 12 inches thick.

In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. The B2 horizon is moderately calcareous or strongly calcareous and moderately alkaline or strongly alkaline.

In the Cca and C horizons, hue is 7.5YR or 10YR; value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; and chroma ranges from 2 to 4. These C horizons are very gravelly silt loam, very cobbly silt loam, very gravelly loam, very cobbly loam, or very cobbly sandy loam, and the content of cobbles and gravel ranges from 50 to 80 percent. The Cca and C horizons are strongly alkaline or very strongly alkaline and strongly calcareous to very strongly calcareous.

Sanpete gravelly silt loam, 6 to 30 percent slopes (SkE).—This soil is on low to intermediate lake terraces in the extreme southwestern part of the survey area. Slopes are medium in length and convex. The profile of this soil is similar to that described as representative for the Sanpete series, but the average annual precipitation for this soil ranges from 8 to 11 inches. The frost-free period is 100 to 120 days. The water-supplying capacity

before moisture is depleted is about 4 to 7 inches. Runoff is medium, and the hazard of erosion is moderate. Sheet erosion is moderate, and a few shallow gullies have been formed.

Included with this soil in mapping are small areas of Palisade silt loam, 6 to 10 percent slopes, and Windmill gravelly loam, 10 to 20 percent slopes.

This Sanpete soil is used entirely for range. Capability unit VII-S, nonirrigated; Semidesert Stony Loam range site.

Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes (SlB).—This soil is on south- and west-facing slopes on intermediate and high lake terraces. Slopes are medium in length. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. The water-supplying capacity before moisture is depleted is about 8 to 9 inches.

Included with this soil in mapping are small areas of Pomat silt loam, 6 to 10 percent slopes, and Stingal loam, 1 to 6 percent slopes.

This Sanpete soil is used for range and nonirrigated small grains. Capability unit IV-UZ, nonirrigated; Upland Stony Loam range site.

Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes (SlD).—This soil is on intermediate and high lake terraces and terrace escarpments. Slopes are medium in length and slightly convex. A profile of this soil is the one described as representative for the Sanpete series. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet erosion is common, and a few shallow gullies have been formed. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. The water-supplying capacity before moisture is depleted is about 8 to 9 inches.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes; Pomat silt loam, 6 to 10 percent slopes; Stingal loam, 6 to 10 percent slopes; and Windmill gravelly loam, 6 to 10 percent slopes.

This Sanpete soil is used for range, nonirrigated small grains, and industrial development. Capability unit IV-UZ, nonirrigated; Upland Stony Loam range site.

Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes (SlE).—This soil is on intermediate to high lake terraces, foothills, and terrace escarpments. Slopes are short to medium in length. Runoff is rapid, and the hazard of erosion is high. Moderate sheet and rill erosion is common, and a few shallow gullies have been formed. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. The water-supplying capacity before moisture is depleted is about 8 to 9 inches.

Included with this soil in mapping are small areas of Middle cobbly silt loam, 10 to 30 percent slopes; Pomat silt loam, 10 to 30 percent slopes; Sterling gravelly loam, 6 to 20 percent slopes; and Windmill gravelly loam, 10 to 20 percent slopes.

This Sanpete soil is used mainly for range. A small area is used for nonirrigated small grains and industrial development. Capability unit VI-U, nonirrigated; Upland Stony Loam range site.

Sanpete gravelly silt loam, high rainfall, 30 to 50 percent slopes (SlG).—This soil is in foothills, on terrace escarpments, and on side slopes of drainageways. Slopes

are short to medium in length and are highly dissected. Runoff is very rapid, and the hazard of erosion is very high. Sheet and gully erosion is commonly moderate to severe. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. The water-supplying capacity before moisture is depleted is about 6 to 7 inches.

Included with this soil in mapping are small areas of Middle cobbly silt loam, 30 to 70 percent slopes; Pomat silt loam, 30 to 40 percent slopes, eroded; and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes.

This Sanpete soil is used for range. Capability unit VIIs-U, nonirrigated; Upland Stony Loam range site.

Saxby Series

The Saxby series consists of well-drained soils. These soils are on lake terraces, terrace escarpments, and foot slopes. They formed in basalt material that has been overwashed with strongly calcareous, mixed lake sediments. Slopes range from 1 to 30 percent. Vegetation consists of big sagebrush, squirreltail, bluebunch wheatgrass, cheatgrass, Sandberg bluegrass, and yellowbrush. Mean annual air temperature ranges from 47° to 51° F. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 100 to 130 days. Elevations range from 4,250 to 4,900 feet.

In a representative profile, the surface layer is light brownish-gray extremely stony silt loam about 4 inches thick. The subsoil is very pale brown very cobbly silt loam about 8 inches thick. The substratum is very pale brown very cobbly silt loam about 6 inches thick. It overlies fractured basalt stones 1 to 5 feet in diameter. These soils are strongly alkaline or very strongly alkaline throughout and moderately calcareous or strongly calcareous.

Permeability is moderate, and the rate of water intake is slow. The available water holding capacity is 2 to 3 inches to the bedrock. The water-supplying capacity is 3 to 5 inches before moisture is depleted. Roots penetrate to bedrock.

These soils are used for range and wildlife habitat.

Representative profile of Saxby extremely stony silt loam, 10 to 30 percent slopes, in an area of Saxby very stony land association, in range, 1,100 feet east and 1,400 feet north of the west quarter corner of section 25, T. 9 N., R. 7 W., about 13 miles southwest of Golden Spike National Monument:

- A1—0 to 4 inches, light brownish-gray (10YR 6/2) extremely stony silt loam, dark grayish-brown (10YR 4/2) when moist; weak, fine, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; common very fine interstitial pores; about 40 percent basalt stones; moderately calcareous; strongly alkaline (pH 9.0); gradual, smooth boundary.
- B2—4 to 12 inches, very pale brown (10YR 7/3) very cobbly silt loam, brown (10YR 4/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine and medium roots; common very fine interstitial pores; about 60 percent cobbles and stones; moderately calcareous; strongly alkaline (pH 8.8); gradual, irregular boundary.
- C1ca—12 to 18 inches, very pale brown (10YR 7/3) very cobbly silt loam, brown (10YR 4/3) when moist; massive; very hard, friable, sticky and slightly plastic; few very fine roots; about 60 percent cobbles and

stones; strongly calcareous; very strongly alkaline (pH 9.2); abrupt, irregular boundary.

R—18 inches, fractured basalt; cemented lime accumulations in cracks and voids.

Depth to bedrock ranges from 17 to 20 inches. The soils are usually dry above bedrock. In the A1 horizon, value is 6 or 7 when the soils are dry; chroma is 2 or 3. This horizon is moderately alkaline or strongly alkaline and ranges from 4 to 6 inches in thickness. In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist. The B2 horizon ranges from 5 to 11 inches in thickness. In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist. This horizon is very cobbly loam or very cobbly silt loam and consists of 40 to 70 percent cobbles and 3 to 15 percent stones. Reaction is strongly alkaline to very strongly alkaline.

Saxby-Thiokol complex, 1 to 6 percent slopes (SMB).—This mapping unit is on lake terraces in the extreme southwestern part of the survey area. It consists of about 50 percent Saxby extremely stony silt loam, 1 to 6 percent slopes, and 30 percent Thiokol silt loam, low rainfall, 1 to 6 percent slopes. Included with this unit in mapping are areas of Very stony land and Palisade silt loam, 1 to 6 percent slopes. These included areas make up about 20 percent of the total acreage.

Soils of this complex are intermingled. The Saxby soil is in slightly raised positions on ridgetops under a cover of yellowbrush, bluebunch wheatgrass, and big sagebrush. The Thiokol soil is in slightly concave positions and in the more nearly level areas between ridges. It is under a cover of bluebunch wheatgrass, squirreltail, annual mustard, and big sagebrush.

Runoff is medium, and the hazard of erosion is moderate on these soils. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 85 to 100 days. The water-supplying capacity is about 6 to 8 inches before moisture is depleted.

The soils of this complex are used for range and wildlife habitat. Capability unit VIIs-S, nonirrigated; Semidesert Shallow Loam range site.

Saxby-Very stony land association (SN).—This mapping unit is on lake terraces and mountain foot slopes in the southwestern part of the survey area. Slopes are short to medium in length. It consists of about 60 percent Saxby extremely stony silt loam, 10 to 30 percent slopes, and 30 percent Very stony land. Included with this unit in mapping are areas of Palisade silt loam, 6 to 10 percent slopes, and Sanpete gravelly silt loam, 6 to 30 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this association are closely intermingled. The Saxby soil is in slightly concave positions under a cover of bluebunch wheatgrass, squirreltail, yellowbrush, and big sagebrush. A profile of this soil is the one described as representative for the Saxby series. Runoff is medium, and the hazard of erosion is moderate. Very stony land is on ridgetops and at random locations in other parts of the association.

This association is used for range and wildlife habitat. Capability unit VIIs-S, nonirrigated; Semidesert Shallow Loam range site.

Sheeprock Series

The Sheeprock soils consist of somewhat excessively drained soils. These soils are on alluvial fans, lake terraces, and dissected lake-terrace escarpments on Fremont

Island and in the southern part of the Promontory Mountains. They formed in very gravelly alluvium and sandy beach deposits derived from limestone, sandstone, and quartzite. Slopes range from 6 to 40 percent. Vegetation is mainly cheatgrass but includes some Indian ricegrass, bluebunch wheatgrass, yellowbrush, big sagebrush, and juniper. Mean annual air temperature ranges from 48° to 52° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 120 to 140 days. Elevations range from 4,220 to 5,100 feet.

In a representative profile, the surface layer is pale-brown gravelly sandy loam about 6 inches thick. Next is a layer of pale-brown gravelly sandy loam and brown gravelly light loam about 8 inches thick. Below this, and extending to a depth of 60 inches, is gray very gravelly sand. These soils are slightly calcareous and moderately alkaline to strongly alkaline to a depth of 14 inches and are strongly calcareous and very strongly alkaline below that depth.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 2.5 to 5 inches to a depth of 5 feet. The water-supplying capacity is 6 to 7 inches before moisture is depleted. Roots penetrate to a depth of 60 inches, but most roots are in the upper 20 to 30 inches of the soil.

Sheeprock soils are used for range.

Representative profile of Sheeprock gravelly sandy loam, 6 to 10 percent slopes, in range, 475 feet west and 650 feet north of the east quarter corner of section 13, T. 5 N., R. 5 W., on Fremont Island:

- A1—0 to 6 inches, pale-brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, medium and fine, granular structure; soft, friable, slightly sticky and nonplastic; common fine and very fine roots; 20 percent gravel; slightly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.
- C1—6 to 10 inches, pale-brown (10YR 6/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, very friable, slightly sticky and nonplastic; common fine and very fine roots; 20 percent gravel; slightly calcareous; moderately alkaline (pH 8.4); abrupt, smooth boundary.
- C2—10 to 14 inches, brown (10YR 5/3) gravelly light loam, dark brown (10YR 3/3) when moist; massive; soft, very friable; few fine and very fine roots; 40 percent gravel; slightly calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.
- C3—14 to 60 inches, gray (10YR 5/1) very gravelly sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose; 65 percent gravel (mainly ¼ to ½ inch in diameter); strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Between depths of 10 and 40 inches, the texture averages very gravelly sand and the content of coarse fragments ranges from 50 to 80 percent. Depth to the very gravelly material ranges from 11 to 20 inches. The soils are usually dry in all parts between depths of 12 to 35 inches.

In the A1 horizon, value is 5 or 6 when the soils are dry and 3 or 4 when they are moist; chroma is 2 to 4. This horizon is gravelly loam or gravelly sandy loam, and the content of fine gravel ranges from 20 to 40 percent. The horizon is mildly alkaline or moderately alkaline and is generally noncalcareous but may be slightly calcareous. In places there is no A1 horizon. In the C horizon, hue ranges from 10YR to 5Y; value ranges from 5 to 7 when the soils are dry and 3 to 6 when they are moist; and chroma ranges from 1 to 4. Reaction is mildly alkaline to very strongly alkaline. The C horizon is mainly strongly calcareous but ranges to slightly calcareous.

Sheeprock gravelly sandy loam, 6 to 10 percent slopes (SoD).—This soil is on south- and west-facing slopes on

lake terraces and alluvial fans on Fremont Island. Slopes are slightly convex and medium in length. A profile of this soil is the one described as representative for the Sheeprock series. Texture of the surface layer is mainly gravelly sandy loam but is gravelly loam in some places. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes.

This Sheeprock soil is used for range. Capability unit VI_s-U, nonirrigated; Upland Sand range site.

Sheeprock gravelly loam, 10 to 40 percent slopes, severely eroded (SpF3).—This soil is on highly dissected lake-terrace escarpments and alluvial fans. Slopes are short to medium in length. The surface layer is mainly gravelly loam but is gravelly sandy loam in places. Runoff is rapid, and the hazard of erosion is high. Gully erosion is commonly severe, and sheet and rill erosion is moderate.

Included with this soil in mapping are small areas of Blue Star gravelly loam, 6 to 20 percent slopes, and Blue Star gravelly loam, gravelly subsoil variant, 6 to 10 percent slopes.

This Sheeprock soil is used for range. Capability unit VII_s-U, nonirrigated; Upland Sand range site.

Smarts Series

The Smarts series consists of well-drained soils. These soils are on mountain slopes and in wooded canyons or ravines. They formed in alluvium derived from sandstone and quartzite. Slopes range from 30 to 70 percent. Vegetation is dominantly maple but includes some chokecherry, oregongrape, snowberry, lupine, and scattered aspen. Mean annual air temperature ranges from 40° to 46° F. Average annual precipitation ranges from 18 to 24 inches, and the frost-free period is 75 to 100 days. Elevations range from 5,400 to 7,000 feet.

In a representative profile, the surface layer is dark grayish-brown loam about 45 inches thick. The subsoil is light-brown gravelly clay loam in the upper part and brown cobbly clay loam in the lower part. It reaches to a depth of 68 inches. The surface layer is mildly alkaline, and the subsoil is moderately alkaline.

Permeability is moderate to a depth of 45 inches but is moderately slow below that depth. The rate of water intake is moderate. Available water holding capacity is 8 to 11 inches to a depth of 5 feet. The water-supplying capacity is 14 to 19 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches.

These soils are used for range, wildlife habitat, and water supply.

Representative profile of Smarts loam, 30 to 70 percent slopes, in range, 1,600 feet north and 200 feet east of the southwest corner of section 20, T. 14 N., R. 4 W.:

- A11—0 to 15 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; common fine roots; few medium and coarse pores; mildly alkaline (pH 7.4); gradual, wavy boundary.
- A12—15 to 32 inches, dark grayish-brown (10YR 4/2) loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few medium and coarse pores; mildly alkaline (pH 7.6); gradual, wavy boundary.

- A13—32 to 45 inches, dark grayish-brown (10YR 4/2) heavy loam; very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine roots; few medium and coarse pores; mildly alkaline (pH 7.8); clear, wavy boundary.
- B2t—45 to 60 inches, light-brown (7.5YR 6/4) gravelly clay loam, brown (7.5YR 3/4) when moist; weak, medium, prismatic structure that parts to moderate, medium, subangular blocky; very hard, firm, sticky and plastic; few fine roots; few fine pores; many thin clay films on ped faces; 40 percent angular gravel and fractured sandstone; moderately alkaline (pH 8.0); clear, wavy boundary.
- B3—60 to 68 inches, brown (7.5YR 5/3) cobbly light clay loam, dark brown (7.5YR 4/3) when moist; weak, medium, subangular blocky structure; hard, firm, sticky and plastic; few fine and very fine roots; common thin clay films on ped faces; 75 percent fractured sandstone and some cobblestones; moderately alkaline (pH 8.2).

Coarse fragments are mainly angular cobblestones and gravel of sandstone and quartzite. Their content ranges from 0 to 45 percent in the A1 horizon and from 30 to 80 percent in the B2t horizon. The soils are usually moist, but they are dry in all parts between depths of 4 to 12 inches for 60 consecutive days or more in summer.

In the A1 horizon, value is 4 to 5 when the soils are dry and 2 or 3 when they are moist; and chroma is 2 or 3. The A1 horizon is loam, silt loam, gravelly loam, or gravelly silt loam and ranges from 24 to 45 inches in thickness. Reaction is neutral to moderately alkaline.

In the B2t horizon, hue is 10YR or 7.5YR; value is 5 or 6 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 2 to 4. Texture is gravelly clay loam, cobbly clay loam, very gravelly clay loam, or very cobbly clay loam. Reaction is neutral to moderately alkaline. Clay films range from common to many and from thin to moderately thick on ped faces.

Smarts loam, 30 to 70 percent slopes (SQG).—This soil is on north- and east-facing mountain slopes in narrow, wooded canyon areas or ravines. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Broad cobbly loam, 30 to 60 percent slopes; Manila loam, 25 to 60 percent slopes; Middle cobbly silt loam, 30 to 70 percent slopes; and a Smarts soil that has a gravelly or cobbly surface layer.

Smarts loam, 30 to 70 percent slopes, is used for range, water supply, and habitat for big-game animals. Capability unit VIIe-M, nonirrigated; Mountain Loam (Shrub) range site.

Snowville Series

The Snowville series consists of well-drained soils. These soils are on rolling hills and foot slopes in the northern part of Hansel Valley. They formed in residuum derived mainly from basalt but partly from limestone. Slopes range from 6 to 20 percent. Vegetation consists of sagebrush, snakeweed, bluebunch wheatgrass, balsamroot, wild onion, and cheatgrass. Mean annual air temperature ranges from 46° to 49° F. Average annual precipitation is 14 to 15 inches, and the frost-free period is 110 to 120 days. Elevations range from 5,200 to 5,500 feet.

In a representative profile, the surface layer is grayish-brown gravelly silt loam about 7 inches thick. The subsoil is light brownish-gray gravelly heavy loam and cobbly light clay loam about 11 inches thick. Below this is an indurated hardpan that is about 2 inches thick and overlies basalt. The soils are moderately alkaline throughout and are slightly calcareous in the surface layer and moderately calcareous in the subsoil.

Permeability is moderate, and the rate of water intake is slow. Available water holding capacity is 2.5 to 3 inches above the hardpan. The water-supplying capacity is 5 to 6 inches before moisture is depleted. Roots penetrate to the hardpan.

These soils are used for range and wildlife habitat.

Representative profile of Snowville gravelly silt loam, 6 to 20 percent slopes, in range, 500 feet north and 100 feet west of the south quarter corner of section 13, T. 14 N., R. 7 W., about 8 miles east of Snowville:

- A11—0 to 3 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine and few medium roots; 20 percent angular gravel; slightly calcareous, lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.
- A12—3 to 7 inches, grayish-brown (10YR 5/2) gravelly silt loam, very dark grayish brown (10YR 3/2) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; many fine and few medium roots; 20 percent angular gravel; slightly calcareous, lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.
- B21—7 to 13 inches, light brownish-gray (10YR 6/2) gravelly heavy loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; slightly hard, friable, slightly sticky and plastic; common fine and few medium roots; 20 percent angular gravel; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.0); clear, smooth boundary.
- B22—13 to 18 inches, light brownish-gray (10YR 6/2) cobbly light clay loam, dark grayish brown (10YR 4/2) when moist; weak, fine and medium, subangular blocky structure; hard, firm, sticky and plastic; common fine and few medium roots; 30 percent angular cobblestones and gravel; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.2); abrupt, wavy boundary.
- C1cam—18 to 20 inches, indurated hardpan.
- R—20 inches, basalt.

Depth to the indurated hardpan ranges from 14 to 20 inches. Coarse fragments are mainly angular fragments of caliche $\frac{1}{4}$ to $\frac{3}{4}$ inch in size. A few large stones and cobblestones of basalt are scattered on the surface. Content of gravel and cobblestones ranges from 15 to 25 percent in the A1 horizon and from 20 to 35 percent in the B2 horizon. The soils are usually moist but are dry above the hardpan for more than 60 consecutive days in summer. The indurated hardpan is immediately over basalt bedrock in most places.

In the A1 horizon, chroma ranges from 2 to 3. Thickness ranges from 7 to 8 inches. The A1 horizon is slightly calcareous or moderately calcareous. In the B2 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. This horizon is gravelly or cobbly heavy loam or gravelly or cobbly light clay loam. Reaction is moderately alkaline or strongly alkaline.

Snowville gravelly silt loam, 6 to 20 percent slopes (SrE).—This soil is on foot slopes and rolling hills in the northern part of Hansel Valley. Slopes are slightly convex and long. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Gemson silty clay loam, 6 to 10 percent slopes; Parleys silt loam, 10 to 20 percent slopes; Middle cobbly silt loam, 10 to 30 percent slopes; and Rock outcrop.

This soil is used for range, which is grazed by cattle and horses, and for wildlife habitat. Capability unit VIIs-U, nonirrigated; Upland Shallow Loam range site.

Sterling Series

The Sterling series consists of somewhat excessively drained soils. These soils are on alluvial fans, lake terraces, escarpments, and mountain foot slopes throughout the survey area. They formed in very gravelly and cobbly, calcareous alluvium, colluvium, and mixed lake sediments derived dominantly from limestone, dolomite, sandstone, and quartzite. Slopes range from 1 to 50 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, western wheatgrass, big sagebrush, Sandberg bluegrass, three-awn, cheatgrass, and annual weeds. Mean annual air temperature ranges from 45° to 48° F. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 120 to 150 days. Elevations range from 4,500 to 5,400 feet.

In a representative profile, the surface layer is grayish-brown and brown gravelly loam about 16 inches thick. The underlying layer is pale-brown cobbly loam to a depth of 27 inches and pale-brown very cobbly loam between depths of 27 and 60 inches or more. A layer of lime accumulation is at a depth of 16 inches. The surface layer is mildly alkaline and moderately calcareous, and the underlying layer is moderately alkaline and strongly calcareous.

Permeability is moderately rapid, and the rate of water intake is very rapid. Most roots penetrate to a depth of 28 to 38 inches in the soil. Only a few roots extend into the very gravelly or very cobbly material.

These soils are used mainly for range, but most of the more nearly level areas are used for nonirrigated crops. Some areas are used for urban development and as a source of gravel.

Representative profile of Sterling gravelly loam, 6 to 20 percent slopes, in range, 2,150 feet east and 700 feet north of the west quarter corner of section 21, T. 13 N., R. 7 W., in Hansel Valley:

- A11—0 to 2 inches, grayish-brown (10YR 5/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, crumb structure; soft, friable, slightly sticky and slightly plastic; many fine roots; 25 percent gravel; moderately calcareous, lime is disseminated; mildly alkaline (pH 7.8); clear, smooth boundary.
- A12—2 to 8 inches, grayish-brown (10YR 5/2) gravelly loam, dark brown (10YR 3/3) when moist; weak, fine and medium, granular structure; soft, friable, slightly sticky and slightly plastic; common fine roots; few very fine tubular pores; 25 percent gravel; moderately calcareous, lime is disseminated; mildly alkaline (pH 7.8); clear, smooth boundary.
- A13—8 to 16 inches, brown (10YR 5/3) gravelly loam, dark brown (10YR 3/3) when moist; weak, medium, granular structure; soft, friable, slightly sticky and slightly plastic; few fine roots; common fine and very fine tubular pores; 35 percent gravel and cobblestones; moderately calcareous, lime is disseminated; mildly alkaline (pH 7.8); gradual, wavy boundary.
- C1ca—16 to 27 inches, pale-brown (10YR 6/3) cobbly loam, brown (10YR 4/3) when moist; massive; soft, very friable, slightly sticky and slightly plastic; few fine roots; common very fine and few tubular pores; 40 percent cobblestones and gravel, coated with lime; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.0); gradual, wavy boundary.
- C2—27 to 60 inches, pale-brown (10YR 6/3) very cobbly light loam, yellowish brown (10YR 5/4) when moist; massive; soft, very friable, slightly sticky and nonplastic; few fine tubular pores; 70 percent cobblestones and gravel, coated with lime; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.0).

Depth to the horizon of carbonate accumulation ranges from 10 to 19 inches. Coarse fragments are rounded and angular limestone and sandstone, mainly gravel and cobblestones. The content of coarse fragments ranges from 20 to 50 percent in the A1 horizon and from 40 to 80 percent in the Cca and C horizons. Texture averages very gravelly or very cobbly light loam between depths of 10 to 40 inches. The soils are usually moist but are dry in all parts between depths of 8 to 24 inches for more than 60 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Texture is gravelly loam or gravelly silt loam. Reaction is mildly alkaline or moderately alkaline. The A1 horizon is slightly calcareous or moderately calcareous and ranges from 10 to 19 inches in thickness.

In the Cca and C horizons, value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; chroma ranges from 2 to 4. Reaction is moderately alkaline or strongly alkaline. Texture is gravelly loam, very gravelly loam, cobbly loam, or very cobbly loam. Very cobbly loamy sand may be present below a depth of 40 inches.

Sterling gravelly loam, 1 to 6 percent slopes (SsB).—This soil is on intermediate and high lake terraces and alluvial fans. Runoff is slow, and the hazard of erosion is slight. Available water holding capacity is 3.5 to 5 inches to a depth of 5 feet. The water-supplying capacity before the moisture is depleted is 8 to 9 inches. Average annual precipitation ranges from 15 to 16 inches, and the frost-free period is 120 to 130 days.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 1 to 6 percent slopes, and Kearns silt loam, 3 to 6 percent slopes.

This Sterling soil is used for nonirrigated small grains. Capability unit IVs-U4, nonirrigated; range site not assigned.

Sterling gravelly loam, 6 to 20 percent slopes (SsD).—This soil is on long alluvial fans, intermediate and high lake terraces, and mountain foot slopes. Slopes are slightly convex. A profile of this soil is the one described as representative for the Sterling series. Runoff is medium, and the hazard of erosion is moderate. Available water holding capacity is 3.5 to 5 inches to a depth of 5 feet. The water-supplying capacity before the moisture is depleted is 8 to 9 inches. Average annual precipitation ranges from 15 to 16 inches, and the frost-free period is 120 to 130 days.

Included with this soil in mapping are small areas of Hupp gravelly silt loam, 6 to 10 percent slopes; Kearns silt loam, 6 to 10 percent slopes; and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes.

This soil is used for range, for nonirrigated small grains, and as a site for gravel pits. Capability unit IVs-U4, nonirrigated; Upland Stony Loam range site.

Sterling gravelly loam, 20 to 30 percent slopes (SsF).—This soil is on alluvial and colluvial fans, lake terraces, dissected escarpments, and mountain foot slopes. Slopes are short to medium in length. Runoff is rapid, and the hazard of erosion is high. Slight sheet and rill erosion is common, and a few shallow gullies have been formed. Available water holding capacity is 3.5 to 5 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 7 to 9 inches. Average annual precipitation ranges from 15 to 16 inches, and the frost-free period is 120 to 130 days.

Included with this soil in mapping are small areas of Abela gravelly loam, 10 to 20 percent slopes, and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes.

This soil is used mainly for range, but small, widely separated areas are used for nonirrigated small grains.

Capability unit VI_s-U, nonirrigated; Upland Stony Loam range site.

Sterling gravelly loam, 30 to 50 percent slopes (S_sG).—This soil is on alluvial and colluvial fans, terrace escarpments, and mountain foot slopes on the east side of Bear River valley in the vicinity of Deweyville. Runoff is rapid, and the hazard of erosion is high. Slight to moderate sheet and rill erosion is common, and a few gullies that are moderately deep have been formed. Available water holding capacity is 3.5 to 4 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 7 to 8 inches. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 130 to 150 days.

Included with this soil in mapping are small areas of Sterling gravelly loam, 20 to 30 percent slopes, and a few stony areas.

This soil is used for range. Capability unit VII_s-U, nonirrigated; Upland Stony Loam range site.

Sterling very stony loam, 10 to 30 percent slopes (StE).—This soil is on alluvial fans along the base of the Wellsville Mountains near Deweyville. Slopes are medium in length and slightly convex. In places stones occupy as much as 3 percent of the surface. Runoff is rapid, and the hazard of erosion is high. Slight sheet erosion is common, and a few moderately deep gullies have been formed. Available water holding capacity is 3 to 4 inches to a depth of 5 feet. The water-supplying capacity before moisture is depleted is 7 to 8 inches. Average annual precipitation ranges from 14 to 17 inches, and the frost-free period is 130 to 150 days.

Included with this soil in mapping are small areas of Sterling gravelly loam, 20 to 30 percent slopes, and Stony alluvial land.

This soil is used for range and urban development. Capability unit VII_s-U, nonirrigated; Upland Stony Loam range site.

Sterling-Parleys complex, 6 to 20 percent slopes (SuE).—This mapping unit is on high lake terraces, fans, terrace escarpments, and hilly uplands in the northern parts of Blue Creek valley and Hansel Valley. It consists of about 60 percent Sterling gravelly loam, 6 to 20 percent slopes, and 25 percent Parleys silt loam, 6 to 20 percent slopes. Included with these soils in mapping are areas of Pomat silt loam, 10 to 30 percent slopes, and Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes. These included soils make up about 15 percent of the total acreage.

Soils of this complex are intermingled. The Sterling soil is on short, convex knolls and escarpments. The Parleys soil is in slightly concave areas between the knolls and ridges.

Runoff is rapid, and the hazard of erosion is high.

The soils of this complex are used for nonirrigated small grains and range. Capability unit IV_s-UZ, nonirrigated Upland Stony Loam range site.

Stingal Series

The Stingal series consists of well-drained soils. These soils are on lake terraces. They formed in strongly calcareous, mixed lake sediments derived dominantly from limestone and sandstone. Elevations range from 4,300 to 5,100 feet. Slopes range from 1 to 10 percent. The vege-

tation in noncultivated areas consists of bluebunch wheatgrass, Russian-thistle, annual weeds, and some big sagebrush. Mean annual air temperature ranges from 47° to 50° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 130 days.

In a representative profile, the surface layer is light brownish-gray loam about 6 inches thick. The subsoil is very pale brown loam about 19 inches thick. The substratum extends to a depth of 60 inches or more. It is very pale brown loam in the upper part and white loam and very fine sandy loam in the lower part. These soils are strongly alkaline or very strongly alkaline and are moderately calcareous or strongly calcareous throughout.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 7.5 to 9.5 inches to a depth of 5 feet. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted. Roots penetrate easily to a depth of 48 inches but may reach to a depth of 60 inches.

These soils have limited use for wildlife habitat and industrial development.

Representative profile of Stingal loam, 1 to 6 percent slopes, in a cultivated field, 1,800 feet east and 175 feet south of the northwest corner of section 4, T. 10 N., R. 7 W., about 5 miles west of Golden Spike National Monument:

- Ap1—0 to 2 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; moderate, medium, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.6); clear, smooth boundary.
- Ap2—2 to 6 inches, light brownish-gray (10YR 6/2) loam, dark grayish brown (10YR 4/2) when moist; moderate, thick and medium, platy structure; soft, very friable, slightly sticky and slightly plastic; many very fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.
- B21—6 to 13 inches, very pale brown (10YR 7/3) loam, brown (10YR 4/3) when moist; weak, coarse, prismatic structure that parts easily to weak, medium, subangular blocky; slightly hard, friable, slightly sticky and slightly plastic; few very fine roots; common fine tubular pores; moderately calcareous; strongly alkaline (pH 8.6); gradual, smooth boundary.
- B22—13 to 25 inches, very pale brown (10YR 7/3) loam, grayish brown (10YR 5/2) when moist; weak, medium, subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; common fine tubular pores; few krotovinas 10 to 15 millimeters in diameter; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); abrupt, irregular boundary.
- C1ca—25 to 34 inches, very pale brown (10YR 8/3) loam, light brownish gray (2.5YR 6/2) when moist; weak, medium, subangular blocky structure; hard, friable, nonsticky and nonplastic; few very fine roots; common fine and few medium tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); abrupt, irregular boundary.
- C2ca—34 to 48 inches, white (10YR 8/2) light loam, light brownish gray (2.5Y 6/2) when moist; massive; hard, very friable, slightly sticky and nonplastic; few very fine roots; few very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); abrupt, wavy boundary.
- C3ca—48 to 56 inches, white (2.5Y 8/2) very fine sandy loam, light brownish gray (2.5Y 6/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine roots; few very fine tubular pores; strongly alkaline (pH 9.4); clear, smooth boundary.

C4—56 to 74 inches, white (2.5Y 8/2) very fine sandy loam, light brownish gray (2.5Y 6/2) when moist; massive; soft, very friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4).

The solum ranges from 12 to 25 inches in thickness. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 15 to 18 percent.

In the A1 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Texture is loam or very fine sandy loam. Reaction is moderately alkaline to very strongly alkaline.

In the B2 horizon value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. This horizon is loam or silt loam and is moderately alkaline to very strongly alkaline and moderately calcareous or strongly calcareous. The B2 horizon ranges from 6 to 19 inches in thickness.

In the Cca and C horizons, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam, very fine loam, or fine sandy loam. Reaction is strongly alkaline to very strongly alkaline. The Cca and C horizons contain 10 to 30 percent fine gravel below a depth of 40 inches in places.

Stingal loam, 1 to 6 percent slopes (SvB).—This soil is on mainly south- and west-facing lake terraces. Slopes are medium in length and convex. A profile of this soil is the one described as representative for the Stingal series. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 1 to 6 percent slopes; Pomat silt loam, 6 to 10 percent slopes; Mellor silt loam, 1 to 6 percent slopes; and Windmill gravelly loam, 1 to 6 percent slopes.

This soil is used mainly for nonirrigated small grains. In recent years large areas of crested wheatgrass have been planted on this soil. This soil also is used for range, wildlife habitat, and industrial development. Capability unit IVE-UZ, nonirrigated; Upland Loam range site.

Stingal loam, 6 to 10 percent slopes (SvD).—This soil is on lake terraces. Slopes are short and convex. Runoff is medium, and the hazard of erosion is moderate to high. Sheet and rill erosion is common. In places moderately deep gullies have been formed.

Included with this soil in mapping are small areas of Eccles fine sandy loam, 6 to 10 percent slopes; Pomat silt loam, 6 to 10 percent slopes; and Stingal loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains and for range. Large areas of crested wheatgrass have been planted on this soil. Wildlife and industry also use this soil. Capability unit IVE-UZ, nonirrigated; range site not assigned.

Stokes Series

The Stokes series consists of moderately well drained soils that are affected by alkali. These soils are on low lake terraces and lake plains in Bear River valley southwest of Tremonton. They formed in fine-textured mixed lake sediments and alluvium. The surface has been reworked by wind or water and, in most places, is made up of many small hummocks or mounds. Slopes are 0 to 1 percent. The vegetation in noncultivated areas is greasewood, big sagebrush, Nuttall saltbush, saltgrass, annual mustard, cheatgrass, and other annuals. Mean annual air temperature ranges from 46° to 51° F. Average annual precipitation ranges from 12 to 14 inches, and the frost-free period is 130 to 150 days. Elevation ranges from 4,220 to 4,300 feet.

In a representative profile (fig. 11), the surface layer is light brownish-gray silt loam about 11 inches thick. The subsoil is light brownish-gray clay and white silty clay about 13 inches thick. The substratum is light-gray silty clay loam and very pale brown heavy silt loam; it reaches to a depth of 68 inches. The surface layer is moderately alkaline. Below the surface layer, and extending to a depth of 68 inches, the soil is very strongly alkaline. The surface layer is noncalcareous, and the subsoil and substratum are moderately calcareous to strongly calcareous. A layer of lime accumulation is at a depth of 18 inches.

Permeability is slow in the subsoil and is moderately slow in the substratum. The rate of water intake is slow. Because of the salt content, the water available to plants is only 7 to 10 inches to a depth of 5 feet and the water-supplying capacity is 9 to 11 inches before moisture is depleted. If the soils are reclaimed, however, the available water holding capacity is 10 to 12 inches to a depth of 5 feet. These soils are strongly affected by alkali. Most roots are in the upper 24 inches of soil, but some roots penetrate to a depth of 60 inches.

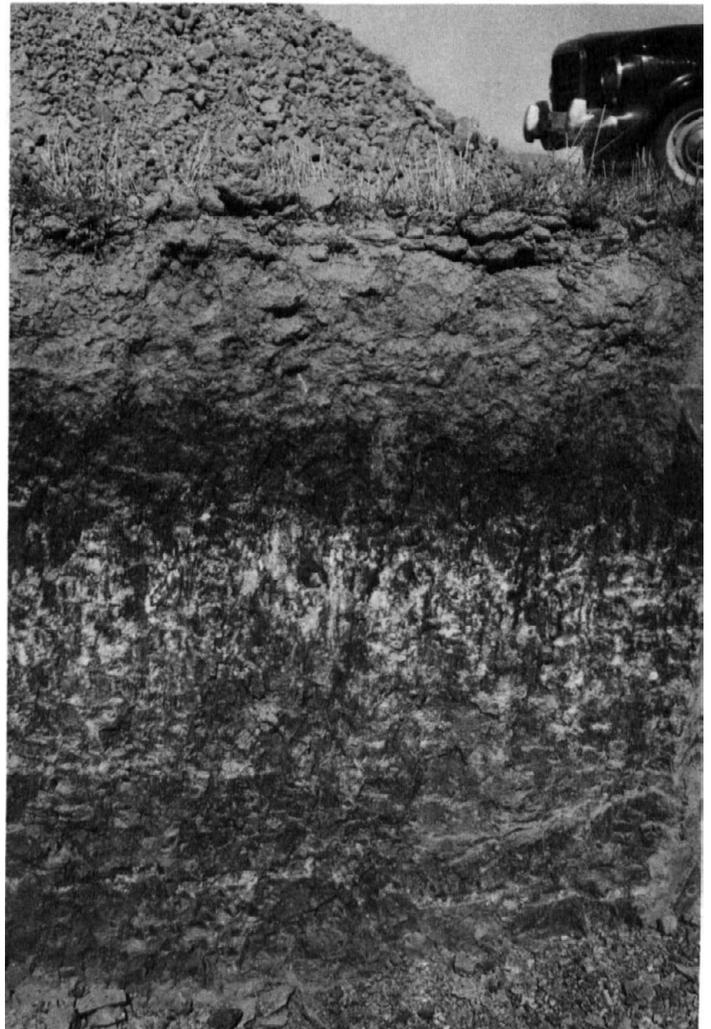


Figure 11.—Profile of Stokes silt loam.

Stokes soils are used for range, irrigated crops, and, to a lesser extent, nonirrigated crops.

Representative profile of Stokes silt loam, in a cultivated field, 2,450 feet west and 100 feet south of the east quarter corner of section 28, T. 10 N., R. 3 W., about 4 miles northwest from the town of Corinne:

- Ap1—0 to 6 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure that parts to weak, fine, granular; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine vesicular pores; moderately alkaline (pH 8.4); abrupt, smooth boundary.
- Ap2—6 to 11 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common very fine roots; common very fine vesicular pores; moderately alkaline (pH 8.4); abrupt, smooth boundary.
- B21t—11 to 18 inches, light brownish-gray (10YR 6/2) clay, dark grayish brown (10YR 4/2) when moist; strong, medium, prismatic structure; very hard, very firm, very sticky and plastic; few very fine roots; many very fine interstitial pores; continuous moderately thick clay films on ped faces; moderately calcareous, lime is disseminated; very strongly alkaline (pH 9.6); clear, wavy boundary.
- B22tca—18 to 24 inches, white (10YR 8/2) silty clay, light brownish gray (2.5Y 6/2) when moist and pale-brown (10YR 6/3) ped faces when moist; common, fine, distinct, brown (10YR 5/3) and pale-olive (5Y 6/3) mottles; moderate, medium, subangular blocky structure; very hard, firm, sticky and plastic; few fine roots; few fine and very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.6); gradual, wavy boundary.
- C1ca—24 to 47 inches, light-gray (2.5Y 7/2) silty clay loam, pale olive (5Y 6/3) and olive (5Y 5/3) when moist; common, medium, prominent, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, firm, sticky and plastic; many very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.6); abrupt, smooth boundary.
- C2—47 to 68 inches, very pale brown (10YR 7/3) heavy silt loam, pale olive (5Y 6/3) when moist; common, medium, prominent, dark yellowish-brown (10YR 4/4) mottles; massive; very hard, friable, sticky and slightly plastic; many fine and very fine interstitial pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.6).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 13 to 24 inches. The soils are usually moist, but in most years they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, hue is 10YR or 2.5Y; chroma is 2 or 3. Texture is mainly silt loam but in places is light silty clay loam. The A1 horizon is moderately alkaline or strongly alkaline and is mostly noncalcareous but ranges to moderately calcareous. The A1 horizon ranges from 5 to 11 inches in thickness.

In the B2t horizon, hue is 10YR or 2.5Y; value ranges from 5 to 8 when the soils are dry and from 3 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is clay or silty clay, and the content of clay ranges from 40 to 55 percent. Structure ranges from weak to strong and is prismatic or subangular blocky. Clay films range from none or few to continuous and from moderately thick to thick on ped faces. Reaction is strongly alkaline or very strongly alkaline. The B21t horizon is slightly calcareous to moderately calcareous, but the B22tca horizon is strongly calcareous.

In the Cca and C horizons, hue is 7.5Y or 5Y; value ranges from 5 to 8 when the soils are dry and is 5 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is silty clay, silty clay loam, or silt loam, and the C horizon is stratified with thin layers of very fine sandy loam. Mottles are common to many and distinct to prominent and are at a depth of 17 to 30 inches. In areas that have been drained, the water table

is at a depth of 48 to more than 60 inches. Depth to the water table averages 40 inches where the soils have not been drained. These soils are strongly affected by alkali and are slightly to moderately affected by salts.

Stokes silt loam (Sw).—This soil is on low lake terraces and lake plains in the lower part of the Bear River valley, about 5 miles southwest of Tremonton. Slopes are 0 to 1 percent. Except where the soil has been leveled, the surface is uneven and is marked with many small mounds or hummocks. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Fridlô silt loam, moderately alkali, and Lasil silt loam, moderately alkali.

This Stokes soil is used mainly for irrigated crops and range. Irrigated crops are alfalfa, sugar beets, small grains, corn for silage, and irrigated pasture. Improved range is mostly tall wheatgrass. Some areas of this soil are used for nonirrigated small grains and for growing alfalfa seed. Capability unit IVw-28, irrigated; Alkali Bottom range site.

Stony Alluvial Land

Stony alluvial land (Sx) is a miscellaneous land type that occurs at scattered locations along the Wasatch Mountains and the Promontory Mountains. It is on small alluvial fans and short breaks between lake terraces and consists of very stony, cobbly, and gravelly alluvium. The coarse fragments are mainly rounded or subrounded limestone or quartzite. Stones and cobblestones cover about 40 to 70 percent of the surface, and a few boulders are present. The vegetation is sparse but provides some grazing. It is mainly big sagebrush, maple, oakbrush, yellowbrush, chokecherry, sand dropseed, three-awn, and cheatgrass.

Stony alluvial land is used mainly for wildlife habitat and range. In places it is used for urban development. Capability unit VIIs-U, nonirrigated; Upland Stony Loam range site.

Sunset Series

The Sunset series consists of moderately well drained soils. These soils are on flood plains and low river terraces along the Bear River. They formed in mixed, medium-textured, stratified alluvium derived dominantly from limestone, sandstone, and quartzite rocks. Slopes range from 0 to 2 percent. The vegetation in noncultivated areas is mainly willow, rose, Great Basin wildrye, western wheatgrass, saltgrass, foxtail, povertyweed, cheatgrass, and annuals. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 12 to 16 inches, and the frost-free period is 125 to 145 days. Elevations range from 4,215 to 4,310 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 10 inches thick. Below this are layers of light brownish-gray heavy silt loam, dark-gray loam, grayish-brown light loam, light brownish-gray light loam and fine sandy loam, and pale-brown loamy fine sand. These extend to a depth of 60 inches or more. In the upper 15 inches, these soils are moderately alkaline and moderately calcareous. Between depths of 15 to 60 inches, they are strongly alkaline or very strongly alkaline and strongly calcareous.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 8.5 to 10 inches to a depth of 5 feet. The water-supplying capacity is 10 to 12 inches before moisture is depleted. Roots penetrate to the water table, which is usually at a depth of between 30 and 40 inches. If the soils are drained, however, roots may penetrate to a depth of more than 60 inches.

Sunset soils are used for irrigated and nonirrigated crops.

Representative profile of Sunset silt loam, in a cultivated field, 1,400 feet north and 200 feet west from the south quarter corner of section 30, T. 10 N., R. 2 W., about 1½ miles north of Corinne:

- Ap—0 to 10 inches, grayish-brown (10YR 5/2) silt loam, very, dark gray (10YR 3/1) when moist; weak, medium, granular structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; moderately calcareous; moderately alkaline (pH 8.0); abrupt, smooth boundary.
- C1—10 to 15 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and fine, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine tubular pores; moderately calcareous, lime is disseminated; moderately alkaline (pH 8.4); clear, wavy boundary.
- A1b—15 to 19 inches, dark-gray (10YR 4/1) loam, very dark gray (10YR 3/1) when moist; moderate, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; many fine and very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); clear, wavy boundary.
- C2—19 to 24 inches, grayish-brown (10YR 5/2) light loam, dark gray (10YR 4/1) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); gradual, wavy boundary.
- C3—24 to 33 inches, light brownish-gray (10YR 6/2) light loam, dark grayish brown (10YR 4/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 9.0); gradual, wavy boundary.
- C4—33 to 38 inches, light brownish-gray (10YR 6/2) fine sandy loam, grayish brown (10YR 5/2) when moist; massive; slightly hard, very friable, nonsticky and nonplastic; few fine and very fine roots; many very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, wavy boundary.
- C5—38 to 60 inches, pale-brown (10YR 6/3) loamy fine sand, grayish brown (10YR 5/2) when moist; few, fine, distinct, yellowish-brown (10YR 5/6) mottles; single grained; loose; few fine and very fine roots; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2).

Texture averages loam between depths of 10 and 40 inches, but the soil at these depths is stratified with layers of fine sandy loam. Content of clay ranges from 15 to 18 percent. The soils are usually moist, and unlike most other soils in the survey area, in most years they are not dry in all parts between depths of 8 and 24 inches for as much as 60 consecutive days in summer. Mottles are at a depth below 34 to 38 inches and range from few to common and from fine to medium. Depth to the water table ranges from 30 to 40 inches unless the soils are drained. Most areas of these soils are nearly free of salt and alkali, but some areas are slightly to moderately affected.

In the A1 horizon, chroma is 1 or 2. This horizon is silt loam or loam. The content of organic matter decreases irregularly with depth. In the C horizon, value is 5 or 6 when the soils are dry and 4 or 5 when they are moist; chroma ranges from 1 to 3.

Sunset silt loam (Sy).—This soil is along the Bear River on low river terraces and flood plains. Slopes are 0 to 2 percent, and the surface is uneven where the soil has not been leveled. Runoff is slow, and the hazard of erosion is slight. This soil is subject to overflow and flooding early in spring in about 4 years out of 10.

Included with this soil in mapping are small areas of Kirkham silt loam and Martini fine sandy loam.

This Sunset soil is used mainly for irrigated alfalfa, small grains, sugar beets, corn for silage, and improved pasture. A small acreage is used for nonirrigated small grains. Capability unit IIw-2, irrigated; range site not assigned.

Syracuse Series

The Syracuse series consists of somewhat poorly drained soils. These soils are on low lake terraces and flood plains south of the Willard Bay Reservoir and extend northward to the town of Corinne. They formed in moderately coarse textured lake sediments and alluvium derived mainly from sandstone, quartzite, and limestone rocks. Slopes are mainly less than 1 percent. The vegetation in noncultivated areas is chiefly saltgrass, foxtail barley, alkali sacaton, greasewood, and annual weeds. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 12 to 17 inches, and the frost-free period is 140 to 150 days. Elevations range from 4,215 to 4,275 feet.

In a representative profile, the surface layer is grayish-brown fine sandy loam about 16 inches thick. The underlying layer is light-gray fine sandy loam that reaches to a depth of 60 inches or more. The surface layer is noncalcareous and strongly alkaline. A layer of lime accumulation is at a depth of 16 inches. Below this, to a depth of 60 inches, the profile is moderately calcareous and strongly calcareous and is very strongly alkaline.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 6.5 to 8.5 inches to a depth of 5 feet. Roots penetrate to the water table, which is commonly at a depth between 30 and 40 inches.

Syracuse soils are used for irrigated crops and range.

Representative profile of Syracuse fine sandy loam, in a cultivated field, 300 feet south and 1,000 feet west from the east quarter corner of section 9, T. 7 N., R. 2 W., about three-fourths of a mile northeast of the pumping plant at Willard Bay Reservoir:

- Ap—0 to 10 inches, grayish-brown (10YR 5/2) fine sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; soft, very friable, nonsticky and nonplastic; few medium and large roots; strongly alkaline (pH 8.5); abrupt, smooth boundary.
- A1—10 to 16 inches, grayish-brown (10YR 5/2) fine sandy loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; soft, very friable, nonsticky and nonplastic; few large and medium roots; strongly alkaline (pH 8.7); clear, smooth boundary.
- C1ca—16 to 28 inches, light-gray (10YR 7/2) heavy fine sandy loam, brown (10YR 5/3) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few medium and fine roots; few very fine tubular pores; moderately calcareous, lime is disseminated; very strongly alkaline (pH 9.2); gradual, wavy boundary.

C2ca—28 to 48 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; common, medium, distinct, strong-brown (7.5YR 5/8) mottles; massive; slightly hard, very friable, nonsticky and nonplastic; few very fine tubular pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); diffuse, wavy boundary.

C3—48 to 60 inches, light-gray (10YR 7/2) fine sandy loam, brown (10YR 5/3) when moist; many, medium and large, distinct, strong-brown (7.5YR 5/8) mottles; massive; soft, very friable, nonsticky and nonplastic; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7).

Texture averages fine sandy loam between depths of 10 and 40 inches. Depth to the horizon of carbonate accumulation ranges from 16 to 20 inches. The soils are usually moist, and unlike most other soils in the survey area, in most years they are not dry in all parts between depths of 8 and 24 inches for as much as 60 consecutive days in summer. Mottles are below a depth of 28 inches and range from common to many, from medium to large, and from faint to distinct. Most of the acreage has been drained, and the depth to water table is 40 to 60 inches or more. Where the soils are not drained, depth to water table is mainly 30 to 40 inches. The effect of salts and alkali is slight to moderate.

In the A1 horizon, chroma is 2 or 3. This horizon is fine sandy loam or sandy loam. Reaction is mildly alkaline to strongly alkaline. In the Cca and C horizons, value is 6 or 7 when the soils are dry and 5 to 6 when they are moist; chroma is 2 or 3. These horizons are strongly alkaline or very strongly alkaline and are moderately calcareous to strongly calcareous. In places the Cca horizon is weakly cemented.

Syracuse fine sandy loam (Sz).—This soil is on low lake terraces and flood plains. It is south of the Willard Bay Reservoir and extends northward to the town of Corinne. Slopes are 0 to 1 percent. Runoff is slow, and the hazard of erosion is slight. Soil blowing is common early in spring if the soil is unprotected.

Included with this soil in mapping are small areas of Gooch silt loam, Lewiston fine sandy loam, and Warm Springs fine sandy loam.

This Syracuse soil is used for irrigated crops and range. Irrigated crops are alfalfa, small grains, sugar beets, tomatoes, corn for silage, and irrigated pasture. Capability unit IIIw-2, irrigated; Alkali Bottom range site.

Thiokol Series

The Thiokol series consists of well-drained soils. These soils are on lake terraces. They formed in strongly calcareous, mixed lake sediments derived from limestone and sandstone. Slopes range from 0 to 10 percent. The vegetation in noncultivated areas is big sagebrush, bluebunch wheatgrass, squirreltail, winterfat, and annual grasses and weeds. Mean annual air temperature ranges from 45° to 50° F. Average annual precipitation ranges from 8 to 14 inches, and the frost-free period is 85 to 130 days. Elevations range from 4,300 to 5,125 feet.

In a representative profile (fig. 12), the surface layer and subsoil are light brownish-gray silt loam about 20 inches in total thickness. The substratum is white silt loam that reaches a depth of 60 inches or more. The soils are moderately calcareous and strongly alkaline to a depth of about 20 inches and are strongly calcareous and very strongly alkaline between depths of 20 inches and 60 inches or more.

Permeability is moderate, and the rate of water intake is high. Available water holding capacity is 10 to 12 inches

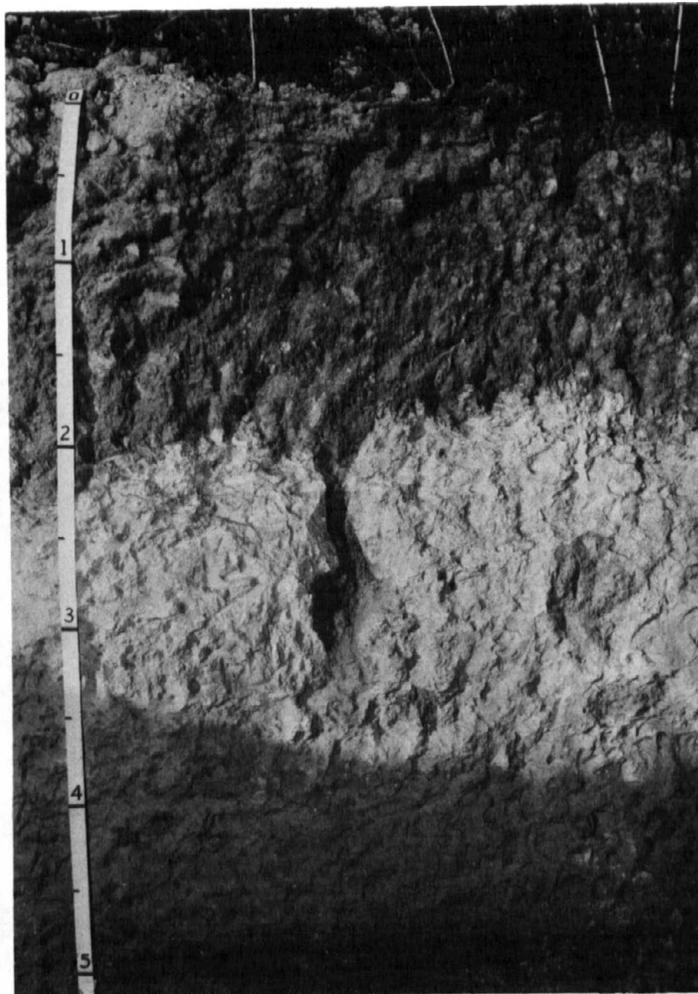


Figure 12.—Profile of Thiokol silt loam, 1 to 6 percent slopes.

to a depth of 5 feet. Roots penetrate to a depth of more than 60 inches.

These soils are used mainly for nonirrigated crops and range (fig. 13). Small areas are used for irrigated crops, wildlife habitat, and industrial development.

Representative profile of Thiokol silt loam, 1 to 6 percent slopes, in a cultivated field, 1,750 feet west and 1,500 feet north of the southeast corner of section 13, T. 13 N., R. 6 W., in Blue Creek valley:

Ap—0 to 5 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; common fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.8); abrupt, smooth boundary.

A1—5 to 9 inches, light, brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; common fine and few medium roots; common fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.7); gradual, wavy boundary.

B21—9 to 13 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 4/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine roots; few fine



Figure 13.—Grassed waterway on Thiokol silt loam, 1 to 6 percent slopes, in Howell Valley.

- and very fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.7); gradual, wavy boundary.
- B22**—13 to 20 inches, light brownish-gray (10YR 6/2) silt loam, grayish brown (10YR 5/2) when moist; moderate, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine and very fine interstitial pores; moderately calcareous; strongly alkaline (pH 8.8); gradual, wavy boundary.
- C1ca**—20 to 28 inches, white (10YR 8/2) heavy silt loam, pale brown (10YR 6/3) when moist; massive; very hard, friable, sticky and slightly plastic; few very fine roots; few very fine interstitial pores; strongly calcareous; very strongly alkaline (pH 9.4); gradual, wavy boundary.
- C2ca**—28 to 36 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; very hard, friable, sticky and slightly plastic; few very fine interstitial pores; strongly calcareous; very strongly alkaline (pH 9.5); gradual, wavy boundary.
- C3**—36 to 60 inches, white (2.5Y 8/2) silt loam, light brownish gray (2.5Y 6/2) when moist; massive; very hard, friable, slightly sticky and slightly plastic; few very fine interstitial pores; strongly calcareous; very strongly alkaline (pH 9.7).

The solum ranges from 14 to 22 inches in thickness. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 19 to 24 percent.

In the A1 horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry; chroma is 2 or 3. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is calcareous or moderately calcareous and ranges from 4 to 10 inches in thickness.

In the B2 horizon, hue is 10YR or 2.5Y; value is 6 or 7 when the soils are dry and ranges from 4 to 6 when they are moist; and chroma is 2 or 3. Texture is silt loam or loam. Reaction is moderately alkaline or strongly alkaline. The B2 horizon is slightly calcareous or moderately calcareous and ranges from 4 to 12 inches in thickness.

In the Cca and C horizons, hue ranges from 10YR to 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 7 when they are moist; and chroma ranges from 2 to 4. Texture is silt loam or very fine sandy loam. Reaction is strongly alkaline or very strongly alkaline. The Cca and C horizons are strongly calcareous or very strongly calcareous.

Thiokol silt loam, 0 to 1 percent slopes (ThA).—This soil is on lake terraces. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is

100 to 130 days. Runoff is slow, and the hazard of erosion is slight. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted.

Included with this soil in mapping are small areas of Thiokol silt loam, 1 to 6 percent slopes, and Hansel silt loam, 0 to 1 percent slopes.

This soil is used mainly for nonirrigated small grains. Some areas are used for wildlife. Capability unit IVc-U, nonirrigated; range site not assigned.

Thiokol silt loam, 1 to 6 percent slopes (ThB).—This soil is on lake terraces. Slopes are slightly convex and long. A profile of this soil is the one described as representative for the Thiokol series. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 130 days. Runoff is medium, and the hazard of erosion is moderate. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted.

Included with this soil in mapping are small areas of Thiokol silt loam, 6 to 10 percent slopes, and Hansel silt loam, 1 to 6 percent slopes.

This soil is used chiefly for nonirrigated small grains. Some areas are used for wildlife and industrial developments. Capability unit IVe-UZ, nonirrigated; range site not assigned.

Thiokol silt loam, 6 to 10 percent slopes (ThD).—This soil is on lake terraces. Slopes are slightly convex and medium in length. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 130 days. Runoff is medium, and the hazard of erosion is moderate. The water-supplying capacity is 8 to 10.5 inches before moisture is depleted.

Included with this soil in mapping are small areas of Pomat silt loam, 10 to 30 percent slopes; Stingal silt loam, 6 to 10 percent slopes; and Kearns silt loam, 6 to 10 percent slopes.

This soil is used mainly for nonirrigated small grains. Wildlife also use this soil. Capability unit IVe-UZ nonirrigated; range site not assigned.

Thiokol silt loam, low rainfall, 0 to 1 percent slopes (TkA).—This soil is on broad lake terraces. Average annual precipitation ranges from 8 to 11 inches, and the frost-free period is 85 to 100 days. Runoff is slow, and the hazard of erosion is slight. The soil will supply 6 to 8 inches of water for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Bram silt loam and of Palisade silt loam, 1 to 6 percent slopes.

This Thiokol soil is used mainly for range. Limited areas are used for irrigated small grains, alfalfa, sugar beets, alfalfa seed, and irrigated pasture. Wildlife also use this soil. Capability unit IIIc-3, irrigated; capability unit VIIc-S, nonirrigated; Semidesert Loam range site.

Thiokol silt loam, low rainfall, 1 to 3 percent slopes (TkB).—This soil is on lake terraces. Slopes are medium in length. Average annual precipitation is 8 to 11 inches, and the frost-free period is 85 to 100 days. Runoff is medium, and the hazard of erosion is moderate. The soil will supply 6 to 8 inches of water for plant growth before moisture is depleted.

Included with this soil in mapping are small areas of Bram silt loam and of Mellor silt loam, 1 to 6 percent slopes.

This Thiokol soil is used mainly for range. Limited areas are used for irrigated small grains, alfalfa, alfalfa seed, and irrigated pasture. Some areas are used by wildlife. Capability unit IIIe-3, irrigated; capability unit VIIe-S, nonirrigated; Semidesert Loam range site.

Timpanogos Series

The Timpanogos series consists of well drained and moderately well drained soils. These soils are on lake terraces and alluvial fans. They formed in mixed lake sediments and local alluvium derived mainly from limestone, sandstone, and quartzite. Slopes range from 0 to 10 percent. The vegetation in noncultivated areas is bluebunch wheatgrass, western wheatgrass, big sagebrush, and annual grasses. Mean annual air temperature ranges from 46° to 51° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 115 to 160 days. Elevations range from 4,250 to 5,175 feet.

In a representative profile, the surface layer is grayish-brown silt loam about 17 inches thick. The subsoil is light brownish-gray and pale-brown heavy silt loam about 19 inches thick. The substratum is pale-brown and light yellowish-brown silt loam that extends to a depth of about 60 inches. The surface layer and upper part of the subsoil are mildly alkaline and noncalcareous. The lower part of the subsoil and the substratum are moderately alkaline and strongly alkaline and moderately calcareous and strongly calcareous. A layer of lime accumulation is at a depth of 32 inches.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 10 to 12 inches to a depth of 5 feet. Unless the soils are irrigated, the water-supplying capacity before moisture is depleted is 11 to 13 inches. Roots penetrate to a depth of 60 inches or more.

These soils are used for nonirrigated and irrigated crops.

Representative profile of Timpanogos silt loam, 1 to 6 percent slopes, in a cultivated field, 1,500 feet east and 500 feet north of the southeast corner of section 32, T. 14 N., R. 6 W., in the northern part of Blue Creek valley:

- Ap—0 to 6 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; soft, friable, slightly sticky and slightly plastic; few fine roots; few fine pores and few large pores; mildly alkaline (pH 7.8); abrupt, smooth boundary.
- A1—6 to 17 inches, grayish-brown (10YR 5/2) silt loam, very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, slightly sticky and slightly plastic; few fine roots; few fine pores and few medium pores; mildly alkaline (pH 7.7); clear, smooth boundary.
- B2t—17 to 32 inches, light brownish-gray (10YR 6/2) heavy silt loam, dark brown (10YR 3/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and plastic; few fine and very fine roots; few fine pores and few medium pores; common thin clay films on ped faces; mildly alkaline (pH 7.7); clear, smooth boundary.
- B3ca—32 to 36 inches, pale-brown (10YR 6/3) heavy silt loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few fine pores; moderately calcareous; moderately alkaline (pH 7.9); gradual, smooth boundary.
- C1ca—36 to 44 inches, pale-brown (10YR 6/3) silt loam, brown (7.5YR 4/4) when moist; massive; very hard, friable, slightly sticky and plastic; few very fine roots;

few very fine pores; strongly calcareous; strongly alkaline (pH 8.6); gradual, wavy boundary.

C2ca—44 to 60 inches, light yellowish-brown (10YR 6/4) silt loam, brown (7.5YR 4/4) when moist; massive; slightly hard, friable, slightly sticky and slightly plastic; few fine pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Depth to the horizon of carbonate accumulation ranges from 19 to 39 inches but depth of 28 to 34 inches is common. In places, some fine gravel is below a depth of 36 inches. The soils are usually moist, but they are dry in all parts between depths of 4 and 12 inches for more than 60 consecutive days in summer unless they are irrigated.

In the A1 horizon, value is 4 or 5 when the soils are dry; chroma is 2 or 3. This horizon is silt loam, loam, or very fine sandy loam and ranges from 7 to 17 inches in thickness. Reaction is mildly alkaline to moderately alkaline. The A1 horizon is generally noncalcareous but ranges to slightly calcareous where the soils are irrigated.

In the B2t horizon, hue is 7.5YR or 10YR; value ranges from 4 to 6 when the soils are dry and is 3 or 4 when they are moist; and chroma ranges from 2 to 4. Texture in the B2t horizon is heavy silt loam, loam, or light silty clay loam, and clay films range from few to continuous on ped faces. The B2t horizon is generally noncalcareous but ranges to moderately calcareous in the lower part. The horizon of carbonate accumulation in the B2t horizon is mildly alkaline or moderately alkaline.

In the Cca or Ch horizons, hue is 7.5YR or 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is light silty clay loam, silt loam, very fine sandy loam, or loamy very fine sand. Reaction in the Cca or C horizons is moderately alkaline to very strongly alkaline. Depth to the water table ranges from 42 to 60 inches or more. In places, distinct mottles are below a depth of 40 inches.

Timpanogos loam, 0 to 3 percent slopes (Tm A).—This soil is on low and intermediate lake terraces and alluvial fans in the Bear River valley south of Garland. Slopes range from 0 to 3 percent but most commonly are less than 1 percent. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Fielding silt loam, warm; Kidman fine sandy loam, 0 to 2 percent slopes; and Parleys loam, 0 to 3 percent slopes.

This soil is used for irrigated sugar beets, tomatoes, alfalfa, small grains, corn, truck crops, and irrigated pasture. Capability unit I-1, irrigated; range site not assigned.

Timpanogos loam, 3 to 6 percent slopes (Tm B).—This soil is on low and intermediate lake terraces and alluvial fans in the Bear River valley south of Garland and benchlands south of Brigham. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 14 to 18 inches. The frost-free period is 140 to 160 days.

Included with this soil in mapping are small areas of Kidman fine sandy loam, 2 to 4 percent slopes, and Parleys loam, 0 to 3 percent slopes. Also included are small areas of well drained to moderately well drained silt loam soils having slopes of 6 to 10 percent.

This soil is used for irrigated alfalfa, corn for silage, small grains, cherries, peaches, apples, apricots, and irrigated pasture. Capability unit IIe-1, irrigated; range site not assigned.

Timpanogos loam, cool, 0 to 3 percent slopes (Tn A).—This soil is on broad, low and intermediate lake terraces and alluvial fans in the Bear River valley north of Garland. Runoff is slow, and the hazard of erosion is slight. Average annual precipitation ranges from 14 to 16 inches, and the frost-free period is 120 to 140 days.

Included with this soil in mapping are small areas of Fielding silt loam and Parleys loam, cool, 0 to 3 percent slopes.

This Timpanogos soil is used for irrigated alfalfa, sugar beets, corn for silage, small grains, and irrigated pasture. Capability unit IIc-2, irrigated; range site not assigned.

Timpanogos silt loam, 1 to 6 percent slopes (To B).—This soil is on intermediate and high lake terraces and alluvial fans. Slopes are slightly convex and long. A profile of this soil is the one described as representative for the Timpanogos series. Runoff is medium, and the hazard of erosion is moderate. Average annual precipitation ranges from 15 to 17 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 3 to 6 percent slopes, and Parleys silt loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains and, to a limited extent, for wildlife habitat. Capability unit IIIe-U, nonirrigated; range site not assigned.

Timpanogos silt loam, 6 to 10 percent slopes (To C).—This soil is on intermediate and high lake terraces and alluvial fans. Slopes are slightly convex and medium in length. Runoff is medium, and the hazard of erosion is moderate. Rill erosion is common, and a few shallow gullies have been formed. Average annual precipitation ranges from 15 to 27 inches, and the frost-free period is 115 to 130 days.

Included with this soil in mapping are small areas of Kearns silt loam, 6 to 10 percent slopes; Hupp gravelly silt loam, 6 to 10 percent slopes; and Parleys silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains and for wildlife habitat. Capability unit IIIe-U, nonirrigated; range site not assigned.

Uffens Series

The Uffens series consists of well-drained soils that are affected by salts and alkali. These soils are on low lake plains and low lake terraces located entirely in the southwestern part of the survey area. They formed in strongly calcareous, mixed lake sediments derived dominantly from limestone and sandstone. Slopes range from 1 to 6 percent but are most commonly 1 to 2 percent. Vegetation consists of greasewood, pickleweed, kochia, shadscale, and annual mustard. Mean annual air temperature ranges from 48° to 51° F. Average annual precipitation ranges from 6 to 8 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,225 to 4,350 feet.

In a representative profile, the surface layer is light brownish-gray silt loam about 3 inches thick. The subsoil is pale-brown silty clay loam about 15 inches thick. The substratum is light-gray light silt loam and white silty clay loam that reaches to a depth of 60 inches or more. The surface layer is strongly alkaline and moderately calcareous. The subsoil is strongly alkaline and very strongly alkaline and moderately calcareous. The substratum is moderately alkaline and strongly alkaline and strongly calcareous.

Permeability is moderately slow, and the rate of water intake is slow. Because of the high salt content, the water available to plants is only about 3 to 7 inches to a depth of 5 feet. If the soils are reclaimed, however, the available

water holding capacity is 10 to 12 inches to that depth. Roots penetrate to a depth of more than 60 inches, but most of them are in the top 18 inches of the soil.

These soils are used for range.

Representative profile of Uffens silt loam, in range, 200 feet west and 500 feet north of the southeast corner of section 18, T. 12 N., R. 10 W., about 4 miles northwest of Locomotive Springs Migratory National Wildlife Refuge headquarters:

- A11—0 to 1 inch, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, platy structure that parts to moderate, very thin, platy; slightly hard, friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine and fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.
- A12—1 to 3 inches, light brownish-gray (2.5Y 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; moderate, thin, platy structure; slightly hard, very friable, slightly sticky and slightly plastic; common fine and very fine roots; many very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.9); abrupt, smooth boundary.
- B21t—3 to 9 inches, pale-brown (10YR 6/3) silty clay loam, dark brown (10YR 3/3) when moist; moderate, fine and medium, prismatic structure that parts to moderate, fine, subangular blocky; hard, firm, sticky and plastic; common fine and very fine and few medium roots; many very fine vesicular pores; many thin clay films on ped faces; moderately calcareous; very strongly alkaline (pH 9.2); clear, wavy boundary.
- B22t—9 to 18 inches, very pale brown (10YR 7/3) silty clay loam, brown (10YR 5/3) when moist; moderate, fine and medium, subangular blocky structure; hard, firm, very sticky and plastic; few very fine roots; common very fine vesicular pores; moderately calcareous; strongly alkaline (pH 8.5); clear, wavy boundary.
- C1—18 to 30 inches, light-gray (2.5Y 7/2) light silt loam, olive gray (5Y 5/2) when moist; weak, coarse, blocky structure; hard, friable, slightly sticky and slightly plastic; few fine and very fine roots; few very fine vesicular pores; strongly calcareous, lime is disseminated; moderately alkaline (pH 8.2); abrupt, wavy boundary.
- C2—30 to 40 inches, white (2.5Y 8/2) light silty clay loam, light olive gray (5Y 6/2) when moist; massive; very hard, firm, sticky and slightly plastic; few very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.4); abrupt, wavy boundary.
- C3—40 to 60 inches, white (2.5Y 8/2) silty clay loam, light olive gray (5Y 6/2) when moist; common, fine, prominent, yellowish-brown (10YR 5/6) mottles; massive; very hard, firm, sticky and plastic; few very fine vesicular pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.5).

The solum ranges from 12 to 19 inches in thickness. Few or common prominent mottles are at a depth below 40 inches and in places are within 30 inches. Content of salts is as much as 1.25 percent in places. These soils are moderately or strongly affected by salts and alkali.

In the A1 horizon, hue is 10YR or 2.5Y; and value is 6 or 7 when the soils are dry. Texture is silt loam or light silt loam. Reaction is strongly alkaline or very strongly alkaline. The A1 horizon ranges from 2 to 4 inches in thickness.

In the B2t horizon, value is 6 or 7 when the soils are dry and ranges from 3 to 5 when they are moist. Texture is silty clay loam or light silty clay loam, and the content of clay ranges from 27 to 33 percent. The B2t horizon has none to many clay films on ped faces. Reaction is strongly alkaline to very strongly alkaline. The B2t horizon is moderately calcareous or strongly calcareous and ranges from 10 to 15 inches in thickness.

In the C horizon, hue ranges from 10YR to 5Y; value is 7 or 8 when the soils are dry and 5 or 6 when they are moist. Texture is silt loam or silty clay loam. Reaction is moderately alkaline or strongly alkaline.

Uffens silt loam (UF).—This soil is on broad, low lake plains and low lake terraces. It occurs only in the adjoining area north and west of the Locomotive Springs National Wildlife Refuge. Slopes are 1 to 6 percent but most commonly are less than 2 percent. Runoff is slow, and the hazard of erosion is slight. In places a few shallow gullies are present.

Included with this soil in mapping are small areas of Drum silt loam.

This Uffens soil is used for range. Capability unit VIIs-D8, nonirrigated; Desert Flats range site.

Very Stony Land

Very stony land (VS) is a miscellaneous land type that consists of areas that have about 80 to 90 percent of the surface covered by basalt stones. This land type is on terrace breaks and terrace escarpments in the southwest part of the survey area. The surface is covered by basalt stones about 1 to 6 feet in diameter. Vegetation consists of big sagebrush, bluebunch wheatgrass, squirreltail, yellowbrush, and cheatgrass.

Very stony land is used for wildlife habitat and very limited grazing. Capability unit VIIs-S, nonirrigated; Semidesert Shallow Loam range site.

Warm Springs Series

The Warm Springs series consists of somewhat poorly drained soils. These soils are on low lake terraces near Corinne and extend southward to the Weber County line. They formed in mixed lake sediments. Slopes are commonly less than 1 percent. The vegetation in noncultivated areas is mainly saltgrass, alkali sacaton, foxtail, wiregrass, and greasewood. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation ranges from 13 to 16 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,215 to 4,225 feet.

In a representative profile, the surface layer is grayish-brown fine sandy loam and loam about 12 inches thick. Next is a layer of light brownish-gray, very pale brown, and light-gray loam and silt loam about 22 inches thick. Below this is light-gray fine sandy loam that extends to a depth of 60 inches or more. These soils are strongly alkaline or very strongly alkaline and are slightly calcareous to strongly calcareous throughout. A layer of lime accumulation is at a depth of 12 inches.

Permeability is moderate, and the rate of water intake is moderate. Available water holding capacity is 8 to 10 inches to a depth of 5 feet. Roots penetrate to the water table, which is usually at a depth between 24 and 40 inches, but roots may extend to a depth of 60 inches or more if the soils are drained.

Warm Springs soils are used for irrigated crops and pasture.

Representative profile of Warm Springs fine sandy loam, in a cultivated field, 1,320 feet south of the north quarter corner of section 16, T. 9 N., R. 3 W., about 5 miles southwest of Corinne:

- A11—0 to 6 inches, grayish-brown (10YR 5/2) fine sandy loam; very dark grayish brown (10YR 3/2) when moist; weak, medium, subangular blocky structure that parts to weak, medium, granular; hard, friable, slightly sticky and plastic; slightly calcareous; strongly alkaline (pH 8.6); abrupt, smooth boundary.

- A12—6 to 12 inches, grayish-brown (10YR 5/2) loam, very dark grayish brown (10YR 3/2) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine pores; slightly calcareous; strongly alkaline (pH 8.6); clear, wavy boundary.
- C1ca—12 to 18 inches, light brownish-gray (10YR 6/2) silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium and coarse, subangular blocky structure; hard, friable, slightly sticky and plastic; many very fine and few fine and medium pores; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); gradual, wavy boundary.
- C2ca—18 to 30 inches, very pale brown (10YR 7/3) loam, brown (10YR 5/3) when moist; few, fine, distinct, brown (7.5YR 4/4) mottles below a depth of 20 inches; massive; hard, friable, slightly sticky and plastic; many very fine and few fine and medium pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.4); clear, wavy boundary.
- C3ca—30 to 34 inches, light-gray (10YR 7/2) light silt loam, pale brown (10YR 6/3) when moist; common, fine and medium, distinct, brown (7.5YR 4/4) mottles; massive; hard, friable, sticky and plastic; many very fine and few medium and fine pores; strongly calcareous, lime is disseminated; very strongly alkaline (pH 9.2); abrupt, wavy boundary.
- C4—34 to 60 inches, light-gray (10YR 7/2) heavy fine sandy loam, brown (10YR 4/3) when moist; common, medium, prominent, yellowish-red (5YR 4/6) mottles; massive; soft, very friable, nonsticky and nonplastic; many very fine and few fine and medium pores; moderately calcareous; strongly alkaline (pH 9.0).

Between depths of 10 to 40 inches, the texture averages heavy fine sandy loam and content of clay ranges from 18 to 22 percent. Depth to the horizon of carbonate accumulation ranges from 10 to 22 inches. Depth to the water table is mainly between 24 and 40 inches where the soils are not drained. These soils are slightly affected by salts and alkali.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 1 or 2. Texture is fine sandy loam or light silt loam. The A1 horizon is strongly alkaline and ranges from 10 to 12 inches in thickness.

In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; chroma is 2 or 3. Reaction is strongly alkaline or very strongly alkaline. In places, lime-cemented nodules are present in this horizon. The Cca horizon ranges from 16 to 22 inches in thickness. In the C horizon, value is 7 or 8 when the soils are dry and ranges from 4 to 6 when they are moist; chroma ranges from 2 to 4. Reaction is strongly alkaline or very strongly alkaline.

Warm Springs fine sandy loam (Wa).—This soil is on low lake terraces. Slopes are less than 1 percent. Most of the acreage has been leveled and drained. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Fridlo silt loam, moderately alkali; Lewiston fine sandy loam; and Syracuse fine sandy loam.

This Warm Springs soil is used for irrigated crops and pasture. Irrigated crops are alfalfa, small grains, sugar beets, tomatoes, and corn for silage. Capability unit IIw-2, irrigated; Alkali Bottom range site.

Wasatch Series

The Wasatch series consists of somewhat excessively drained soils. These soils are on alluvial fans along the mountains near the town of Willard. They formed in alluvium derived from quartzite, gneiss, and schist. Slopes range from 3 to 25 percent. Vegetation is mainly sand dropseed, three-awn, big sagebrush, annual grasses, and weeds. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 14 to

18 inches, and the frost-free period is 140 to 150 days. Elevations range from 4,275 to 5,200 feet.

In a representative profile, the surface layer is grayish-brown and brown gravelly sandy loam about 11 inches thick. The underlying layer extends to a depth of 60 inches or more and is brown gravelly loamy sand in the upper part and very gravelly loamy sand in the lower part. These soils are mildly alkaline throughout.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 3 to 3.75 inches, and the water-supplying capacity is 6 to 7 inches for plant growth before moisture is depleted. Roots are concentrated in the upper 24 to 30 inches of the soil but may penetrate to a depth of 60 inches or more.

Wasatch soils are used for irrigated crops, range, and wildlife habitat. These soils also are used as a source of fill material for roads, highways, and embankments.

Representative profile of Wasatch gravelly sandy loam, 3 to 10 percent slopes, in a cultivated field, 1,000 feet west and 500 feet north of the east quarter corner of section 11, T. 7 N., R. 2 W., south of Willard in White's orchard:

- A11—0 to 1 inch, grayish-brown (10YR 5/2) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, thin, platy structure; soft, very friable, nonsticky and nonplastic; many fine roots; few medium pores; 20 percent gravel; mildly alkaline (pH 7.0); abrupt, smooth boundary.
- A12—1 to 11 inches, brown (10YR 5/3) gravelly sandy loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few fine roots; few medium pores; 20 percent gravel; mildly alkaline (pH 7.6); gradual, wavy boundary.
- C1—11 to 29 inches, brown (10YR 5/3) gravelly sandy loam, dark brown (10YR 3/3) when moist; weak, fine, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; 25 percent gravel; mildly alkaline (pH 7.5); gradual, wavy boundary.
- C2—29 to 60 inches, brown (10YR 5/3) very gravelly sand, dark brown (10YR 3/3) when moist; single grained; loose; 55 percent gravel; mildly alkaline (pH 7.5).

Coarse fragments are dominantly gravel and cobblestones. Between depths of 10 and 40 inches, the texture averages gravelly coarse loamy sand and the content of coarse fragments is 25 to 35 percent. The soils are usually moist but are dry in all parts between depths of 12 and 35 inches for more than 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry; and chroma is 2 or 3. Texture is gravelly or cobbly sandy loam in the upper part of the A1 horizon, but it ranges to gravelly loamy sand that is 20 to 35 percent gravel or cobblestones in the lower part. Reaction is neutral or mildly alkaline. The A1 horizon ranges from 7 to 17 inches in thickness.

In the C horizon, hue is 10YR or 7.5YR; value is 4 or 5 when the soils are dry and 3 or 4 when they are moist; chroma ranges from 1 to 4. Texture is gravelly loamy sand, very gravelly loamy sand, very gravelly sand, cobbly sandy loam, or very cobbly loamy sand. Structure is weak, subangular blocky, or the horizon is single grained. Content of coarse fragments ranges from 25 to 80 percent. These fragments are gravel, cobblestones, and some stones.

Wasatch gravelly sandy loam, 3 to 10 percent slopes (WcC).—This soil is on alluvial fans at the base of mountains. A profile of this soil is the one described as representative for the Wasatch series. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Francis loamy fine sand, 3 to 6 percent slopes; Kilburn gravelly sandy loam, 3 to 6 percent slopes; and Stony alluvial land.

This soil is used mainly for irrigated crops. Peaches, apricots, cherries, apples, alfalfa, tomatoes, melons, and small grains are the main crops grown. One area near Willard is used as a source of fill material for roads and embankments. Capability unit IVs-16, irrigated; range site not assigned.

Wasatch gravelly sandy loam, 10 to 25 percent slopes (WcE).—This soil is on alluvial fans at the base of mountains. The surface layer is 7 inches thick; hue in the lower layers is 10YR or 7.5YR; and chroma ranges from 1 to 4. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 10 to 20 percent slopes, and Stony alluvial land.

This soil is used mainly for range and wildlife habitat. A small area is used for irrigated peaches, apricots, and apples and includes small acreages of alfalfa-grass, melons, and small grains. Capability unit VIs-U, nonirrigated; Upland Sand range site.

Wasatch Series, Gravelly Subsoil Variant

The Wasatch series, gravelly subsoil variant, consists of excessively drained soils. These soils are on alluvial fans deposited in the receding waters of prehistoric Lake Bonneville near Brigham City. They formed in alluvium derived mainly from quartzite, gneiss, and schist. Slopes range from 10 to 70 percent. Vegetation consists of sand dropseed, three-awn, big sagebrush, annual grasses, and weeds. Mean annual air temperature ranges from 48° to 50° F. Average annual precipitation ranges from 14 to 18 inches, and the frost-free period is 140 to 160 days. Elevations range from 4,400 to 4,700 feet.

In a representative profile, the surface layer is dark grayish-brown gravelly sandy loam about 12 inches thick. Next is a layer of light yellowish-brown gravelly sandy loam about 9 inches thick. Below this is light-brown and light-gray very gravelly loamy sand that reaches to a depth of 60 inches or more. These soils are neutral throughout.

Permeability is rapid, and the rate of water intake is very rapid. Available water holding capacity is 2.5 to 3.5 inches, and the water-supplying capacity is about 5 inches of water for plant growth before moisture is depleted. Roots are concentrated in the top 18 inches of the soil, but some plant roots can penetrate to a depth of more than 50 inches.

These soils are commonly used as a commercial source of high-quality gravel and sand for making concrete.

Representative profile of Wasatch gravelly sandy loam, gravelly subsoil variant, 30 to 70 percent slopes, in range, 4,400 feet east and 500 feet north of the southwest corner of section 19, T. 9 N., R. 1 W., east of Brigham City:

A1—0 to 12 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam, very dark brown (10YR 2/2) when moist; weak, medium, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; common fine and very fine roots; 25 percent gravel; neutral (pH 7.0); gradual, wavy boundary.

C1—12 to 21 inches, light yellowish-brown (10YR 6/4) gravelly light sandy loam, dark yellowish brown (10YR 3/4) when moist; weak, coarse, subangular blocky structure; slightly hard, friable, nonsticky and nonplastic; few very fine roots; 35 percent gravel; neutral (pH 6.9); gradual, wavy boundary.

C2—21 to 35 inches, light-brown (10YR 7/1) very gravelly loamy sand, gray (10YR 6/1) when moist; single grained; loose; 75 percent gravel; neutral (pH 6.8); clear, wavy boundary.

C3—35 to 60 inches, light-gray (10YR 7/1) very gravelly loamy sand, gray (10YR 6/1) when moist; single grained; loose; 75 percent gravel; neutral.

Coarse fragments are mainly rounded gravel. Between depths of 10 and 40 inches, the texture averages gravelly or very gravelly loamy sand that is 50 to 55 percent gravel. The soils are usually moist but are dry in all parts between depths of 12 and 35 inches for more than 90 consecutive days in summer.

In the A1 horizon, value is 4 or 5 when the soils are dry and 2 or 3 when they are moist; chroma is 2 or 3. Content of gravel ranges from 20 to 25 percent. In the C horizon, hue is 10YR or 7.5YR; value is 6 or 7 when the soils are dry; chroma ranges from 1 to 4. Texture ranges from gravelly light sandy loam to gravelly loamy sand in the upper part of the C horizon. Below a depth of 18 to 35 inches, the texture is very gravelly loamy sand that extends to a depth of 5 feet or more.

Wasatch gravelly sandy loam, gravelly subsoil variant, 30 to 70 percent slopes (WdG).—This soil is on alluvial fans that have been deposited by the receding waters of prehistoric Lake Bonneville. A profile of this soil is the one described as representative for the Wasatch series, gravelly subsoil variant. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Kilburn gravelly sandy loam, 30 to 60 percent slopes, and Kilburn gravelly sandy loam, 20 to 30 percent slopes.

This Wasatch soil is used mainly as a source of high-quality gravel and sand for making concrete. Capability unit VIIs-U, nonirrigated; Upland Sand range site.

Wasatch cobbly sandy loam, gravelly subsoil variant, 10 to 20 percent slopes (WeE).—This soil is on alluvial fans at the base of mountains. The profile of this soil is similar to that described as representative for the Wasatch series, gravelly subsoil variant. The surface layer is cobbly sandy loam about 17 inches thick. The underlying layers range from cobbly sandy loam to very cobbly loamy sand. Runoff is medium, and the hazard of erosion is moderate.

Included with this soil in mapping are small areas of Wasatch gravelly sandy loam, 10 to 25 percent slopes, and Stony alluvial land.

This soil is used for range and as a source of fill material for roads and embankments. Capability unit VIIs-U, nonirrigated; Upland Sand range site.

Wheelon Series

The Wheelon series consists of well-drained soils. These soils are on high lake terraces and terrace escarpments near the town of Beaver Dam. They formed in mixed lake sediments derived from light-colored tuff, tuffaceous sandstone, limestone, and conglomerate of the Salt Lake geologic formation. Slopes range from 6 to 60 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, Indian ricegrass, balsamroot, and big sagebrush. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation is 15 to 16 inches, and the frost-free period is 120 to 130 days. Elevations range from 4,700 to 5,500 feet.

In a representative profile, the surface layer is light-gray silt loam about 6 inches thick. Next is a layer of white silt loam about 23 inches thick; this layer has a high accumulation of lime. Below this is white silt loam

to a depth of 60 inches or more. These soils are strongly alkaline and strongly calcareous throughout.

Permeability is moderate, and the rate of water intake is slow. Available water holding capacity is 9 to 11 inches to a depth of 5 feet, and the water-supplying capacity is about 11 to 12 inches for plant growth before moisture is depleted. Roots are commonly concentrated in the top 30 to 36 inches of soil but may extend to a depth of more than 60 inches.

These soils are used for nonirrigated crops, range, and wildlife habitat.

Representative profile of Wheelon silt loam, 10 to 30 percent slopes, in an area of Wheelon-Collinston silt loams, 10 to 30 percent slopes, in a cultivated field, 1,500 feet south and 1,050 feet west of the northeast corner of section 22, T. 12 N., R. 2 W., east of Collinston:

- Ap—0 to 6 inches, light-gray (10YR 7/2) light silt loam, grayish brown (2.5Y 5/2) when moist; weak, thin and thick, platy structure; slightly hard, friable, slightly sticky and slightly plastic; many very fine roots; strongly calcareous; strongly alkaline (pH 8.7); abrupt, smooth boundary.
- C1ca—6 to 13 inches, white (2.5Y 8/2) silt loam, light gray (2.5Y 7/2) when moist; weak, medium, subangular blocky structure; hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous; strongly alkaline (pH 8.7); clear, wavy boundary.
- C2ca—13 to 29 inches, white (5Y 8/2) silt loam, light gray (5Y 7/2) when moist; massive; extremely hard, friable, slightly sticky and slightly plastic; few very fine roots; many very fine pores; strongly calcareous; strongly alkaline (pH 8.7); diffuse, wavy boundary.
- C3—29 to 60 inches, white (5Y 8/2) silt loam, light olive gray (5Y 6/2) when moist; massive; extremely hard, friable, slightly sticky and slightly plastic; strongly calcareous; strongly alkaline (pH 8.8).

Thickness of the solum and depth to the horizon of carbonate accumulation range from 6 to 18 inches. Between depths of 10 and 40 inches, the texture averages silt loam and the content of clay ranges from 18 to 25 percent. The soils are usually moist but are dry in all parts between depths of 4 and 12 inches for 60 to 90 consecutive days in summer.

In the A1 horizon, hue is 10YR or 2.5Y; value ranges from 6 to 7 when the soils are dry; chroma is 2 to 3. The A1 horizon is moderately calcareous or strongly calcareous and ranges from 6 to 18 inches in thickness.

In the Cca horizon, value ranges from 6 to 8 when the soils are dry and from 5 to 7 when they are moist; chroma is 2 or 3. Reaction is strongly alkaline or very strongly alkaline. The Cca horizon ranges from 11 to 23 inches in thickness. In the C horizon, chroma ranges from 1 to 3.

Wheelon silt loam, 30 to 60 percent slopes (WhG).—This soil is on high lake terraces and terrace escarpments. Runoff is very rapid, and the hazard of erosion is very high. Moderate to severe sheet and rill erosion is common.

Included with this soil in mapping are small areas of Wheelon silt loam, 10 to 30 percent slopes; Collinston silt loam, 10 to 30 percent slopes; and Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes.

This soil is used mainly for range. Some areas are used for wildlife habitat. Capability unit VIIe-U, nonirrigated; Upland Shallow Loam range site.

Wheelon-Collinston silt loams, 10 to 30 percent slopes (WmE).—This complex is on lake terraces and terrace escarpments in the vicinity of Beaver Dam. It consists of about 60 percent Wheelon silt loam, 10 to 30 percent slopes, and 30 percent Collinston silt loam, 10 to 30 percent slopes. Included with these soils in mapping are areas of Mendon silt loam, 6 to 10 percent slopes, and Wheelon

gravelly silt loam, shallow variant, 20 to 60 percent slopes. These included soils make up about 10 percent of the total acreage.

Soils of this complex are so closely intermingled that they cannot be separated at the scale used in mapping. The Wheelon soil has slightly concave slopes and is hilly; the Collinston soil has slightly concave slopes. Each of these soils has the profile described as representative for its respective series. Both soils are under a cover of mainly bluebunch wheatgrass, slender wheatgrass, Indian ricegrass, balsamroot, buckwheat, and big sagebrush. Runoff is rapid, and the hazard of erosion is high.

The soils of this complex are used for range and wildlife habitat, and some of the less sloping areas are used for nonirrigated small grains. Capability unit VIe-U, nonirrigated; Upland Shallow Loam range site.

Wheelon Series, Shallow Variant

The Wheelon series, shallow variant, consists of well-drained soils. These soils are on lake terraces, terrace escarpments, and mountain foot slopes. They formed in mixed lake sediments derived from light-colored tuffaceous sandstone, limestone, and conglomerate of the Salt Lake geologic formation. Slopes range from 20 to 60 percent. Vegetation is mainly bitterbrush, serviceberry, big sagebrush, mountainmahogany, bluebunch wheatgrass, Indian ricegrass, and scattered juniper. Mean annual air temperature ranges from 46° to 48° F. Average annual precipitation ranges from 15 to 18 inches, and the frost-free period is 100 to 120 days. Elevations range from 4,880 to 6,000 feet.

In a representative profile, the surface is light brownish-gray gravelly silt loam about 10 inches thick. The underlying layer is very pale brown very cobbly silt loam that is about 9 inches thick over consolidated tuffaceous sandstone bedrock. A layer of lime accumulation is at a depth of 10 inches. The surface layer is moderately alkaline and moderately calcareous or strongly calcareous. The next layer is strongly alkaline and strongly calcareous.

Permeability is moderately slow, and the rate of water intake is moderate. Available water holding capacity is 1.5 to 2.5 inches for the soil above the consolidated tuff. The water-supplying capacity is about 4 to 5.5 inches for plant growth before moisture is depleted. Roots penetrate to the tuffaceous material.

These soils are used for range and wildlife habitat.

Representative profile of Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes, in range, 350 feet west and 3,100 feet north of the south quarter corner of section 5, T. 13 N., R. 2 W., about 3½ miles northeast of Plymouth:

- A11—0 to 3 inches, light brownish-gray (10YR 6/2) gravelly silt loam, dark grayish brown (10YR 4/2) when moist; weak, medium, granular structure; soft, very friable, slightly sticky and nonplastic; few fine and medium roots; 25 percent angular gravel; moderately calcareous; moderately alkaline (pH 8.2); clear, smooth boundary.
- A12—3 to 10 inches, light brownish-gray (10YR 6/2) gravelly silt loam, brown (10YR 4/3) when moist; weak, medium, subangular blocky structure; soft, very friable, slightly sticky and nonplastic; few fine and medium roots; 35 percent angular gravel and cobbles; strongly calcareous; moderately alkaline (pH 8.4); abrupt, wavy boundary.
- Cca—10 to 19 inches, very pale brown (10YR 8/3) very cobbly silt loam, pale brown (10YR 6/3) when moist; mas-

sive; slightly hard, very friable, slightly sticky and nonplastic; few fine and medium roots; 70 percent angular cobbles and gravel; strongly calcareous; strongly alkaline (pH 9.0); abrupt, irregular boundary.

R—19 inches, consolidated tuffaceous sandstone.

A few stones are on the surface. Depth to consolidated tuff ranges from 15 to 20 inches. The soils are usually moist but are dry above the consolidated tuff for more than 90 consecutive days in summer.

In the A1 horizon, value is 3 or 4 when the soils are moist; chroma is 2 or 3. Texture is gravelly silt loam or gravelly very fine sandy loam, and content of gravel ranges from 20 to 35 percent. Reaction is mildly alkaline to strongly alkaline. The A1 horizon ranges from 8 to 10 inches in thickness.

In the Cca horizon, hue is 10YR, 2.5Y, or 5Y; value ranges from 6 to 8 when the soils are dry and from 4 to 6 when they are moist; and chroma ranges from 1 to 3. Texture is very gravelly or very cobbly silt loam or fine sandy loam, and content of cobbles and gravel ranges from 55 to 80 percent. Reaction is mildly alkaline to strongly alkaline. The Cca horizon ranges from 7 to 10 inches in thickness.

Wheelon gravelly silt loam, shallow variant, 20 to 60 percent slopes (W1G).—This soil is on south- and west-facing terrace escarpments and mountain foot slopes. Slopes are convex. Runoff is rapid, and the hazard of erosion is high.

Included with this soil in mapping are small areas of Wheelon silt loam, 30 to 60 percent slopes; Collinston silt loam, 10 to 30 percent slopes; and Middle cobbly silt loam, 30 to 70 percent slopes.

This soil is used for range and wildlife habitat. Capability unit VII_s-U, nonirrigated; Upland Shallow Loam range site.

Windmill Series

The Windmill series consists of well-drained soils. These soils are on alluvial fans, lake terraces, and offshore bars. They formed in mixed alluvium, reworked lake sediments, and beach deposits derived mainly from limestone rocks. Slopes range from 1 to 20 percent. The vegetation in noncultivated areas consists of bluebunch wheatgrass, Sandberg bluegrass, sand dropseed, yellowbrush, big sagebrush, annual weeds, and some juniper in places. Mean annual air temperature ranges from 47° to 49° F. Average annual precipitation ranges from 11 to 14 inches, and the frost-free period is 100 to 140 days. Elevations range from 4,350 to 5,200 feet.

In a representative profile, the surface layer is dark grayish-brown and light brownish-gray gravelly loam about 10 inches thick. The subsoil is pale-brown gravelly loam about 7 inches thick. The substratum extends to a depth of more than 60 inches. It is pale-brown gravelly fine sandy loam in the upper part and light brownish-gray and grayish-brown loamy very fine sand in the lower part. These soils are strongly calcareous to very strongly calcareous throughout. The surface layer is moderately alkaline, and the subsoil and substratum are strongly alkaline.

Permeability is moderately rapid, and the rate of water intake is rapid. Available water holding capacity is 5 to 7 inches to a depth of 5 feet. The water-supplying capacity is 8 to 9 inches before moisture is depleted. Roots penetrate easily to a depth of 60 inches, but most roots are within a depth of 30 inches.

These soils are used for nonirrigated crops, range, and wildlife habitat.

Representative profile of Windmill gravelly loam, 10 to 20 percent slopes, in range, 850 feet south and 675 feet west of the northwest corner of section 19, T. 10 N., R. 3 W., about 6 miles northwest of Corinne:

A11—0 to 4 inches, dark grayish-brown (10YR 4/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, fine, granular structure; slightly hard, very friable, slightly sticky and nonplastic; many fine and very fine roots; 30 percent fine gravel; strongly calcareous; moderately alkaline (pH 8.6); clear smooth boundary.

A12—4 to 10 inches, light brownish-gray (10YR 6/2) gravelly loam, very dark grayish brown (10YR 3/2) when moist; weak, coarse, granular structure; slightly hard, very friable, slightly sticky and nonplastic; many fine and very fine roots; 30 percent fine gravel; strongly calcareous; moderately alkaline (pH 8.4); clear, smooth boundary.

B2—10 to 17 inches, pale-brown (10YR 6/3) gravelly loam, brown (10YR 4/3) when moist; weak, medium and coarse, subangular blocky structure; slightly hard, very friable, slightly sticky and nonplastic; few very fine roots; 30 percent fine gravel; strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); clear, smooth boundary.

C1—17 to 23 inches, pale-brown (10YR 6/3) gravelly fine sandy loam, brown (10YR 4/3) when moist; massive; soft, very friable, nonsticky and nonplastic; few very fine roots; 30 percent fine gravel; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8.7); gradual, wavy boundary.

C2—23 to 32 inches, light brownish-gray (10YR 6/2) gravelly loamy very fine sand, grayish brown (10YR 5/2) when moist; single grained; loose; few very fine roots; 40 percent fine gravel; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8); clear, smooth boundary.

C3—32 to 44 inches, light brownish-gray (10YR 6/2) gravelly loamy very fine sand, dark grayish brown (10YR 4/2) when moist; single grained; loose; 40 percent fine gravel; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8.6); gradual, smooth boundary.

C4—44 to 60 inches, grayish-brown (10YR 5/2) gravelly loamy very fine sand, very dark grayish brown (10YR 3/2) when moist; single grained; loose; 40 percent fine gravel; very strongly calcareous, lime is disseminated; strongly alkaline (pH 8.8).

Thickness of the solum and depth to the C horizon range from 12 to 21 inches. Fine gravel is on the surface and throughout the profile. Pebbles are $\frac{1}{8}$ to $\frac{1}{2}$ inch in diameter. Content of coarse fragments, which are mainly limestone, ranges from 20 to 50 percent and averages 40 percent. The soils are usually dry throughout. Texture averages gravelly sandy loam between depths of 10 and 40 inches.

In the A1 horizon, value ranges from 4 to 6 when the soils are dry and is 3 to 4 when they are moist; chroma is 2 or 3. Texture is gravelly loam or gravelly sandy loam. Reaction is moderately alkaline or strongly alkaline. The A1 horizon is moderately calcareous or strongly calcareous and ranges from 3 to 11 inches in thickness.

In the B2 horizon, value is 6 or 7 when the soils are dry and 4 or 5 when they are moist; chroma is 2 or 3. Texture is gravelly loam or gravelly sandy loam. Reaction is moderately alkaline or strongly alkaline. The B2 horizon is moderately calcareous to strongly calcareous and ranges from 5 to 11 inches in thickness.

In the C horizon, hue ranges from 10YR to 5Y; value ranges from 5 to 8 when the soils are dry and 3 to 6 when they are moist; and chroma ranges from 2 to 4. Texture is gravelly fine sandy loam, gravelly loam, very loamy very fine sand, very gravelly loamy fine sand, or gravelly fine sand. In places, some cobbles are below a depth of 25 inches. Reaction is strongly alkaline or very strongly alkaline. The C horizon is strongly calcareous to very strongly calcareous.

Windmill gravelly loam, 1 to 6 percent slopes (WnB).—This soil is on lake terraces and offshore bars. Slopes are

convex and medium in length. Runoff is slow, and the hazard of erosion is slight.

Included with this soil in mapping are small areas of Sanpete gravelly silt loam, high rainfall, 1 to 6 percent slopes; Sterling gravelly loam, 1 to 6 percent slopes; and Stingal loam, 1 to 6 percent slopes.

This soil is used for nonirrigated small grains, range, and wildlife habitat. Capability unit IVe-UZ, nonirrigated; Upland Loam range site.

Windmill gravelly loam, 6 to 10 percent slopes (WnD).—This soil is on dissected lake terraces, offshore bars, and alluvial fans. Slopes are convex and short to medium in length. Runoff is medium, and the hazard of erosion is moderate. Rill erosion is common, and shallow gullies have been formed in places.

Included with this soil in mapping are small areas of Sanpete gravelly silt loam, high rainfall, 6 to 10 percent slopes; Sterling gravelly loam, 6 to 10 percent slopes; Stingal loam, 6 to 10 percent slopes; and Thiokol silt loam, 6 to 10 percent slopes.

This soil is used for nonirrigated small grains, range, and wildlife habitat. Capability unit IVe-UZ, nonirrigated; Upland Loam range site.

Windmill gravelly loam, 10 to 20 percent slopes (WnE).—This soil is on dissected lake terraces, offshore bars, and fans. Slopes are convex and short to medium in length. A profile of this soil is the one described as representative for the Windmill series. Runoff is medium, and the hazard of erosion is moderate. Moderate sheet erosion is common, and a few shallow to moderately deep gullies have been formed in places.

Included with this soil in mapping are small areas of Pomat silt loam, 10 to 30 percent slopes; Sanpete gravelly silt loam, high rainfall, 10 to 30 percent slopes; and Stingal loam, 6 to 10 percent slopes.

This soil is used chiefly for range. A small acreage is used for nonirrigated small grains and for wildlife habitat. Capability unit VIe-U, nonirrigated; Upland Loam range site.

Woods Cross Series

The Woods Cross series consists of poorly drained soils. These soils are on flood plains and low terraces. They formed in noncalcareous alluvium and mixed lake sediments. Slopes range from 0 to 3 percent. The vegetation in noncultivated areas is wiregrass, sedges, saltgrass, Kentucky bluegrass, foxtail, willow, and teasel. Mean annual air temperature ranges from 46° to 50° F. Average annual precipitation ranges from 11 to 17 inches, and the frost-free period is 100 to 150 days. Elevations range from 4,220 to 4,550 feet.

In a representative profile, the surface layer is dark-gray silty clay loam about 24 inches thick. The underlying layer extends to a depth of 60 inches. It is light brownish-gray and light-gray silty clay loam that is stratified with thin layers of very fine sandy loam. These soils are mildly alkaline throughout.

Permeability is slow, and the rate of water intake is slow. Roots penetrate to the water table, which is generally at a depth of 30 inches, but if the soils are drained, roots can grow to a depth of more than 60 inches. Most roots are within a depth of 30 inches, but some are at a depth

of more than 60 inches if the soils are drained and if the water table is lowered.

Woods Cross soils are used for meadow, pasture, and irrigated crops.

Representative profile of Woods Cross silty clay loam, in range, 700 feet north and 300 feet east of the southeast corner of section 25, T. 9 N., R. 2 W., about one-fourth mile south of Brigham City:

A11—0 to 10 inches, dark-gray (10YR 4/1) silty clay loam, black (10YR 2/1) when moist; moderate, medium, granular structure; very hard, firm, slightly sticky and plastic; many very fine and fine roots and common medium roots; mildly alkaline (pH 7.6); gradual, wavy boundary.

A12—10 to 24 inches, dark-gray (10YR 4/1) heavy silty clay loam, black (10YR 2/1) when moist; few, fine, faint, yellowish-brown (10YR 5/6) mottles in lower part of horizon; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky and very plastic; many very fine and fine roots and few medium roots; many very fine interstitial pores; mildly alkaline (pH 7.4); gradual, wavy boundary.

C1g—24 to 34 inches, light brownish-gray (2.5Y 6/2) heavy silty clay loam, dark grayish brown (2.5Y 4/2) when moist; many, medium, prominent, yellowish-red (5YR 5/8) mottles; moderate, medium and coarse, subangular blocky structure; very hard, firm, sticky and very plastic; few fine roots; many very fine interstitial pores; mildly alkaline (pH 7.4); clear, smooth boundary.

C2g—34 to 37 inches, light-gray (2.5Y 7/2) heavy very fine sandy loam, grayish brown (2.5Y 5/2) when moist; many, medium, prominent, yellowish-red (5Y 5/8) mottles; massive; soft, very friable, slightly sticky and nonplastic; common very fine tubular pores; mildly alkaline (pH 7.4); gradual, wavy boundary.

C3g—37 to 60 inches, light-gray (2.5Y 7/1) silty clay loam, grayish brown (2.5Y 5/2) when moist; many, medium, prominent, yellowish-red (5Y 5/8) mottles; massive; very hard, firm, sticky and very plastic; many very fine interstitial pores; mildly alkaline (pH 7.4).

Between depths of 10 and 40 inches, the texture averages heavy silty clay loam and the content of clay ranges from 35 to 40 percent. In places a peaty horizon, 1 to 6 inches thick, is on the surface.

In the A1 horizon, hue is 10YR or 2.5Y; value ranges from 3 to 5 when the soils are dry and is 2 or 3 when they are moist; and chroma is 1 or less. Texture is silty clay loam or light silty clay. Reaction is neutral or mildly alkaline. The A1 horizon ranges from 24 to 32 inches in thickness.

In the C horizon, hue is 2.5 to 5Y; value ranges from 5 to 7 when the soils are dry and from 2 to 5 when they are moist; and chroma is 2 or less. This horizon is silty clay loam or silty clay and is commonly stratified with thin layers of loam to very fine sandy loam. Reaction in the C horizon is mildly alkaline to moderately alkaline. Mottles are below a depth of 24 inches and range from few to many and from distinct to prominent. Depth to the water table ranges from 20 to 40 inches unless the soils are drained. In places these soils are moderately affected by salts.

Woods Cross silty clay loam (Wo).—This soil is on low lake terraces and flood plains. Slopes are slightly concave. A profile of this soil is the one described as representative for the Woods Cross series. Slopes range from 0 to 3 percent but most commonly are less than 1 percent. Average annual precipitation ranges from 13 to 17 inches, and the frost-free period is 130 to 150 days. Runoff is slow, and the hazard of erosion is none to slight. Available water holding capacity is 11 to 12 inches to a depth of 5 feet.

Included with this soil in mapping are small areas of James Canyon loam, 0 to 3 percent slopes; Logan silty clay loam; and Roshe Springs silt loam.

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