SOIL SURVEY

Salcha-Big Delta Area, Alaska

Issued June 1973

UNITED STATES DEPARTMENT OF AGRICULTURE
Soil Conservation Service
In cooperation with
UNIVERSITY OF ALASKA INSTITUTE OF AGRICULTURAL SCIENCES

Major fieldwork for this soil survey was done in the period 1963–67. Soil names and descriptions were approved in 1967. Unless otherwise indicated, statements in the publication refer to conditions in the Area in 1967. This survey was made cooperatively by the Soil Conservation Service and the University of Alaska Institute of Agricultural Sciences. It is part of the technical assistance furnished to the Salcha-Big Delta Soil Conservation Subdistrict of Alaska.

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

HOW TO USE THIS SOIL SURVEY

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

Locating Soils

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

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

Finding and Using Information

The "Guide to Mapping Units" can be used to find information. This guide lists all the soils of the Area in alphabetic order by map symbol. It shows the page where each soil is described, and also gives the management group into which the soils have 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 management groups.

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

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

Newcomers in the Salcha-Big Delta Area will be especially interested in the section "General Soil Map," where broad patterns of soils are described. They will also be interested in the information about the area given at the back of the publication in "General Nature of the Area."

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SOIL SURVEY OF SALCHA-BIG DELTA AREA, ALASKA

BY DALE B. SCHOEPHORSTER[1]

UNITED STATES DEPARTMENT OF AGRICULTURE, SOIL CONSERVATION SERVICE, IN COOPERATION WITH UNIVERSITY OF ALASKA INSTITUTE OF AGRICULTURAL SCIENCES

THE SALCHA-BIG DELTA AREA is in the Tanana Valley of interior Alaska (fig. 1). The Area includes about 495 square miles of a strip, 3 to 10 miles wide and 90 miles long, that extends from Eielson Air Force Base southeastward along the Richardson and Alaska Highways to the Gerstle River. All the Area except the easternmost part is within the Salcha-Big Delta Soil Conservation Subdistrict.

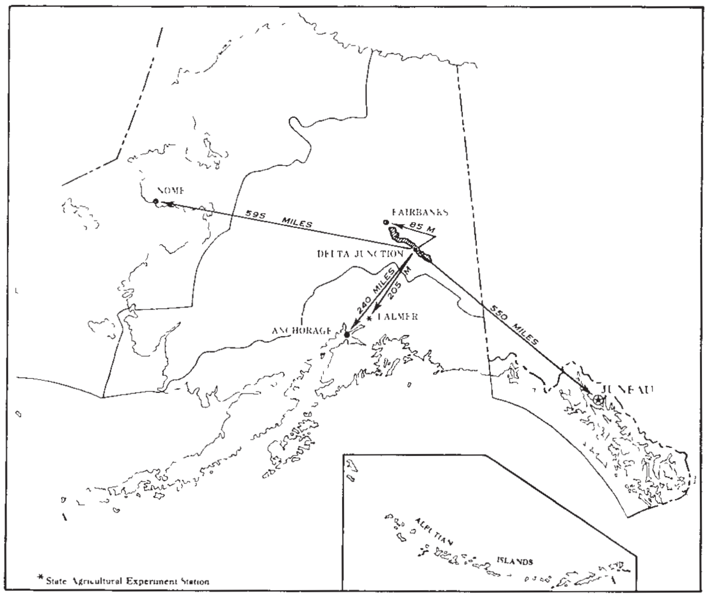

Figure 1.—Location of the Salcha-Big Delta Area in Alaska.

How This Survey Was Made

Soil scientists made this survey to learn what kinds of soil are in the Salcha-Big Delta Area, where they are located, and how they can be used. The soil scientists went into the Area knowing they likely would find many soils they had already seen and perhaps some they had not. They observed the steepness, length, and shape of slopes, the size and speed of streams, the kinds of native plants or crops, the kinds of rock, and many facts about the soils. They dug many holes to expose soil profiles. A profile is the sequence of natural layers, or horizons, in a soil; it extends from the surface down into the parent material that has not been changed much by leaching or by the action of plant roots.

The soil scientists made comparisons among the profiles they studied, and they compared these profiles with those in areas 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. Fairbanks and Tanana, 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 soil and in slope, stoniness, or some other characteristic that affects use of the soils by man. On the basis of such differences, a soil series is divided into phases. The name of a soil phase indicates a feature that affects management. For example, Fairbanks silt loam, gently sloping, is one of several phases within the Fairbanks series.

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

In most areas surveyed there are places where it is not feasible to classify the soil by soil series. These places are shown on the soil map and are described in the survey,

[1] Assisting with the fieldwork were EUGENE P. DAVIS, JAMES A. DEMENT, CHARLES F. HOTZ, CHARLES W MAINE, ROBERT B. MCNUTT, CHARLES H. POWERS, DUPREE SANDERS, JACK C. WILLIAMS.

but they are called land types and are given descriptive names. Local alluvial land and Peat is a land type in the Salcha-Big Delta Area.

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

But only part of a soil survey is done when the soils have been named, described, and delineated on the map, and the laboratory data and yield data have been assembled. The mass of detailed information then needs to be organized in such a way as to be readily useful to different groups of users, among them farmers, managers of woodland and rangeland, and engineers.

On the basis of yield and practice tables and other data, the soil scientists set up trial groups. They test these groups by further study and by consultation with farmers, agronomists, engineers, and others, 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 present methods of use and management.

General Soil Map

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

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

The soil associations in the Salcha-Big Delta Area are discussed in the following pages. The terms for texture used in the title for several of the associations apply to the surface layer. For example, in the title for association 1, the words silt loams refer to texture of the surface layer.

1. Steese-Minto-Gilmore Association

Dominantly gently sloping to steep, well drained and moderately well drained silt loams that are very shallow to deep over bedrock; on uplands

This association is on uplands on a series of high ridges and hills that are separated by valleys and drainageways of tributaries of the Tanana River. Elevation ranges from 600 feet above sea level near flood plains along the Tanana River to 2,000 feet on ridgetops. On the average, annual air temperature is 26° F .and annual precipitation is 13 inches. The frost-free season is about 108 days.

Soils that have south-facing slopes in this association generally are well drained and are free of permafrost. They support vegetation dominantly of quaking aspen, paper birch, and white spruce. The soils that have north-facing slopes receive less direct sunlight and commonly have a perennially frozen subsoil. These poorly drained soils support stands of stunted black spruce.

This association occupies about 30 percent of the survey area. Steese and Minto soils in equal parts make up about 60 percent of the association, and Gilmore soils about 15 percent. Other less extensive soils make up the remaining 25 percent.

Steese soils have south-facing slopes and are free of permafrost. They are well drained and moderately deep and range from moderately sloping to steep.

Minto soils are on foot slopes and low ridges. They are nearly level to strongly sloping and are moderately well drained. These soils commonly are underlain by isolated masses of buried ice.

Gilmore soils are near the top of high ridges. They are moderately sloping to steep, well drained, and shallow to very shallow to bedrock.

Fairbanks soils make up about 12 percent of the acreage of the less extensive soils in this association, and Ester, Goldstream, and Saulich soils make up the remaining 13 percent. Fairbanks soils have south-facing slopes and are within a mile or two of the Tanana River. These well-drained soils are gently sloping to steep. The Ester, Goldstream, and Saulich soils are poorly drained and are shallow to permafrost. The strongly sloping to steep Ester soils commonly occupy areas near the top of north-facing slopes. In these areas little direct sunlight is received, and the mantle of loess generally is thin. Saulich soils occupy positions below Ester soils in the landscape. They are gently sloping to strongly sloping and are deeper to bedrock than Ester soils. The gently sloping Goldstream soils commonly are in drainageways.

Most of this association is wooded, but a few scattered tracts are cleared and are cultivated. The Fairbanks, Minto, and Steese soils are better suited to farming than the other soils in this association. If these soils are fertilized and properly managed, grasses, small grains, potatoes, and other hardy vegetables can be grown. Unless they remain under a permanent cover of vegetation, the steep soils in this association are susceptible to severe water erosion. In places, if areas of Minto soils are cleared, they are subject to uneven settling or pitting because of the melting of buried ice blocks. The shallow, moderately steep and steep soils are better suited to woodland and to wildlife than to other uses. The moderately deep, strongly sloping soils are suitable for hay and pasture. Also, the poorly drained minor soils, other than the Ester soils, are suited to hay and pasture if they are artificially drained.

This association is moderately populated by the various kinds of wildlife that frequent the survey area. Although the vegetation on the Fairbanks, Gilmore, Minto, and Steese soils affords only a small to moderate quantity of browse for moose, it is important for the unbroken cover it provides for animals and birds that migrate back and forth to feeding areas in nearby valleys. Patches of brush along small streams and drainageways and on recently burned areas generally provide food of good quality for browsing animals and a dense cover for smaller mammals and birds. Birds and a few bear feed on scattered patches of blueberries on the Ester and Saulich soils. In addition, fox, mice, rabbits, and spruce grouse use the dense patches of black spruce on these soils as cover. A few mink and otter travel along the small streams, and a few marten, wolverine, and lynx frequent the wooded areas.

Most of the streams in this association are small, cut through steep slopes, and fluctuate rapidly. Except in a few places, these streams are not suitable for natural fisheries. Northern pike and whitefish, however, are in several lakes in the Area, and trout has recently been planted in Birch Lake. The lakes in the Area are used as stopover points for migratory waterfowl, and a few ducks use them for nesting.

The several lakes in this association are used for such recreational activities as camping, boating, and swimming. The well-drained soils along the edges of the lakes provide excellent sites for cabins, camps, and trails. Panning for gold in a few of the small streams is another recreational activity.

2. Salchaket-Tanana Association

Dominantly nearly level, well-drained to somewhat poorly drained very fine sandy loams and silt loams that are deep over gravel and cobblestones; on alluvial plains and terraces

This association is on broad alluvial plains and low terraces. Most of these soils formed in water-laid sediment that ranges from a few inches to many feet thick over deposits of gravel and cobblestones. The somewhat poorly drained and poorly drained soils are shallow to permafrost, but in the well-drained soils, permafrost is deep or it is lacking. On the average, annual air temperature is about 26° F. and annual precipitation is about 12 inches. The frost-free season is about 108 days.

Stands of paper birch, quaking aspen, and white spruce are dominant on the well-drained soils in this association. Alder, black spruce, and willow are common on the somewhat poorly drained and poorly drained soils, but several large tracts are treeless and are covered with mosses, low-growing shrubs, and sedge tussocks.

This association occupies about 20 percent of the survey area. Salchaket soils make up about 35 percent of the association, Tanana soils about 25 percent, and other less extensive soils about 40 percent.

Salchaket soils are on alluvial plains along the major rivers and streams of the survey area. These well-drained soils formed in very fine sandy loam that contains thin strata of fine sandy loam, silt loam, and sand.

Tanana soils are on alluvial plains and broad terraces. They formed in deep silty sediment and are somewhat poorly drained.

Beales, Bradway, Chena, and Jarvis soils make up 25 percent of the acreage in the association, and Goldstream and Lemeta soils make up 15 percent. The sandy Beales soils are on low dunes, and narrow strips of poorly drained Bradway soils are in old abandoned stream channels. The very shallow Chena soils are on alluvial plains. The poorly drained Goldstream soils and the very poorly drained Lemeta peats generally are near Tanana soils. Jarvis soils are moderately deep. They generally are near Salchaket soils.

The Jarvis, Salchaket, and Tanana soils are better suited to crops than the other soils in this association. All climatically adapted crops can be grown on these soils, but Salchaket and Jarvis soils tend to be droughty. Bradway and Goldstream soils are suitable for crops if they are artificially drained, but the choice of crops generally is restricted because of excess moisture in these soils in spring. Beales soils are also suitable for crops, but they are droughty and are susceptible to soil blowing. Chena soils are suited only to grasses and trees.

In places stands of white spruce on the Salchaket and Jarvis soils are harvested to provide logs and lumber for local use. Stands of black spruce on the Tanana soils are slow growing and have little commercial value.

The wide variety of vegetation in this association provides excellent habitat for wildlife. Patches of aspen, birch, and willow on the Jarvis, Salchaket, and Tanana soils provide moderate quantities of browse for moose, especially in winter. This vegetation also provides food and cover for many small mammals and birds. The Bradway and Goldstream soils support a variety of aquatic plants that are used by moose in spring and in summer. Grasses are grazed by a herd of bison that was established in the southeastern part of the Area in 1928. Most of the streams that flow through or border this association are used by waterfowl and furbearers. Among the fish in these streams are grayling, northern pike, and salmon.

The use of the soils in this association for recreational activities is limited mainly to boating, camping, hunting, and fishing. Many areas of the Chena, Jarvis, and Salchaket soils are suitable as sites for camps and recreational buildings, but flooding and severe streambank erosion are hazards in places.

3. Goldstream Association

Dominantly nearly level, poorly drained silt loams that are shallow to permafrost; on alluvial plains

This association is on broad alluvial plains. On the average, annual air temperature is 26° F. and average precipitation is about 12 inches. The frost-free season is about 108 days.

The vegetation commonly consists of low shrubs that grow from a thick mat of moss and sedge tussocks and of stunted black spruce, willow, and tamarack (fig. 2).

This association occupies about 20 percent of the survey area. Goldstream soils make up more than 70 percent of the association, and other less extensive soils make up the remaining 30 percent.

Goldstream soils formed in deep silty sediment. They are poorly drained, and the subsoil is perennially frozen.

Among the less extensive soils are scattered areas of Tanana soils, a few tracts of Lemeta peat, and scattered patches of Salchaket soils. Tanana soils are somewhat poorly drained, and Lemeta peats are very poorly drained. Salchaket soils are well drained.

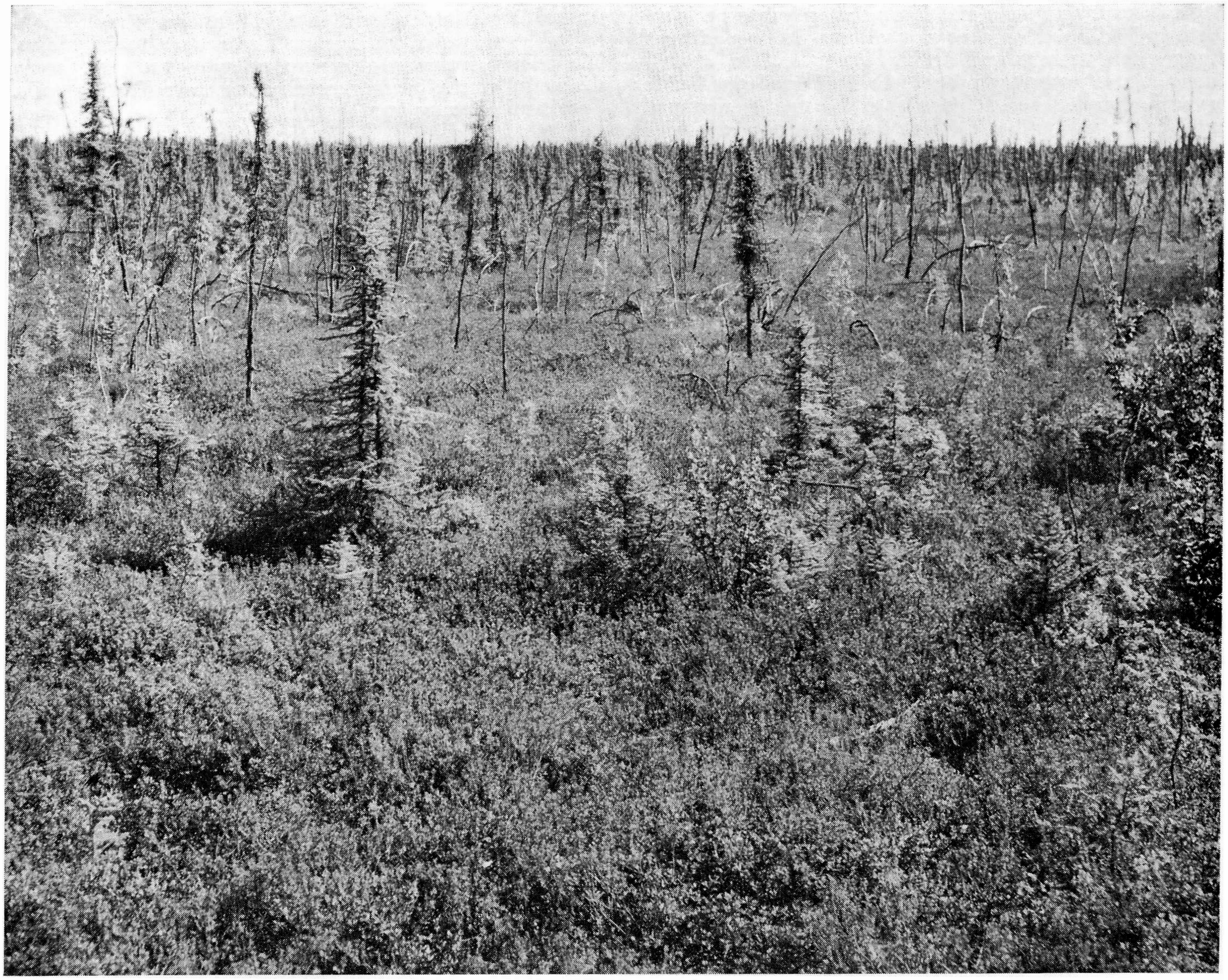

Figure 2.—Native vegetation on Goldstream silt loam, nearly level.

If Goldstream soils are artificially drained, they are suitable for cultivation. The choice of crops would be limited, however, because these soils have excess moisture and a low temperature in spring.

Treeless tracts are extensive in this association, especially on Goldstream soils. These open tracts do not provide suitable cover for large animals, but they are important as habitat for small mammals, songbirds, and waterfowl. A few aquatic plants that grow in small shallow ponds provide small quantities of forage for moose early in summer, and they serve as nesting areas for ducks. Beaver, mink, otter, and other furbearing animals frequent the small streams in this association.

Because the soils in this association are poorly drained, they are not well suited to recreational activities. They generally are not suitable for use as sites for camps and recreational buildings. A few of the streams are excellent for grayling fishing.

4. Volkmar-Nenana-Richardson Association

Dominantly nearly level to moderately sloping, moderately well drained to well drained silt loams that are shallow to deep over gravel or sand; on outwash plains and terraces

This association is mainly on broad outwash plains and terraces. These areas are interrupted by a gravelly moraine that extends into the association east of Delta Junction. Also, near the flood plains of major streams in the association are low stabilized dunes. On the average, annual air temperature is about 25° F. and precipitation is about 11 inches. The frost-free season is about 108 days.

Most of this association is wooded, but many cleared areas, recently burned tracts, and poorly drained sites that are treeless are also in the association. The vegetation on the better drained soils is dominantly quaking aspen, but paper birch and white spruce grow in places.

Also, a few poorly drained less extensive soils in the association commonly support dense stands of black spruce and have a thick cover of moss. Many differences exist in the vegetation on the soils in this association because of past forest fires.

This association occupies about 30 percent of the survey area. Volkmar soils make up about 40 percent of the association, Nenana soils 30 percent, and Richardson soils 15 percent. Other less extensive soils make up the remaining 15 percent.

Volkmar soils are on broad tracts on outwash plains. They are moderately well drained and formed in silt loam 15 to 40 inches thick over very gravelly sand or sand.

Nenana soils are on outwash plains and the gravelly moraine. They are well drained and formed in a mantle of silty material 12 to 24 inches thick over gravelly outwash, gravelly glacial till, or sand.

Richardson soils are on outwash plains. They are moderately well drained and formed in deep silty loess over very gravelly deposits.

Chena soils make up about 7 percent of the association, Beales soils 7 percent, and Tanana soils less than 1 percent. Local alluvial land and Peat make up a very small percentage.

Chena soils commonly are on the moraine. They are excessively drained and formed in silty material that is very shallow over gravelly and stony glacial drift. Beales soils are on stabilized dunes. They are somewhat excessively drained and formed in deep fine sand that has a thin mantle of silty material. Tanana soils are in shallow depressions. They are somewhat poorly drained and formed in stratified sediment washed from surrounding areas. Local alluvial land and Peat are in many small depressions scattered on the moraine.

The Nenana, Richardson, Tanana, and Volkmar soils are better suited to crops than the other soils in this association. If these soils are adequately fertilized and otherwise well managed, all crops adapted to the climate can be grown. Beales soils are suitable for grasses and small grains, but they tend to be droughty. Chena soils are suited to grass crops.

Most of the soils in this association are susceptible to soil blowing if they are cleared for cultivation. Leaving properly spaced strips of trees or other vegetation for windbreaks on cleared areas helps to control soil blowing.

Most of this association is wooded. A few white spruce on the well-drained soils are harvested to provide logs and lumber for local use, and a few paper birch and spruce are harvested for fuel.

The quality and quantity of habitat for wildlife vary greatly throughout the association. Sprouts of paper birch, aspen, and willow and grasses, blueberries, lowbush cranberries, and many shrubs on recently burned areas provide moderate quantities of feed for moose, bear, grouse, rabbits, and a variety of songbirds and mammals. In addition, the wooded areas provide excellent cover for migrating wildlife to escape from predators. Many of the small ponds and lakes in depressions on the moraine are used by waterfowl, but these areas lack natural populations of fish. Other than the Clearwater Creek, only a few small streams are in the association, and they are not well suited to fish. The Clearwater Creek has excellent spawning beds for grayling. The population of predators, including fox, lynx, owls, and wolves, fluctuates in accordance with the number of small mammals in the Area.

All of the better drained soils in this association are suitable as sites for camps, recreational buildings, and other intensive recreational uses. The scarcity of natural water frontages, however, limits the desirability of many areas for such uses.

Descriptions of the Soils

This section provides detailed information about the soils in the Salcha-Big Delta Area. It describes each soil series, and then each soil, or mapping unit. The soils are described in alphabetical order.

The description of a soil series mentions features that apply to all of the soils of that series. Differences among the soils of one series are pointed out in the descriptions of the individual soils or are apparent in the name.

A representative profile of each series is described in detail in the first mapping unit. This profile is for use by scientists, engineers, and others who need to make highly technical soil interpretations. The layers, or horizons, are designated by symbols such as A1, B21, and C1. These symbols have special meaning for soil scientists. Many readers, however, need only remember that symbols beginning with "A" are for surface soil; those with "B" are for subsoil; and those with "C" are for substratum, or parent material.

The color of each horizon is described in words, such as yellowish brown, and is also indicated by symbols for hue, value, and chroma, such as 10YR 3/2. These symbols, which are called Munsell color notations, are used by soil scientists to evaluate the color of the soil precisely (*17*).[2] Unless otherwise stated, the color terms in the survey are for moist soils.

The texture of the soil refers to the content of sand, silt, and clay. It is determined by the way the soil feels when rubbed between the fingers, and it is checked by laboratory analyses. Each mapping unit is identified by a textural class name, such as "fine sandy loam." This name refers to the texture of the surface layer or A horizon.

The structure is indicated by the way the individual soil particles are arranged in larger grains or aggregates, and the amount of pore space between grains. The structure of the soil is described by terms that denote strength or grade, size, and shape of the aggregates. For example, a layer may consist of soil materials that have weak, fine, blocky structure.

Boundaries between the horizons are described so as to indicate their thickness and shape. The terms for thickness are *abrupt*, *clear*, *gradual*, and *diffuse*. The shape of the boundary is described as *smooth*, *wavy*, *irregular*, or *broken*.

Other terms used for describing the soils are defined in the Glossary. For more general information about the soils, the reader can refer to the section "General Soil Map," in which the broad patterns of soils are described.

Following the name of each mapping unit is a symbol in parentheses. This symbol identifies the soil or land type on the detailed map at the back of this survey.

[2] Italic numbers in parentheses refer to literature cited, p. 49.

Shown at the end of each description of each mapping unit are the management group and the capability classification in which the mapping unit has been placed. The page on which the management group is described is listed in the "Guide to Mapping Units." The locations of the soils in the Area are shown on the detailed map at the back of this survey, and the acreage and proportionate extent of the mapping units are shown in table 1.

Alluvial Land

Alluvial land (Ad) consists of soil formed in loose sandy, gravelly, and stony material deposited by water. The areas are next to rivers and sloughs and are dissected by many small secondary channels. In places the loose coarse material is covered by a thin mantle of grayish fine sand and silt. Elevation is slightly higher than average stream level, and flooding is frequent.

The vegetation is mainly willow and alder brush, low shrubs, and sparse stands of grass and sedge, but black spruce and a few cottonwood (balsam poplar) grow in places. A few areas of this land type are barren of vegetation.

Alluvial land is not suitable for crops. The scattered stands of trees have little commercial value. Much of the vegetation, however, provides food and cover for many kinds of wildlife. Management group 27 (VIIIw–1).

Beales Series

In the Beales series are nearly level to moderately steep, somewhat excessively drained soils. These soils are on stabilized dunes near or next to flood plains of the major rivers and streams in the survey area. The vegetation is dominantly white spruce and paper birch, but quaking aspen and low-growing shrubs grow on many burned areas. Elevation ranges from about 900 to 1,300 feet. On the average, annual air temperature is 26° F. and annual precipitation is 12 inches. The frost-free season is about 108 days.

In a representative profile a very dark brown mat of fine roots and partly decomposed litter, about 3 inches thick, overlies dark yellowish-brown silt loam about 2 inches thick. The subsoil is dark yellowish-brown silt loam in the uppermost part and yellowish-brown loamy fine sand and sand below. The underlying material is at a depth of 18 to 40 inches and is olive-brown fine sand.

The principal associated soils are in the Chena, Nenana, and Volkmar series and Tanana, sandy subsoil variant. Beales soils have 3 to 10 inches of silt loam over fine sand, but Chena soils have less than 10 inches of silt loam over gravel, and Nenana and Volkmar soils have about 20 inches of silt loam over sand or very gravelly sand. Beales soils are similar to the somewhat poorly drained Tanana soils, but Tanana soils are somewhat poorly drained and have a thicker mantle of silt loam.

Beales soils are suitable for limited cultivation, pasture, woodland, and wildlife habitat.

Beales silt loam, nearly level (0 to 3 percent slopes) (BaA).—This soil has the profile described as representative of the series. It commonly occupies broad areas between stabilized dunes and large outwash plains.

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

Soil	Acres	Extent	Soil	Acres	Extent
Alluvial land	3, 830	1 2	Minto silt loam, moderately sloping	10, 450	3. 4
Beales silt loam, nearly level	6, 410	2 1	Minto silt loam, nearly level	2, 400	. 8
Beales silt loam, undulating	5, 180	1. 7	Minto silt loam, gently sloping	13, 050	4 2
Beales silt loam, rolling	1, 590	. 5	Minto silt loam, strongly sloping	1, 570	. 5
Beales silt loam, moderately steep	380	. 2	Nenana silt loam, nearly level	20, 730	6. 7
Bradway very fine sandy loam	1, 320	. 4	Nenana silt loam, gently sloping	1, 630	. 5
Chena silt loam, nearly level	5, 730	1 9	Nenana silt loam, moderately sloping	2, 250	. 7
Chena silt loam, undulating	3, 150	1 0	Nenana silt loam, strongly sloping	620	. 2
Chena very fine sandy loam, nearly level	860	. 3	Nenana silt loam, sandy subsoil, nearly level	1, 030	. 3
Ester silt loam, steep	4, 890	1. 6	Nenana silt loam, sandy subsoil, undulating	970	. 3
Ester silt loam, strongly sloping	1, 010	. 3	Nenana silt loam, sandy subsoil, rolling	1, 740	. 6
Ester silt loam, moderately steep	1, 280	. 4	Richardson silt loam, nearly level	14, 370	4. 7
Fairbanks silt loam, moderately sloping	3, 510	1. 1	Salchaket very fine sandy loam	21, 480	6 9
Fairbanks silt loam, gently sloping	680	. 2	Saulich silt loam, moderately sloping	2, 250	. 7
Fairbanks silt loam, strongly sloping	4, 140	1. 3	Saulich silt loam, gently sloping	1, 170	. 3
Fairbanks silt loam, moderately steep	2, 820	. 9	Saulich silt loam, strongly sloping	880	3
Fairbanks silt loam, steep	900	. 3	Steese silt loam, moderately sloping	6, 810	2 2
Gilmore silt loam, moderately steep	3, 350	1. 1	Steese silt loam, strongly sloping	9, 680	3 1
Gilmore silt loam, moderately sloping	1, 490	. 5	Steese silt loam, moderately steep	9, 660	3 1
Gilmore silt loam, strongly sloping	1, 610	. 5	Steese silt loam, steep	2, 710	9
Gilmore silt loam, steep	5, 730	1. 9	Tanana silt loam	24, 460	7. 9
Gilmore silt loam, very shallow, steep	2, 640	. 9	Tanana silt loam, sandy subsoil variant	1, 010	3
Goldstream silt loam, nearly level	42, 510	13 8	Volkmar silt loam, nearly level	33, 030	10 8
Goldstream silt loam, gently sloping	1, 280	. 4	Volkmar silt loam, gently sloping	3, 310	1 1
Goldstream silt loam, gravelly subsoil variant, nearly level	950	. 3	Volkmar silt loam, sandy subsoil, nearly level	910	3
Gravel pits	110	. 1	Total land area	308, 960	100 0
Jarvis very fine sandy loam, moderately deep	8, 490	2. 7	Lakes and streams	7, 450	
Jarvis very fine sandy loam, shallow	660	. 2			
Local alluvial land and Peat	1, 010	3	Total	316, 410	
Lemeta peat	3, 280	1. 1			

Representative profile (NW¼SW¼ sec. 26, T. 11 S., R. 12 E.):

O1—3 inches to 0, very dark brown (10YR 2/2) mat of partly decomposed organic litter coated with fresh silt; many fine roots; mycelia; charcoal fragments; abrupt, smooth boundary

A1—0 to 2 inches, dark yellowish-brown (10YR 3/4) silt loam; weak, very thin, platy structure; very friable; many fine roots; micaceous; strongly acid; clear, smooth boundary

B21—2 to 5 inches, dark yellowish-brown (10YR 4/4) silt loam; moderate, thin, platy structure; friable; ends of broken plates are dark brown (7.5YR 4/4); a few fine roots; a few very fine pores; micaceous; very strongly acid; clear, smooth boundary

IIB22—5 to 10 inches, dark yellowish-brown (10YR 4/4) loamy fine sand, a few patches of brown (10YR 4/3); single grain; loose; a few roots; very strongly acid; clear, smooth boundary.

IIB3—10 to 18 inches, yellowish-brown (10YR 5/6 and 5/4) sand; single grain; loose; patches of olive brown (2.5Y 4/4); a few roots; very strongly acid; gradual boundary.

IIC—18 to 40 inches, olive-brown (2.5Y 4/4) fine sand; patches of light olive brown (2.5Y 5/4); a few, medium, distinct, brown mottles; single grain; loose; a few roots; strongly acid

The mantle of silt loam ranges from 3 to 10 inches in thickness over fine sand. In places thin bands of silty material are in the sandy substratum. This soil generally is more than 60 inches deep, but in places it is underlain by stratified coarse sand and gravel at a depth of 3 or 4 feet. The silt and sand generally contain many fine mica flakes. Reaction ranges from very strongly acid to medium acid in the A horizon, but it commonly is less acid below.

Permeability is moderate in the silt loam and rapid below. Runoff is slow. The hazard of soil blowing is severe, and the hazard of water erosion is slight.

Included with this soil in mapping are small tracts of Beales silt loam, undulating. Also included are small areas of soils of the Nenana series.

Most of this Beales soil is wooded, but a few areas are cultivated. The principal crops are grasses, barley, oats, potatoes, and hardy vegetables. Management group 8 (IIIe–3).

Beales silt loam, undulating (3 to 7 percent slopes) (BaB).—This soil occupies scattered areas on low stabilized dunes. It has short, choppy slopes. The hazard of soil blowing is severe.

Included with this soil in mapping are a few areas of soils where slopes are short and as steep as 12 percent. Also included are a few somewhat poorly drained spots and small areas of Chena and Nenana soils.

Most of this Beales soil is wooded, but a few scattered areas are cleared and are cultivated. The principal crops are barley, oats, potatoes, hardy vegetables, and grasses grown for hay, silage, or pasture. Management group 8 (IIIe–3).

Beales silt loam, rolling (7 to 12 percent slopes) (BaC).—This soil occupies small areas on long low ridges. The areas commonly are oriented in a southeast-northwest direction.

Runoff is slow to medium on cleared areas. The hazard of water erosion is moderate, and the hazard of soil blowing is severe.

Included with this soil in mapping are a few small areas of moderately steep soils that have a surface layer of sand. Also included are small tracts of Tanana and Volkmar soils in shallow depressions.

459-932—73——2

Most of this Beales soil supports vegetation that is used for woodland and as wildlife habitat. If cleared, this soil is suitable for such crops as barley, grasses, oats, and hardy vegetables. Management group 15 (IVe–2).

Beales silt loam, moderately steep (20 to 30 percent slopes) (BaE).—This soil is on a few narrow long ridges in the eastern part of the survey area.

Runoff is rapid on this soil if it is cleared. The hazards of water erosion and soil blowing are severe.

Included with this soil in mapping are a few hilly areas that have slopes of 12 to 20 percent. Also included are a few spots of soils that have a surface layer of sand.

Most of this Beales soil is wooded and is used mainly as wildlife habitat. This soil is not suitable for intensive cultivation, but if it is cleared, it is suitable for improved pasture or hay. Management group 20 (VIe–2).

Bradway Series

The Bradway series consists of nearly level, poorly drained soils that are perennially frozen below a depth of about 2 feet. These soils occupy former stream channels in alluvial plains. They commonly support dense stands of sedges and grasses, but low-growing shrubs and clumps of black spruce grow in a few places. Elevation ranges from about 600 to 1,000 feet. On the average, annual air temperature is 26° F. and annual precipitation is 12 inches. The frost-free season is about 108 days.

In a representative profile a very dark brown and black mat of roots and partly decomposed plant parts, about 5 inches thick, overlies a surface layer of very dark gray very fine sandy loam about 3 inches thick. Below this is dark greenish-gray very fine sandy loam that contains mottles of dark brown. Below a depth of about 10 inches is dark greenish-gray loamy fine sand that contains thin lenses of silt. At a depth of 20 to 30 inches the soil material is perennially frozen and contains many lenses of clear ice.

The principal associated soils are in the Jarvis, Salchaket, and Tanana series. Bradway soils have a perennially frozen substratum and a high water table that are lacking in the Jarvis and Salchaket soils. They are similar to Tanana soils, but those soils consist mainly of silty material that contains lenses of sand.

Bradway soils are under a cover of native vegetation that is used for limited grazing and as wildlife habitat.

Bradway very fine sandy loam (0 to 3 percent slopes) (Br).—This is the only Bradway soil mapped in the Area. It occupies former stream channels on alluvial plains.

Representative profile (SE¼NE¼ sec. 28, T. 5 S., R. 4 E.):

O11—5 to 3 inches, very dark brown (10YR 2/2) mat of dead grasses and sedge leaves.

O12—3 inches to 0, black (10YR 2/1) mat of decomposing organic matter; many fine roots, clear, wavy boundary.

A1—0 to 3 inches, very dark gray (10YR 3/1) very fine sandy loam; weak, fine, granular structure; very friable; many roots; medium acid; clear, wavy boundary

C1g—3 to 10 inches, dark greenish-gray (5GY 4/1) very fine sandy loam; common, medium, prominent, dark-brown (7.5YR 4/4) mottles; massive; very friable; micaceous; common roots; medium acid; gradual boundary.

C2g—10 to 30 inches, dark greenish-gray (5GY 5/1) loamy fine sand, single grain; very friable; micaceous; many lenses of dark greenish-gray silt as much as a half inch thick; frozen below a depth of 24 inches in midsummer; clear ice lenses at a depth of 30 inches; a few roots; water table at a depth of 16 inches; slightly acid

The mat of organic material ranges from about 3 to 5 inches in thickness. The A horizon ranges from about 2 to 5 inches in thickness. The C2g horizon is dominantly loamy fine sand, but in most places it contains thin lenses of silt. The C horizon ranges from dark gray to dark greenish gray or dark bluish gray in color. Reaction ranges from medium acid to mildly alkaline.

Permeability is moderate in this soil. The water table fluctuates from the surface to a depth of several inches above the permafrost. Unless this soil is drained, it generally is saturated during most of the growing season. Runoff is very slow, and in places this soil is ponded in spring and early in summer. The hazard of erosion is slight.

Included with this soil in mapping are a few small tracts of Lemeta peat.

The vegetation, which is dominantly a mixture of native grasses and sedges, is used primarily as wildlife habitat. In places the vegetation is suitable for limited grazing.

If this Bradway soil were adequately drained, it would be suitable for growing grasses and small grains for forage. Management group 17 (IVw–1).

Chena Series

In the Chena series are nearly level to undulating, excessively drained soils on flood plains, outwash plains, and moraines. These soils formed in a thin mantle of silt loam over very gravelly sand. The vegetation is mainly paper birch, quaking aspen, and white spruce, but young aspen, clumps of willow, low shrubs, and thin patches of native grasses grow in many areas that have been severely burned. Elevation ranges from 600 to 1,400 feet. On the average, annual air temperature is 26° F. and annual precipitation is 12 inches. The frost-free season is about 108 days.

In a representative profile a dark reddish-brown mat of partly decomposed organic matter, about 1½ inches thick, overlies a surface layer of very dark brown and dark-brown silt loam about 3 inches thick. The subsoil is dark yellowish-brown silt loam that extends to a depth of about 7 inches. The underlying material is yellowish-brown and dark yellowish-brown very gravelly coarse sand that commonly contains many cobblestones and a few other stones.

The principal associated soils are in the Jarvis, Nenana, and Volkmar series. Chena soils have a thin layer of silt loam over a substratum of very gravelly sand, but Jarvis soils have 10 to 40 inches of stratified fine sandy and silty material over a substratum of gravelly sand, and the Nenana and Volkmar soils have about 20 inches of silt loam over a substratum of sand or very gravelly sand. Chena soils lack the mottles of Volkmar soils.

The areas of Chena soils are suitable for limited cultivation, pasture, wildlife habitat, and woodland.

Chena silt loam, nearly level (0 to 3 percent slopes) (CnA).—This soil has the profile described as representative of the series. It is in broad areas east of Delta Junction and generally is next to large tracts of Nenana and Volkmar soils.

Representative profile (SE¼SE¼ sec. 12, T. 11 S., R. 11 E.):

01—1½ inches to 0, dark reddish-brown (5YR 2/2) mat of partly decomposed organic matter, many charcoal fragments; admixture of silt; many fine roots; mycelia; extremely acid; abrupt, wavy boundary

A11—0 to 1½ inches, very dark brown (10YR 2/2) silt loam; weak, fine, granular structure; very friable; many fine roots; charcoal fragments; micaceous; extremely acid; abrupt, broken boundary.

A12—1½ to 2½ inches, dark-brown (7.5YR 3/2) silt loam; weak, fine, granular structure; very friable; common roots; micaceous; very strongly acid; clear, wavy boundary.

B—2½ to 7 inches, dark yellowish-brown (10YR 4/4) silt loam; very weak, thin, platy structure; very friable; common roots; micaceous; a few cobblestones; very strongly acid; clear, smooth boundary.

IIC—7 to 18 inches, yellowish-brown (10YR 5/6) and dark yellowish-brown (10YR 4/4) very gravelly coarse sand; single grain; loose; a few roots to a depth of 15 inches; many cobblestones and a few other stones, strongly acid.

Reaction ranges from extremely acid to medium acid in the A horizon and from strongly acid to slightly acid below a depth of 10 inches.

Permeability is moderate in the silt loam and very rapid in the gravelly substratum. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate to severe.

Included with this soil in mapping are a few small ponds, scattered depressions where drainage is poor, and a few patches of stones. Also included are small tracts of Nenana soils.

Most of this Chena soil is wooded, but a few areas were recently burned over. In addition, a few small areas are cultivated. The principal crops are barley, oats, and perennial grasses grown for hay, silage, or pasture. The wooded areas are used as wildlife habitat. Stones that occur near the surface in places are likely to interfere with tillage if they are not removed. During seasons of low rainfall, or if the rain is poorly distributed, yields are likely to be reduced because of shortage of moisture. Management group 16 (IVs–1).

Chena silt loam, undulating (3 to 7 percent slopes) (CnB).—This soil is on gravelly glacial moraines. Slopes are short and irregular. This soil is slightly darker and contains a few more stones than Chena silt loam, nearly level, but the two profiles otherwise are similar.

Runoff is slow to medium on cleared areas. The hazard of water erosion is moderate.

Included with this soil in mapping are a few areas of soils that have slopes as steep as 12 percent. Also included are patches of Nenana soils and a few small ponds and poorly drained depressions.

Most of this Chena soil is wooded, but a few areas are used mainly for barley, oats, and perennial grasses. A few burned areas are covered by scattered clumps of brush and sparse stands of native grasses. In most places the natural vegetation is used as wildlife habitat. This soil tends to be droughty and generally is suitable only for crops that need shallow tillage. In places, stones must be removed before crops can be planted. Management group 16 (IVs–1).

Chena very fine sandy loam, nearly level (0 to 3 percent slopes) (ChA).—This soil occupies a few scattered areas on alluvial plains along the Delta River and the Tanana River. It has about 5 to 10 inches of stratified dark grayish-brown to light olive-brown very fine sandy loam, fine sand, and very fine sand over coarse sand, gravel, and rounded cobblestones, but the profile otherwise is similar to that described as representative of the series. Runoff is very slow on this soil.

Included with this soil in mapping are a few patches of stones. Also included are small tracts of Jarvis soils.

Most of this Chena soil is wooded, but a few small tracts are used for vegetable gardens. This soil is too droughty and too shallow for row crops. If this soil is cleared, it should remain in perennial grasses for hay or pasture. Management group 16 (IVs-1).

Ester Series

The Ester series consists of strongly sloping to steep, poorly drained soils. These soils are on high hills and ridges in the northwestern part of the Area, and they have north-facing slopes. They are shallow to bedrock and to permafrost. The vegetation consists mainly of stunted black spruce, scattered alder, willow, and a thick ground cover of mosses, lichens, and low shrubs. Paper birch also grows in places. Elevation ranges from about 1,000 to 1,900 feet. On the average, annual air temperature is 25° F. and annual precipitation is 13 inches. The frost-free season is 90 to 100 days.

In a representative profile a mat of raw sphagnum moss and partly decomposed moss, twigs, leaves, and roots, about 12 inches thick, overlies a surface layer of very dark grayish-brown silt loam that contains streaks of black. Below is dark-gray silt loam and very gravelly silt loam, which contain dark grayish-brown streaks. At a depth of about 16 inches is schist bedrock.

The principal associated soils are in the Gilmore, Saulich, and Steese series. Ester soils are similar in depth to Gilmore soils, but the thick surface mat of moss and the permafrost are lacking in Gilmore soils. Ester soils are shallower to bedrock than Saulich and Steese soils. They are higher on north-facing slopes than Saulich Soils. Moss and permafrost are lacking in Steese soils.

Most of the acreage of Ester soils is under a cover of vegetation that provides habitat for wildlife.

Ester silt loam, steep (30 to 45 percent slopes) (EsF).—This soil has the profile described as representative of the series. It has north-facing slopes and is on high hills and ridges.

Representative profile (NE¼SE¼ sec. 15, T. 7 S., R. 6 E.):

O11—12 to 6 inches, raw sphagnum moss; clear, smooth boundary

O12—6 inches to 0, yellowish-brown (10YR 5/4) decomposing moss; many twigs, leaves, and roots; extremely acid; abrupt, smooth boundary.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam that contains black (10YR 2/1) streaks; weak, thin, platy structure; many roots, very friable; very strongly acid; clear, wavy boundary.

C1g—2 to 12 inches, dark-gray (5Y 4/1) silt loam that contains many very dark grayish-brown (2.5Y 3/2) streaks; weak, thin, platy structure, frozen; clear ice lenses; a few angular rock fragments; strongly acid, clear, wavy boundary

IIC2—12 to 16 inches, very dark grayish-brown (2.5Y 3/2) very gravelly silt loam; weathered schist fragments make up more than 60 percent of mass, by volume; frozen; medium acid.

IIC3—16 inches, schist bedrock.

The mat of moss, roots, and partly decomposed organic matter ranges from 6 to 18 inches in thickness. The mantle of silt loam ranges from 12 to 20 inches in thickness over bedrock or shattered rock fragments. Reaction ranges from extremely acid to strongly acid in the A horizon and from strongly acid to medium acid in the C horizon Depth to the permafrost table generally is about 3 to 10 inches below the surface mat of moss and organic material. Where the mat is very thick, however, the permafrost table is likely to be in the lower part of the mat.

Permeability is moderate in this soil, but the high permafrost table and shallowness to bedrock restrict the movement of air and water. Runoff is slow on uncleared areas and rapid on cleared areas. The hazard of water erosion is very severe.

Included in mapping with this soil are a few rock outcrops and small tracts of Gilmore and Steese soils.

Ester silt loam, steep, is not suited to cultivated crops. The vegetation is suitable for use as wildlife habitat. Management group 24 (VIIw-1).

Ester silt loam, strongly sloping (12 to 20 percent slopes) (EsD).—This soil is on high hills and ridges. It has long slopes that face north. The lower boundary of the areas generally is near Saulich soils, and the upper boundary generally is near Gilmore and Steese soils. Depth to bedrock or shattered rock is about 18 inches, but the profile otherwise is like that of the soil described as representative of the series.

Runoff is slow on uncleared areas, but it is rapid if the areas are cleared. The hazard of erosion is severe.

Included with this soil in mapping are a few small tracts of Gilmore, Saulich, and Steese soils.

Most of this Ester soil is under a cover of vegetation that is used mainly as wildlife habitat. Only the uppermost few inches of this soil thaws in summer, and the areas are not suitable for cultivated crops. Management Group 24 (VIIw-1).

Ester silt loam, moderately steep (20 to 30 percent slopes) (EsE).—This soil is on high hills and ridges. Runoff is slow to medium on uncleared areas, but it is rapid if the areas are cleared. The hazard of erosion is severe.

Included with this soil in mapping are a few rock outcrops. Also included are small tracts of Gilmore, Saulich, and Steese soils.

Most of this Ester soil is under a cover of vegetation that is used mainly as wildlife habitat. Only the uppermost few inches of this soil thaws in summer, and the areas are not suitable for cultivated crops. Management group 24 (VIIw-1).

Fairbanks Series

In the Fairbanks series are gently sloping to steep, well-drained soils on uplands. These soils have south-facing slopes. The vegetation commonly consists of stands of white spruce and paper birch, but quaking aspen is dominant on many areas that are burned or cutover. Elevation ranges from about 800 to 1,500 feet. On the average, annual air temperature is 25° F. and annual precipitation is 13 inches. The frost-free season is 108 days.

In a representative profile a dark reddish-brown mat of roots and partly decomposed organic matter, about 2 inches thick, overlies a surface layer of dark-brown and brown silt loam 5 inches thick. The subsoil is dark yellowish-brown and olive-brown silt loam about 20 inches thick. The underlying material is olive silt loam.

The principal associated soils are in the Minto and Steese series. Fairbanks soils are similar to Minto soils, but Minto soils have a surface layer of dark grayish brown, are mottled, and commonly overlie buried ice masses. Fairbanks soils are deeper over bedrock than Steese soils, which have 20 to 40 inches of silt loam over bedrock.

Fairbanks soils are used for cultivated crops, pasture, hay, and recreation and as wildlife habitat.

Fairbanks silt loam, moderately sloping (7 to 12 percent slopes) (FaC).—This soil has the profile described as representative of the series. It is on low ridges and on the middle and lower parts of long slopes that face south. The lower boundary of this soil generally is near Minto soils, and the upper boundary generally is near Steese soils or the strongly sloping Fairbanks soil.

Representative profile (SE¼SW¼ sec. 13, T. 7 S., R. 5 E.):

O1—2 inches to 0, dark reddish-brown (5YR 2/2) mat of partly decomposed organic matter; many roots; mycelia; strongly acid.

A1—0 to 3 inches, dark-brown (7.5YR 3/2) silt loam that contains streaks of dark yellowish brown (10YR 3/4); very weak, fine, granular structure, very friable; many roots; strongly acid; clear, wavy boundary.

A2—3 to 5 inches, brown (10YR 4/3) silt loam that contains a few streaks of yellowish brown (10YR 5/4), very weak, thin, platy structure; very friable; micaceous, many roots; strongly acid, clear, wavy boundary.

B21—5 to 9 inches, dark yellowish-brown (10YR 3/4) silt loam that contains streaks of dark brown (7.5YR 4/4); weak, very thin, platy structure; very friable; micaceous; common roots; medium acid, clear, smooth boundary

B22—9 to 14 inches, dark yellowish-brown (10YR 4/4) silt loam; plate faces are yellowish brown (10YR 5/4); weak, medium, platy structure; very friable; micaceous; a few dark-brown (10YR 3/3) bands of silty clay loam that are undulating, but they generally are horizontal and about ⅛ to ¼ inch thick; a few roots; medium acid; gradual boundary.

B3—14 to 25 inches, olive-brown (2.5Y 4/4) silt loam that contains a few large olive (5Y 5/3) patches; weak, thin, platy structure; very friable; a few brown (10YR 4/3) bands of silty clay loam that are undulating, but they generally are horizontal and about ¼ to ⅛ inch thick; a few, medium, distinct, brown (7.5YR 5/4) mottles; micaceous; medium acid; gradual boundary.

C—25 to 50 inches, olive (5Y 5/3) silt loam that contains yellowish, brown streaks (10YR 5/4); weak, thin, platy structure; friable; micaceous; slightly acid.

The mantle of loess ranges from 40 inches to many feet in thickness over bedrock. Texture is dominantly silt loam throughout the profile, but in a few places the B horizon is very fine sandy loam. Reaction ranges from strongly acid to medium acid in the A horizon and from medium acid to slightly acid in the B horizon. The bands of silty clay loam in the B horizon range from ⅛ to ½ inch in thickness These bands generally are horizontal, but they fork and merge into an irregular pattern. In a few places a IIC horizon of fine sand that is as much as several feet thick occurs below a depth of 36 inches. On a few bluffs along the Tanana River, this soil is not so brown as it is in other parts of the Area.

Permeability is moderate in this soil. Runoff is medium on cleared areas. The hazard of water erosion is moderate to severe.

Included with this soil in mapping are small tracts of Minto and Steese soils. Also included are a few soils that are steeper than this soil.

Most of this Fairbanks soil is wooded, but a few areas are cultivated. The principal crops are perennial grasses, oats, barley, potatoes, and hardy vegetables. Management group 6 (IIIe–1).

Fairbanks silt loam, gently sloping (3 to 7 percent slopes) (FaB).—Some areas of this soil are on scattered low hills and ridges, and a few areas are on broad ridgetops near the Tanana River. Slopes generally are long and smooth. On low ridges and on foot slopes this soil commonly is next to areas of Minto soils, and on ridgetops it is next to areas of steeper Fairbanks soils and Steese soils.

Runoff is slow to medium on cultivated areas. The hazard of water erosion is moderate, and the hazard of soil blowing is slight.

Included with this soil in mapping are small tracts of Minto and Steese soils. Also included are a few areas of Fairbanks silt loam, moderately sloping.

Most of this Fairbanks soil is wooded, but a few areas are cultivated. The principal crops are perennial grasses, oats, barley, potatoes, and hardy vegetables. Management group 3 (IIe–1).

Fairbanks silt loam, strongly sloping (12 to 20 percent slopes) (FaD).—Areas of this soil commonly are dissected by many small drainageways. Slopes are long. Depth to bedrock generally is 40 to 50 inches. The upper boundary of areas of this soil generally is next to Gilmore and Steese soils that occupy higher positions on the landscape. The lower boundary is next to Minto soils and to other Fairbanks soils that are less steep. In addition, a few areas are next to soils of the Ester and Saulich series.

Runoff is medium to rapid on cleared areas of this soil. The hazard of water erosion is severe.

Included with this soil in mapping are small tracts of Fairbanks silt loam, moderately steep. Also included are small tracts of Minto and Steese soils.

Most of this Fairbanks soil is wooded, but a few areas are used chiefly for growing perennial grasses for hay, silage, or pasture. Oats and barley are also grown in a few places. Management group 14 (IVe–1).

Fairbanks silt loam, moderately steep (20 to 30 percent slopes) (FaE).—This soil is on high ridges. Slopes generally are smooth. The areas are dissected by small drainageways in a few places. The lower boundary of areas of this soil commonly is next to Fairbanks soils that are less steep, and the upper boundary generally is next to soils that are shallower to bedrock.

Runoff is rapid on this soil if it is cleared. The hazard of water erosion is severe.

Included with this soil in mapping are patches of Steese soils and a few areas of steeper Fairbanks soils.

This Fairbanks soil is used mainly as woodland and as wildlife habitat. It is too steep and too susceptible to water erosion for cultivated crops. If this soil is cleared, it is suitable for growing perennial grasses for pasture or hay. Management group 19 (VIe–1).

Fairbanks silt loam, steep (30 to 45 percent slopes) (FaF).—This soil is on high hills and ridgetops.

Runoff is very rapid on this soil if it is cleared. The hazard of water erosion is very severe.

Included with this soil in mapping are small areas of Ester and Steese soils.

Most of this Fairbanks soil is wooded. The areas are used mainly as wildlife habitat. Management group 23 (VIIe-1).

Gilmore Series

In the Gilmore series are moderately sloping to steep, well-drained silt loams that are shallow and very shallow to bedrock. These soils generally are on high ridges. The vegetation is dominantly paper birch, quaking aspen, and white spruce. Elevation ranges from 800 to 2,000 feet. On the average, annual air temperature is 26° F. and annual precipitation is 13 inches. The frost-free period is about 100 days.

In a representative profile a dark reddish-brown mat of roots and partly decomposed organic matter, about 1½ inches thick, overlies a surface layer of dark-brown and brown silt loam about 4 inches thick. The subsoil, a dark yellowish-brown and brown silt loam, is underlain by grayish-brown silt loam at a depth of about 9 inches. Weathered schist that has a coating of olive silt is at a depth of about 16 inches.

Gilmore soils are near the Ester and Steese soils. They lack the thick surface mat of moss and the permafrost of Ester soils. Gilmore soils are shallower to bedrock than Steese soils, which have 20 to 40 inches of silt loam over bedrock.

Most areas of Gilmore soils are used for woodland and as wildlife habitat.

Gilmore silt loam, moderately steep (20 to 30 percent slopes) (GmE).—This soil has the profile described as representative of the series. It generally is next to areas of Ester, Steese, and other Gilmore soils.

Representative profile (NE¼SE¼ sec. 18, T. 5 S., R. 5 E.):

O1—1½ inches to 0, dark reddish-brown (5YR 2/2) mat of partly decomposed organic matter; mycelia; many roots; medium acid; abrupt, smooth boundary.

A1—0 to 2½ inches, dark-brown (10YR 3/3) and very dark grayish-brown (10YR 3/2) silt loam, weak, fine, granular structure; very friable; micaceous; many roots; medium acid; clear, smooth boundary.

A2—2½ to 3½ inches, brown (10YR 4/3) silt loam that contains many large patches of dark grayish-brown; weak, thin, platy structure; micaceous; very friable; common roots; medium acid; clear, wavy boundary.

B—3½ to 9 inches, dark yellowish-brown (10YR 3/4) and brown (7.5YR 4/4) silt loam; weak, thin, platy structure; very friable; micaceous; common roots; medium acid; clear, wavy boundary.

C1—9 to 16 inches, dark grayish-brown (10YR 4/2) gravelly silt loam; weak, thin, platy structure; friable; micaceous; many angular rock fragments; a few roots; medium acid; clear, smooth boundary.

IIC2—16 to 26 inches, angular coarse fragments of weathered schist that have a coating of olive (5YR 4/3) silt.

The mantle of silt loam ranges from 10 to 20 inches in thickness over schist bedrock. Reaction ranges from strongly acid to slightly acid.

Permeability is moderate in the silt loam. Runoff is rapid if this soil is cleared.

Included with this soil in mapping are a few rock outcrops and patches of very shallow soils that are underlain by rock at a depth of 5 to 10 inches. Also included are small tracts of Steese soils and a few small areas of Ester soils.

This Gilmore soil is wooded. It is too steep, droughty, and susceptible to water erosion for improved pasture or cultivated crops. Management group 19 (VIe-1).

Gilmore silt loam, moderately sloping (7 to 12 percent slopes) (GmC).—This soil occupies a few scattered areas near the tops of high hills. It generally is next to other Gilmore soils that are steeper and to areas of Steese soils.

Runoff is medium on this soil if it is cleared. The hazard of water erosion is moderate to severe.

Included with this soil in mapping are a few areas of Gilmore silt loam, gently sloping, and small tracts of Steese soils. Also included are small areas of soils that are very shallow to rock.

Most of this Gilmore soil is wooded. If this soil is cleared, it is suitable for pasture, hay, and crops that need shallow tillage. Management group 15 (IVe-2).

Gilmore silt loam, strongly sloping (12 to 20 percent slopes) (GmD).—This soil is on hills and ridges. Slopes face south and are fairly long. In places the areas are dissected by many small drainageways. This soil generally is next to areas of other Gilmore soils and of Steese soils.

Runoff is medium to rapid on this soil if it is cleared. The hazard of erosion is severe.

Included with this soil in mapping are a few rock outcrops and many small spots of soils that are less than 10 inches deep over bedrock. Also included are Gilmore soils that are steep and small tracts of Steese soils.

Most of this Gilmore soil is wooded and is used as wildlife habitat. If this soil is cleared, it is suitable for perennial grasses for hay or pasture. Management group 15 (IVe-2).

Gilmore silt loam, steep (30 to 45 percent slopes) (GmF).—This soil occupies scattered areas on high hills and ridges.

Runoff is very rapid on this soil if it is cleared. The hazard of water erosion is very severe.

Included with this soil in mapping are a few rock outcrops. Also included are patches of Gilmore soils that are very shallow.

Most of this Gilmore soil is wooded and is used as wildlife habitat. It is too steep for cultivation or for improved pasture. Management group 23 (VIIe-1).

Gilmore silt loam, very shallow, steep (30 to 45 percent slopes) (GrF).—Some areas of this soil are on hillsides, and others are on bluffs that rise abruptly from stream and river valleys. Depth to bedrock is less than 10 inches and the mantle of silt loam ranges from 5 to 10 inches in thickness over schist, but the profile otherwise is like that described as representative of the series.

Runoff is very rapid on this soil if it is cleared. The hazard of water erosion is very severe.

Included with this soil in mapping are patches of bare rock.

Most of this Gilmore soil is wooded and is used as wildlife habitat. It is too steep and droughty for cultivated crops or for improved pasture. Management group 23 (VIIe-1).

Goldstream Series

In the Goldstream series are nearly level to gently sloping, poorly drained silt loams that have a perennially frozen substratum. These soils are on broad alluvial plains and valley bottoms. The vegetation consists of low shrubs, mosses, and sedge tussocks that are about 12 to 18 inches in diameter and as much as 18 inches in height. Elevation ranges from 600 to 1,200 feet. On the average, annual air temperature is 25° F. and annual precipitation is 13 inches. The frost-free season is 108 days.

In a representative profile a dark-brown and black mat of moss, roots, and partly decomposed organic matter, about 7 inches thick, overlies a surface layer of black silt loam about 4 inches thick. The underlying material is dark-gray silt loam that contains brown to dark reddish-brown mottles.

Goldstream soils are mainly near Lemeta, Minto, Saulich, and Tanana soils. Goldstream soils are silty, and Lemeta soils consist of deep peat that is perennially frozen at a depth of 15 to 30 inches. Goldstream soils are similar to Minto and Saulich soils, but Minto soils are dark grayish brown and generally are underlain by deeply buried discontinuous masses of ice, rather than continuous permafrost. Goldstream soils have a thicker surface mat than Tanana soils and are shallower to permafrost. They are more strongly acid than Saulich soils.

Goldstream soils are used mainly as wildlife habitat. If these soils are adequately drained, they are suitable for hay, pasture, and a few cultivated crops.

Goldstream silt loam, nearly level (0 to 3 percent slopes) (GtA).—This soil has the profile described as representative of the series. It occupies broad flats on alluvial plains.

Representative profile (NW¼NW¼ sec. 9, T. 5 S., R. 4 E.):

01—7 to 3 inches, dark-brown (7 5YR 3/2) mat of moss, roots, and decomposing organic matter; extremely acid; clear, smooth boundary.

02—3 inches to 0, black (5Y 2/2) very finely divided organic matter; a few coarse sedge leaves; very strongly acid; clear, smooth boundary.

A1—0 to 4 inches, black (5Y 2/2) silt loam; massive; friable; many roots; very strongly acid; abrupt, wavy boundary.

C1g—4 to 11 inches, dark-gray (5Y 4/1) silt loam; common, medium, distinct brown (10YR 4/3) mottles that have a diffuse boundary; weak, very thin, platy structure, friable; a few roots; strongly acid, clear, smooth boundary

C2g—11 to 27 inches, dark-gray (5Y 4/1) silt loam that contains streaks of black (5Y 2/1); many coarse, prominent, dark reddish-brown (5YR 3/3) mottles that have a diffuse boundary, weak, very thin, platy structure; friable; frozen below a depth of 17 inches late in summer; strongly acid

The surface mat of organic litter ranges from about 5 to 10 inches in thickness. Reaction ranges from extremely acid to very strongly acid in the surface mat and from very strongly acid to strongly acid below the mat, but it generally is less acid with depth In places thin lenses of fine sand are in the C horizon. Depth to perennially frozen soil ranges from 10 to 24 inches

Permeability is moderate in the silty sediment, but it is restricted by permafrost. On uncleared areas the zone above the permafrost is always wet. Runoff is very slow, and the hazard of erosion is slight.

Included with this soil in mapping are a few small ponds and spots of Lemeta peat. Also included are small tracts of Tanana soils and a few patches of Bradway soils.

Most of the vegetation on this Goldstream soil is used as wildlife habitat. If the cover of moss is removed and the soil is adequately drained, the areas are suitable for growing hardy vegetables that mature early, for hay and pasture plants, and for oats and barley for forage. Management group 17 (IVw–1).

Goldstream silt loam, gently sloping (3 to 7 percent slopes) (GtB).—This soil occupies scattered areas on valley bottoms and alluvial fans.

If this soil is cleared, runoff is slow to medium. The hazard of erosion is moderate.

Included with this soil in mapping are patches of Saulich and Minto soils and soils on nearby foot slopes. Also included are a few sandy natural levees along small streams.

All of this Goldstream soil supports native vegetation that is used mainly as wildlife habitat. If the surface mat is removed and the soil is artificially drained, the areas are suitable for growing hardy vegetables that mature early, for perennnial grasses, and for oats and barley for forage. Management group 18 (IVw–2).

Goldstream Series, Gravelly Subsoil Variant

The Goldstream, gravelly subsoil variants, consist of nearly level, poorly drained soils. These soils are on low terraces that are slightly above flood plains. The vegetation consists of black spruce and of a dense ground cover of mosses and low shrubs. Elevation ranges from about 700 to 800 feet. On the average, annual air temperature is 25° F. and annual precipitation is 13 inches. The frost-free season is 108 days.

In a representative profile a very dark gray mat of partly decomposed moss, twigs, and leaves, about 5 inches thick, overlies a surface layer of black silt loam, about 6 inches thick, that contains patches of very dark brown. The underlying material is mottled dark grayish-brown gravelly sandy loam and olive-gray very gravelly sand that extends to a depth of more than 38 inches.

The principal associated soils are in the Beales and Nenana series. The Goldstream, gravelly subsoil variants, are similar in texture of the surface layer to the somewhat excessively drained Beales soils, but their substratum is gravelly sand and that of Beales soils is fine sand. The Goldstream, gravelly subsoil variants, lack the dark yellowish-brown silt loam subsoil typical of the well-drained Nenana soils.

The Goldstream, gravelly subsoil variants, are used mainly as wildlife habitat. If these soils are adequately drained, they are suitable for a few cultivated crops and for hay and pasture.

Goldstream silt loam, gravelly subsoil variant, nearly level (0 to 3 percent slopes) (GuA).—This is the only Goldstream, gravelly subsoil variant mapped in the survey area. It occupies a few low terraces that are slightly above flood plains.

Representative profile (NW¼NW¼ sec. 16, T. 10 S., R. 12 E.):

01—5 inches to 0, very dark gray (10YR 3/1) mat of partly decomposed moss, twigs, and leaves that have thin coatings of gray silt; a few pockets of gray silt; many fine roots; extremely acid; clear, smooth boundary.

A1—0 to 6 inches, black (10YR 2/1) silt loam that contains many large very dark brown (10YR 2/2) patches; very weak, medium, platy structure; very friable; common roots; micaceous; many rounded pebbles in lower part of horizon; very strongly acid; abrupt, irregular boundary

IIC1—6 to 27 inches, dark grayish-brown (10YR 4/2) gravelly sandy loam; common, medium, faint, olive-gray mottles, massive; friable; micaceous; 40 percent of the mass consists of large pockets of patchy black (10YR 2/1) and very dark grayish-brown (10YR 3/2) silt loam; a few, fine, distinct, reddish-brown mottles; weak, thin, platy structure; friable; a few roots; micaceous; many rounded pebbles and stones; strongly acid; clear, smooth boundary

IIIC2—27 to 38 inches, olive-gray (5Y 4/2) very gravelly sand; single grain; loose; micaceous; many subrounded cobblestones and other stones; strongly acid.

The C horizon consists of varying quantities of roughly stratified silty and sandy material that is 20 to 40 percent rounded pebbles and includes a few cobblestones.

Permeability is moderate in the silt loam and very rapid in the gravelly sand. The water table generally is at a depth of 2 feet early in summer, but it is much deeper late in summer. Runoff is very slow, and the hazard of water erosion is slight.

Included with this soil in mapping are shallow gravelly spots. Also included are small areas of stones that interfere with deep tillage if the soil is cultivated.

This soil is used mainly as wildlife habitat. If this soil is cleared and adequately drained, it is suitable for growing hardy vegetables that mature early, for perennial grasses, and for oats and barley for forage. Management group 17 (IVw–1).

Gravel Pits

Gravel pits (Gv) consists of excavations along flood plains of the Tanana River and on outwash plains southeast of Delta Junction. On flood plains these pits commonly are at a depth of several feet below the normal water table, and they are ponded during most of the summer. On outwash plains these pits generally are at a depth of about 10 to 20 feet, and they seldom are ponded.

The bottoms of most Gravel pits are almost barren of vegetation, but the edges generally are under a cover of alder, aspen sprouts, brushy willow, and young paper birch. These areas generally are not suitable for pasture or for trees. In places, however, the vegetation provides excellent browse and cover for various kinds of wildlife. Areas of Gravel pits smaller than 5 acres are indicated on the detailed soil map by the conventional symbol for gravel pits. Management group 26 (VIIIs–1).

Jarvis Series

In the Jarvis series are nearly level, well-drained very fine sandy loams. These soils are on alluvial plains and low terraces along the major streams of the Area. The vegetation is dominantly paper birch and white spruce, but a few stands of cottonwood (balsam poplar) grow in places. Elevation ranges from 600 to 1,200 feet. On the average, annual air temperature is 25° F. and annual precipitation is about 12 inches. The frost-free season is about 108 days.

In a representative profile (fig. 3) a dark reddish-brown mat of partly decomposed moss, leaves, and twigs overlies a surface layer of very dark grayish-brown silt loam and dark grayish-brown very fine sandy loam. The silt loam contains streaks of dark brown, and the very fine sandy loam contains streaks of dark yellowish brown. Below is grayish-brown and olive-gray very fine sand, about 19 inches thick, that contains thin lenses of silt. At a depth of 26 to 40 inches is very gravelly coarse sand that contains many rounded pebbles and cobblestones.

The principal associated soils are the Bradway, Chena, and Salchaket soils. Jarvis soils lack the permafrost that is in the poorly drained Bradway soils at a moderate depth. They are deeper over very gravelly sand than Chena soils and shallower to very gravelly sand than Salchaket soils. Chena soils are less than 10 inches deep over very gravelly sand, and Salchaket soils are more than 40 inches deep over very gravelly sand.

Most areas of Jarvis soils are wooded. A few areas are used for pasture, hay, and cultivated crops.

Jarvis very fine sandy loam, moderately deep (0 to 3 percent slopes) (Ja).—This soil has the profile described as representative of the series. It is on alluvial plains and low terraces along the Tanana and Salcha Rivers.

Representative profile (SW¼NW¼ sec. 19, T. 5 S., R. 5 E.):

O11—5 to 3 inches, mat of undecomposed moss, leaves, and twigs

O12—3 inches to 0, dark reddish-brown (5Y 2/2) mat of decomposing moss, leaves, and twigs; many fine roots; abrupt, smooth boundary.

A1—0 to 2 inches, very dark grayish-brown (10YR 3/2) silt loam that contains streaks of dark brown (10YR 3/3); weak, very fine, granular structure; very friable; many fine roots; strongly acid; clear, wavy boundary.

AC—2 to 7 inches, dark grayish-brown (10YR 4/2) very fine sandy loam that contains streaks of dark yellowish brown (10YR 3/4); weak, very thin, platy structure; very friable; micaceous; common roots; strongly acid; gradual boundary.

C1—7 to 17 inches, grayish-brown (2.5Y 5/2) very fine sand; a few dark yellowish-brown (10YR 4/4) patches; weak, thin, platy structure; very friable; a few thin lenses of gray silt from 1/16 to ¼ inch thick; micaceous; a few roots; medium acid; clear, smooth boundary.

C2—17 to 26 inches, olive-gray (5Y 5/2) very fine sand; weak, thin, platy structure; very friable; thin lenses of gray (5Y 5/1) silt make up about 30 percent of mass, by volume; micaceous; slightly acid; clear, smooth boundary.

IIC3—26 to 40 inches, very gravelly coarse sand; loose; rounded pebbles; slightly acid.

The layered sediment ranges from 20 to 40 inches in thickness over very gravelly coarse sand. The A horizon ranges from strongly acid to medium acid in reaction, and the C horizon ranges from medium acid to slightly acid

Permeability is moderate in the silt loam, moderately rapid in the very fine sand, and rapid in the very gravelly substratum. Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate. Streambank erosion and occasional flooding are hazards in a few places that are next to rivers.

In places areas of this soil are scarred by narrow abandoned stream channels that are a foot or two lower in elevation than this soil. In most places these channels can be leveled to avoid irregular boundaries in farm fields. Included with this soil in mapping are a few areas of Bradway soils in abandoned stream channels. Also included are a few spots that are shallow to gravel and small tracts of Salchaket and Tanana soils.

Most of this Jarvis soil is wooded and is used as wildlife habitat. A few areas, however, are used for improved pasture and for cultivated crops. The principal crops are hardy vegetables, perennial grasses, barley, oats, and potatoes. Management group 5 (IIs–1).

Jarvis very fine sandy loam, shallow (0 to 3 percent slopes) (Js).—This soil occupies a few scattered tracts on

Figure 3.—**Profile of Jarvis very fine sandy loam, moderately deep.**

broad alluvial plains along the Salcha and Tanana Rivers. It is 10 to 20 inches deep over coarse very gravelly deposits, but the profile otherwise is similar to that described as representative of the series. Occasional flooding and streambank erosion are hazards in places next to major rivers in the Area.

Included with this soil in mapping are small tracts of Bradway, Chena, and Salchaket soils.

Most of this Jarvis soil is wooded, but a few areas are cultivated. The principal crops are hardy vegetables, potatoes, perennial grasses, oats, and barley. Old abandoned stream channels are likely to interfere with tillage in places. Management group 10 (IIIs–1).

Local Alluvial Land and Peat

Local alluvial land and Peat (0 to 3 percent slopes) (Lo) is in a few small depressions on gravelly moraines. Local alluvial land makes up about 50 percent of the mapping unit, and Peat makes up about 50 percent. Elevation ranges from 1,000 to 1,400 feet. On the average, annual air temperature is 26° F. and annual precipitation is 12 inches. The frost-free season is 108 days.

Local alluvial land consists of moderately deep, somewhat poorly drained, dark silt loam sediment over a substratum of sand and gravel. The sediment is stony in places. Local alluvial land generally occupies a peripheral zone in the depressions and is under a dense cover of grasses.

The coarse brownish peat was derived chiefly from sedges. It generally occurs slightly below Local alluvial land in the middle of the depressions. The material ranges from about 20 to 40 inches in depth over loam or silty clay loam sediment. The sediment is likely to be stony. The peat is perennially frozen below a depth of about 30 inches.

Local alluvial land and Peat is ponded in spring. The peat material remains wet throughout the summer.

Included with this land type in mapping are a few small permanent ponds and spots of gravel. Also included are soils at the edges of depressions that have a surface layer of thick light-gray silty material over a dark reddish-brown, sandy or gravelly, cemented subsoil.

The areas of Local alluvial land and Peat are used for wild hay and pasture and as wildlife habitat. Management group 22 (VIw–2).

Lemeta Series

The Lemeta series consists of nearly level, very poorly drained peats that have a perennially frozen substratum. These soils are in muskegs. The material was derived chiefly from sphagnum moss, but it contains layers of sedge peat. The vegetation generally is dense stands of low shrubs and sedges and scattered black spruce and tamarack. Elevation ranges from 600 to 1,200 feet. On the average, annual air temperature is 26° F. and annual precipitation is 12 inches. The frost-free season is 108 days.

In a representative profile the peat material generally ranges from brown to dark brown. This material extends to a depth of more than 60 inches.

Lemeta soils are mainly near the Goldstream, and Tanana soils. They are similar to the poorly drained Goldstream soils and the somewhat poorly drained Tanana soils in having a perennially frozen substratum.

Areas of Lemeta soils are used mainly as wildlife habitat.

Lemeta peat (0 to 3 percent slopes) (Lp).—This is the only Lemeta soil mapped in the Area. It is in muskegs that generally are next to large tracts of Goldstream, and Tanana soils.

Representative profile (NW¼SE¼ sec. 13, T. 7 S., R. 5 E.):

Oi1—0 to 10 inches, brown (7.5YR 5/4), when moist, to light-brown (7.5YR 6/4), when squeezed dry, fibrous moss peat; contains pockets of dark-brown (7.5YR 3/2) sedge peat; many roots; very strongly acid.

Oi2—10 to 22 inches, dark-brown (7.5YR 4/4 and 3/2), when moist, to strong-brown (7.5YR 5/6), when squeezed dry; fibrous moss peat; many woody particles; many roots; very strongly acid.

Oi3—22 to 60 inches, brown (7.5YR 5/4) frozen fibrous moss peat; large clear lenses of ice.

The water table is always at or near the surface in this soil. Reaction ranges from extremely acid to strongly acid. Depth to permafrost ranges from 15 to 30 inches.

Included with this soil in mapping are a few small ponds. Also included are small areas of Goldstream and Tanana soils.

This Lemeta soil is under a cover of natural vegetation that is used mainly as wildlife habitat. It is not suitable for cultivated crops, and artificial drainage for this purpose is not feasible. Management group 25 (VIIw–2).

Minto Series

In the Minto series are nearly level to strongly sloping, moderately well drained silt loams that generally are underlain by large masses of ice at a depth of 6 feet or more. These soils are on foot slopes of ridges and high hills. The vegetation consists mainly of paper birch, quaking aspen, and white spruce, but black spruce grows in a few places. Elevation ranges from 700 to 1,200 feet. On the average, annual air temperature is 26° F. and annual precipitation is 13 inches. The frost-free season is 108 days.

In a representative profile a very dark brown mat of partly decomposed forest litter, about 3 inches thick, overlies a surface layer of very dark grayish-brown and dark-brown silt loam about 5 inches thick. Below is dark grayish-brown silt loam that contains mottles of yellowish brown and brown to a depth of 40 inches or more.

The principal associated soils are in the Fairbanks, Goldstream, Saulich, and Tanana series. Minto soils lack the brownish subsoil of Fairbanks soils and the permafrost that occurs in the Goldstream, Saulich, and Tanana soils. In addition, the mat on Minto soils is thinner than that on Goldstream and Saulich soils.

Minto soils are used for pasture, hay, and cultivated crops. They are also used as woodland, as wildlife habitat, and for recreational activities.

Minto silt loam, moderately sloping (7 to 12 percent slopes) (MnC).—This soil has the profile described as representative of the series. It is on foot slopes of high ridges and on low hills next to alluvial plains. Slopes generally are smooth and long.

Representative profile (SW¼SW¼ sec. 4, T. 7 S., R. 5 E.):

01—3 inches to 0, very dark brown (10YR 2/2) mat of decomposing organic matter, moss, leaves, twigs, and many roots; very strongly acid; abrupt, smooth boundary.

A11—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam that contains streaks of dark grayish brown; weak, very thin, platy structure; friable, many black charcoal fragments; many fine roots; strongly acid; abrupt, wavy boundary.

A12—3 to 5 inches, patchy dark-brown (10YR 4/3) and dark grayish-brown (2.5Y 4/2) silt loam; common, medium, distinct mottles that have a reddish-brown (5YR 4/4) center that fades to yellowish brown on the exteriors; weak, very thin, platy structure; very friable; a few buried leaves and twigs; many roots; strongly acid; clear, wavy boundary.

AC—5 to 8½ inches, dark grayish-brown (10YR 4/2) silt loam; common, medium, faint, yellowish-brown (10YR 5/4) mottles; weak, very thin, platy structure; very friable; micaceous; a few black charcoal fragments; common roots; strongly acid; clear, wavy boundary.

C1—8½ to 15 inches, dark grayish-brown (2.5Y 4/2) silt loam; common, medium, distinct, brown (7.5YR 5/4) mottles that have a yellowish-red center and a diffuse boundary; weak, thin, platy structure; very friable; micaceous; a few roots; medium acid; gradual boundary.

C2—15 to 40 inches, dark grayish-brown (2.5Y 4/2) silt loam that contains large olive (5Y 4/3) patches; a few medium, distinct, yellowish-brown (10YR 5/6) mottles that have a diffuse boundary; very friable; micaceous; medium acid.

Depth to bedrock ranges from 40 inches to many feet, but it generally is more than 6 feet. Reaction ranges from strongly acid in the A horizon to medium acid or mildly alkaline in the C horizon. In places a few angular rock fragments are in the C horizon.

Permeability is moderate in this soil. Runoff is medium on cleared areas, and the hazard of water erosion is moderate to severe. Cleared areas are susceptible to uneven settling or pitting because of the melting of ice blocks below the surface (fig. 4). In some places uneven settling takes place immediately after clearing, in others it takes

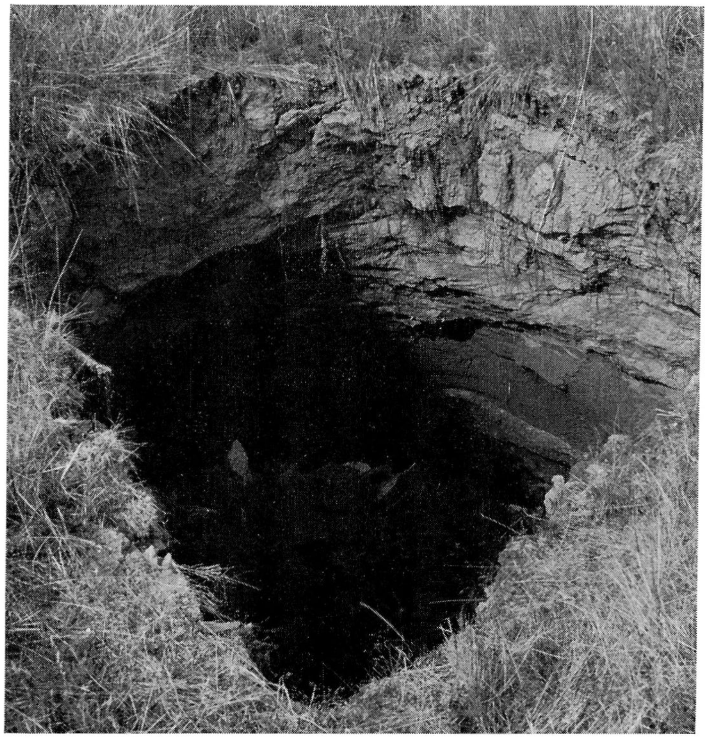

Figure 4.—**This steep-walled pit on a cleared area of Minto silt loam, moderately sloping, was caused by the melting of ice blocks below the surface.**

place many years following clearing, and in still others uneven settling does not occur.

Included with this soil in mapping are a few small tracts of Fairbanks and Saulich soils. Also included are a few areas of steeper soils that have short slopes.

Most of this Minto soil is wooded, but a few areas are cultivated. The principal crops are perennial grasses, oats, barley, potatoes, and hardy vegetables. Many of the areas where uneven settling occurs can be leveled and restored for farming, but in a few places the settling and pitting is severe enough to prevent further cultivation. Management group 7 (IIIe–2).

Minto silt loam, nearly level (0 to 3 percent slopes) (MnA).—This soil is on foot slopes of high ridges. The lower boundary of the areas generally is next to Goldstream and Tanana soils. The upper boundary is next to Fairbanks soils that have steeper south-facing slopes and to Minto soils that occupy higher positions on foot slopes. This soil generally supports a thicker cover of moss and is more highly mottled than Minto silt loam, moderately sloping, but the profile otherwise is similar.

Runoff is slow on this soil. The hazard of water erosion is slight.

Included with this soil in mapping are small tracts of Fairbanks, Goldstream, Saulich, and Tanana soils.

Most of this Minto soil is wooded, but a few areas are cultivated. Leveling is needed to facilitate cultivation in places where uneven settling or pitting has taken place. The principal crops are hardy vegetables, potatoes, perennial grasses, barley, and oats. Management group 2 (IIc–2).

Minto silt loam, gently sloping (3 to 7 percent slopes) (MnB).—Some areas of this soil are on moderately long foot slopes on uplands, and others are on low isolated hills next to flood plains.

Runoff is slow on uncleared areas and slow to medium on cleared areas. The hazard of water erosion is moderate. Cleared areas are susceptible to uneven settling or pitting because of the melting of ice blocks below the surface.

Included with this soil in mapping are a few small areas of Goldstream soils along drainageways. Also included are patches of Fairbanks, Saulich, and Tanana soils.

Most of this Minto soil is wooded, but a few areas are cultivated. Leveling is needed to facilitate cultivation in places where uneven settling has taken place. The principal crops are hardy vegetables, potatoes, perennial grasses, barley, and oats. Management group 4 (IIe–2).

Minto silt loam, strongly sloping (12 to 20 percent slopes) (MnD).—This soil is in a few scattered areas on foot slopes of high ridges.

Runoff is medium to rapid on cleared areas. The hazard of water erosion is severe.

Included with this soil in mapping are a few areas of soils that are moderately sloping. Also included are small tracts of Fairbanks, Saulich, and Steese soils.

Most of this Minto soil is wooded, but a few areas are used mainly for crops. The principal crops are perennial grasses for hay and pasture. Management group 14 (IVe–1).

Nenana Series

In the Nenana series are nearly level to strongly sloping, well-drained silt loams that are underlain by very gravelly sand or deep fine sand. Some areas of these soils are on broad outwash plains east of the Delta River, others are on gravelly moraines bordering outwash plains, and still others are on stabilized dunes. The vegetation consists mainly of paper birch, quaking aspen, and white spruce. Elevation ranges from 700 to 1,400 feet. On the average, annual air temperature is 26° F. and annual precipitation is 12 inches. The frost-free season is 108 days.

In a representative profile a black mat of partly decomposed organic matter, about 2 inches thick, overlies a surface layer of dark-brown silt loam about 7 inches thick. The subsoil is dark yellowish-brown and grayish-brown silt loam about 13 inches thick. The underlying material is very gravelly sand to a depth of more than 40 inches.

Nenana soils generally are near Beales, Chena, and Volkmar soils. Nenana soils are deeper over underlying material than the Beales and Chena soils. Beales soils have less than 10 inches of silt loam over deep sand, and Chena soils have less than 10 inches of silt loam over very gravelly sand. Volkmar soils contain mottles, which are lacking in the upper part of Nenana soils.

Most of the acreage of Nenana soils is wooded, but a few areas are used for cultivated crops, pasture, and hay. The wooded areas are used mainly as wildlife habitat, though a few areas are used as woodland and for recreation.

Nenana silt loam, nearly level (0 to 3 percent slopes) (NaA).—This soil has the profile described as representative of the series. It is on broad outwash plains east of the Delta River.

Representative profile (SW¼SW¼ sec. 13, T. 10 S., R. 11 E.):

O1—2½ inches to 0, black (10YR 2/1) mat of decomposing organic matter and charcoal; many fine roots, abrupt, smooth boundary

A1—0 to 3 inches, dark-brown (10YR 3/3) silt loam; weak, very fine, subangular blocky structure; very friable; micaceous; many fine roots; charcoal fragments; strongly acid; clear, wavy boundary.

A2—3 to 7 inches, dark-brown (10YR 4/3) silt loam; moderate, very thin, platy structure; very friable; micaceous; many fine roots; many fine pores; a few charcoal fragments; strongly acid, clear, wavy boundary

B21—7 to 9 inches, dark yellowish-brown (10YR 4/4) silt loam that contains broad horizontal streaks and patches of dark brown (7.5YR 4/4); moderate, very thin, platy structure; very friable; micaceous; common fine roots, many fine pores; strongly acid: clear, wavy boundary.

B22—9 to 13 inches, dark yellowish-brown (10YR 4/4) silt loam that contains streaks of brown (10YR 5/3); moderate, very thin, platy structure; very friable; micaceous; common fine roots; strongly acid; clear, wavy boundary.

B3—13 to 20 inches, grayish-brown (10YR 5/2) micaceous silt loam; common, medium, distinct mottles of dark yellowish brown (10YR 4/4); moderate, very thin, platy structure; very friable; micaceous; common fine roots; many fine pores; strongly acid; clear, wavy boundary.

IIC—20 to 40 inches, very gravelly sand; single grain; loose; medium acid; rounded pebbles

The mantle of silty material generally ranges from about 18 to 20 inches in thickness, but where it is over very gravelly sand it ranges from 12 to 24 inches in thickness. Reaction generally is strongly acid in the A and B horizons, but it ranges from medium acid to neutral in the C horizon.

Permeability is moderate in the silt loam and very rapid in the very gravelly substratum. Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate to severe.

Included with this soil in mapping are small tracts of Beales, Chena, and Volkmar soils.

Most of this Nenana soil is wooded and is used as wildlife habitat. Many tracts, however, are used for cultivated crops, pasture, and hay. The principal crops are hardy vegetables, potatoes, perennial grasses, oats, and barley. Management group 10 (IIIs–1).

Nenana silt loam, gently sloping (3 to 7 percent slopes) (NaB).—This soil is on low moraines next to outwash plains. Its subsoil is slightly redder than that in the profile described as representative of the series, but otherwise the two profiles are similar.

Runoff is slow to medium on cleared areas. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small tracts of Beales, Chena, and Volkmar soils.

Most of this Nenana soil is wooded, but a few areas are cultivated. The principal crops are hardy vegetables, potatoes, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. Management group 9 (IIIe–4).

Nenana silt loam, moderately sloping (7 to 12 percent slopes) (NaC).—This soil is on low gravelly moraines. Slopes are short. The subsoil is slightly redder than that in the soil described as representative of the series, but the two profiles otherwise are similar.

Runoff is medium on cleared areas. The hazard of water erosion is moderate to severe, and the hazard of soil blowing is moderate.

Included with this soil in mapping are a few small depressions that are ponded. Also included are small tracts of Beales, Chena, and Volkmar soils.

Most of this Nenana soil is wooded, but a few areas are cultivated. The principal crops are hardy vegetables, potatoes, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. Management group 9 (IIIe–4).

Nenana silt loam, strongly sloping (12 to 20 percent slopes) (NaD).—This soil is on gravelly moraines. Slopes are short and choppy. The subsoil is slightly redder than that in the soil described as representative of the series, but the two profiles otherwise are similar.

Runoff is medium to rapid if this soil is cleared. The hazard of water erosion is severe, and the hazard of soil blowing is moderate.

Included with this soil in mapping are patches of Chena soils and a few small depressions that are ponded.

Most of this Nenana soil is wooded and is used as wildlife habitat. If this soil is cleared, it is suitable for perennial grasses and a few grain crops. Management group 15 (IVe–2).

Nenana silt loam, sandy subsoil, nearly level (0 to 3 percent slopes) (NeA).—This soil is on dunes next to alluvial plains and outwash plains. The underlying material is fine sand, but the profile otherwise is similar to that of the soil described as representative of the series. The silty material generally is about 20 inches in thickness, but it ranges from 15 to 25 inches in thickness over deep fine sand.

Permeability is rapid in the fine sand. The hazard of soil blowing is moderate.

Included with this soil in mapping are small tracts of Volkmar soils. Also included are a few areas of Beales soils on sandy knolls.

Most of this Nenana soil is wooded, but a few areas are cultivated. The principal crops are hardy vegetables, potatoes, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. Management group 10 (IIIs–1).

Nenana silt loam, sandy subsoil, undulating (3 to 7 percent slopes) (NeB).—This soil occupies a few areas on outwash plains that generally are next to stabilized dunes and flood plains of former glacial rivers. Slopes generally are short and irregular. This soil has the profile described as representative of the series, except that it is underlain by fine sand. Depth to fine sand is about 18 inches, but it ranges from 10 to 30 inches within short distances.

Permeability is rapid in the fine sand. Runoff is slow to medium on cleared areas. The hazards of water erosion and soil blowing are moderate.

Included with this soil in mapping are small tracts of Beales soils on sandy knolls. Also included are small tracts of a moderately steep soil that has short slopes.

Most of this Nenana soil is wooded, but a few areas are cultivated. The principal crops are hardy vegetables, potatoes, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. Management group 9 (IIIe–4).

Nenana silt loam, sandy subsoil, rolling (7 to 12 percent slopes) (NeC).—This soil is on stabilized dunes on outwash plains next to former flood plains. Slopes are short and choppy. This soil has the profile described as representative of the series, except that it is underlain by fine sand. Depth to the fine sand is about 10 to 25 inches.

Permeability is rapid in the fine sand. Runoff is medium on cleared areas. The hazard of water erosion is moderate to severe, and the hazard of soil blowing is moderate.

Included with this soil in mapping are a few areas of Beales soils on sandy knolls. Also included are a few small depressions that are somewhat poorly drained.

Most of this Nenana soil is wooded, though a few areas are cultivated. The principal crops are hardy vegetables, potatoes, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. Management group 9 (IIIe-4).

Richardson Series

The Richardson series consists of nearly level, moderately well drained silt loams. These soils are on outwash plains and low terraces east of the Delta River. The vegetation commonly is paper birch and white spruce, but black spruce grows in places. Elevation ranges from about 1,000 to 1,400 feet. On the average, annual air temperature is 25° F. and annual precipitation is 12 inches. The frost-free season is 108 days.

In a representative profile a very dark brown mat of partly decomposed roots, moss, and other forest litter, about 4 inches thick, overlies a surface layer of very dark grayish-brown silt loam, about 3 inches thick, that contains brown mottles. The subsoil is dark yellowish-brown and olive-brown silt loam that contains streaks of grayish brown and gray. The underlying material, at a depth of about 10 inches, is dark-gray silt loam that contains streaks of olive-brown. Loose very gravelly coarse sand is at a depth of about 48 inches.

Richardson soils generally are near Nenana and Volkmar soils. Richardson soils are deeper to underlying gravelly material than Nenana and Volkmar soils. Nenana soils have about 20 inches of silt loam over very gravelly sand. Volkmar soils have about 20 inches of mottled silt loam over very gravelly sand or fine sand.

Richardson soils are used for cultivated crops, pasture, and hay and as woodland and wildlife habitat.

Richardson silt loam, nearly level (0 to 3 percent slopes) (RcA).—This is the only Richardson soil mapped in the survey area. It is on outwash plains and terraces. Slopes are smooth, and the soils are very gently undulating.

Representative profile (SW¼SW¼ sec. 24, T. 10 S., R. 11 E.):

O1—4 inches to 0, very dark brown (10YR 2/2) mat of partly decomposed moss, leaves, and twigs; abrupt, smooth boundary

A1—0 to 3 inches, very dark grayish-brown (10YR 3/2) silt loam; common, medium, distinct, brown (7.5YR 4/4) mottles; weak, very fine, granular structure; very friable; strongly acid; clear, wavy boundary.

B2—3 to 7 inches, dark yellowish-brown (10YR 4/4) silt loam that contains streaks of dark grayish brown (2.5Y 4/2); weak, very thin, platy structure; very friable; pores in plate faces; strongly acid; gradual boundary.

B3—7 to 10 inches, olive-brown (2.5Y 4/4) silt loam that contains streaks of gray; weak to moderate, very thin, platy structure; very friable; pores in plate faces; strongly acid; gradual boundary.

C1—10 to 48 inches, dark-gray (5Y 4/1) silt loam that contains streaks of olive brown (2.5Y 4/4); weak to moderate, very fine, platy structure; very friable; medium acid; abrupt boundary.

IIC2—48 to 60 inches, very gravelly coarse sand; medium acid

The mantle of silt loam, which contains many flakes of mica, ranges from 40 to 60 inches in thickness over very gravelly material. Reaction is strongly acid to medium acid in the A horizon and strongly acid to slightly acid in the B and C horizons.

Permeability is moderate in the silt loam and very rapid in the very gravelly coarse sand. The moisture in the soil is seldom below the wilting point during the growing season. Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small tracts of Nenana and Volkmar soils. Also included are a few small depressions that are somewhat poorly drained.

Most of this Richardson soil is wooded, but a few areas are cultivated. The principal crops are hardy vegetables, potatoes, and perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. Management group 1 (IIc-1).

Salchaket Series

The Salchaket series consists of nearly level, well-drained soils that formed in medium-textured sediment laid down by water. These soils are on broad alluvial plains next to rivers and streams. The vegetation consists mainly of paper birch, scattered stands of cottonwood (balsam poplar), and white spruce. Elevation ranges from 600 to 1,200 feet. On the average, annual air temperature is 26° F. and annual precipitation is 12 inches. The frost-free season is about 108 days.

In a representative profile a very dark brown mat of partly decomposed moss, roots, and other forest litter, about 3 inches thick, overlies a surface layer of very dark grayish-brown and dark-brown very fine sandy loam about 4 inches thick. The underlying material is dark grayish-brown and grayish-brown very fine sandy loam and fine sandy loam over grayish-brown finely stratified fine sandy loam, silt loam and very fine sand. This material contains streaks of dark yellowish brown and dark brown and olive gray.

Salchaket soils generally are near Bradway, Jarvis, and Tanana soils. They lack the perennially frozen substratum typical of Bradway soils and of the dominantly silty Tanana soils. In addition, Salchaket soils lack the high water table present in Bradway soils. Salchaket soils are deeper to very gravelly sand than Jarvis soils.

Most areas of Salchaket soils are used for cultivated crops, woodland, pasture, and hay, and as wildlife habitat.

Salchaket very fine sandy loam (0 to 3 percent slopes) (Sc).—This is the only Salchaket soil mapped in the survey area. It is on alluvial plains next to rivers and large streams.

Representative profile (SW¼NW¼ sec. 18, T. 9 S., R. 10 E.):

O1—3 inches to 0, very dark brown (10YR 2/2) mat of partly decomposed moss, twigs, and leaves; many fine roots; mycelia; very strongly acid; abrupt, wavy boundary.

A11—0 to 1½ inches, very dark grayish-brown (10YR 3/2) very fine sandy loam; weak, fine, granular structure; very friable; many roots; strongly acid; abrupt, wavy boundary.
A12—1½ to 4 inches, dark-brown (10YR 4/3) and dark grayish-brown (10YR 4/2) very fine sandy loam; weak, fine, granular structure; very friable; common roots; strongly acid; clear, wavy boundary.
C1—4 to 13 inches, dark grayish-brown (2.5Y 4/2) very fine sandy loam; very weak, thin, platy structure; very friable; a few roots; medium acid; gradual boundary.
C2—13 to 16 inches, grayish-brown (2.5Y 5/2) fine sandy loam; a few streaks of dark yellowish brown; very weak, medium, platy structure; very friable; a few thin lenses of silt loam; a few roots; medium acid; clear, smooth boundary.
C3—16 to 40 inches, grayish-brown (2.5Y 5/2) finely stratified fine sandy loam, silt loam, and very fine sand that ranges from ¼ to 2 inches in thickness; streaks of dark brown (10YR 4/3) and olive gray (5Y 4/2); weak, thin, platy structure; very friable; a few roots at a depth of 30 inches; medium acid

Reaction ranges from strongly acid in the A horizon to medium acid and mildly alkaline in the C horizon. The strata in the C horizon vary greatly in thickness and order within short distances. Very gravelly sand occurs at a depth of 40 to 72 inches.

Permeability is moderate in this soil. Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is slight to moderate.

Included with this soil in mapping are patches of Jarvis soils. Also included are long narrow areas of Bradway soils in former stream channels.

Most of this Salchaket soil is wooded and is used as wildlife habitat, but a few areas are cultivated. The principal crops are hardy vegetables, potatoes, perennial grasses, oats, and barley. Management group 1 (IIc–1).

Saulich Series

In the Saulich series are gently sloping to strongly sloping, poorly drained silt loams on foot slopes of high hills and ridges. These soils have long slopes that face north. They are perennially frozen at a depth of 10 to 20 inches below the surface mat of moss. The vegetation commonly is black spruce, scattered clumps of alder, and willow brush. Elevation ranges from about 900 to 1,800 feet. On the average, annual air temperature is 26° F. and annual precipitation is about 13 inches. The frost-free season is about 108 days.

In a representative profile a mat of undecomposed sphagnum moss and roots and dark reddish-brown decomposing moss, about 10 inches thick, overlies a surface layer of very dark grayish-brown and dark grayish-brown silt loam about 8 inches thick. The underlying material is dark-gray silt loam that contains patches of olive gray and a few dark yellowish-brown mottles.

Saulich soils generally are near Ester, Goldstream, and Minto soils. They are deeper over bedrock than Ester soils, where bedrock is at a depth of less than 20 inches, and they have a thicker surface mat of organic matter than the moderately well drained Minto soils. Goldstream soils generally are strongly acid throughout the profile.

The areas of Saulich soils are used mainly as wildlife habitat.

Saulich silt loam, moderately sloping (7 to 12 percent slopes) (SuC).—This soil has the profile described as representative of the series. It is on foot slopes of high hills and ridges and has long slopes that face north.

Representative profile (NE¼SW¼ sec. 14, T. 7 S., R. 6 E.):

O11—10 to 4 inches, mat of undecomposed sphagnum moss and roots; clear, smooth boundary.
O12—4 inches to 0, dark reddish-brown (5YR 2/2) mat of decomposing moss; many charcoal fragments, twigs, and roots; very strongly acid; abrupt, smooth boundary.
A1—0 to 3 inches, very dark grayish-brown (2.5Y 3/2) silt loam that contains streaks of black (10YR 2/1) and very dark brown (10YR 2/2); very weak, thin, platy structure; very friable; micaceous; common roots; strongly acid; clear, wavy boundary.
AC—3 to 8 inches, dark grayish-brown (2.5Y 4/2) silt loam that contains common, medium, distinct, dark-brown (7.5YR 4/4) mottles and streaks of olive brown (2.5Y 4/4); weak to moderate, thin, platy structure; friable; micaceous; a few roots; slightly acid; gradual boundary.
Cg—8 to 28 inches, dark-gray (5Y 4/1) silt loam that contains patches of olive gray (5Y 4/2) and a few, medium, distinct dark yellowish-brown (10YR 4/4) mottles; weak, thin, platy structure; friable; micaceous; a few angular rock fragments below a depth of 18 inches; frozen below a depth of 16 inches; many clear ice lenses; slightly acid.

The mantle of silt loam ranges from 40 inches to many feet thick over bedrock. Depth to permafrost ranges from 10 to 20 inches below the thick surface mat of moss, but the soil thaws to a greater depth if the moss cover is removed. Reaction ranges from strongly acid in the A horizon to medium acid or slightly acid in the C horizon. Below a depth of 18 inches, the soil generally contains a few partly weathered rock fragments.

Permeability is moderate in the silty material, but it is restricted by permafrost. Runoff is slow, but it would be medium if this soil were cleared. The hazard of water erosion is moderate to severe. This soil remains wet throughout the growing season.

Included with this soil in mapping are small tracts of Goldstream and Minto soils. Also included are small areas of Saulich silt loam, strongly sloping.

This Saulich soil is wooded and is used as wildlife habitat. If this soil were cleared and artificially drained, it would be suitable for growing grasses and small grains for forage. Management group 18 (IVw–2).

Saulich silt loam, gently sloping (3 to 7 percent slopes) (SuB).—This soil occupies scattered areas on foot slopes of high ridges. Slopes are long and face north.

Runoff would be slow to medium if this soil were cleared. The hazard of water erosion is moderate.

Included with this soil in mapping are small tracts of Goldstream and Minto soils. Also included are small areas of Saulich soils, moderately sloping.

This Saulich soil is wooded and is used as wildlife habitat. If it were cleared and artificially drained, however, it would be suitable for growing perennial grasses and small grains for forage. Management group 18 (IVw–2).

Saulich silt loam, strongly sloping (12 to 20 percent slopes) (SuD).—This soil is on foot slopes of high ridges. Slopes face north.

If the vegetation were removed, runoff would be medium to rapid on this soil. The hazard of water erosion would be severe.

Included with this soil in mapping are patches of Ester and Minto soils. Also included are a few areas of Saulich soils, moderately sloping.

This Saulich soil is under a cover of vegetation and is used mainly as wildlife habitat. In places the vegetation is suitable for limited grazing. Management group 21 (VIw–1).

Steese Series

In the Steese series are moderately sloping to steep, well-drained silt loams that are underlain by bedrock. These soils are on ridges and hillsides and have slopes that face south. The vegetation is dominantly paper birch, quaking aspen, and white spruce. Elevation ranges from about 800 to 1,900 feet. On the average, annual air temperature is 26° F. and annual precipitation is 13 inches. The frost-free season is about 108 days.

In a representative profile a dark reddish-brown mat of decomposing organic matter and roots, about 2 inches thick, overlies a surface layer of dark-brown and brown silt loam about 4 inches thick. The subsoil is dark yellowish-brown and olive-brown silt loam about 15 inches thick. The underlying material, at a depth between about 19 and 22 inches, is olive silt loam. Shattered schist bedrock extends to a depth of about 28 inches, where it grades to solid rock.

Steese soils generally are near Ester, Fairbanks, and Gilmore soils. They are deeper over bedrock than Ester and Gilmore soils, but they are shallower to bedrock than Fairbanks soils. Bedrock is at a depth of less than 20 inches in Ester and Gilmore soils and at a depth of more than 40 inches in Fairbanks soils. Also, Steese soils have a thinner surface mat of organic matter than Ester soils, and they lack the perennially frozen substratum of those soils.

Areas of Steese soils are suitable for cultivated crops, pasture, hay, woodland, wildlife habitat, and recreational activities.

Steese silt loam, moderately sloping (7 to 12 percent slopes) (SvC).—This soil has the profile described as representative of the series. It is on hillsides and broad ridgetops.

Representative profile (NW¼SE¼ sec. 12, T. 6 S., R. 4 E.):

O1—2 inches to 0, dark reddish-brown (5YR 2/2) mat of decomposing organic matter; many roots; abrupt, wavy boundary.

A1—0 to 2 inches, dark-brown (10YR 3/3) silt loam; weak, fine, granular structure; very friable; common roots, micaceous; strongly acid; clear, wavy boundary.

A2—2 to 4 inches, brown (10YR 4/3) silt loam; large streaks and patches of yellowish brown (10YR 5/4); weak, thin, platy structure; very friable; common roots; micaceous, medium acid; clear, wavy boundary.

B2—4 to 11 inches, dark yellowish-brown (10YR 3/4) silt loam; a few streaks of dark brown (7.5YR 4/4); weak, thin, platy structure; very friable; common roots; micaceous; medium acid; gradual boundary.

B3—11 to 19 inches, olive-brown (2.5Y 4/4) silt loam; patches of dark grayish brown (2.5Y 4/2); moderate, thin, platy structure; very friable; a few roots; micaceous; a few, thin, roughly horizontal, brown (7.5YR 4/4) bands of silty clay loam; medium acid, gradual boundary.

C—19 to 22 inches, olive (5Y 4/3) silt loam; streaks and patches of olive brown; moderate, thin, platy structure; very friable; a few roots; micaceous; medium acid; clear, smooth boundary.

IIR—22 to 28 inches, coarse, sharply angular undisplaced fragments of shattered schist that are coated with olive (5Y 5/3) silt loam; medium acid; grades to solid rock at a depth of 28 inches.

Reaction ranges from strongly acid to medium acid in the A and B horizons, but it is less acid below. The silt loam ranges from 20 to 40 inches thick over shattered partly weathered schist bedrock or solid rock.

Permeability is moderate in this soil. Runoff is medium on cleared areas, and the hazard of water erosion is moderate to severe.

Included with this soil in mapping are a few undulating areas. Also included are patches of Ester, Fairbanks, Gilmore, and Minto soils.

Most areas of this Steese soil are wooded, but a few areas are cultivated. The principal crops are hardy vegetables, potatoes, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. Management group 6 (IIIe–1).

Steese silt loam, strongly sloping (12 to 20 percent slopes) (SvD).—This soil is on high ridges and hillsides on slopes that face south. Runoff is medium to rapid on cleared areas. The hazard of water erosion is severe.

Most areas of this Steese soil are wooded and are used as wildlife habitat. A few areas are cleared and are used mainly for growing perennial grasses for hay or pasture, though oats and barley grow in places. Management group 14 (IVe–1).

Steese silt loam, moderately steep (20 to 30 percent slopes) (SvE).—This soil is on high hills and ridges on slopes that face south. If this soil is cleared, runoff is rapid and the hazard of water erosion is severe.

Included with this soil in mapping are small tracts of Ester, Fairbanks, and Gilmore soils.

This Steese soil is wooded and is used as wildlife habitat. Management group 19 (VIe–1).

Steese silt loam, steep (30 to 45 percent slopes) (SvF).—This soil occupies areas near the top of high ridges. Slopes face south.

If this soil is cleared, runoff is very rapid and the hazard of water erosion is very severe.

Included with this soil in mapping are patches of Ester and Gilmore soils. Also included are a few areas of Steese silt loam, moderately steep.

This Steese soil is wooded and is used as wildlife habitat. Management group 23 (VIIe–1).

Tanana Series

In the Tanana series are nearly level, somewhat poorly drained soils that formed in silty and very fine sandy sediment laid down by water. These soils are on broad low terraces and alluvial plains. Uncleared areas are perennially frozen at a depth of about 30 inches below the surface mat of organic material. The vegetation is dominantly alder, black spruce, scattered clumps of aspen, white spruce, and willow. Elevation ranges from 700 to 1,400 feet. On the average, annual air temperature is 26° F. and annual precipitation is 13 inches. The frost-free season is 108 days.

In a representative profile a mat of fresh and partly decomposed moss, leaves, and twigs, about 3 inches thick, overlies a surface layer of very dark gray and olive-brown silt loam, about 6 inches thick, that contains streaks of dark grayish brown. The underlying material is olive silt loam that contains lenses of very fine sand, streaks of olive brown, and brown mottles.

Tanana soils generally are near Bradway, Goldstream, Minto, and Salchaket soils. Tanana soils are dominantly silty, but Bradway soils are sandy. Goldstream soils have a thicker mat of organic material on the surface, are more acid, and are not so brown as Tanana soils. Continuous permafrost underlies the Tanana soils, but Minto soils are underlain by deeply buried discontinuous masses of ice. Salchaket soils are dominantly sandy loams, and they lack permafrost.

Areas of Tanana soils are used for cultivated crops, hay, and pasture. They are also used as woodland and as wildlife habitat.

Tanana silt loam (0 to 3 percent slopes) (Ta).—This is the only Tanana soil mapped in the Area. It is on broad terraces and alluvial plains.

Representative profile (NW¼NW¼ sec. 36, T. 5 S., R. 4 E.):

O11—3 inches to 1 inch, mat of fresh moss, leaves, and twigs.
O12—1 inch to 0, dark reddish-brown (5YR 2/2) mat of decomposing moss, leaves, and twigs; many charcoal fragments, very strongly acid; abrupt, smooth boundary.
A1—0 to 3 inches, very dark gray (10YR 3/1) silt loam that contains many streaks of dark grayish brown (2.5Y 4/2); weak, fine, granular structure; very friable; micaceous, many roots; medium acid; clear, wavy boundary.
AC—3 to 6 inches, olive-brown (2.5Y 4/4) silt loam that contains many streaks of dark grayish brown (2.5Y 4/2); common, medium, distinct, brown (7.5YR 4/4) mottles; weak, thin, platy structure; very friable; micaceous; a few roots; medium acid; gradual boundary.
Cg—6 to 40 inches, olive (5Y 4/3) silt loam that contains lenses of very fine sand ¼ to 1 inch thick; streaks of olive brown (2.5Y 4/4); a few medium, distinct, brown (7.5YR 4/4) mottles; weak to moderate, thin, platy structure; friable; frozen below a depth of 20 inches in summer; micaceous; a few dark reddish-brown concretions; a few rounded pebbles; a few roots; medium acid.

The texture is dominantly silt loam throughout the profile, but the C horizon contains lenses of very fine sand. In most places the C horizon is underlain by gravel at a depth of 6 to 10 feet. Reaction ranges from strongly acid to medium acid in the A horizon and from medium acid to mildly alkaline in the C horizon. The permafrost table generally is at a depth of 20 to 30 inches below the surface mat of organic material, but the soil thaws to a greater depth if the vegetation is removed.

Permeability is moderate in the unfrozen material. Runoff is slow, and the hazard of water erosion is slight.

Included with this soil in mapping are small tracts of poorly drained Goldstream soils and a few patches of Minto soils.

Most areas of this Tanana soil are wooded, though a few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. On cleared areas the permafrost table recedes to a greater depth than on uncleared areas, which permits moisture to drain downward in the soil. In places artificial drainage is needed to remove excess moisture. Management group 12 (IIIw-1).

Tanana Series, Sandy Subsoil Variant

The Tanana, sandy subsoil variants, consist of nearly level, somewhat poorly drained soils that formed in silty and loamy sediment over fine sand. These soils are in a few shallow depressions and along drainageways on outwash plains. Permafrost, if present, is deeper than 5 feet. The vegetation is dominantly black spruce and a ground cover of moss. Elevation ranges from 1,000 to 1,400 feet. On the average, annual air temperature is 26° F. and annual precipitation is 13 inches. The frost-free season is 108 days.

In a representative profile a dark reddish-brown mat of moss, forest litter, and roots, about 4 inches thick, overlies a surface layer of dark yellowish-brown silt loam, about 3 inches thick, that contains patches of dark brown. The subsoil is dark yellowish-brown and light olive-brown fine sandy loam that contains pockets and lenses of silt loam and gray mottles. Below a depth of 16 inches are patches of yellowish-brown and olive fine sand that contain lenses of silt loam.

Tanana, sandy subsoil variants, generally are near Beales and Volkmar soils. They are similar in texture to the excessively drained Beales soils, but Beales soils lack a permafrost table. Unlike the moderately well drained Volkmar soils, the Tanana, sandy subsoil variants, have a substratum of fine sand rather than of very gravelly coarse sand.

The areas of Tanana, sandy subsoil variants, are used mainly as wildlife habitat. If these soils were cleared, they would be suitable for cultivated crops.

Tanana silt loam, sandy subsoil variant (0 to 3 percent slopes) (Tn).—This is the only Tanana, sandy subsoil variant, mapped in the Area. It is in a few shallow depressions and along drainageways on outwash plains.

Representative profile (NE¼SE¼ sec. 26, T. 11 S., R. 12 E.):

O1—4 inches to 0, dark reddish-brown (5YR 2/2) mat of moss and forest litter; many fine roots, mycelia; clear, wavy boundary.
A1—0 to 3 inches, dark yellowish-brown (10YR 3/4) silt loam; many patches of dark brown (10YR 4/3 and 7.5YR 3/2); very weak, thin, platy structure; very friable; many fine roots; charcoal fragments; micaceous; strongly acid; clear, wavy boundary.
B—3 to 16 inches, patches of dark yellowish-brown (10YR 4/4) and light olive-brown (2.5Y 5/4) roughly stratified fine sandy loam that contains pockets and thin lenses of silt loam; common, medium, distinct, gray mottles; fine sandy loam has very weak, thin, platy structure and is very friable; silt loam has moderate, thin, platy structure and is friable; a few roots; many fine pores; micaceous; strongly acid; gradual boundary.
C—16 to 40 inches, patches of yellowish-brown (10YR 5/6) and olive (5Y 4/3) fine sand; a few thin lenses of silt loam; single grain; loose and friable; micaceous; strongly acid.

Reaction is strongly acid in the A horizon, but it ranges to medium acid with depth The strata of fine sand and silt in the B horizon vary in number and in thickness.

Permeability is moderate in this soil. Under a cover of moss, this soil thaws very slowly and remains cool and moist throughout the summer. Runoff is very slow, and seepage of moisture from surrounding areas contributes to wetness. The hazard of water erosion is slight.

Included with this soil in mapping are a few soils that have a surface layer of sandy loam. Also included are patches of Volkmar soils and a few areas of soils that are underlain by gravelly material at a depth of 20 to 30 inches.

All of Tanana silt loam, sandy subsoil variant, is under a cover of vegetation and is used mainly as wildlife habitat. If this soil were cleared, it would be suitable for cultivated crops. Management group 13 (IIIw-2).

Volkmar Series

In the Volkmar series are nearly level to gently sloping, moderately well drained silt loams that are underlain by very gravelly sand or by fine sand. These soils are on outwash plains and terraces in the southeastern part of the Area. The vegetation generally is paper birch and white spruce, but black spruce grows in places. Elevation ranges from 1,000 to 1,500 feet. On the average, annual air temperature is 26° F. and annual precipitation is about 13 inches. The frost-free season is 108 days.

In a representative profile a mat of sphagnum moss, about 2 inches thick, overlies a surface layer of very dark brown and very dark grayish-brown silt loam about 2 inches thick. The subsoil is mixed dark grayish-brown and dark-brown silt loam that contains reddish-brown and brown mottles. Below is olive-brown silt loam to a depth of 7 to 17 inches and olive very gravelly coarse sand that extends to a depth of more than 30 inches.

Volkmar soils generally are near Beales, Richardson, and Nenana soils. They have a thicker mantle of silt loam than Beales soils and a thinner mantle of silt loam than Richardson soils. Beales soils have less than 10 inches of silt loam over sand, and Richardson soils have more than 40 inches of silt loam over very gravelly sand. Volkmar soils are mottled throughout the profile, but Nenana soils are mottled only with depth.

Most of the acreage of Volkmar soils is wooded, but a few areas are cultivated.

Volkmar silt loam, nearly level (0 to 3 percent slopes) (VkA).—This soil has the profile described as representative of the series. It occupies broad areas on outwash plains and terraces east of the Delta River. Slopes are smooth to very gently undulating.

Representative profile (SW¼SE¼ sec. 9, T. 10 S., R. 11 E.):

01—2 inches to 0, mat of sphagnum moss.

A11—0 to 1 inch, very dark brown (10YR 2/2) silt loam; weak, very fine, granular structure; friable; common roots; micaceous; very strongly acid; abrupt, smooth boundary.

A12—1 to 2 inches, very dark grayish-brown (2.5Y 3/2) silt loam; very weak, very fine, subangular blocky structure; friable; a few roots; micaceous; very strongly acid; abrupt, smooth boundary.

B2—2 to 7 inches, mixed dark grayish-brown (10YR 4/2) and dark-brown (7.5YR 3/2) silt loam; common, medium, distinct mottles of reddish brown (5YR 4/4), mostly in lower part of horizon; weak, very thin, platy structure; very friable; a few roots; micaceous; strongly acid; clear, wavy boundary.

C1—7 to 17 inches, olive-brown (2.5Y 4/4) silt loam; common, medium, distinct mottles of brown (10YR 5/3); moderate, very thin, platy structure; very friable, a few roots; micaceous; medium acid; abrupt, wavy boundary.

IIC2—17 to 30 inches, olive very gravelly coarse sand; medium acid.

Reaction ranges from very strongly acid in the A horizon to medium acid in the IIC2 horizon. In most places the silt loam ranges from 15 to 20 inches in thickness over very gravelly coarse sand, but in a few places it is as much as 40 inches in thickness.

Permeability is moderate in the silt loam and very rapid in the gravelly sand. Runoff is slow. The hazard of water erosion is slight, and the hazard of soil blowing is moderate.

Included with this soil in mapping are small tracts of Nenana, Richardson, and Tanana soils.

Most of this Volkmar soil is wooded, though large areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. Management group 10 (IIIs-1).

Volkmar silt loam, gently sloping (3 to 7 percent slopes) (VkB).—This soil is on a few low ridges and knolls on outwash plains. Slopes are long.

Runoff is slow to medium on cleared areas. The hazard of water erosion is moderate.

Included with this soil in mapping are small tracts of Beales and Nenana soils.

Most of this Volkmar soil is wooded, but a few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. Management group 9 (IIIe-4).

Volkmar silt loam, sandy subsoil, nearly level (0 to 3 percent slopes) (VmA).—This soil is in small scattered areas that commonly lie between larger areas of other Volkmar soils and stabilized dunes occupied by Beales soils. Except that it has a thicker mantle of silt loam and is underlain by deep fine sand, this soil has a profile similar to that described as representative of the series. Depth to fine sand ranges from 20 to 40 inches. Runoff is slow, and the hazard of water erosion is slight.

Included with this soil in mapping are a few tracts of soils that have short slopes of 3 to 7 percent. Also included are a few small areas of Beales soils.

Most of this Volkmar soil is wooded, but a few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. Management group 1 (IIc-1).

Use and Management of the Soils for Crops and Pasture

This section discusses land clearing, fertilizer needs, and estimated yields of principal crops. Then, the system of capability classification used by the Soil Conservation Service is described, and suggested management by groups of soils, or capability units, is given.

Land Clearing

Most of the soils in the Salcha-Big Delta Area are wooded. If cleared, however, many of these soils are suitable for crops and pasture. Harvesting the merchantable trees for lumber, building logs, fence posts, and other uses before clearing land for crops prevents waste and facilitates clearing. Piling and burning the tree tops and branches left after harvesting permits clearing equipment to be used without difficulty.

The well-drained soils can be cleared at any time of the year except in winter, when deep snows are a hindrance. If the soil is not frozen, roots, brush, and trees that are left after logging can be removed by a bulldozer equipped with a scarifier blade.

If the soil is frozen, brush and trees can be sheared at ground level by a bulldozer equipped with a shearing blade. This method is effective in improving pasture or in clearing light brush and trees from areas not intended for intensive development. In places where trees larger than about 6 inches in diameter are sheared, however, removing stumps and heavy roots is difficult and time consuming. After the soil thaws in spring, stumps and large roots can be moved to windrows by a scarifier blade. Small stumps and roots can be loosened by a large breaking plow or a heavy disk, but this method generally involves the difficult task of removing many roots and other debris by hand before the soil can be tilled. If these materials are left in the soil, they decompose slowly, and the larger pieces are likely to interfere with cultivation for many years.

Freeing roots and stumps of as much soil as possible before pushing them into windrows for burning is important in clearing land in the Area. This practice is especially important where soils are shallow to gravel and stones can interfere with tillage.

The poorly drained soils are underlain by permafrost. Such soils commonly have a thick mat of undecomposed mosses or sedges on the surface. This mat should be removed during clearing because it reduces the effectiveness of fertilizer and keeps the soil from drying. Excess moss and sedge can be turned up in small windrows by using an angle blade or a similar implement. After it has dried, it should be burned in place. If the undecomposed material is piled into large windrows, it dries slowly and is difficult to burn.

After most of the organic matter is removed from soils that are underlain by permafrost, depth to the permafrost table gradually increases. These soils generally are not dry enough to be tilled for about a year after clearing. In some soils the excess moisture perched above the permafrost table must be removed by means of ditches before crops can be grown.

Leaving a strip of vegetation of adequate width and spacing helps to protect the soil from blowing by strong winds.

Keeping windrows and debris intended for burning away from wooded areas and brush helps to prevent fires from spreading.

Fertilizer Requirements

Good growth of crops in the Area depends largely on whether the soils are adequately fertilized. Large amounts of fertilizer that contains nitrogen, phosphorus, and potassium are needed on all of the soils. Nitrogen is especially needed on newly cleared soils because much nitrogen is used by bacteria in decomposing the native organic material.

On the basis of experience and research, the Alaska Agricultural Experiment Station (now the University of Alaska Institute of Agricultural Sciences) *(8)* periodically publishes minimum fertilizer application rates. These rates, provided as a guide for determining needs, are general suggestions and are subject to change.

Under continued cultivation the structure of the soils in the survey area tends to break down. Adding manure or other organic material helps to maintain tilth.

Estimated Yields

Estimated average yields per acre of principal crops grown on soils in the Area are given in table 2. These estimates are averages expected over several years under average management and under improved management.

Practices and conditions under average management include the following: (1) Minimum amounts of fertilizer are applied according to results of occasional soil tests; (2) organic matter is returned to the soil to a limited extent; and (3) conservation practices to control soil blowing and water erosion are applied to a limited extent.

Practices and conditions under improved management include: (1) Fertilizer is applied at rates determined from periodic soil tests; (2) barnyard manure and crop residue are used to help to maintain sufficient organic matter in the soil; and (3) conservation practices are applied where needed to control soil blowing and water erosion. Figure 5 shows the harvesting of potatoes grown under improved management.

Because farming is relatively new in the Salcha-Big Delta Area, sufficient data are not available to establish quantitative differences in the productivity of the soils. Most of the crops are grown on nearly level to gently sloping, moderately deep to deep, moderately well drained and well drained soils. Few crops are grown on the strongly sloping, very shallow, poorly drained soils. It is likely that some of the crops listed in table 2 cannot be grown on these soils and that the yields of most crops will be lower than those estimated in table 2.

In most years the moisture level of the well-drained soils in midsummer generally is lower than the level required for optimum plant growth. Preliminary investigations indicate that yields can be increased by using sprinklers for irrigation, but data on the effect and economic feasibility of extensive irrigation systems are not available.

Abnormal crop seasons, past management, and the possible effect of irrigation are not considered in the yield estimates given in table 2.

Capability Grouping

Capability grouping shows, in a general way, the suitability of soils for most kinds of field crops. The soils are grouped according to their limitations when used for field crops, the risk of damage when they are used, and the way they respond to treatment. The grouping does not take into account major and generally expensive landforming that would change slope, depth, or other characteristics of the soils; does not take into consideration possible but unlikely major reclamation projects; and does not apply to cranberries, horticultural crops, or other crops requiring special management.

Those familiar with the capability classification can infer from it much about the behavior of soils when used for other purposes, but this classification is not a substi-

TABLE 2.—*Estimated average yields per acre of principal crops under two levels of management*

Crop	Average management	Improved management
Potatoes .... tons	6–7	10–12
Barley .... bushels	30–35	50–55
Oats .... bushels	45–50	60–70
Bromegrass hay .... tons	1½–2	2½–3
Bromegrass for silage .... tons	5–6	7–9
Oat-pea for silage .... tons	4–5	8–10

Figure 5.—**Harvesting potatoes on Salchaket very fine sandy loam. Average yields of 10 to 12 tons per acre can be expected on this soil under improved management.**

tute for interpretations designed to show suitability and limitations of groups of soils for range, for forestry, or for engineering.

In the capability system, the kinds of soil are grouped at three levels: the capability class, the subclass, and the unit. These are discussed in the following paragraphs.

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

Class I soils (none in this Area) have few limitations that restrict their use.

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

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

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

Class V soils (none in this Area) are subject to little or no erosion but have other limitations, impractical to remove, that limit their use largely to pasture, range, woodland, or wildlife habitat.

Class VI soils have severe limitations that make them generally unsuited to cultivation and limit their use largely to pasture or range, woodland, or wildlife habitat.

Class VII soils have very severe limitations that make them unsuited to cultivation and that restrict their use largely to pasture or range, woodland, or wildlife habitat.

Class VIII soils and land forms have limitations that preclude their use for commercial plants and restrict their use to recreation, wildlife habitat, or water supply, or to esthetic purposes.

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

In class I there are no subclasses, because the soils of this class have few limitations. Class V can contain, at the most, only the subclasses indicated by *w*, *s*, and *c*, because the soils in class V are subject to little or no erosion, though they have other limitations that restrict their use largely to pasture, range, woodland, wildlife habitat, or recreation.

Capability Units are soil groups within the subclasses. In this survey they are designated management groups. The soils in one capability unit are enough alike to be suited to the same crops and pasture plants, to require similar management, and to have similar productivity and other responses to management. Thus, the capability unit is a convenient grouping for making many statements about management of soils. Capability units are generally designated by adding an Arabic numeral to the subclass symbol, for example, IIe-1 or IIIe-4. Thus, in one symbol, the Roman numeral designates the capability class, or degree of limitation; the small letter indicates the subclass, or kind of limitation, as defined in the foregoing paragraph; and the Arabic numeral specifically identifies the capability unit within each subclass. In this survey the capability unit numbers are in parentheses following the management group numbers.

Management Groups

In the pages that follow, management groups of the Salcha-Big Delta Area are described, and suggestions are given for the use, management, and conservation of the soils in each group. The names of all the soils in any management group can be found in the "Guide to Mapping Units" at the back of this survey. Management group 11 is not described, because it is not represented in the Area.

No specific recommendations are made as to the amounts and kinds of fertilizer needed, the most suitable crop varieties, or the best seeding rates, because these elements change as new developments occur in farming. Current information and recommendations are available from the local Extension Service agent and from the University of Alaska Institute of Agricultural Sciences.

Management group 1 (IIc–1)

This group consists of nearly level silt loams and very fine sandy loams that are well drained and moderately well drained. Permafrost is at a great depth in some of these soils, and in others it is absent.

Permeability is moderate in these soils. Runoff is slow. The hazard of water erosion is slight, and in places the hazard of soil blowing is moderate.

Most of the acreage of these soils is wooded, but a few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. The wooded areas are used mainly as wildlife habitat, though in a few places mature white spruce is harvested to provide saw logs and logs for houses, and paper birch is harvested to provide firewood.

Organic matter is needed to help keep these soils in good tilth and to promote efficient use of moisture and plant nutrients. Returning crop residue to the soil and adding manure regularly are ways of helping to maintain the content of organic matter. Leaving a strip of vegetation at right angles to the prevailing wind on areas cleared for cultivation and including alternate strips of grasses in the cropping system are practices that help to control soil blowing. Most crops on these soils respond well to fertilizer that contains nitrogen, phosphorus, and potassium. In most years crops respond well to supplemental irrigation.

Management group 2 (IIc–2)

Only Minto silt loam, nearly level, is in this group. This moderately well drained soil is on foot slopes of high ridges. It is underlain by large discontinuous masses of ice that melt if the areas are cleared.

Permeability is moderate in this soil. Runoff is slow, and the hazard of water erosion is slight.

Most of the acreage of Minto silt loam, nearly level, is wooded, but a few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses (fig. 6), oats, and barley. In places white spruce and paper birch are harvested for local use.

In places cleared areas of this soil become hummocky and badly pitted because of uneven settling resulting from the melting of masses of ice below the surface. These areas generally can be levelled sufficiently to make them suitable for crops. In places, however, scattered areas that are severely pitted have little or no value for cultivation. Organic matter is needed to help keep this soil in good tilth and to help to control erosion. Returning crop residue to the soil, adding manure, and including grasses in the cropping system are ways of helping to maintain the content of organic matter. Minto silt loam, nearly level, remains moist throughout the growing season, and crops respond well to fertilizer that contains nitrogen, phosphorus, and potassium.

***Figure 6.*—Baling bromegrass hay on Minto silt loam, nearly level. Average annual yields of 2½ to 3 tons per acre of hay can be expected on this soil under improved management.**

Management group 3 (IIe-1)

Only Fairbanks silt loam, gently sloping, is in this group. It is well drained, Permafrost is at a great depth or is absent.

Permeability is moderate in this soil. Runoff is slow to medium on cultivated areas. The hazard of water erosion is moderate.

Most of Fairbanks silt loam, gently sloping, is wooded, but a few areas are cleared and are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. The wooded areas are used mainly as wildlife habitat, but in places trees are harvested to provide saw logs, house logs, and firewood.

Organic matter is needed to help keep this soil in good tilth and to promote efficient use of moisture and plant nutrients. Returning crop residue to the soil and adding manure regularly and including grasses in the cropping system are ways of helping to maintain the content of organic matter. Cultivating and stripcropping on the contour and using grassed waterways are practices that help to control water erosion. Crops respond well to fertilizer that contains nitrogen, phosphorus, and potassium. In most years crops respond to supplemental sprinkler irrigation.

Management group 4 (IIe-2)

Only Minto silt loam, gently sloping, is in this group. It is moderately well drained and is underlain by large discontinuous masses or blocks of ice.

Permeability is moderate in this soil. Runoff is slow to medium on cultivated areas. The hazard of water erosion is moderate.

Most of Minto silt loam, gently sloping, supports stands of trees, but a few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. The trees and other vegetation on wooded areas are used mainly as wildlife habitat, but in places a few white spruce and paper birch are harvested to provide saw logs and firewood.

Cleared areas of this soil are susceptible to uneven settling and pitting caused by the melting of ice masses below the surface. Most of these areas can be reclaimed for crops, but in places scattered areas are so severely pitted that they have little or no value for crops. Sheet and gully erosion are moderate hazards on cleared areas. Cultivating and stripcropping on the contour and keeping natural waterways in sod are ways that help to control water erosion. Crops respond well to fertilizer that contains nitrogen, phosphorus, and potassium. Organic matter is needed to help keep this soil in good tilth, and to promote efficient use of moisture and plant nutrients. Returning crop residue to the soil and adding manure are ways of helping to maintain the content of organic matter. This soil generally remains moist throughout the growing season. In most years it is unlikely that crops will respond significantly to supplemental irrigation.

Management group 5 (IIs-1)

Only Jarvis very fine sandy loam, moderately deep, is in this group. This nearly level, well-drained soil is on alluvial plains. It consists of stratified layers of very fine sandy and silty material. Permafrost is at a greater depth or is absent.

Permeability is moderate in the silt loam, moderately rapid in the very fine sand, and rapid in the very gravelly substratum. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is moderate in this soil in the southeastern part of the Area. In places scattered areas are subject to flooding for short periods, but crops seldom are damaged.

Most areas of this soil are wooded, though a few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. The wooded areas are used chiefly as wildlife habitat, but a few white spruce and paper birch are harvested to provide logs and firewood for local use.

This soil becomes warm early in spring, which lengthens the growing season and makes the soil well suited to vegetables and other crops that need early planting. Organic matter is needed to help keep this soil in good tilth and promote efficient use of moisture and plant nutrients. Returning crop residue to the soil and adding manure regularly are ways of helping to maintain the content of organic matter. Leaving strips of vegetation as windbreaks and growing contour strips of grasses are practices that help to control soil blowing. Crops respond well to fertilizer that contains nitrogen, phosphorus, and potassium. In most years crops respond well to supplemental irrigation.

Management group 6 (IIIe-1)

In this group are moderately sloping, well-drained silt loams. They are on uplands. Permafrost is at a great depth or is absent.

Permeability is moderate in these soils. Runoff is medium. The hazard of water erosion is moderate to severe.

Most of the acreage of these soils is wooded, but a few areas have been cleared and are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. The wooded areas are used mainly as wildlife habitat. In a few places, however, white spruce is harvested to provide logs, and paper birch is harvested to provide fuel.

Cultivated areas are susceptible to sheet and gully erosion. Stripcropping on the contour, keeping natural waterways in sod, and including grasses in the cropping system are ways that help to control erosion. Returning crop residue to the soil and adding manure regularly are practices that help to keep the soil in good tilth. Crops respond well to fertilizer that contains nitrogen, phosphorus, and potassium. In most years crops respond to supplemental irrigation.

Management group 7 (IIIe-2)

Only Minto silt loam, moderately sloping, is in this group. This soil is moderately well drained and is on uplands. It commonly is underlain by large discontinuous masses or blocks of ice that melt if the areas are cleared of vegetation.

Permeability is moderate in this soil. Runoff is medium on cleared areas. The hazard of water erosion is moderate to severe.

Most of the acreage of Minto silt loam, moderately sloping, is wooded, but a few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley.

Stripcropping on the contour, including grasses in the cropping system, and keeping waterways in sod are ways that help to control water erosion on cultivated areas. Cleared areas are likely to become hummocky or pitted because of the melting of ice masses below the surface. These areas generally can be leveled well enough to make them suitable for crops, but in a few places they are likely to be too rough for tillage. Organic matter is needed to keep this soil in good tilth and to promote efficient use of moisture and plant nutrients. Returning crop residue to the soil and adding manure are ways of helping to maintain the content of organic matter. This soil remains moist during the growing season, and crops respond well to fertilizer that contains nitrogen, phosphorus, and potassium. Supplemental irrigation probably is not needed on this soil.

Management group 8 (IIIe-3)

In this group are nearly level and undulating silt loams that are somewhat excessively drained. These soils are on low stabilized dunes. Permafrost is at a great depth or is absent.

Permeability is rapid in this soil. Runoff is slow, and the hazard of water erosion is slight. The hazard of soil blowing is severe.

Most of the acreage of the soils in this group is wooded, but small areas are cleared and are cultivated. The principal crops are barley, oats, and perennial grasses, but a few hardy vegetables are grown.

Leaving strips of natural vegetation around areas cleared for crops, stripcropping, and growing grasses in the cropping system are practices that help to reduce soil blowing on cleared areas. Adding manure, returning crop residue to the soil, and including grasses in the cropping sequence are ways of maintaining the content of organic matter and of promoting efficient use of moisture. The soils in this group warm earlier in spring than finer textured soils. Consequently, planting can be done early in spring, which in effect lengthens the growing season. In most years crops respond to supplemental irrigation.

Management group 9 (IIIe-4)

This group consists of well-drained silt loams that are gently sloping to moderately sloping and undulating to rolling. These soils are on moraines and stabilized dunes.

Permeability is rapid in the silt loam and very rapid in the substratum. Runoff is medium. The hazard of water erosion is moderate to severe, and the hazard of soil blowing is moderate.

Most of the acreage of these soils is under a cover of trees and other native vegetation and is used as wildlife habitat. A few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley.

Leaving strips of vegetation as windbreaks, stripcropping, and including grasses in the cropping system are ways of helping to control wind and water erosion on cultivated areas. Organic matter is needed to help keep these soils in good tilth. Returning crop residue to the soil and adding manure regularly help to maintain the content of organic matter. Crops respond well to fertilizer that contains nitrogen, phosphorus, and potassium. In most years crops respond to supplemental irrigation.

Management group 10 (IIIs-1)

In this group are nearly level, well drained and moderately well drained very fine sandy loams and silt loams. These soils are on alluvial plains and outwash plains. Permafrost is at a great depth or is absent.

Runoff is slow on these soils. The hazard of water erosion is slight, and the hazard of soil blowing is moderate to severe.

Most of the acreage of these soils is wooded, but large areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley.

Organic matter is needed to keep these soils in good tilth and to promote efficient use of moisture and plant nutrients. Returning crop residue to the soil and adding manure are ways that help to maintain the content of organic matter. Leaving a strip of vegetation at right angles to the prevailing wind as a windbreak on areas cleared for cultivation, and including grasses in the cropping system are ways of helping to control soil blowing. In most years crops respond well to supplemental irrigation.

Management group 12 (IIIw-1)

Only Tanana silt loam is in this group. This nearly level, somewhat poorly drained soil is on alluvial plains. It is underlain by permafrost.

Permeability is moderate in this soil. Runoff is slow, and the hazard of water erosion is slight.

Most of Tanana silt loam is wooded, though a few areas are cultivated. The principal crops are potatoes, hardy vegetables, perennial grasses, oats, and barley. The wooded areas are used as wildlife habitat. On uncleared areas the permafrost table generally is at a depth of about 30 inches below the surface mat of organic material, and the soil remains moist throughout the growing season. On cleared areas the permafrost table recedes to a greater depth, and excess moisture drains downward into the soil. After clearing about a year is needed before the soil is dry enough to be cultivated. In places shallow ditches are needed to remove excess water in spring. Plants can then be planted early, thereby reducing the risk of crop damage by frost late in summer. Crops respond well to fertilizer that contains nitrogen, phosphorus, and potassium.

Management group 13 (IIIw-2)

Only Tanana silt loam, sandy subsoil variant, is in this group. This soil is nearly level and poorly drained. Permafrost, if present, is below a depth of 5 feet.

Permeability is moderate in this soil. Runoff is very slow, and the hazard of water erosion is slight.

This soil is under a cover of vegetation that generally consists of a thick ground cover of moss, black spruce, alder, and low-growing shrubs. This vegetation acts as insulation and delays thawing until late in spring or early in summer. The soil is therefore cool and moist throughout the growing season. Cleared areas thaw more rapidly than uncleared areas, and they are suitable for cultivation. In many places ditches are likely to be needed to remove excess moisture in spring to allow early planting. If this soil were cleared, drained, and adequately fertilized, it would be suited to perennial grasses, oats, barley, and hardy vegetables.

Management group 14 (IVe-1)

This management group consists of strongly sloping, well drained and moderately well drained silt loams. These soils are on uplands.

Permeability is moderate in these soils. Runoff is medium to rapid. The hazard of water erosion is severe.

Most of the acreage of these soils is wooded, but a few small areas are used mainly for hay or pasture. The wooded areas are used as wildlife habitat. Keeping a cover of perennial grasses on the areas most of the time and growing contour strips of small grain occasionally are practices that help to control water erosion and to protect the areas from gully erosion. These soils respond well to fertilizer that contains nitrogen, phosphorus, and potassium.

Management group 15 (IVe-2)

This group consists of moderately sloping, strongly sloping, and rolling silt loams that are somewhat excessively drained. Most of these soils are on ridges and hills.

Permeability is moderate to rapid in these soils. Runoff is medium to rapid. The hazards of water erosion and soil blowing are moderate to severe.

Most of the acreage of these soils is wooded, and the vegetation provides habitat for wildlife. If these soils are cleared, they are suitable for limited cultivation. Keeping a cover of perennial grasses on the areas most of the time and growing strips of barley and oats on the contour help to control water erosion and soil blowing. Returning crop residue to the soil, adding manure regularly, and including grasses in the cropping system help to keep these soils in good tilth and to promote efficient use of moisture. Crops on these soils respond well to fertilizer that contains nitrogen, phosphorus, and potassium, but in most years lack of moisture limits crop growth.

Management group 16 (IVs-1)

This group consists of nearly level and undulating very fine sandy loams and silt loams that are excessively drained. These soils are on flood plains, outwash plains, and moraines.

Permeability is moderate in the surface layer and very rapid in the coarse-textured subsoil and substratum. Runoff is very slow to medium. The hazard of water erosion is slight to moderate, and the hazard of soil blowing is moderate to severe.

Most of the acreage of the soils in this group is wooded, but small areas are used mainly for hay and pasture and an occasional crop of oats or barley. The wooded areas provide habitat for wildlife.

Leaving strips of trees or other vegetation around cleared areas as windbreaks, keeping a cover of grass on cleared areas, and seeding grasses in alternate strips with small grains help to control soil blowing. Adding manure and returning crop residue to the soils help to keep these soils in good tilth and to promote efficient use of moisture and plant nutrients. Most crops on these soils respond well to small applications of fertilizer that contains nitrogen, phosphorus, and potassium. In most years, however, crop production is likely to be limited by lack of moisture.

Management group 17 (IVw-1)

This group consists of nearly level, very fine sandy loams and silt loams that are poorly drained. These soils are on alluvial plains and low terraces. Most of them are perennially frozen.

Runoff is very slow on these soils. The hazard of erosion is slight.

Most of the acreage of these soils is under a cover of vegetation that provides habitat for wildlife. In places, however, the native grasses are suitable for limited grazing.

These soils are cold and wet throughout the growing season. If they are used for cultivated crops, the surface mat of organic material must be removed to permit the permafrost table to gradually thaw to a greater depth. Excess moisture must then be removed by ditching. Even after clearing and draining, these soils tend to dry slowly in spring. As a result, late planting increases the risk of crop damage by frost late in summer. Grasses, small grains grown for forage, and vegetables that mature early are suited, and they respond well to fertilizer that contains nitrogen, phosphorus, and potassium.

Management group 18 (IVw-2)

In this group are poorly drained silt loams that are gently sloping and moderately sloping. These soils are on alluvial plains and foot slopes of high ridges. They are perennially frozen.

Runoff is slow to medium if these soils are cleared. The hazard of erosion is moderate to severe.

Most of the acreage of these soils is under a cover of vegetation that provides habitat for wildlife. Under a thick mat of moss and other plants, these soils have a high permafrost table and they remain cold and wet throughout the growing season. Also, they commonly receive seepage water from surrounding areas. If these soils are used for cultivated crops, the surface mat must be removed to permit the permafrost table to gradually thaw to a greater depth. Diversion ditches can then be used to drain the excess moisture. If these soils are cleared, drained, and adequately fertilized, they would be suitable for vegetables that mature early and for perennial grasses, oats and barley grown for forage. Avoiding tillage when the soil is wet and adding manure and crop residue regularly help to keep these soils in good tilth.

Management group 19 (VIe-1)

In this group are moderately steep silt loams that are well drained. These soils commonly are on high ridges. Permafrost is at a great depth or is absent.

Permeability is moderate in these soils. Runoff is rapid if the areas are cleared. The hazard of water erosion is severe.

Most of the acreage of these soils is wooded and is used mainly as habitat for wildlife. In a few places, however, white spruce is harvested for local use and paper birch is harvested to provide firewood.

The soils in this group are too steep and too susceptible to water erosion to be cultivated. Cleared and burned areas are suited to pasture if they are improved by disking or digging to prepare a rough seedbed, topdressing with fertilizer, and seeding to perennial grasses.

Management group 20 (VIe-2)

Only Beales silt loam, moderately steep, is in this group. It is somewhat excessively drained and is on stabilized dunes.

Permeability is moderate in the surface layer and rapid in the coarse-textured underlying material. Runoff is rapid if this soil is cleared. The hazards of water erosion and soil blowing are severe.

Most of Beales silt loam, moderately steep, is wooded and supports vegetation that provides habitat for wildlife. Keeping a cover of vegetation on the areas helps to control water erosion and soil blowing. Cleared and burned areas can be used for pasture if they are improved by disking or digging to prepare a rough seedbed, topdressing with fertilizer, and seeding to perennial grasses. In most years, however, forage production is likely to be reduced by insufficient moisture.

Management group 21 (VIw-1)

Only Saulich silt loam, strongly sloping, is in this group. It is poorly drained and is underlain by permafrost.

Runoff is rapid on this soil if the vegetation is removed. The hazard of water erosion is severe.

Most of Saulich silt loam, strongly sloping, supports vegetation that is used as wildlife habitat. In places a few patches of grasses and sedges are suitable for limited grazing. Under a thick mat of moss and roots, this soil remains cold and wet throughout the growing season. In addition, it commonly receives seepage from surrounding areas. Cleared and burned areas can be seeded to perennial grasses and used as pasture.

Management group 22 (VIw-2)

Only Local alluvial land and Peat is in this group. It is nearly level and is in depressions. Local alluvial land consists of silt loam sediment and is somewhat poorly drained. Peat is poorly drained and is perennially frozen.

Local alluvial land and Peat supports stands of grasses and sedges that are suitable for grazing or cutting for hay in summer. The grasses, however, are easily destroyed by overgrazing or by frequent cutting. The areas are ponded in spring, and they remain cold and wet throughout the growing season. The depressions generally are too deep to permit outlet ditches to be constructed for artificial drainage. On areas that are not too wet in summer, forage production can be improved by preparing a good seedbed, fertilizing according to the needs indicated by soil tests, and reseeding to adapted varieties of tame grasses.

Management group 23 (VIIe-1)

In this group are steep and very shallow to deep silt loams that are well drained. These soils generally are on high hills and ridges.

Permeability is moderate in these soils. Runoff is very rapid, and the hazard of water erosion is very severe.

Most of the acreage of these soils is wooded. These soils are too steep and too susceptible to gullying and washing to be cultivated. They are suitable for woodland, wildlife habitat, and watershed protection.

Management group 24 (VIIw-1)

In this group are strongly sloping to steep, poorly drained silt loams on high hills and ridges. These soils have north-facing slopes, and they are shallow to bedrock and to permafrost.

If these soils are cleared, runoff is medium to rapid. The hazard of water erosion is severe to very severe. The vegetation is dominantly scattered black spruce, low-growing shrubs, and a thick ground cover of moss. These soils remain cold and wet throughout the growing season. They are not suitable for cultivation or for pasture, and they are suitable mainly for wildlife habitat and watershed protection.

Management group 25 (VIIw-2)

Only Lemeta peat is in this group. It is in muskegs. This soil is very poorly drained, and it has a high permafrost table.

Lemeta peat has little value for farming. It remains cold and wet throughout the growing season, and artificial drainage is not feasible. In places this soil supports vegetation that is suitable for light grazing. The peat material has value for some commercial uses.

Management group 26 (VIIIs-1)

Only Gravel pits is in this group. The areas, more than 5 acres in size, consist of excavations from which soil has been removed to provide gravel or road fill.

Gravel pits have no value for farming or for trees. Many areas, however, support stands of alder, willow, and aspen that are used as wildlife habitat.

Management group 27 (VIIIw-1)

Only Alluvial land is in this group. It consists of sediment laid down by water. The areas are along the edges of large rivers, and they are frequently flooded. Alluvial land is not suitable for farming or for trees. Patches of willow and other vegetation that grow in many places are used for wildlife habitat.

Engineering Uses of the Soils

Some soil properties are of special interest to engineers because they affect the construction and maintenance of roads, airports, and pipelines; the foundations of buildings; facilities for storing water; structures for controlling erosion; drainage systems; and systems for disposing of sewage. Among the properties most important to the engineer are shear strength, compaction characteristics, soil drainage, permeability, shrink-swell characteristics, grain size, plasticity, and reaction. Also important are depth to seasonal high water table, flooding hazard, and relief. Such information is available in this section. Engineers can use it to—

1. Make studies that will aid in selecting and developing sites for industries, businesses, residences, and recreational areas.

2. Make estimates of the engineering properties of soils for use in the planning of systems for draining cropland and pasture, grassed waterways, farm ponds, irrigation systems, terraces and diversions, and other structures for conserving soil and water.
3. Make preliminary evaluations of soil conditions that will aid in selecting locations for highways, airports, pipelines, cables, and sewage disposal fields and in planning more detailed surveys of the soils at the selected locations.
4. Locate probable sources of sand, gravel, and other materials for use in construction.
5. Correlate the performance of engineering structures with the soil mapping units to develop information for general planning that will be useful in designing and maintaining new structures.
6. Determine the suitability of the soils for cross-country movement of vehicles and of construction equipment.
7. Supplement information obtained from other published maps, reports, and aerial photographs for the purpose of making maps and reports that can be readily used by engineers.
8. Develop other preliminary estimates for construction purposes pertinent to the particular area.

Used with the soil map to identify the soils, the engineering interpretations in this section are useful for many purposes. It should be emphasized, however, that these in-

TABLE 3.—*Engineering*

[Tests performed by the Alaska Department of Highways, Road Materials Laboratory, in cooperation with the U.S. Department of Officials (AASHO) (*2*). Absence of an entry indicates no

Soil name and location	Parent material	Depth from surface	Moisture density data [1]	
			Maximum dry density	Optimum moisture
		Inches	*Lb/cu. ft.*	*Percent*
Beales silt loam:				
NW¼SW¼ sec. 26, T. 11 S., R. 13 E.	Thin layer of silty loess over sand laid down by water	2–5	111	16
		5–10	115	8
		18–40	109	13
Goldstream silt loam:				
NE¼NW¼ sec. 9, T. 5 S., R. 4 E. (Uncleared area)	Silty alluvium that has permafrost	2½–6	98	18
NW¼SE¼ sec. 13, T. 7 S., R. 5 E. (Cleared area)	Silty alluvium	2–32	96	20
Nenana silt loam:				
SE¼SW¼ sec. 11, T. 10 S., R. 11 E.	Silty loess over gravelly glacial outwash.	4–9	106	17
		13–22	114	12
		22–34	134	7
SW¼SW¼ sec. 23, T. 1 S., R. 11 E. (Sandy subsoil)	Silty loess over sand laid down by water.	0–4	96	18
		8–13	122	10
		13–24	108	12
Richardson (deep) silt loam:				
NW¼ SW¼ sec. 24, T. 10 S., R. 11 E.	Silty loess	1½–6	96	21
		6–17	106	17
		23–34	111	16
Volkmar silt loam:				
SE¼SE¼ sec. 5, T. 10 S., R. 11 E.	Silty loess over gravelly outwash	1½–4	93	18
		4–18	100	18
		18–28	140	6
NW¼NW¼ sec. 34, T. 12 S., R. 14 E. (Sandy subsoil)	Silty loess over fine sand	4–10	103	15
		10–16	102	16
		16–24	112	12

[1] Based on AASHO Designation: T–180–57 (*2*).
[2] Mechanical analysis according to the AASHO Designation T–88 57 (*2*). Results by this procedure may differ somewhat from the results that would have been obtained by the soil survey procedure of the Soil Conservation Service (SCS). In the AASHO procedure, the fine material is analyzed by the hydrometer method, and the various grain-size fractions are calculated on the basis of all the material, including that coarser than 2 millimeters in diameter. In the SCS soil survey procedure, the fine material is analyzed by the pipette method, and the material coarser than 2 millimeters in diameter is excluded from calculations of grain-size fractions. The mechanical analyses

terpretations are not a substitute for the sampling and testing needed at a site chosen for a specific engineering work that involves heavy loads or at a site where excavations are to be deeper than the depths of the layers here reported. Nevertheless, by using this survey, an engineer can select and concentrate on those soils most important for this proposed kind of construction, and in this manner reduce the number of soil samples taken for laboratory testing and complete an adequate soil investigation at minimum cost.

The soil mapping units shown on the maps in this survey may include small areas of a different soil material. These included soils may be as much as 2 acres in size. They are too small to be mapped separately and generally are not significant to the farming in the area, but they may be important in engineering planning.

Information of value in planning engineering work is given throughout the text, particularly in the sections "Descriptions of the Soils" and "Formation and Classification of Soils."

Some of the terms used in this publication have a special meaning to soil scientists and a different meaning to engineers. The Glossary defines many such terms as they are used in soil science.

Much of the information in this section is given in tables. Table 3 gives engineering test data, table 4 gives engineering properties of the soils, and table 5 gives engineering interpretations of the soils.

test data

Commerce, Bureau of Public Roads (BPR), in accordance with standard procedures of the American Association of State Highway determination was made or information does not apply]

Mechanical analysis [2]									Liquid limit	Plasticity index	Classification	
Percentage passing sieve—					Percentage smaller than—						AASHO	Unified [3]
3/8 in	No 4 (4.7 mm)	No 10 (2.0 mm.)	No 40 (0.42 mm)	No. 200 (0.074 mm)	0.05 mm.	0.02 mm.	0.005 mm.	0.002 mm.				
									Percent			
--------	--------	100	98	75	58	39	15	8	24	[4] NP	A-4(8)	ML
--------	--------	100	92	16	13	8	5	4	[5] NV	NP	A-2-4(0)	SM
--------	--------	100	99	15	8	6	3	2	NV	NP	A-2-4(0)	SM
--------	--------	--------	100	96	--------	50	13	6	30	NP	A-4(8)	ML
--------	--------	100	99	95	--------	40	8	4	47	NP	A-5(9)	ML, OL
--------	--------	100	98	89	--------	41	13	7	31	NP	A-4(8)	ML
--------	--------	100	97	84	58	27	9	4	26	NP	A-4(8)	ML
[6] 85	74	65	53	30	23	11	6	5	NV	NP	A-2-4(0)	SM
--------	--------	100	99	92	--------	39	10	5	31	NP	A-4(8)	ML
--------	--------	100	98	59	53	31	12	10	20	NP	A-4(5)	ML
--------	--------	100	99	6	5	4	3	2	29	NP	A-3(0)	SP-SM
--------	--------	100	99	93	--------	42	12	9	34	NP	A-4(8)	ML
--------	--------	--------	100	92	--------	42	15	9	28	NP	A-4(8)	ML
--------	--------	--------	100	92	--------	28	10	6	23	NP	A-4(8)	ML
--------	--------	100	97	87	--------	40	13	8	33	NP	A-4(8)	ML
--------	--------	--------	100	90	--------	41	15	9	29	NP	A-4(8)	ML
[6] 81	61	42	18	8	18	6	3	2	NV	NP	A-1-a(0)	SW-SM
--------	--------	--------	100	90	--------	39	13	8	29	NP	A-4(8)	ML
--------	--------	100	99	85	--------	38	13	9	27	NP	A-4(8)	ML
--------	--------	100	95	31	21	10	5	3	NV	NP	A-2-4(0)	SM

data used in this table are not suitable for use in naming textural classes for soils.

[3] SCS and BPR have agreed to consider that all soils having plasticity indexes within 2 points from A-line are to be given a borderline classification An example of a borderline classification so obtained is SP-SM

[4] Nonplastic.

[5] No value

[6] 100 percent of the material passed the 3/4-inch sieve.

459-932—73——3

TABLE 4.—*Estimated engineering*

[Absence of data indicates that no estimate

Soil series and map symbols	Depth to— Bedrock	Permafrost table in uncleared areas	Seasonal high water table	Depth from surface of typical profile	Classification: Dominant USDA texture
	Feet	*Feet*	*Feet*	*Inches*	
Alluvial land. Ad	[1]	0	1–3 [2]	0–60	Very gravelly sand
Beales: BaA, BaB, BaC, BaE	[1]	0	[4]	0–5 5–40	Silt loam Fine sand
Bradway: Br	[1]	1½–2½	0–2 [5]	0–10 10–30	Very fine sandy loam Loamy fine sand (contains lenses of silt).
Chena.					
ChA	[1]	0	[4]	0–9 9–20	Very fine sandy loam (stratified) Very gravelly sand
CnA, CnB	[1]	0	[4]	0–7 7–18	Silt loam Very gravelly sand
Ester: EsD, EsE, EsF	1–1½	1+	0–1 [5]	12–0 0–12 12–16 16	Peat Silt loam Very gravelly silt loam Schist bedrock
Fairbanks FaB, FaC, FaD, FaE, FaF	3½–10+	0	[4]	0–50	Silt loam
Gilmore: GmC, GmD, GmE, GmF, GrF	½–1½	0	[4]	0–16 16	Silt loam Weathered schist bedrock
Goldstream. GtA, GtB	[1]	1–2	0–½ [5]	7–0 0–4 4–27	Peat Silt loam Silt loam
Goldstream, gravelly subsoil variant GuA	10+	0	1–2	0–6 6–27 27–38	Silt loam Gravelly sandy loam and silt loam Very gravelly sand
Gravel pits. Gv	[1]	0	0–2	0–60	Very gravelly sand
Jarvis Ja, Js	[1]	0–10+	4–8	0–26 26–40	Silt loam, very fine sandy loam, and very fine sand (stratified). Very gravelly sand
Local alluvial land and Peat La					
Local alluvial land	[1]	6+	2–3	0. 13 13–29 29	Silt loam (high content of organic matter). Silt loam Gravelly sand
Peat	[1]	2–4	0 [5, 6]	0–30 30	Peat Loam
Lemeta: Lp	[1]	1–3	[5] 0–¼	0–60	Peat
Minto. MnA, MnB, MnC, MnD	3½–10+	[7] 6+	3–5	0–40	Silt loam
Nenana:					
NaA, NaB, NaC, NaD	[1]	0	[4]	0–20 20–40	Silt loam Very gravelly sand
NeA, NeB, NeC	[1]	0	[4]	0–20 20–40	Silt loam Fine sand
Richardson. RcA	[1]	0–10+	3–5	0–48 48–60	Silt loam Very gravelly sand

See footnotes at end of table.

properties of the soils

was made. >=greater than; <=less than]

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm)			
					Inches per hour	*In /in of soil*	*pH value*
GW or SW–SM	A–1	[3] 30–60	25–50	0–10	>5. 0	>0 02	----------
ML	A–4	100	100	75–90	0. 8–2 5	0 18–0. 23	4 5–5 5
SP to SM	A–1 or A–3	100	95–100	5–15	5–10	0 04–0 06	4. 5–5 5
ML	A–4	100	100	60–70	0 8–2 5	0 18–0 23	5 6–6 0
SM or ML	A–2 or A–4	100	95–100	30–60	2. 5–6 0	0. 12–0 16	6 1–7 8
SM or SP–SM	A–2 or A–4	100	90–100	25–50	0 8–2 5	0 09–0. 13	4 0–6 0
GW or SM	A–1	[3] 30–60	25–50	0–10	>10 0	<0. 02	6 1–6 5
ML	A–4	[3] 95–100	95–100	80–90	0. 8–2 5	0. 18–0. 23	4. 0–6 0
GW or GW–GM	A–1	[3] 30–50	20–40	0–10	>10 0	<0. 04	5 1–6. 5
Pt	A–8	----------	----------	----------	2 5–5 0	0. 20–0. 30	4 0–4. 5
ML	A–4	100	100	85–95	0 8–2 5	0. 18–0 23	4. 0–5 5
GM	A–1 or A–2	30–50	20–35	10–30	0 8–2 5	0. 09–0. 13	5 1–6 0
----------	----------	----------	----------	----------	----------	----------	----------
ML	A–4	100	100	90–95	0. 8–2 5	0. 18–0. 23	5. 1–6 5
ML	A–4	100	95–100	90–95	0 8–2 5	0. 18–0 23	5. 1 6 5 5 6–6 0
----------	----------	----------	----------	----------	----------	----------	
Pt	A–8	----------	----------	----------	2. 5–5 0	0 20–0. 30	4. 0–5 0
OL	A–5	100	100	80–95	0 8–2 5	0 20–0. 25	4 5–5 0
ML	A–4	100	95–100	80–95	0 8–2 5	0. 18–0 23	5. 1–5 5
OL	A–5	100	95–100	90–95	0 8–2 5	0 20–0 25	4 5–5. 0
SM	A–2 or A–4	[3] 60–80	55–70	20–40	2 5–5. 0	0 10–0. 14	5 1–5 5
GW	A–1	[3] 25–50	20–40	0–5	>10	0. 02–0. 04	5 1–5 5
GW or SM	A–1	20–40	15–30	0–5	>10	<0. 02	----------
ML or SM	A–4	100	95–100	45–75	0. 8–2 5	0. 12–0. 16	5 1–6 5
GW or SW	A–1	[3] 30–60	25–50	0–5	>5. 0–10 0	0. 02–0. 04	6 1–6 5
OL	A–5	[3] 100	95–100	90–95	0. 8–2 5	0 20–0. 25	4 5–5. 0
ML	A–4	95–100	90–100	85–95	0 8–2 5	0. 18–0 23	5 1–5. 5
GW or SM	A–1	30–50	20–40	5–20	5–10	0 02–0 04	5 1–5. 5
Pt	A–8	----------	----------	----------	2 5–5 0	0. 20–0 30	4 0–5. 5
M	A–4	[3] 90–100	90–100	60–90	0 8–2 5	0 18–0 23	5 0–5 5
Pt	A–8	----------	----------	----------	2 5–5 0	0 20–0 30	4. 5–5 0
ML	A–4	100	100	90–95	0 8–2. 5	0 18–0 23	5 1–7. 8
ML	A–4	100	95–100	85–95	0. 8–2 5	0 18–0. 23	5 1–5 5
GW	A–1	20–40	15–30	0–5	>10	<0. 02	5 6–7. 3
ML	A–4	100	95–100	85–95	0 8–2 5	0 18–0. 23	4 5–5. 0
SP–SM or SM	A–2 or A–3	90–100	75–95	5–15	5–10	0 04–0 06	5. 1–5 5
ML	A–4	100	95–100	85–95	0. 8–2 5	0 18–0 23	5. 1–6. 0
GW	A–1	20–40	15–30	0–5	>10	<0. 02	5. 6–6. 5

TABLE 4—*Estimated engineering*

Soil series and map symbols	Depth to— Bedrock	Depth to— Permafrost table in uncleared areas	Depth to— Seasonal high water table	Depth from surface of typical profile	Classification: Dominant USDA texture
	Feet	*Feet*	*Feet*	*Inches*	
Salchaket: Sc	(1)	0–10+	(4)	0–40	Very fine sandy loam, fine sandy loam, very fine sand, and silt loam (stratified)
Saulich: SuB, SuC, SuD	2½–10	1–2	0–1½ (5)	10–0 0–28	Peat Silt loam
Steese: SvC, SvD, SvE, SvF	2½–3½	0	(4)	0–22 22	Silt loam Schist bedrock
Tanana: Ta	(1)	1½–2½	1½–2½ (5)	0–3 3–40	Silt loam Silt loam
Tanana, sandy subsoil variant: Tn	(1)	0	2–4	0–16 16–40	Fine sandy loam (stratified) contains lenses of silt loam. Fine sand and lenses of silt loam
Volkmar:					
VkA, VkB	(6)	0–10+	3–5	0–17 17–30	Silt loam Very gravelly coarse sand
VmA	(6)	0–10+	3–5	0–20 20–50	Silt loam Fine sand

[1] Bedrock not encountered to depth of observation, which generally is 5 feet.
[2] Frequently flooded.
[3] Coarse fragments greater than 3 inches not considered in table.

TABLE 5.—*Engineering*

[Absence of an entry indicates

Soil series and map symbols	Suitability as source of— Topsoil	Suitability as source of— Sand	Suitability as source of— Gravel	Suitability as source of— Road fill	Susceptibility to frost action
Alluvial land: Ad	Poor: very gravelly sand.	Good after screening	Good	Poor: water table at a depth of 3 feet	Low
Beales: BaA, BaB, BaC, BaE	Fair to poor: silt loam in uppermost 3 to 10 inches, sandy subsoil and substratum	Fair to poor	Unsuitable	Fair if slope is 12 percent and fair to poor if slope is 20 to 30 percent; moderate susceptibility to frost action.	Moderate to low.
Bradway: Br	Poor: poorly drained; high water table at a depth of 0 to 2 feet, permafrost.	Poor to unsuitable, permafrost	Unsuitable	Poor: high water table at a depth of 0 to 2 feet, permafrost	High to moderate: permafrost
Chena:					
ChA	Poor to fair: stratified very fine sandy loam and fine sand 5 to 10 inches thick, gravelly substratum.	Good after screening	Good; many cobblestones and a few other stones.	Good	Moderate to low.

See footnote at end of table.

properties of the soils—Continued

Classification—Continued		Percentage passing sieve—			Permeability	Available water capacity	Reaction
Unified	AASHO	No. 4 (4.7 mm.)	No. 10 (2.0 mm.)	No. 200 (0.074 mm.)			
					Inches per hour	*In./in. of soil*	*pH value*
SM or ML	A-4	100	95-100	40-70	0.8-2.5	0.12-0.16	5.1-7.8
Pt	A-8	----	----	----	2.5-5.0	0.20-0.30	4.5-5.0
ML	A-4	100	100	90-95	0.8-2.5	0.18-0.23	5.1-6.5
ML	A-4	100	100	90-95	0.8-2.5	0.18-0.23	5.1-6.0
----	----	----	----	----	----	----	5.6-6.0
ML or OL	A-4 or A-8	100	100	95-100	0.8-2.5	0.20-0.25	5.1-6.0
ML	A-4	100	95-100	90-100	0.8-2.5	0.18-0.23	5.5-7.8
SM or ML	A-4	100	95-100	40-60	0.8-2.5	0.14-0.18	5.1-5.5
SM	A-2	100	95-100	15-30	0.8-2.5	0.10-0.14	5.1-6.0
ML	A-4	100	95-100	85-95	0.8-2.5	0.18-0.23	4.5-6.0
GW	A-1	20-40	15-30	0-5	>10	<0.02	5.1-6.0
ML	A-4	100	95-100	85-95	0.8-2.5	0.18-0.23	4.5-6.0
SP-SM or SM	A-2 or A-3	90-100	75-95	5-15	5-10	0.02-0.04	5.1-6.0

[4] Water table not observed to depth of observation, which generally is 5 feet, or to depth to bedrock, whichever is less.
[5] Perched above permafrost.
[6] Occasionally flooded.
[7] Sporadic.

interpretations of the soils

information does not apply]

Soil features affecting—					
Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Grassed waterways
Subject to frequent flooding.	Rapid or very rapid permeability.	Rapid or very rapid permeability, large stones in places.	Subject to frequent flooding.	Subject to frequent flooding.	Very gravelly sand.
Exposed embankments susceptible to erosion, loose sand to a depth of 1 foot.	Rapid permeability to a depth of 1 foot.	Loose sand, rapid permeability to a depth of 1 foot.	Somewhat excessively drained.	Very low water-holding capacity.	Sandy substratum to a depth of 1 foot, slopes of 0 to 30 percent.
High water table: permafrost.	Moderate permeability, high water table, permafrost.	Moderate permeability, poor stability.	Poorly drained, high water table, moderate permeability	High water table; permafrost.	
Most features favorable.	Very rapid permeability.	Very rapid permeability.	Excessively drained__	Very low water-holding capacity; very rapid permeability.	

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of— Topsoil	Sand	Gravel	Road fill	Susceptibility to frost action
Chena—Continued CnA, CnB	Fair to poor silt loam in the uppermost 5 to 10 inches, gravelly substratum.	Good after screening	Good, many cobblestones and other stones	Good	Moderate to low.
Ester EsD, EsE, EsF.	Poor poorly drained, high water table at a depth of 0 to 1 foot, permafrost.	Unsuitable	Unsuitable	Poor high water table at a depth of 0 to 1 feet; permafrost.	High permafrost.
Fairbanks FaB, FaC, FaD, FaE, FaF	Good if slope is 7 percent, fair if slope is 12 percent, poor if slope is 45 percent	Unsuitable to poor.	Unsuitable	Poor to fair if slope is 20 percent and poor if slope is 45 percent, high to moderate susceptibility to frost action	High to moderate.
Gilmore: GmC, GmD, GmE, GmF, GrF	Fair if slope is 12 percent and poor if slope is 45 percent.	Unsuitable	Unsuitable	Poor: bedrock at a depth of 5 to 20 inches.	High to moderate.
Goldstream: GtA, GtB	Poor poorly drained, high water table at a depth of 0 to ½ foot, permafrost.	Unsuitable	Unsuitable	Poor poorly drained, water table at a depth of 0 to ½ foot, permafrost.	High: permafrost.
Goldstream, gravelly subsoil variant GuA	Poor poorly drained, water table at a depth of 1 to 2 feet.	Good to fair after screening.	Good	Poor: poorly drained, water table at a depth of 1 to 2 feet	Moderate to high.
Gravel pits Gv	Poor very gravelly sand.	Good after screening.	Good	Good or poor; pits are ponded in places.	Low
Jarvis Ja	Good to fair. stratified silt loam to very fine sand at a depth of about 1½ to 3½ feet, gravelly substratum.	Good after screening.	Good	Fair to poor: high to moderate susceptibility to frost action in sandy material at a depth of 1½ to 3½ feet, gravelly substratum.	High to moderate.
Js	Fair stratified silt loam to very fine sand at a depth of about 1 to 1½ feet, gravelly substratum	Good after screening.	Good	Good	Moderate to low.
Local alluvial land and Peat. La Local alluvial land	Good seasonally ponded.	Good after screening.	Good	Poor high susceptibility to frost action.	High
Peat	Poor: water table near surface; permafrost.	Unsuitable	Unsuitable	Unsuitable	High. permafrost.

See footnote at end of table

interpretations of the soils—Continued

Soil features affecting—					
Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Grassed waterways
Most features favorable	Pervious material in substratum permits excessive seepage.	Very rapid permeability in gravelly substratum; excessive seepage	Excessively drained	Very low water-holding capacity, very rapid permeability	Shallow to gravel, not needed in some places.
Shallow to bedrock, slopes of 12 to 45 percent, permafrost.	Shallow to bedrock, slopes of 12 to 45 percent.	Shallow to bedrock	Poorly drained, high water table, slopes of 12 to 45 percent	High water table, slopes of 12 to 45 percent	
High to moderate susceptibility to frost action; exposed embankments susceptible to erosion	Moderate permeability	Susceptible to piping; poor stability.	Well drained	Moderate water-holding capacity, moderate permeability.	Highly erodible.
Shallow to very shallow to bedrock; exposed embankments susceptible to erosion, slopes of 7 to 45 percent.	Shallow to very shallow to bedrock; slopes of 7 to 45 percent	Shallow to very shallow to bedrock.	Well drained	Shallow to very shallow to bedrock; slopes of 7 to 45 percent.	Highly erodible; slopes of 7 to 45 percent
High water table, permafrost	High water table, permafrost.	High water table; permafrost; poor stability, susceptible to piping.	Poorly drained, high water table, moderate permeability	High water table, permafrost.	Poorly drained, permafrost.
High water table	Seasonal high water table; very rapid permeability in substratum	Moderate permeability and fair stability in uppermost 10 to 36 inches, very rapid permeability in substratum.	Poorly drained, high water table, very rapid permeability in substratum.	High water table.	
----------	----------	Very rapid permeability.			
High to moderate susceptibility to frost action, well drained, subject to occasional flooding in places	Rapid permeability in substratum	Fair stability in uppermost 20 to 40 inches, rapid permeability in substratum	Well drained	Moderate to rapid permeability; low water-holding capacity.	
Moderate to low susceptibility to frost action, well drained; subject to occasional flooding in places	Rapid permeability in substratum.	Fair stability in uppermost 10 to 20 inches, rapid permeability in substratum	Well drained	Moderate to rapid permeability; very low water-holding capacity	
High water table, seasonally ponded, permafrost.	High water table, permafrost.	High water table; poor stability.	High water table, difficult to locate outlets.	High water table, permafrost.	
Peat material; high water table; permafrost.	High water table, peat material, permafrost	Peat material	Very poorly drained, high water table	Peat material	

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—				Susceptibility to frost action
	Topsoil	Sand	Gravel	Road fill	
Lemeta Lp	Poor: water table at a depth of 0 to ¼ foot, permafrost.	Unsuitable	Unsuitable	Unsuitable	High permafrost.
Minto: MnA, MnB, MnC, MnD.	Good if slope is 7 percent, fair if slope is 12 percent, poor if slope is 20 percent, discontinuous permafrost below a depth of 6 feet.	Unsuitable	Unsuitable	Poor to fair if slope is 12 percent and poor if slope is 20 percent, high to moderate susceptibility to frost action.	High to moderate.
Nenana NaA, NaB, NaC, NaD	Good to fair if slope is 7 percent, fair if slope is 12 percent, poor if slope is 20 percent, silty material to a depth of 1 to 2 feet, gravelly substratum	Good after screening.	Good	Fair if slope is 12 percent and poor if slope is 20 percent; moderate susceptibility to frost action in silty material at a depth of 1 to 2 feet, gravelly substratum	High to moderate
NeA, NeB, NeC	Good to fair if slope is 7 percent, fair if slope is 12 percent, poor if slope is 20 percent, silty material to a depth of 1 to 2 feet; sandy substratum.	Fair to poor	Unsuitable	Fair to poor if slope is 12 percent, high to moderate susceptibility to frost action in silty material at a depth of 1 to 2 feet; sandy substratum	High to moderate.
Richardson RcA	Good	Good [1]	Good [1]	Fair to poor: high to moderate susceptibility to frost action.	High to moderate.
Salchaket Sc	Good	Poor to unsuitable, good in lower part after screening [1]	Good [1]	Fair to poor: moderate to high susceptibility to frost action	Moderate to high.
Saulich: SuB, SuC, SuD	Poor: poorly drained, water table at a depth of 0 to ½ foot; permafrost	Unsuitable	Unsuitable	Poor: poorly drained, water table at a depth of 0 to ½ foot.	High: permafrost.
Steese: SvC, SvD, SvE, SvF	Fair if slope is 12 percent and poor if slope is 45 percent.	Unsuitable	Unsuitable	Poor: bedrock at a depth of 2½ to 3½ feet	High to moderate.
Tanana: Ta	Good: permafrost at a depth of 20 to 30 inches	Unsuitable	Unsuitable	Poor: high susceptibility to frost action	High: permafrost.
Tanana, sandy subsoil variant Tn.	Good	Poor	Unsuitable	Poor to fair: high to moderate susceptibility to frost action.	High to moderate.

See footnote at end of table.

interpretations of the soils—Continued

Soil features affecting—					
Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Grassed waterways
Very poorly drained, peat material, permafrost.	Very poorly drained; high water table.	Peat material	Very poorly drained; high water table.	Peat material.	
High to moderate susceptibility to frost action; underlain by ice masses in places; susceptible to uneven subsidence; exposed embankments susceptible to erosion.	Moderate permeability; underlain by ice masses in places; susceptible to uneven subsidence.	Poor stability, susceptible to piping	Well drained	Moderate water-holding capacity; underlain by ice masses in places; susceptible to uneven subsidence.	Highly erodible; slopes of 0 to to 20 percent.
High to moderate susceptibility to frost action, silty material in exposed embankments susceptible to erosion	Very rapid permeability in substratum.	Poor stability in silty material, susceptible to piping, very rapid permeability in substratum	Well drained	Low water-holding capacity, moderate permeability.	Highly erodible, slopes of 0 to 20 percent.
High to moderate susceptibility to frost action, well drained; silty material in exposed embankments susceptible to erosion.	Rapid permeability in substratum.	Poor stability in silty material; susceptible to piping; rapid permeability in substratum	Well drained	Low water-holding capacity, moderate permeability.	Highly erodible; slopes of 0 to 20 percent.
High to moderate susceptibility to frost action, moderately well drained, exposed embankments susceptible to erosion.	Very rapid permeability in substratum.	Poor stability in silty material; porous material in substratum.	Well drained	Moderate permeability, moderate water-holding capacity.	Highly erodible.
Well drained, subject to occasional flooding in places.	Moderate permeability.	Fair stability	Well drained	Moderate permeability; low water-holding capacity.	
High water table; poorly drained; permafrost, slopes of 3 to 20 percent.	High water table, permafrost; slopes of 3 to 20 percent.	High water table; poor stability, susceptible to piping.	Poorly drained; high water table, slopes of 3 to 20 percent.	High water table, permafrost	Highly erodible; permafrost; slopes of 3 to 20 percent.
Slopes of 7 to 45 percent, bedrock at a depth of 2½ to 3½ feet.	Bedrock at a depth of 2½ to 3½ feet, slopes of 7 to 45 percent.	Susceptible to piping; poor stability.	Well drained; slopes of 7 to 45 percent.	Slopes of 7 to 45 percent; moderate permeability; low water-holding capacity.	Highly erodible; slopes of 7 to 45 percent
Somewhat poorly drained; permafrost.	High water table, permafrost.	High water table; poor stability, susceptible to piping.	Somewhat poorly drained; moderate permeability; permafrost.	High water table, moderate permeability; permafrost.	
Somewhat poorly drained; high water table	High water table, fine sand in substratum.	Susceptible to piping; fair stability.	Somewhat poorly drained, moderate permeability.	High water table; low water-holding capacity.	

TABLE 5.—*Engineering*

Soil series and map symbols	Suitability as source of—				Susceptibility to frost action
	Topsoil	Sand	Gravel	Road fill	
Volkmar.					
VkA, VkB	Good	Good after screening.	Good	Poor to fair: high to moderate susceptibility to frost action in silty material at a depth of 15 to 40 inches; gravelly substratum.	High to moderate.
VmA	Good	Good	Unsuitable	Poor to fair: high to moderate susceptibility to frost action.	High to moderate.

[1] Very gravelly sand or fine sand occurs at a depth of 3½ to 5 or 6 feet.

Engineering Classification Systems

Soil scientists of the United States Department of Agriculture (USDA) classify soils according to texture (*17*). In some ways this system of naming textural classes is comparable to the systems most commonly used by engineers for classifying soils; that is, the systems of the American Association of State Highway Officials (AASHO) (*2*) and the Unified system developed by the U.S. Department of Defense (*19*).

Most highway engineers classify soil material in accordance with the AASHO system. In this system soil materials are classified in eight principal groups. The groups range from A–1 (gravelly soils having high bearing capacity, the best soils for subgrade) to A–8 (highly organic soils). If the soil material is near a classification boundary, it is given a symbol showing both classes; for example, A–2 or A–4.

Within each group, the relative engineering value of the soil material is indicated by a group index number. These numbers range from 0 for the best material to 20 for the poorest. The group index number for the tested soils of the Salcha-Big Delta Area are shown in parentheses following the soil group symbol in table 3.

Some engineers prefer to use the Unified Soil Classification System (*19*). In this system soil materials are identified as coarse grained (eight classes), fine grained (six classes), or highly organic. An approximate classification of soils by this system can be made in the field.

Engineering Test Data

Table 3 gives test data for samples obtained from five soil series that are extensive in the Salcha-Big Delta Area. Selected layers were tested by standard procedures in the Roads Materials Laboratory of the Alaska Department of Highways. The samples were chosen to represent the range in properties in the soils of each series. The results of the tests can be used as a guide in estimating the engineering properties of the soils in the survey area. Tests were made for moisture density relationships, grain-size distribution, liquid limit, and plasticity index.

In the moisture density tests, a sample of the soil material is compacted several times with a constant compactive effort, each time at a successively higher moisture content. The moisture content is increased until the optimum moisture content is reached. After that, the density decreases with increase in moisture content. The highest density obtained in the compaction test is termed "maximum dry density." Moisture-density data are important in planning earthwork because generally the soil is more stable if it is compacted to about its maximum dry density when it is at about the optimum moisture content.

Mechanical analyses were made to determine the percentages of clay and coarser material in the soils. The analyses were done by the combined sieve and hydrometer methods. The percentage of clay determined by the hydrometer method should not be used as a basis for naming textural classes of soils.

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

Engineering Properties of the Soils

Table 4 lists the soil series in the survey area and the map symbols for each mapping unit, and gives estimates of soil properties that are significant to engineering. The

interpretations of the soils—Continued

Soil features affecting—					
Local roads and streets	Pond reservoir areas	Embankments, dikes, and levees	Drainage of cropland and pasture	Irrigation	Grassed waterways
High to moderate susceptibility to frost action; moderately well drained.	Very rapid permeability in substratum.	Poor stability and susceptibility to piping in uppermost 15 to 40 inches, porous material in substratum.	Moderately well drained; moderate permeability in silty material; very rapid permeability in substratum.	Moderate permeability; low water-holding capacity.	Highly erodible.
High to moderate susceptibility to frost action; modately well drained.	Rapid permeability in substratum.	Poor stability and susceptibility to piping in uppermost 20 to 40 inches; porous material in substratum.	Moderately well drained; moderate permeability in silty material; rapid permeability in substratum.	Moderate permeability; low water-holding capacity.	Highly erodible.

estimates are based partly on test data in table 3 and partly on experience with soils within the Area and that gained in working with and observing similar soils in other areas.

In general, the estimates in table 4 apply only to the soil depths indicated in the table, but these data are reasonably reliable for soil material to a depth of about 5 feet.

Soil texture is described in table 4 in the standard terms used by the Department of Agriculture. These terms take into account relative percentages of sand, silt, and clay in soil material that is less than 2.0 millimeters in diameter. "Loam," for example, is soil material that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the soil contains gravel or other particles coarser than sand, an appropriate modifier is added, as for example, "gravelly sandy loam." "Sand," "silt," "clay," and some of the other terms used in USDA textural classifications are defined in the Glossary of this soil survey.

In table 4, permeability is estimated in inches of water percolation per hour. The data are based on uncompacted soils from which free water has been removed. The estimates are based largely on texture, structure, and consistence.

Available water capacity, expressed as inches of water per inch of soil depth, is the capacity of a soil to hold water available for use by most plants. It is the estimated amount of water held in a soil between field capacity and the permanent wilting point of plants. Available water capacity data in table 4 are based on 3 feet of usable soil for rooting depth. The roots of most crops in the survey area do not penetrate below this depth.

Reaction is the degree of acidity or alkalinity of a soil, expressed as pH value. The pH value, and relative terms used to describe soil reaction, are explained in the Glossary.

Shrink-swell potential indicates the volume change to be expected of a soil with change in moisture content. Ratings of the shrink-swell potential of the soils are not given in table 4, because all the soils in the Salcha-Big Delta Area have low shrink-swell potential.

Engineering Interpretations of the Soils

Table 5 gives ratings of the soils according to their suitability as a source of topsoil, sand, gravel, and road fill. It also lists soil features that affect the suitability of the soils for several engineering practices. The ratings and other interpretations are based on test data in table 3, on estimated soil properties in table 4, and on field experience.

Most of the soils in the Salcha-Big Delta Area formed in silty or very fine sandy material that ranges from a few inches to many feet in thickness. The soils on uplands generally are underlain by schist bedrock. Depth to bedrock ranges from 40 inches to many feet in the Fairbanks, Minto, and Saulich soils; from 20 to 40 inches in the Steese soils; and from 5 to 20 inches in the Ester and Gilmore soils. On the alluvial plains, moraines, stabilized dunes, and in outwash areas the soils generally are underlain by loose sandy or gravelly deposits. Depth to the substratum ranges from 40 inches to many feet in the Bradway, Goldstream, Richardson, Salchaket, and Tanana soils; from 10 to 40 inches in the Jarvis, Nenana, and Volkmar soils; and from 5 to 10 inches in the Chena soils.

Topsoil refers to soil material, preferably rich in organic matter, that is used as a topdressing on slopes, embankments, lawns, gardens, and the like. The suitability ratings are based mainly on the texture and on the organic-matter content of the soil. Well-drained silty soils, the best sources of topsoil, are well distributed throughout the survey area.

The ratings for sand and gravel are based on the probability that mapped areas of the soils contain sizable deposits of sand and gravel at a depth of at least 6 feet. Some soils have little or no sand or gravel in the uppermost 4 or 5 feet. Yet, observations made in deep cuts and on knowledge about geology of the Area, indicate that many of these soils are underlain by sand or gravel. The ratings provided in table 4 do not reflect the quality and extent of the deposits nor the economic feasibility of removing the deposits.

On alluvial plains in the survey area, some of the soils have a high water table or contain cobblestones or other stones that interfere with excavating sand and gravel. The Chena and Jarvis soils are underlain by well-graded gravel that commonly contains strata of sand, and this material can be excavated without difficulty. In addition, many areas of Salchaket soils contain gravel that can be easily obtained.

On outwash plains rounded well-graded gravel generally can be excavated without difficulty from areas of Nenana and Volkmar soils.

On moraines the gravelly material generally contains a higher percentage of fines than the gravelly material on alluvial plains and outwash plains.

The upland soils generally are a poor source of gravel. Nevertheless, angular gravel derived from schist bedrock can be obtained from Gilmore soils near the top of ridges.

Road fill refers to soil material that is used to build embankments. The suitability ratings are based on the performance of soil material moved from borrow pits for this purpose. Factors that affect the suitability of a soil for road fill are texture, available water capacity, and depth to permafrost. Organic soils are rated *unsuitable*, soils that are shallow to permafrost are rated *poor*, and sandy and gravelly soils that lack permafrost are rated *good*.

In places permafrost, or perennially frozen soil, is a major concern in the Salcha-Big Delta Area where the soils are used for engineering purposes. On uplands the subsoil is perennially frozen in the Ester and Saulich soils, which have north-facing slopes, and in the sloping Goldstream soils in valleys along secondary drainageways. On alluvial plains and low terraces, large areas of Bradway, Goldstream, and Tanana soils are underlain by permafrost. If moss or other insulating vegetation is removed from the surface of these soils, the uppermost part of the permafrost thaws and commonly causes subsidence of the overlying soil material. Roads and structures constructed on these soils are susceptible to uneven settling, unless special construction methods are used. These soils are always nearly saturated in the zone above the permafrost in summer. If the excess water is not removed, especially along roads, even more irregular settling is likely because the hazard of frost heaving is severe in these soils in spring. In areas of Minto soils on foot slopes, irregular subsidence and the formation of deep steep-walled pits are likely because of the melting of underground masses of ice.

Frost action in soils that have permafrost or that lack permafrost is a problem throughout the Area. Among the soil properties that influence frost action are texture and depth to the water table during periods of freeze. Although a precise correlation has not been established, only soils in the Salcha-Big Delta Area that contain less than 3 percent of material finer than 0.074 millimeter (No. 200 sieve) are believed to be nonsusceptible to heaving by frost. None of the soils in the Area fully meet this requirement. The well-drained soils on alluvial plains, outwash plains, moraines, and stabilized dunes have a gravelly substratum, and they generally have low potential frost action. Soils that formed in deep silty and very fine sandy material and that have permafrost and a high water table have high potential frost action.

The factors that affect pond reservoir areas are those features and qualities of undisturbed soils that affect their suitability for water impoundments. Of importance are soil properties that affect seepage. Excessive seepage is a major concern in constructing reservoirs and farm ponds in the Salcha-Big Delta Area. Lining with impervious material generally must be done. Throughout most of the survey area the soils are silty and fine sandy material. They generally are not well suited to embankments, because they are highly susceptible to piping. Movement of water through the silty and fine sandy material is likely to form subsurface channels that can rapidly drain a pond.

Artificial drainage for farming is feasible on some of the somewhat poorly drained and poorly drained mineral soils. Costs and estimated benefits of drainage systems, however, should be carefully considered before construction. It generally is more economical to clear and improve the better drained soils that are suitable for crops than it is to make extensive improvements on wet land. An exception to this is the Tanana soils, where drainage is improved after clearing and subsequent recession of the permafrost table. Drainage of Lemeta peats for farming is not feasible, because these soils are low in fertility and have undesirable physical characteristics for producing the crops commonly grown in the Area.

The sloping soils in the Area are susceptible to severe erosion if the vegetation is removed. Careful planning and designing generally are needed to insure that ditches and waterways for the removal of runoff water are safe and adequate. Highway ditches in such soils as the Fairbanks and Minto are especially subject to washing unless they are kept in sod. Constructing diversions, waterways, and ditches with gentle slopes helps to keep gullies from forming, though structures may be needed in places. Farming and stripcropping on the contour and including grasses in the cropping system are practices that help to control erosion on sloping areas. Keeping sod on areas where surface water concentrates also helps to control erosion.

The silty well-drained soils on uplands, including the Fairbanks and Steese, are not well suited to the offroad movement of vehicles and heavy equipment, because much of the terrain is strongly sloping to steep. In addition, these soils are dusty when dry and slippery when wet. On both uplands and alluvial plains, the soils that are underlain by permafrost are wet throughout the summer and can be traversed only by vehicles designed to operate in wet areas. The well-drained soils on outwash areas and alluvial plains, including the Salchaket, Jarvis, and Nenana soils, generally can be traversed by vehicles and heavy equipment after the ground has thawed in spring.

Formation and Classification of Soils

In this section the factors that have affected the formation of soils in the Salcha-Big Delta Area are discussed, and important processes in the differentiation of soil horizons are briefly described. Then, the current system of soil classification is explained, and the soil series represented in the survey are placed in some of the categories of this system. The soil series of the Salcha-Big Delta Area, including a profile representative of each series, are described in the section "Descriptions of the Soils."

Factors of Soil Formation

Soil is produced by the action of soil-forming processes on materials deposited or accumulated by geologic forces. The characteristics of the soil at any given point are determined by the interaction of five major factors: (1) parent material, (2) climate, (3) plants and animals, (4) relief, and (5) time. Also important are the cultural environment and man's use of the soil (*6*).

Climate and plants and animals are the active factors of soil formation. They act on the parent material that has accumulated through the weathering of rocks and slowly change it into a natural body with genetically related horizons. The effects of climate and plants and animals are conditioned by relief. The soils in low-lying areas of the Salcha-Big Delta area, for example, are quite different from those on the well-drained uplands because they have a permanently high water table. The parent material also affects the kind of profile that can be formed and, in extreme cases, determines it almost entirely. Finally, time is needed for the changing of parent material into a soil. It may be much or little, but some time is always required for differentiation of soil horizons. Generally, a long time is needed for distinct horizons to form.

Parent material.—Parent material is the unconsolidated mass from which a soil forms. It determines the limits of the chemical and mineral composition of the soil.

The soils in the Salcha-Big Delta Area formed mainly in alluvial material and loess. Both materials are micaceous because many of the rocks in the Area contain significant amounts of mica. Fairbanks, Gilmore, Nenana, Steese, and Volkmar soils, on uplands and outwash plains, are examples of soils that formed in loess derived from glacial outwash. Jarvis, Tanana, and Salchaket soils, on broad alluvial plains along the major rivers of the Area, are examples of soils that formed in water-deposited sand and silt derived primarily from glaciers. Minto soils, on foot slopes, formed mainly in silty material washed from nearby hillsides. The peats in the Lemeta series are in depressions on broad alluvial plains and in glacial moraines.

Climate.—The Area has a continental climate characterized by long, cold winters and short, warm summers. The total annual precipitation is only about 12 inches, about half of which falls as rain in summer. Winds are light in the northwestern part of the Area, but strong winds are common in all seasons in the southeastern part. Uncultivated well-drained soils generally are moist throughout the summer, but they are likely to be dry if the rainfall is exceptionally low. Other soils in the Area are moist or wet in summer. The soils in most cleared fields, however, are deficient in moisture part of the time.

Plants and animals.—All of the well-drained soils and most of the moderately well drained soils in the Area formed under vegetation that consists mainly of paper birch, quaking aspen, and white spruce. The somewhat poorly drained Tanana soils support stunted stands of paper birch, quaking aspen, and white spruce that are mixed with black spruce, tamarack, and willow. In addition, these soils have a dense cover of grasses, low shrubs, and moss. Some areas of the poorly drained Goldstream soils and the very poorly drained Lemeta soils support sparse stands of trees that are mainly black spruce, but others are treeless. These soils have a ground cover of moss, sedge tussocks, and shrubs.

Relief.—In this survey area the influence of relief on soil development is strongest in its effect on natural drainage. Soils on uplands that have north-facing slopes receive much less heat from the sun than soils that have south-facing slopes. Ester and Saulich soils, for example, have north-facing slopes, and they generally are underlain by permafrost and are always cold and wet. In contrast, most of the nearly level soils that have south-facing slopes lack permafrost, and they are moderately well drained or well drained (*7*). Goldstream and Tanana soils on broad, low, alluvial plains have a perennially frozen substratum, and these soils are somewhat poorly drained or poorly drained. In the well-drained Jarvis and Salchaket soils, which occupy slightly higher positions on levees along rivers, permafrost is deep or is lacking.

Time.—A long time is needed for formation of soils that have distinct horizons. The length of time that parent material has been in place generally is reflected in the degree of formation of the soil profile.

Only the southeastern part of the Salcha-Big Delta Area has been glaciated, but all soils in the Area most likely have developed since the maximum glacial advance from the mountains to the south. Only the well-drained Fairbanks, Steese, Gilmore, and Nenana soils of the uplands and outwash plains, on which loess is no longer being deposited, are mature. Soils forming in recent deposits of alluvial plains are young and have not had time for horizon differentiation. The poorly drained soils on both uplands and alluvial plains show little horizon development.

Classification of Soils

Soils are classified so that we can more easily remember their significant characteristics. Classification enables us to assemble knowledge about soils; to see their relationship to one another and to the whole environment; and to develop principles that help us to understand their behavior and response to kinds of treatment.

Thus, in classification, soils are placed in narrow categories that are used in detailed surveys so that knowledge about the soils can be organized and applied in managing farms, fields, and woodland; in developing rural areas; in engineering work; and in many other ways. The soils are placed in broad classes to facilitate study and comparison in large areas, such as countries and continents.

Two systems of classifying soils have been used in the United States in recent years. The older system was adopted in 1938 (*3*) and later revised (*16*). The system currently used was adopted for general use by the National Cooperative Soil Survey in 1965. It is under continual study. Therefore, readers interested in this system should search the latest literature available (*15*), (*18*). The soil series of the Salcha-Big Delta Area are placed in some categories of the current system in table 6.

TABLE 6.—*Classification of soil series of Salcha-Big Delta Area*

Series	Current classification			1938 classification
	Family	Subgroup	Order	Great group
Beales	Mixed	Typic Cryopsamments	Entisols	Regosols
Bradway	Loamy, mixed, nonacid	Pergelic Cryaquepts	Inceptisols	Low-Humic Gley soils.
Chena	Sandy-skeletal, mixed	Typic Cryorthents	Entisols	Alluvial soils.
Ester	Loamy, mixed, acid	Histic Lithic Cryaquepts	Inceptisols	Humic Gley soils.
Fairbanks	Coarse-silty, mixed	Alfic Cryochrepts	Inceptisols	Subarctic Brown Forest soils
Gilmore	Loamy, mixed	Lithic Cryochrepts	Inceptisols	Subarctic Brown Forest soils.
Goldstream	Loamy, mixed, acid	Histic Pergelic Cryaquepts	Inceptisols	Humic Gley soils
Goldstream, gravelly subsoil variant.	Loamy-skeletal, mixed, acid	Histic Cryaquepts	Inceptisols	Humic Gley soils.
Jarvis	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid.	Typic Cryofluvents	Entisols	Alluvial soils.
Lemeta	Dysic	Pergelic Sphagnofibrists	Histosols	Bog soils.
Minto	Coarse-silty, mixed, nonacid	Aeric Cryaquepts	Inceptisols	Subarctic Brown Forest soils intergrading toward Low-Humic Gley soils.
Nenana	Coarse-silty over sandy or sandy-skeletal, mixed	Typic Cryochrepts	Inceptisols	Subarctic Brown Forest soils.
Richardson	Coarse-silty, mixed, nonacid	Aeric Cryaquepts	Inceptisols	Subarctic Brown Forest soils intergrading toward Low-Humic Gley soils
Salchaket	Coarse-loamy, mixed, nonacid	Typic Cryofluvents	Entisols	Alluvial soils.
Saulich	Loamy, mixed, nonacid	Histic Pergelic Cryaquepts	Inceptisols	Humic Gley soils.
Steese	Coarse-silty, mixed	Typic Cryochrepts	Inceptisols	Subarctic Brown Forest soils
Tanana	Loamy, mixed, nonacid	Pergelic Cryaquepts	Inceptisols	Low-Humic Gley soils intergrading toward Alluvial soils.
Tanana, sandy subsoil variant.	Sandy, mixed, acid	Typic Cryaquepts	Inceptisols	Low-Humic Gley soils.
Volkmar	Coarse-silty over sandy or sandy-skeletal, mixed, nonacid.	Aeric Cryaquepts	Inceptisols	Subarctic Brown Forest soils intergrading toward Low-Humic Gley soils

The current system of classification has six categories. Beginning with the broadest, these categories are order, suborder, great group, subgroup, family, and series. In this system the criteria used as a basis for classification are soil properties that are observable and measurable. The properties are chosen, however, so that the soils of similar origin are grouped together. The placement of some soil series in the current system of classification, particularly in families, may change as more precise information becomes available. The categories of the current system are briefly defined in the paragraphs that follow:

ORDERS. Ten soil orders are recognized. They are Entisols, Vertisols, Inceptisols, Aridisols, Mollisols, Spodosols, Alfisols, Ultisols, Oxisols, and Histosols. The properties used to differentiate the soil orders tend to give broad climatic groupings of soils. Two exceptions, the Entisols and the Histosols, are present in many kinds of climate. The three soil orders represented in the Salcha-Big Delta Area are Entisols, Histosols, and Inceptisols.

Entisols have few, if any, clearly expressed characteristics. In the Salcha-Big Delta Area, these soils are represented by *Typic Cryofluvents*, which are well-drained stratified soils on alluvial plains; by *Typic Cryorthents*, which are well-drained clayey, loamy, or very gravelly soils; and by *Typic Cryopsamments*, which are well-drained sandy soils.

Histosols consist primarily of organic material. They are represented in the Salcha-Big Delta Area by *Pergelic Sphagnofibrists*, which are perennially frozen peats that formed mainly from fibrous remains of sphagnum moss.

Inceptisols are soils in which the parent material has been modified. They have weakly expressed horizons. In the Salcha-Big Delta Area Cryaquepts and Cryochrepts are recognized. *Typic Cryaquepts* are gray or grayish brown in color and are mottled, characteristics associated with wetness. *Aeric Cryaquepts* are brownish in color, in addition to mottling, a characteristic associated with wetness. *Pergelic Cryaquepts* are perennially frozen. They are gray in color, and they commonly contain mottles. *Hystic Cryaquepts* have a fairly thick accumulation of organic material on the surface, are gray in color, and commonly contain mottles. *Histic Pergelic Cryaquepts* are perennially frozen. They have a fairly thick accumulation of organic material on the surface, are gray in color, and commonly contain mottles. *Histic Lithic Cryaquepts* in this Area are perennially frozen. They have a fairly thick accumulation of organic material on the surface and characteristics associated with wetness. Bedrock is at a depth of less than 20 inches. *Typic Cryochrepts* are well drained, and their surface layer and subsoil are brown. *Lithic Cryochrepts* are well drained and have a brown surface layer and subsoil. Bedrock is at a depth of less than 20 inches.

SUBORDERS. Each order is divided into suborders, primarily on the basis of those soil characteristics that seem to produce classes having the greatest genetic similarity. Suborders narrow the broad climatic range of the orders. The soil properties used to distinguish suborders are mainly those that reflect the presence or absence of waterlogging or soil differences that result from the effects of climate or vegetation.

GREAT GROUPS. The suborders are divided into great groups on the basis of uniformity in the kinds and sequence of major soil horizons and features. The horizons used as a basis for distinguishing between great groups are those in which (1) clay, iron, or humus have accumulated; (2) a pan has formed that interferes with growth of roots, movement of water, or both; or (3) a thick, dark-colored surface horizon has formed. The other features commonly used are the self-mulching properties of clay, soil temperature, major differences in chemical composition (mainly calcium, magnesium, sodium, and potassium), or the dark-red or dark-brown colors associated with soils formed in material weathered from basic rock.

SUBGROUPS. Great soil groups are divided into subgroups. One of these represents the central, or typic, segment of the group. Other subgroups, called intergrades, have properties of the group, but have one or more properties of another great group, suborder, or order. Subgroups may also be made for soils that have properties that grade to characteristics outside the range of any other great group, suborder, or order.

FAMILIES. Families are separated within a subgroup primarily on the basis of properties important to the growth of plants or to the behavior of soils when used for engineering. Among the properties considered are texture, mineralogy, reaction, soil temperature, permeability, thickness of horizons, and consistence. A family name consists of a series of adjectives preceding the subgroup name. The adjectives are the class names for texture, mineralogy, temperature, and so on.

SERIES. The series is a group of soils that formed from a particular kind of parent material and have major horizons that, except for texture of the surface layer, are similar in important characteristics and in arrangement in the profile. The soils are given the name of a geographic location near the place where that series was first observed and mapped.

General Nature of the Area

This section is provided mainly for those who are unfamiliar with the survey area. Factors discussed are physiography and drainage; geology; climate; vegetation; and settlement and development.

Physiography and Drainage

The northwestern part of the Salcha-Big Delta Area consists mainly of rounded hills and ridges. Most valley bottoms are narrow, but the alluvial plains along the Tanana and Salcha Rivers are broad and nearly level. Elevation in this part of the Area ranges from about 600 feet on the Tanana River bottom to almost 2,000 feet on the prominent ridgetops.

Glacial outwash plains and alluvial plains are dominant in the southeastern part of the Area. These broad nearly level tracts are interrupted by stabilized dunes and by a low moraine that extends into the Area southeast of Delta Junction.

Extensive stands of aspen, paper birch, and white spruce grow on most of the well-drained sites. Dense stands of black spruce generally grow on sites where drainage is poor, but mosses, sedges, and low-growing shrubs cover broad waterlogged areas.

The entire Area is drained by the Tanana River and its tributaries. Streams that drain the unglaciated uplands are relatively clear, but the major tributaries that flow from mountains in the south, as well as the Tanana River, are glacier fed and are heavily laden with silt and sand. Flood plains, alluvial plains, and low terraces bordering the major rivers and streams of the Area consist mainly of silty and fine sandy water-laid sediment over thick deposits of rounded gravel and sand.

Permafrost in the Area is discontinuous (*11*). It generally is at a depth of less than 30 inches in the thick silty sediment on alluvial bottoms, in upland drainageways, in areas where slopes face north, and in depressions filled with organic material. In these places the high permafrost table is preserved by a thick surface layer of moss or other vegetation that serves as insulating material. If this material is removed, burned, or disturbed, the permafrost table recedes to a greater depth.

Soils on uplands that have south-facing slopes lack permafrost, but on colluvial foot slopes large ice masses are buried in redeposited loess (*12*). If the vegetation is removed, these ice masses melt, and thermokarst forms, characterized by steep-walled pits and extremely hummocky relief.

Geology

The rounded hills and ridges in the northwestern part of the Area, north of the Tanana River, are a part of the unglaciated Yukon-Tanana Upland. The bedrock is chiefly Precambrian Birch Creek schist, but a few masses of granite and quartz diorite are exposed (*4, 10*). Except for a few steep cliffs and bluffs, most areas on uplands are covered by a mantle of silty micaceous loess derived chiefly from outwash plains south of the Tanana River (*13*). This mantle of loess ranges from a few inches to many feet in thickness on most of the hills and ridges. It generally is thinner in places farther away from the

Tanana River and on the higher ridges. Much of the original loess washed from the slopes, and it accumulated on foot slopes and in upland valleys.

The geology of the southeastern part of the Area, south of the Tanana River, contrasts sharply with the unglaciated northwestern part. Glaciers from the Alaska Range extended into this part of the Area during the Pleistocene era. As they retreated, large deposits of coarse sandy and gravelly material were laid down by glacial melt water, and broad outwash plains were formed. These plains slope gradually toward the Tanana River to the north. Also included in the Area is stony and gravelly material of the Delta moraine, which is just east of Delta Junction. This moraine is characterized by a kettel and kame topography of low relief. Low stabilized sand dunes occur on the outwash plains, especially next to flood plains of major streams. A large area of dunes borders the Shaw Creek Flats north of the mouth of the Delta River.

Climate [3]

The Salcha-Big Delta Area has a continental climate typical of the Interior Basin of Alaska. The climate is characterized by extreme seasonal variations in temperature and by low total precipitation. Table 7 provides temperature and precipitation data compiled from records kept at Big Delta FAA (Fort Greeley) and at Eielson Air Force Base. Table 8 provides these data based on records kept at Richardson Roadhouse. Probability data for the occurrence of specified temperatures in spring and in fall shown in table 9 are based on records kept at Eielson Air Force Base and at Big Delta. The climatic data presented in these tables are considered representative of the Salcha-Big Delta Area.

Soil temperature data are available for only the Big Delta Station. A summary of 14 years of data, based on

[3] By Harold W. Searby, regional climatologist for Alaska, National Weather Service, U.S. Department of Commerce.

TABLE 7.—*Temperature and precipitation data*

EIELSON AIR FORCE BASE, ALASKA

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 10 will have at least 4 days with— Maximum temperature equal to or higher than—	Two years in 10 will have at least 4 days with— Minimum temperature equal to or lower than—	Average total	One year in 10 will have— Less than—	One year in 10 will have— More than—	Days with snow cover	Average depth of snow on ground last day of month
					Inches	*Inches*	*Inches*	*Number*	*Inches*
January	−1	−18	27	−44	1 13	0 15	2. 07	31	18
February	6	−17	30	−40	. 89	. 17	2. 10	28	21
March	24	−4	41	−29	. 69	. 22	1 57	31	16
April	40	17	55	−7	66	. 03	1 58	23	1
May	58	37	72	22	. 80	18	1 66	(1)	0
June	69	48	82	42	1. 77	. 41	3. 15	0	0
July	71	50	84	40	2. 52	. 81	4 44	0	0
August	66	45	80	36	2. 27	84	3 58	0	0
September	53	34	67	25	1. 65	21	2 97	1	(1)
October	34	18	48	−5	1 18	. 30	2 98	17	3
November	11	−4	33	−29	87	. 23	2. 00	25	8
December	−3	−18	25	−42	94	. 02	2. 44	29	13
Year	36	16			15 37				
BIG DELTA, ALASKA									
January	3	−12	23	−36	0 35	0 01	1 32	29	10
February	11	−7	29	−33	41	07	2 93	26	13
March	23	0	39	−24	32	05	80	28	9
April	40	19	52	−5	35	02	1 85	17	2
May	57	37	69	22	89	. 04	2 03	4	0
June	67	47	77	41	2 34	80	4 91	0	0
July	69	50	79	45	2 41	61	3. 17	0	0
August	64	46	75	38	1 99	. 71	3 65	0	0
September	52	35	63	25	1 20	57	1. 91	1	(1)
October	33	19	46	−2	55	. 05	1 20	18	4
November	14	1	33	−22	37	09	1. 11	24	4
December	3	−11	22	−39	46	. 13	1 00	30	8
Year	36	19			11 64				

[1] Less than 0.5 day.

the work of Aitken (*1*), is shown in table 10. As would be expected, the soil temperature and free-air temperature trends in spring and in fall are relatively abrupt. This pattern gives little or no advance warning for the first freeze in fall; however, after the first freeze in fall, the downward trend in temperature is rapid.

Temperature extremes in the survey area range from 95° in summer to 63° below zero in winter. Readings of 70° or higher have been recorded for about 38 percent of the days in June, July, and August. A temperature of 32° or lower has been recorded for every month except July at Eielson Air Force Base and at Big Delta, and it has

TABLE 8.—*Temperature and precipitation data*

RICHARDSON, ALASKA

Month	Temperature				Precipitation				
	Average daily maximum	Average daily minimum	Two years in 7 will have at least 4 days with—		Average total	One year in 7 will have—		Days with snow cover	Average depth of snow on ground last day of month
			Maximum temperature equal to or higher than—	Minimum temperature equal to or lower than—		Less than—	More than—		
					Inches	*Inches*	*Inches*	*Number*	*Inches*
January	13	−9	32	−30	1. 04	(1)	4 60	31	16
February	14	−10	29	−36	. 35	(1)	1 24	28	18
March	26	−4	45	−26	. 09	(1)	. 21	31	13
April	49	19	59	−4	. 25	. 0	1. 42	13	5
May	63	31	73	25	. 65	. 15	1. 36	2	0
June	73	42	83	33	2. 20	1. 29	3. 89	0	0
July	73	43	82	37	2. 57	1. 29	4 18	0	0
August	69	41	78	32	2 60	. 62	3 76	0	0
September	58	32	70	22	1 40	81	2 45	1	(2)
October	39	18	55	0	79	. 29	1. 86	8	2
November	18	−1	38	−22	. 56	. 12	1. 72	27	6
December	8	−10	33	−38	. 39	. 05	. 77	31	9
Year	42	16			12 89				

[1] Trace.
[2] Less than 0 5 day.

TABLE 9.—*Probability of specified temperatures in spring and in fall*

EIELSON AIR FORCE BASE, ALASKA

Probability	Dates for given probability and temperature of—				
	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring.					
1 year in 10 later than	May 4	May 6	May 10	May 15	May 26
2 years in 10 later than	May 1	May 3	May 8	May 13	May 24
5 years in 10 later than	April 24	April 27	May 1	May 9	May 19
Fall					
1 year in 10 earlier than	September 29	September 19	September 14	September 4	August 29
2 years in 10 earlier than	October 1	September 23	September 17	September 6	August 30
5 years in 10 earlier than	October 9	October 2	September 26	September 11	September 3

BIG DELTA, ALASKA

Probability	16° F. or lower	20° F. or lower	24° F. or lower	28° F. or lower	32° F. or lower
Spring:					
1 year in 10 later than	May 3	May 6	May 11	May 20	May 31
2 years in 10 later than	May 1	May 4	May 9	May 18	May 28
5 years in 10 later than	April 24	April 25	May 1	May 10	May 19
Fall·					
1 year in 10 earlier than	September 30	September 20	September 14	September 2	August 30
2 years in 10 earlier than	October 2	September 24	September 17	September 5	September 1
5 years in 10 earlier than	October 12	October 3	September 27	September 14	September 6

TABLE 10.—*Average soil temperatures recorded first day of month*

Period of record 1947–60

BIG DELTA, ALASKA

Soil depth	Average soil temperature in—											
	January	February	March	April	May	June	July	August	September	October	November	December
Feet	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.	°F.
0.0[1]	14.2	10.8	14.3	20.4	43.0	60.9	64.6	62.4	52.6	35.4	25.7	20.6
0.5	16.9	11.8	13.9	19.4	32.6	48.2	55.9	56.6	50.2	35.8	29.0	22.1
1.0	19.5	13.5	15.1	19.8	31.4	45.8	54.2	55.6	51.1	37.3	30.8	25.6
2.0	21.7	15.6	16.6	21.0	30.3	40.0	50.5	54.8	50.5	38.6	31.9	27.8
4.0	30.2	24.1	21.3	23.5	27.6	31.2	38.9	47.5	47.9	40.2	34.6	33.0
7.0	33.7	31.4	28.7	27.7	29.2	31.1	31.3	36.4	41.4	39.5	36.5	34.8
11.0	34.5	33.4	32.2	31.0	30.7	30.6	31.5	32.1	37.1	36.2	36.9	35.7
16.0	35.3	34.4	34.0	33.1	32.7	32.5	32.5	32.4	34.3	35.3	36.3	35.8
22.0	35.0	34.6	34.4	33.6	33.3	32.7	32.8	32.6	32.7	33.7	34.4	34.2

[1] Sensor installed at a depth of ⅛ to ¼ inch below the surface.

been recorded for every month of the year at Richardson.

Differences in elevation and terrain throughout the Area account for wide variations in the length of the growing season. In some places the growing season begins as early as mid-May and lasts as late as mid-September. In 9 out of 10 years, the growing season is 110 days at Big Delta, 106 days at Eielson Air Force Base, and 88 days at Richardson, which is exposed to cold-air drainage. Long periods of daylight, which promote rapid growth of most crops, compensate for the short growing seasons.

Annual precipitation ranges from about 11 to about 16 inches. The distribution of rain in summer is fairly even. One-half or more of the total annual rainfall comes in June, July, and August. For short periods, however, the supply of moisture is short because precipitation in summer occurs mostly as showers. Thunderstorms that may be accompanied by hail are fairly common, but crops seldom are damaged. Total annual snowfall ranges from about 36 inches in the southern and central parts of the Area to about 60 inches in the northern part. Snow generally covers the ground from mid-October to mid-April.

In summer surface winds are strong. They generally are caused by large pressure differentials or accompany thunderstorms. Winds resulting from large pressure differentials are local in nature and generally occur next to passes or valleys, thus forcing large volumes of air through small areas. These winds last longer than those associated with thunderstorms. Winds associated with thunderstorms occur throughout the Area, but winds resulting from any one storm affect only a small part of the Area at any one time. Both types of winds can be strong enough to erode the soil.

Vegetation

Most of the Salcha-Big Delta Area is wooded, but large treeless tracts are common. The stands differ in type, age, and density. Sharp boundaries between stands of contrasting age and type frequently result from past forest fires, and gradual boundaries indicate differences in environmental influences.

Paper birch (*Betula papyrifera*), quaking aspen (*Populus tremuloides*), and white spruce (*Picea glauca*) are dominant on well-drained soils on uplands, on outwash plains, and on alluvial plains (*5, 9*). On uplands, quaking aspen generally is dominant on soils that face south, and paper birch generally is dominant on soils that face northeast and northwest. Black spruce (*Picea mariana*) grows on many of the poorly drained soils on north-facing slopes and on alluvial plains. Cottonwood, or balsam poplar, (*Populus balsamifera*) is common on soils on alluvial plains along the major streams of the Area, and tamarack (*Larix laricina*) grows in a few places where drainage is poor. Stands of bushy green alder (*Alnus crispa*), thinleaf alder (*Alnus tenuifolia*), and willow (*Salix spp*) are along streams, on the edges of muskegs, and on a few burned-over areas. Many poorly drained soils that have a high permafrost table are treeless, and they commonly have a thick cover of moss, sedge tussocks, and low shrubs.

On well-drained soils the climax woody vegetation consists mainly of white spruce, but only a few remain, largely because of overcutting and widespread forest fires in the past. Following repeated forest fires, fireweed, grasses, or shrubs invade burned-over areas. Paper birch and quaking aspen grow in almost pure stands in places, but white spruce commonly is in the understory. If white spruce is not disturbed, it eventually replaces the climax trees.

Most of the trees in the Area are young, but stands of paper birch and quaking aspen are mature, or are approaching maturity, in many places, especially in soils on uplands. At an estimated age of 90, dominant and codominant trees in these stands average about 70 feet in height and about 7 to 8 inches in diameter at breast height (*5*). The average gross merchantable volume in well-stocked stands is about 2,000 to 2,500 cubic feet per acre for birch and about 3,000 to 4,000 cubic feet per acre for aspen. Willow and alder commonly are in the understory of established stands.

Most of the plants, including trees, have a shallow root system. The roots of most plants are limited to the organic material on the surface of the soil. Consequently, windthrow generally is a hazard. A few trees are cut to provide lumber and logs for local needs.

Wildlife

Wildlife is abundant in the Salcha-Big Delta Area. Moose are the principal big game animal, but many black bear, a few grizzly bear, and many smaller animals also live in the Area (*14*). A herd of more than 500 bison live near Delta Junction in winter. This herd originally consisted of about 30 head that were transplanted from Montana in 1928.

Ducks, geese, and other migratory waterfowl use the Area as a stopover and nesting ground. Upland game birds include sharptail grouse, spruce grouse, summer songbirds, and willow ptarmigan.

Grayling, northern pike, salmon, and trout are in many of the lakes and streams.

The kinds and abundance of wildlife in the various parts of the Area depend largely on the type and condition of habitat, which, in turn, is related to the kind of soil and land use. Distribution of wildlife in relation to the soil associations in the Salcha-Big Delta Area is briefly discussed in the section "General Soil Map," and the soils in each association are shown on the map in the back of this survey.

Settlement and Development

Alaska was settled by the Russians from 1741 to 1867. The settlements generally were confined to coastal areas; consequently, the interior of Alaska, inhabitated mainly by Athabascan Indians, was virtually unexplored during that period. Although a few fur traders and several groups explored the Area between 1850 and 1880, settlement away from the coast did not begin until after gold was discovered late in the 19th century.

Shortly after 1900 Fairbanks became the principal center of population and activity. Men, supplies, and equipment were first transported to the region by riverboats and barges by way of the Yukon River. About 1913, however, a wagon road, the Richardson Trail, was constructed from Valdez to Fairbanks. This road, which roughly paralleled the present route of the Richardson Highway, passed through the northwestern part of the Salcha-Big Delta Area. Roadhouses and trading centers that were established along the Richardson Trail represent the first permanent settlements in the Area. Mining for placer gold was a major activity on many of the streams during this period. By 1920 the easily accessible deposits of gold were exhausted, and the population of the Area declined rapidly.

With the construction of military bases and the Alaska Highway, which connects Fairbanks with Dawson Creek, B.C., a new period of development began in the Area in the 1940's. Homesteading and the establishment of small businesses followed.

Delta Junction, the only incorporated city in the Salcha-Big Delta Area, is the largest trading center. In addition, several businesses along the Alaska and Richardson Highways cater to local residents and to travelers. No large industries are in the Area, but tourism and the military bases provide opportunities for business and employment.

Several residents are engaged in farming. For the most part, however, income from farming is supplemented by other forms of employment.

Farming

The first significant demands for farm products in the Tanana Valley came because of an increase in the number of gold miners and prospectors who migrated to the Area at the turn of the century and as the result of railroad construction in the early 1920's. Most of the settlers were in Fairbanks, and farm products grown near there provided many of the settler's needs. During this time limited farming was done in the northwestern part of the Salcha-Big Delta Area along the Richardson Trail. The principal crops were hay and grain for horses, but a few vegetables were grown and sold to operators of roadhouses along the Richardson Trail.

Farm settlements were established in the Area following completion of military bases and the Alaska Highway during World War II. In the postwar period a number of settlers, many of whom included veterans and their families, moved to the Area to develop homesteads. Some of these families settled on or near highways, but most of the farm settlements were near Clearwater Lake east of Delta Junction. Because of the high cost of clearing and improving the land and the long time required to prepare the land for crops, most of the settlers had to supplement their farm income by means of other employment. Many abandoned their homesteads and moved elsewhere to seek employment.

Some of the settlers developed their homesteads and are engaged in full-time farming, but their income still must be supplemented. Potatoes, small grains, and hardy vegetables are the principal crops. In addition dairying is a source of income on several farms.

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Glossary

Alluvium. Soil material, such as sand, silt, or clay, that has been deposited on land by streams

Available water capacity (also termed available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field capacity and the amount at wilting point It is commonly expressed as inches of water per inch of soil.

Clay. As a soil separate, the mineral soil particles less than 0 002 millimeter in diameter. As a soil textural class, soil material that is 40 percent or more clay, less than 45 percent sand, and less than 40 percent silt.

Consistence, soil. The feel of the soil and the ease with which a lump can be crushed by the fingers Terms commonly used to describe consistence are—

Loose—Noncoherent when dry or moist; does not hold together in a mass

Friable—When moist, crushes easily under gentle pressure between thumb and forefinger and can be pressed together into a lump.

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

Plastic.—When wet, readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky.—When wet, adheres to other material, and tends to stretch somewhat and pull apart, rather than to pull free from other material.

Hard.—When dry, moderately resistant to pressure; can be broken with difficulty between thumb and forefinger

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

Cemented.—Hard and brittle; little affected by moistening.

Drainage class (natural) Refers to the conditions of frequency and duration of periods of saturation or partial saturation that existed during the development of the soil, as opposed to altered drainage, which is commonly the result of artificial drainage or irrigation but may be caused by the sudden deepening of channels or the blocking of drainage outlets. Seven different classes of natural soil drainage are recognized.

Excessively drained soils are commonly very porous and rapidly permeable and have a low-water-holding capacity.

Somewhat excessively drained soils are also very permeable and are free from mottling throughout their profile.

Well-drained soils are nearly free from mottling and are commonly of intermediate texture.

Moderately well drained soils commonly have a slowly permeable layer in or immediately beneath the solum They have uniform color in the A and upper B horizons and have mottling in the lower B and the C horizons

Somewhat poorly drained soils are wet for significant periods but not all the time, and some soils commonly have mottling at a depth below 6 to 16 inches

Poorly drained soils are wet for long periods and are light gray and generally mottled from the surface downward, although mottling may be absent or nearly so in some soils

Very poorly drained soils are wet nearly all the time. They have a dark-gray or black surface layer and are gray or light gray, with or without mottling, in the deeper parts of the profile.

Flood plain. Nearly level land, consisting of stream sediments, that borders a stream and is subject to flooding unless protected artificially

Glacial till (geology). Unassorted, nonstratified glacial drift consisting of clay, silt, sand, and boulders transported and deposited by glacial ice.

Horizon, soil. A layer of soil, approximately parallel to the surface, that has distinct characteristics produced by soil-forming processes. These are the major horizons:

O horizon—The layer of organic matter on the surface of a mineral soil This layer consists of decaying plant residues.

A horizon—The mineral horizon at the surface or just below an O horizon. This horizon is the one in which living organisms are most active and therefore is marked by the accumulation of humus. The horizon may have lost one or more of soluble salts, clay, and sesquioxides (iron and aluminum oxides)

B horizon.—The mineral horizon below an A horizon. The B horizon is in part a layer of change from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics caused (1) by accumulation of clay, sesquioxides, humus, or some combination of these, (2) by prismatic or blocky structure: (3) by redder or stronger colors than the A horizon, or (4) by some combination of these. Combined A and B horizons are usually called the solum, or true soil If a soil lacks a B horizon, the A horizon alone is the solum.

C horizon—The weathered rock material immediately beneath the solum In most soils this material is presumed to be like that from which the overlying horizons were formed If the material is known to be different from that in the solum, a Roman numeral precedes the letter C

R layer—Consolidated rock beneath the soil The rock usually underlies a C horizon but may be immediately beneath an A or B horizon.

Loess. Fine-grained material, dominantly of silt-sized particles, that has been deposited by wind.

Mottling, soil. Irregularly marked with spots of different colors that vary in number and size Mottling in soils usually indicates poor aeration and lack of drainage Descriptive terms are as follows: Abundance—*few, common,* and *many;* size—*fine, medium,* and *coarse;* and contrast—*faint, distinct,* and *prominent.* The size measurements are these: *fine* less than 5 millimeters (about 0 2 inch) in diameter along the greatest dimension; *medium,* ranging from 5 millimeters to 15 millimeter (about 0 2 to 0 6 inch) in diameter along the greatest dimension: and *coarse,* more than 15 millimeters (about 0 6 inch) in diameter along the greatest dimension.

Munsell notation. A system for designating color by degrees of the three simple variables—hue, value, and chroma For example, a notation of 10YR 6/4 is a color with a hue of 10YR, a value of 6, and a chroma of 4.

Nutrient, plant. Any element taken in by a plant, essential to its growth and used by it in the production of food and tissue. Nitrogen, phosphorus, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, zinc, and perhaps other elements obtained from the soil, and carbon, hydrogen, and oxygen, obtained largely from the air and water, are plant nutrients.

Parent material. Disintegrated and partly weathered rock from which soil has formed.

Permafrost. Layers of soil in which the temperatures permanently are at or below 0° C., whether the consistence is very hard or loose (dry permafrost).

Permeability. The quality that enables the soil to transmit water or air. Terms used to describe permeability are as follows: *very slow, slow, moderately slow, moderate, moderately rapid, rapid, and very rapid.*

Reaction, soil. The degree of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7 0 is precisely neutral in reaction because it is neither acid nor alkaline. An acid, or "sour," soil is one that gives an acid reaction; an alkaline soil is one that is alkaline in reaction In words, the degrees of acidity or alkalinity are expressed thus:

	pH		*pH*
Extremely acid	Below 4.5	Neutral	6 6 to 7.3
Very strongly acid	4 5 to 5.0	Mildly alkaline	7 4 to 7.8
Strongly acid	5 1 to 5 5	Moderately alkaline	7 9 to 8.4
Medium acid	5 6 to 6 0	Strongly alkaline	8.5 to 9.0
Slightly acid	6.1 to 6.5	Very strongly alkaline	9 1 and higher

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

Sand. Individual rock or mineral fragments in a soil that range in diameter from 0 05 to 2 0 millimeters. Most sand grains consist of quartz, but they may be of any mineral composition. The textural class name of any soil that contains 85 percent or more sand and not more than 10 percent clay.

Silt. Individual mineral particles in a soil that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0 05 millimeter). Soil of the silt textural class is 80 percent or more silt and less than 12 percent clay.

Soil. A natural, three-dimensional body on the earth's surface that supports plants and that has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil separates. Mineral particles, less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes of separates recognized in the United States are as follows: *Very coarse sand* (2 0 to 1 0 millimeter); *coarse sand* (1 0 to 0 5 millimeter); *medium sand* (0 5 to 0 25 millimeter); *fine sand* (0 25 to 0 10 millimeter); *very fine sand* (0 10 to 0 05 millimeter); *silt* (0.05 to 0.002 millimeter); and *clay* (less than 0.002 millimeter). The separates recognized by the International Society of Soil Science are as follows: I (2 0 to 0.2 millimeter); II (0 2 to 0 02 millimeter); III (0 02 to 0.002 millimeter); IV (less than 0 002 millimeter).

Structure, soil. The arrangement of primary soil particles into compound particles or clusters that are separated from adjoining aggregates and have properties unlike those of an equal mass of unaggregated primary soil particles. The principal forms of soil structure are—*platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering together without any regular cleavage, as in many claypans and hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. Technically, the part of the soil below the solum.

Surface soil. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, about 5 to 8 inches in thickness. The plowed layer

Terrace (geological). An old alluvial plain, ordinarily flat or undulating, bordering a river, lake, or the sea. Stream terraces are frequently called second bottoms, as contrasted to flood plains, and are seldom subject to overflow. Marine terraces were deposited by the sea and are generally wide

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil The basic textural classes, in order of increasing proportion of fine particles, are *sand, loamy sand, sandy loam, loam, silt loam, silt, sandy clay loam, clay loam, silty clay loam, sandy clay, silty clay,* and *clay.* The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

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

Water table. The highest part of the soil or underlying rock material that is wholly saturated with water In some places an upper, or perched, water table may be separated from a lower one by a dry zone.

Windbreak. Any shelter that protects from the wind. A vegetative windbreak is a strip of closely spaced trees or shrubs that is planted primarily to deflect wind currents and thereby reduce soil blowing, control snow drifting, conserve moisture, and protect crops, orchards, livestock, and buildings.

GUIDE TO MAPPING UNITS

For a full description of a mapping unit, read both the description of the mapping unit and that of the soil series to which the mapping unit belongs. In referring to a management group, read the introduction to the subsection it is in for general information about management of the soils. Other information is given in tables as follows:

Acreage and extent, table 1, p. 6.
Estimated yields, table 2, p. 23.

Engineering uses of the soils, tables 3, 4, and 5, pp. 30 through 41.

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