



United States Department of Agriculture,
Natural Resources Conservation Service

In cooperation with
the University of Alaska Fairbanks
Agricultural and Forestry Experiment
Station, and the State of Alaska Department
of Natural Resources

Soil Survey of Upper Tanana Area, Alaska



This soil survey is a publication of the National Cooperative Soil Survey, a joint effort of the United States Department of Agriculture (USDA) and other Federal agencies, State agencies, and local agencies. The Natural Resources Conservation Service (NRCS) (formerly the Soil Conservation Service) has leadership for the Federal part of the National Cooperative Soil Survey.

Major fieldwork for this soil survey was completed in 1982. Soil names and descriptions were approved in 1986. Unless otherwise indicated, statements in this publication refer to conditions in the Survey Area in 1982. This survey was made cooperatively by the Natural Resources Conservation Service, the University of Alaska Fairbanks Agricultural and Forestry Experiment Station, and the State of Alaska Department of Natural Resources. It is part of the technical assistance furnished to the Salcha-Big Delta Soil and Water Conservation District.

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Cover: Mt. Hayes, in the Alaska Range, dominates Map Unit 311—Jarvis-Fubar complex, 0 to 7 percent slopes, on the alluvial plain.

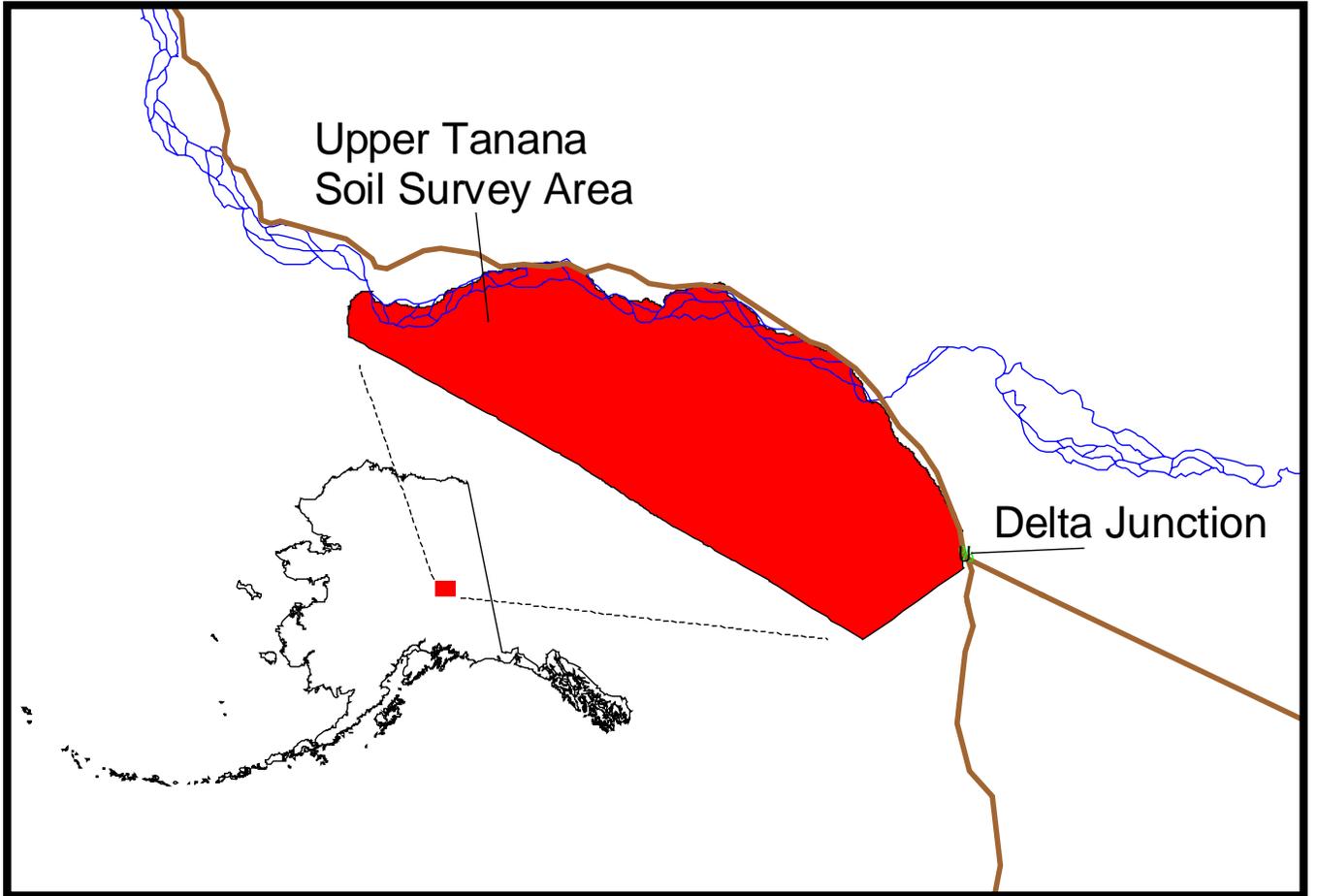


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Foreword

This soil survey contains information that affects land use planning in the Upper Tanana Area, Alaska. It contains predictions of soil behavior for selected land uses, and highlights limitations and hazards inherent in the soil, improvements needed to overcome the limitations, and the impact of selected land uses on the environment.

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

Various land use regulations of Federal, State, and local governments may impose special restrictions on land use or land treatment. The information in this report is intended to identify soil properties that are used in making various land use or land treatment decisions. Statements made in this report are intended to help the land users identify and reduce the effects of soil limitations that affect various land uses. The landowner or user is responsible for identifying and complying with existing laws and regulations.

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

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



Charles Bell
State Conservationist
Natural Resources Conservation Service

Soil Survey of Upper Tanana Area, Alaska

By Byron E. Koepke, Natural Resources Conservation Service

Fieldwork by Pete Crews, Marvin E. Haagen, Richard Hosler, Byron E. Koepke, and Joseph W. McCloskey, Natural Resources Conservation Service

Edited by Linda L. Giani, Natural Resources Conservation Service

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General Nature of the Survey Area

Introduction

The Upper Tanana Area is located in east-central Alaska, extending approximately 34 miles northwest from the community of Delta Junction. It is bounded by the Delta River on the east, the Tanana River on the north, and Fort Greely Military Reservation on the south. The area totals 182,717 acres or about 286 square miles. The population is limited to a few homesteads near the confluence of the Delta and Tanana Rivers and a few recreational cabins on Clear Creek.

Alluvial plains associated with the major drainageways, glacial moraines, glacial outwash plains, and some hills related to the Yukon-Tanana Uplands (north of the Tanana River) characterize the area. Elevations range from 850 to 1,750 feet (259 to 533 m). Permafrost is scattered throughout the area, but is dominant on the nearly level alluvial plains and broad mountain valleys and foot slopes. The broad glacial outwash plain in the central part of the area, and the glacial moraine in the eastern part of the area, are mantled with micaceous loess. These two areas have the greatest agricultural potential.

During the survey, the area was accessible only by aircraft (and to a limited degree by boat). The few homesteaders in the area access their homesteads by boat across the Tanana River in the summer, and over the ice in the winter. Heavy freight loads are moved over the ice. These homesteads produce some hay and pasture, and a few livestock. Due to inaccessibility and the lack of development, the area is prime wildlife habitat that provides opportunities for trapping and recreational activities such as hunting and fishing.

History

Prepared by Roger Boyer, former District Conservationist, Natural Resources Conservation Service

Delta Junction, the only incorporated town near the Survey Area, lies on the east bank of the Delta River about nine miles south of the confluence of the Delta and Tanana Rivers.

Settlement of the area began in 1903 following the establishment of an overland trail between Valdez and Fairbanks, along the route of what is now the Richardson Highway. A roadhouse was built on the Tanana River, near the mouth of the Delta River, in an area known as Big Delta (later called Rika's Landing). Buffalo Center was established in 1927 (named after a wild herd of buffalo introduced into the area two years earlier). In 1942, when construction of Fort Greely began, the Alaska Highway was connected with the Richardson Highway at Buffalo Center, and the town's name was changed to Delta Junction.

In 1984, 1,170 people resided in Delta Junction and 2,420 inhabited the rural areas. An additional 2,200 soldiers and dependents were housed at Fort Greely. More than 100 small- and medium-sized businesses provided employment, including two grain handling facilities, a bulk fertilizer plant, several small sawmills, an Alaska Pipeline pump station, and numerous retail outlets, restaurants, and motels. Government agencies, schools, and utilities also provided opportunities for employment.

The more than 300 farms in the immediate vicinity centered on small grains (mainly barley and grass seed), hay production, beef cattle, dairy, and swine. More than 100,000 acres of agricultural land had been cleared and was in various degrees of development or production. All but about 15,000 acres had been released by the state through agricultural land sales that began in 1978. The remainder had been released under the earlier state and federal homesteading programs dating back to the early 1950's. Many hunters, trappers, and fisherman resided in the area.

Climate

The climate of the Upper Tanana Area is continental. Summer temperatures are mild, with maximum temperatures in the 65 to 80°F range (reaching 90°F on rare occasions), with 18-21 hours of daylight. The average freeze-free period is 114 days, extending from mid-May to early September. Winters are cold, with four months having minimum temperatures below zero. Days are short; nights are long. Transitional periods between summer and winter and vice-versa are rapid.

Annual precipitation is less than 12 inches—low for crop growth. However, well over half occurs during the summer when it is most needed. Snowfall is light and generally remains on the ground throughout the winter. Numerous thunderstorms occur during the summer.

Surface winds are strongest in winter, lightest in summer. The direction of the wind (east-southeast) follows the orientation of the Tanana River valley from early fall to early spring, and the orientation of the Delta River valley (southwest) from May to July. Wind averages and extremes are high when compared to other Interior Alaska locations. With strong pressure gradients, the Tanana and Delta River valleys experience a "venturi" effect accentuating the already high speeds.

[Table 1](#) gives data on temperature, wind, relative humidity, and calculated growing-degree days; [Table 2](#) gives data on precipitation; and [Table 3](#) gives data on the mean number of days of types of cloud cover, types and amounts of precipitation, and temperatures above and below given readings. Data were recorded at the Big Delta Airport, located to the east and across the Delta River from the Upper Tanana Area, 3 miles south of the Community of Delta Junction. Data are for the period 1944 to 1983 ([United States Department of Commerce 1983](#)).

Geology

Prepared by William Wolfe, Geologist, Fairbanks, Alaska

The Tanana River and associated alluvial plain are the dominant features in the Survey Area. The river occupies a deep structural basin. The floor of the basin lies below sea level in several places and is covered by as much as 590 feet (180 m) of sediments, mostly Quaternary alluvium (*Péwé 1975*). The river drains an area of 44,000 square miles, and carries an average annual sediment load of 19.1 to 22.1 million tons. In many areas, the supply of sediment exceeds the capacity of the river to transport it. The result is an aggrading stream channel and the deposition of bars consisting of gravel, sand, and silt (*Selkregg 1974; Reger and Updike 1983*).

The Survey Area was affected by two episodes of valley glaciation that extended northward from the Alaska Range along what is now the lower valley of the Delta River. The first of these, known as the Delta Glaciation, is thought to have occurred in the late Illinoian Stage, or approximately 400,000 years before the present. Morainal deposits mark the terminus of this glacial advance in the southeastern part of the present Survey Area between the Delta River and Delta Creek. These moraines are characterized by an irregular topography that includes many small ponds or kettles (*Péwé 1975; Reger and Updike 1983*).

During the Wisconsin Stage, approximately 20,000 to 50,000 years before the present, the Donnelly Glaciation flowed down the Delta Valley. Although its terminus lies up-valley of the southern boundary of the Survey Area, this glaciation is the probable source of most of the wind-blown silt or loess that blankets much of the Area, including the terminal moraines of the earlier Delta Glaciation (*Péwé 1975; Reger and Updike 1983*).

The hills in the western part of the area are geologically related to the Yukon-Tanana Uplands and to the Alaska Range north of the Denali Fault. These hills are largely composed of deformed metamorphic rock of Precambrian to Paleozoic age (at least 250 million years old) known as the Birch Creek Formation. The bedrock is generally mantled with various depths of loess on slopes. Alluvium is along the valleys.

Permafrost and Frost Heaving

The Upper Tanana Area lies within the zone of discontinuous permafrost; that is, permafrost occurs in some areas and others are permafrost-free (*Selkregg 1974*). The discontinuous nature of the occurrence of permafrost is dependent on aspect, drainage, slope, and vegetative cover. Permafrost soils in the Upper Tanana Area are permanently frozen because of one or more of these features. Ester soils are an example of permafrost soils caused by aspect and vegetative cover. They occur dominantly on north-facing slopes that receive less solar energy. As a result, a cool microclimate exists that is conducive to a black spruce forest with a thick moss ground cover that insulates the soil and keeps it frozen. Histosols are examples of permafrost soils caused by drainage and slope. They occur in plane and concave areas on alluvial plains. Because Histosols are composed of mosses and sedges in various stages of decomposition, they insulate the subsurface soil and maintain the frozen condition. Tanana and Goldstream soils are permanently frozen primarily because of their vegetative cover. The climax vegetation, which these soils typically support, has a thick organic layer at the surface that insulates the underlying mineral soil and keeps it frozen.

Permafrost soils in the Upper Tanana Area range from well drained to very poorly drained. The drainage state is dependent on depth to the permafrost table and the volume of water and ice held within the soil. Since permafrost is impermeable to water, both the water that is held in the thawed soil above the permafrost and the water that percolates into the soil from precipitation are perched above the permafrost.

Frost heaving is a phenomenon that occurs in soil because of annual freezing and

thawing. The result is a change in volume of the soil. The most important soil properties pertinent to frost heaving are moisture content and texture. In relatively coarse grained soils with a low water content, the ice acts as a binder and does not produce much heaving. If the soil is relatively fine grained, such as silt loam, silt, or very fine sandy loam, and the water content is high, masses of segregated ice form and maximum frost heaving occurs (*Ferrians, Kachadoorian, and Greene 1969*). Koyukuk and Nenana soils are examples of soils that frost heave. Fubar soil has a very low hazard of frost heaving.

How This Survey Was Made

This survey was made to provide information about the soils and miscellaneous areas in the Upper Tanana Area, and includes a description and location of the soils and miscellaneous areas and a discussion of their suitability, limitations, and management for specified uses.

Before the fieldwork began, relevant information on the climate, geology, geomorphology, hydrology, and vegetation of the Survey Area was assembled. Aerial photography was acquired and prepared for field use and mapping.

A reconnaissance of the area was done by low-altitude helicopter flights prior to detailed soils mapping. At representative locations and landforms, soil scientists investigated the nature of the soils. Soil-landform patterns and map unit concepts were developed for use during detailed mapping. Representative areas for future intensive soils investigation were identified and located.

The level of mapping intensity was determined by the degree of potential for the specified uses of the survey, and by accessibility. Accessible areas with higher potential were mapped in greater detail. Map unit boundaries in these areas were determined in the field and by photo-interpretation of known soil-landform and soil-vegetation relationships. Because of the size of the Survey Area and the limited amount of time available, it was not possible to visit each delineation.

Due to the lack of ground access, daily helicopter flights were used to place teams of soil scientists and biological technicians at various locations in the Survey Area. Some areas at higher elevations were inaccessible due to the lack of safe helicopter landing sites. Inaccessible areas and areas with low potential for use were mapped primarily by photo-interpretation.

The soils and miscellaneous areas in the Survey Area are in an orderly pattern that is related to the geology, landforms, relief, climate, and natural vegetation. Each kind of soil and miscellaneous area is associated with a particular kind of landform or segment of the landform. By observing the soils and miscellaneous areas in the Survey Area and relating their position to specific segments of the landform, soil scientists develop a concept or model of how the soils were formed. During mapping, this model enables the soil scientist to predict with considerable accuracy the kind of soil or miscellaneous area at a specific location on the landscape.

Individual soils on the landscape commonly merge into one another as their characteristics gradually change. To construct an accurate map, however, soil scientists must determine the boundaries between the soils. They can observe only a limited number of soil profiles. Nevertheless, these observations, supplemented by an understanding of the soil-vegetation-landscape relationships, are sufficient to predict the kinds of soil in an area and to determine the boundaries.

Soil scientists observed the steepness, length, and shape of the slopes; the general pattern of drainage; the kinds of native plants; and the kinds of geologic materials. They dug many holes to study the soil profile (the sequence of natural layers, or horizons, in a soil). The profile extends from the surface down into the unconsolidated material in which the soil formed. The unconsolidated material is devoid of roots and other living organisms and has not been changed by other biological activity. Soil scientists recorded the

characteristics of the soil profiles they studied. They noted color, texture, size, and shape of soil aggregates; kind and amount of rock fragments; distribution of plant roots; soil temperature; reaction; and other features.

After describing the soils and determining their properties, soil scientists assigned the soils to taxonomic classes (units). Taxonomic classes are concepts. Each taxonomic class has a set of soil characteristics with precisely defined limits. The classes are used as a basis for comparison to classify soils systemically. Soil taxonomy, the system of taxonomic classification used in the United States (*Soil Survey Staff 1975*), is based mainly on the kind and character of soil properties and the arrangement of horizons within the profile. After soil scientists classified and named the soils in the Survey Area, they compared the individual soils with similar soils in the same taxonomic class in other areas so that they could confirm data and assemble additional data based on experience and research.

While the soil survey was in progress, samples of some of the soils in the Area were collected for laboratory analyses and engineering tests. Soil scientists interpreted the data from these analyses and tests, as well as the field-observed characteristics and the soil properties, to determine the expected behavior of the soils under different uses

Predictions about soil behavior are based not only on soil properties, but also on such variables as climate and biological activity. Soil conditions are predictable over long periods of time, but they are not predictable from year to year. For example, soil scientists can predict with a fairly high degree of accuracy that a given soil will have a high water table within certain depths in most years, but they cannot predict that a high water table will always be at a specific level in the soil on a specific date.

After soil scientists located and identified the significant natural bodies of soil in the Survey Area, they drew the boundaries of these bodies on aerial photographs and identified each as a specific map unit. Each map unit consists of an area of specified soil or soils having similar use and management. It also contains minor inclusions of soils with different use and management. Each map unit is also defined in terms of non-soil features such as slope, climate, and landform. Aerial photographs help to accurately locate boundaries by showing trees, lakes and rivers.

The descriptions, names, and delineations of the soils in this Survey Area do not fully agree with those of the soils in adjacent survey areas. Differences are the result of a better knowledge of soils, modifications in series concepts, or variations in the intensity of mapping or in the extent of the soils in the survey areas.

Detailed Soil Map Units

The map units delineated on the detailed maps included with this survey represent the soils or miscellaneous areas in the Survey Area. The map unit descriptions in this section, along with the maps, can be used to determine the suitability and potential of a unit for specific uses. They also can be used to plan the management needed for those uses. More information about each map unit is given under the heading "[Use and Management of the Soils.](#)"

A map unit delineation on the detailed soil maps represents an area on the landscape and consists of one or more soils or miscellaneous areas. A map unit is identified and named according to the taxonomic classification of the dominant soils or miscellaneous areas. Within a taxonomic class there are precisely defined limits for the properties of the soils. On the landscape, however, the soils and miscellaneous areas are natural phenomena, and they have the characteristic variability of all natural phenomena. Thus, the range of some observed properties may extend beyond the limits defined for a taxonomic class. Areas of soils of a single taxonomic class rarely, if ever, can be mapped without including areas of other taxonomic classes. Consequently, every map unit is made up of the soils or miscellaneous areas for which it is named and some "included" areas that belong to other taxonomic classes.

Most included soils have properties similar to those of the dominant soil or soils in the map unit, and they do not affect use and management. These are called similar soils. They may or may not be mentioned in the map unit description. However, other included soils and miscellaneous areas have properties and behavioral characteristics divergent enough to affect use or to require different management. These are called contrasting inclusions. They generally are in small areas and could not be mapped separately because of the scale used. The included areas of contrasting soils or miscellaneous areas are mentioned in the map unit descriptions. A few included areas may not have been observed, and consequently they are not mentioned in the descriptions, especially where the pattern was so complex that it was impractical to make enough observations to identify all the soils and miscellaneous areas on the landscape.

The presence of included areas in a map unit in no way diminishes the usefulness or accuracy of the data. The objective of mapping is not to delineate pure taxonomic classes but rather to separate the landscape into segments that have similar use and management requirements. The delineation of such landscape segments on the map provides sufficient information for the development of resource plans, but if intensive use of small areas is planned, on-site investigation is needed to define and locate the soils and miscellaneous areas.

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

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

Soils of one series can differ in texture of the surface layer or of the underlying layers. They also can differ in slope, stoniness, degree of erosion, and other characteristics that affect their use. On the basis of such differences, a soil series is divided into *soil phases*.

Most of the areas shown on the detailed soil maps are phases of soil series. The name of a soil phase commonly indicates a feature that affects use or management. For example, [Map Unit 312](#)—Koyukuk silt loam, 0 to 3 percent slopes ([Figure 4](#)), is a phase of the Koyukuk series.

Some map units are made up of two or more major soils or miscellaneous areas. These map units are complexes, associations, or undifferentiated groups.

A *complex* consists of two or more soils or miscellaneous areas in such an intricate pattern or in such small areas that they cannot be shown separately on the maps. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas. [Map Unit 311](#)—Jarvis-Fubar complex, 0 to 7 percent slopes ([cover photo](#)), is an example.

An *association* is made up of two or more geographically associated soils or miscellaneous areas that are shown as one unit on the maps. Because of present or anticipated uses of the map units in the Survey Area, it was not considered practical or necessary to map the soils or miscellaneous areas separately. The pattern and relative proportion of the soils or miscellaneous areas are somewhat similar. [Map Unit 302](#)—Ester-Steese association, 7 to 12 percent slopes, is an example.

An *undifferentiated group* is made up of two or more soils or miscellaneous areas that could be mapped individually but are mapped as one unit because similar interpretations can be made for use and management. The pattern and proportion of the soils or miscellaneous areas in a mapped area are not uniform. An area can be made up of only one of the major soils or miscellaneous areas, or it can be made up of all of them. [Map Unit 308](#)—Goldstream and Histosols, 0 to 3 percent slopes ([Figures 2 and 3](#)), is an undifferentiated group in this Survey Area.

This survey includes *miscellaneous areas*. Such areas have little or no soil material and support little or no vegetation. Riverwash is an example.

This survey was mapped at more than one level of intensity. Deep, well drained soils on slopes suitable for agricultural development were mapped in more detail than excessively or very poorly drained soils on steep slopes. All map units were constructed and interpretations were made to meet the needs of the users at the time the survey was made.

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

Map Unit Descriptions

301—Cryorthents, flooded

Composition

Cryorthents and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Characteristics of Cryorthents

Position on landscape: lake borders ([Figure 4](#))

Slope range: 0 to 3 percent

Slope features: concave

Organic mat on surface: 0 to 1 inch (0 to 3 cm) thick

Native vegetation: willows, paper birch, and grasses

Reference profile:

- * 0 to 6 inches (0 to 15 cm)—very dark grayish brown very fine sandy loam
- * 6 to 18 inches (15 to 46 cm)—grayish brown very gravelly loamy sand
- * 18 to 60 inches (46 to 152 cm)—variegated very gravelly coarse sand

Depth class: very shallow and shallow (2 to 18 inches or 5 to 46 cm) to underlying gravelly sand

Drainage class: moderately well drained and well drained

Permeability: above the sand—moderate; below this—rapid

Available water capacity: low

Root-restricting feature: coarse underlying material

Runoff: slow

Hazard of erosion: by water—slight; by wind—severe

Hazard of flooding: frequency—occasional; duration—long and very long

Included Areas

- * gravelly outcroppings
- * soils that are moderately deep to gravelly material
- * soils that are poorly drained or very poorly drained

Major Uses

Current uses: wildlife habitat and recreation

302—Ester-Steese association, 7 to 12 percent slopes

Composition

Ester peat and similar inclusions: 60 percent

Steese silt loam and similar inclusions: 30 percent

Contrasting inclusions: 10 percent

Characteristics of Ester Soil

Position on landscape: hillsides

Slope range: 7 to 12 percent

Slope features: plane to convex

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, and low-growing shrubs

Typical profile:

- * 10 inches to 0 (25 cm to 0)—peat
- * 0 to 2 inches (0 to 5 cm)—very dark gray silt loam
- * 2 to 8 inches (5 to 20 cm)—olive gray silt loam
- * 8 to 16 inches (20 to 41 cm)—frozen very dark grayish brown extremely gravelly silt loam
- * 16 inches (41 cm)—weathered schist

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting features: permafrost and bedrock

Runoff: medium

Depth to permafrost: 7 to 14 inches (18 to 36 cm)

Depth to bedrock: 12 to 20 inches (30 to 51 cm)
Depth to perched water table: 0 to 12 inches (0 to 30 cm)
Hazard of erosion: by water—slight if the organic mat is not removed, severe if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Characteristics of Steese Soil

Position on landscape: hillsides and ridgetops
Slope range: 7 to 12 percent
Slope features: concave to convex
Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick
Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

- * 0 to 4 inches (0 to 10 cm)—very dark grayish brown silt loam
- * 4 to 9 inches (10 to 23 cm)—dark brown silt loam
- * 9 to 14 inches (23 to 36 cm)—brown silt loam
- * 14 to 30 inches (36 to 76 cm)—dark yellowish brown very channery sandy loam
- * 30 inches (76 cm)—fractured schist over consolidated schist

Depth class: moderately deep (20 to 40 inches or 51 to 102 cm) to unconsolidated bedrock
Drainage class: well drained
Permeability: in the loess mantle—moderate; below this—moderately rapid
Available water capacity: moderate
Runoff: medium
Hazard of erosion: by water—slight if the organic mat is not removed, severe if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed
Hazard of flooding: none

Included Areas

- * soils that have bedrock within a depth of 12 inches (30 cm)
- * soils that have slopes of more than 12 percent

Major Uses

Current uses: recreation and wildlife habitat
Potential uses if thawed and drained: hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: slope, depth to permafrost, depth to bedrock, wind erosion, water erosion, and frost heaving

Hayland and Pastureland

General management considerations:

- * When Esther soil is thawed and drained, this unit can be used for hay and pasture.
- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Prepare seedbeds on the contour or across the slope, seed to a cover crop, and shape waterways and seed them to perennial grass to reduce the risk of water erosion.

- * Leave strips of trees as windbreaks when clearing land, or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum forage production, protect farm and ranch buildings, and provide cover for wildlife.

303—Fubar soils and Riverwash, 0 to 3 percent slopes

Composition

Fubar fine sandy loam, Riverwash, and similar inclusions: 90 percent
 Contrasting inclusions: 10 percent

Characteristics of Fubar Soil

Position on landscape: alluvial plains and terraces

Slope range: 0 to 3 percent

Slope features: plane to convex

Organic mat on surface: 1 to 6 inches (3 to 15 cm) thick

Native vegetation: willow and alder

Typical profile:

* 0 to 2 inches (0 to 5 cm)—dark grayish brown fine sandy loam

* 2 to 60 inches (5 to 152 cm)—brown very gravelly sand that has thin lenses of silt

Depth class: very shallow (1 to 8 inches or 3 to 20 cm) to sand and gravel

Drainage class: moderately well drained

Permeability: in the upper part—moderate; below this—rapid

Available water capacity: very low

Runoff: slow

Hazard of erosion: by water—slight whether or not the organic mat is removed; by wind—slight if the organic mat is not removed, moderate if the mat is removed

Hazard of flooding: frequency—occasional; months—May to August

Characteristics of Riverwash

Kind of material: stratified sand and gravel

Included Areas

- * soils that have slopes of more than 3 percent

Major Uses

Current uses: recreation and wildlife habitat

304—Goldstream peat, 0 to 3 percent slopes

Composition

Goldstream peat and similar inclusions: 85 percent
 Contrasting inclusions: 15 percent

Characteristics of Goldstream Soil

Position on landscape: alluvial plains and moraines

Slope range: 0 to 3 percent

Slope features: plane to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, low-growing shrubs, Labrador tea, sedges, and mosses

Typical profile:

* 12 inches to 0 (30 cm to 0)—peat consisting of partially decomposed organic matter

* 0 to 6 inches (0 to 15 cm)—black silt loam

* 6 to 12 inches (15 to 30 cm)—dark gray silt loam

* 12 to 22 inches (30 to 56 cm)—frozen dark gray silt loam

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting feature: permafrost

Runoff: ponded

Hazard of erosion: by water—slight; by wind—none to severe, depending on drainage

Depth to permafrost: 10 to 20 inches (25 to 51 cm)

Depth to perched water table: in May through September—6 inches (15 cm) above the surface to a depth of 6 inches (15 cm) below the surface

Hazard of flooding: none

Included Areas

* soils that have slopes of more than 3 percent

* soils that have an organic mat more than 16 inches (41 cm) thick

Major Uses

Current uses: recreation and wildlife habitat

305—Goldstream peat, 3 to 7 percent slopes

Composition

Goldstream peat and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Characteristics of Goldstream Soil

Position on landscape: alluvial plains and moraines

Slope range: 3 to 7 percent

Slope features: plane to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, low-growing shrubs, Labrador tea, sedges, and mosses

Typical profile:

* 12 inches to 0 (30 cm to 0)—peat consisting of partially decomposed organic matter

* 0 to 6 inches (0 to 15 cm)—black silt loam

* 6 to 12 inches (15 to 30 cm)—dark gray silt loam

* 12 to 22 inches (30 to 56 cm)—frozen dark gray silt loam

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting feature: permafrost

Runoff: ponded to slow

Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Depth to permafrost: 10 to 20 inches (25 to 51 cm)

Depth to perched water table: in May through September—6 inches (15 cm) above the surface to a depth of 6 inches (15 cm) below the surface

Hazard of flooding: none

Included Areas

* soils that have slopes of more than 7 percent

* soils that have an organic mat more than 16 inches (41 cm) thick

Major Uses

Current uses: recreation and wildlife habitat

Potential uses if thawed and drained: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: depth to permafrost, depth to perched water table, lack of drainage outlets, frost heaving, wind and water erosion

Cropland, Hayland, and Pastureland

General management considerations:

* Suitable crops for planting are small grain, cool-season row crops and adapted grasses.

* Clearing and subsequent thawing of soil results in lowering the water table if adequate drainage outlets are available and cleared areas are large enough to overcome seepage from adjacent uncleared areas.

* On-site investigation is needed to determine if adequate drainage outlets are available before the soil is cleared.

* Crops respond to fertilizer and lime.

* Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

* Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; return crop residue to the soil; and grow cover crops to maintain and improve fertility and tilth.

* Prepare seedbeds on the contour or across the slope, seed to cover crops, use conservation tillage, maintain crop residue on or near the surface, strip-crop, maintain tilth and organic matter content, and include legumes and grasses in a rotation system to reduce water erosion.

* Use diversions and shaped waterways seeded to perennial grasses to reduce erosion and improve surface drainage.

* Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, and limit the width of strips of unprotected soils to reduce wind erosion.

* Use narrow grass barriers with strip-cropping.

- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

306—Goldstream peat, 7 to 12 percent slopes

Composition

Goldstream peat and similar inclusions: 85 percent
 Contrasting inclusions: 15 percent

Characteristics of Goldstream Soil

Position on landscape: alluvial plains and moraines

Slope range: 7 to 12 percent

Slope features: convex to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, low-growing shrubs, Labrador tea, sedges, and mosses

Typical profile:

- * 12 inches to 0 (30 cm to 0)—peat consisting of partially decomposed organic matter
- * 0 to 6 inches (0 to 15 cm)—black silt loam
- * 6 to 12 inches (15 to 30 cm)—dark gray silt loam
- * 12 to 22 inches (30 to 56 cm)—frozen dark gray silt loam

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting feature: permafrost

Runoff: ponded to slow

Hazard of erosion: by water—slight if the organic mat is not removed, severe if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Depth to permafrost: 10 to 20 inches (25 to 51 cm)

Depth to perched water table: in May through September—6 inches (15 cm) above the surface to a depth of 6 inches (15 cm) below the surface

Hazard of flooding: none

Included Areas

- * soils that have slopes of more than 12 percent
- * soils that have an organic mat more than 16 inches (41 cm) thick

Major Uses

Current uses: recreation and wildlife habitat

Potential uses if thawed and drained: hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: depth to permafrost, depth to perched water table, frost heaving, wind and water erosion, and slope

Hayland and Pastureland

General management considerations:

- * Clearing and subsequent thawing of soil results in lowering the water table if adequate drainage outlets are available and cleared areas are large enough to overcome seepage from adjacent uncleared areas.
- * On-site investigation is needed to determine if adequate drainage outlets are available before the soil is cleared.
- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Prepare seedbeds on the contour or across the slope and seed to cover crops to reduce water erosion.
- * Use diversions and shaped waterways seeded to perennial grasses to reduce erosion and improve surface drainage.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum forage production yields, protect farm and ranch buildings, and provide cover for wildlife.

307—Goldstream-Tanana complex, 0 to 3 percent slopes

Composition

Goldstream peat and similar inclusions: 60 percent

Tanana silt loam and similar inclusions: 25 percent

Contrasting inclusions: 15 percent

Characteristics of Goldstream Soil

Position on landscape: alluvial plains ([Figure 1](#))

Slope range: 0 to 3 percent

Slope features: plane to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, low-growing shrubs, Labrador tea, sedges, and mosses

Typical profile:

- * 12 inches to 0 (30 cm to 0)—peat consisting of partially decomposed organic matter
- * 0 to 6 inches (0 to 15 cm)—black silt loam
- * 6 to 12 inches (15 to 30 cm)—dark gray silt loam
- * 12 to 22 inches (30 to 56 cm)—frozen dark gray silt loam

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting feature: permafrost

Runoff: ponded

Hazard of erosion: by water—none if the organic mat is not removed, slight if the mat is removed; by wind—none if the organic mat is not removed, slight to severe if the mat is removed, depending on drainage

Depth to permafrost: 10 to 20 inches (25 to 51 cm)

Depth to perched water table: in May through September—6 inches (15 cm) above the surface to a depth of 6 inches (15 cm) below the surface

Hazard of flooding: none

Characteristics of Tanana Soil

Position on landscape: alluvial plains (Figure 1)

Slope range: 0 to 3 percent

Slope features: plane

Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick

Native vegetation: black spruce and low-growing shrubs

Typical profile:

* 0 to 7 inches (0 to 18 cm)—very dark gray silt loam

* 7 to 23 inches (18 to 58 cm)—dark gray silt loam

* 23 to 33 inches (58 to 84 cm)—frozen dark gray silt loam

Drainage class: poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting feature: permafrost

Runoff: slow

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, severe if the mat is removed

Depth to permafrost: 21 to 30 inches (53 to 76 cm)

Depth to perched water table: 12 to 24 inches (30 to 61 cm)

Hazard of flooding: none

Included Areas

* soils that have an organic mat more than 16 inches (41 cm) thick

Major Uses

Current uses: recreation and wildlife habitat

308—Goldstream and Histosols, 0 to 3 percent slopes

Composition

Goldstream peat, Histosols, and similar inclusions: 95 percent

Contrasting inclusions: 5 percent

Characteristics of Goldstream Soil

Position on landscape: alluvial plains (Figures 2 and 3)

Slope range: 0 to 3 percent

Slope features: plane to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, low-growing shrubs, Labrador tea, sedges, and mosses

Typical profile:

* 12 inches to 0 (30 cm to 0)—peat consisting of slightly and partially decomposed organic matter

* 0 to 6 inches (0 to 15 cm)—black silt loam

* 6 to 12 inches (15 to 30 cm)—dark gray silt loam

* 12 to 22 inches (30 to 56 cm)—frozen dark gray silt loam

Drainage class: very poorly drained
Permeability: above the permafrost—moderate; below this—impermeable
Available water capacity: low
Root-restricting feature: permafrost
Runoff: ponded
Hazard of erosion: by water—none if the organic mat is not removed, slight if the mat is removed; by wind—none if the organic mat is not removed, slight if the mat is removed
Depth to permafrost: 10 to 20 inches (25 to 51 cm)
Depth to perched water table: in May through September—6 inches (15 cm) above the surface to a depth of 6 inches (15 cm) below the surface
Hazard of flooding: none

Characteristics of Histosols

Position on landscape: alluvial plains (Figures 2 and 3)
Slope range: 0 to 3 percent
Slope features: plane to concave
Native vegetation: sedges, mosses, bog birch, willow, and low-growing shrubs

Reference profile:

- * 0 to 6 inches (0 to 15 cm)—fibrous peat
- * 6 to 18 inches (15 to 46 cm)—partially decomposed peat
- * 18 to 28 inches (46 to 71 cm)—frozen partially decomposed moss

Depth class: shallow (10 to 20 inches or 25 to 51 cm) to permafrost
Drainage class: very poorly drained
Permeability: above the permafrost—assumed to be rapid; below this—impermeable
Root-restricting feature: permafrost
Runoff: ponded
Hazard of erosion: by water—none; by wind—none
Depth to permafrost: 10 to 20 inches (25 to 51 cm)
Depth to perched water table: in May through September—0 to 6 inches (0 to 15 cm)
Hazard of flooding: none

Included Areas

- * soils that have a thinner organic mat

Major Uses

Current uses: wildlife habitat and recreation

309—Goodpaster Variant-Goldstream complex, 0 to 3 percent slopes

Composition

Goodpaster Variant silt loam and similar inclusions: 70 percent
Goldstream peat and similar inclusions: 20 percent
Contrasting inclusions: 10 percent

Characteristics of Goodpaster Variant Soil

Position on landscape: alluvial plains and terraces
Slope range: 0 to 3 percent
Slope features: plane

Organic mat on surface: 1 to 6 inches (3 to 15 cm) thick
Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

- * 0 to 2 inches (0 to 5 cm)—very dark grayish brown silt loam
- * 2 to 7 inches (5 to 18 cm)—dark brown silt loam
- * 7 to 15 inches (18 to 38 cm)—dark grayish brown silt loam
- * 15 to 21 inches (38 to 53 cm)—dark grayish brown gravelly silt loam
- * 21 to 31 inches (53 to 79 cm)—frozen light olive brown extremely gravelly coarse sand

Drainage class: poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Root-restricting feature: permafrost

Available water capacity: low

Runoff: very slow

Depth to permafrost: 20 to 30 inches (51 to 76 cm)

Depth to perched water table: 12 to 24 inches (30 to 61 cm)

Hazard of erosion: by water—slight; by wind—none if the organic mat is not removed, slight to severe if the mat is removed, depending on drainage

Hazard of flooding: none

Characteristics of Goldstream Soil

Position on landscape: alluvial plains

Slope range: 0 to 3 percent

Slope features: plane to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, low-growing shrubs, Labrador tea, sedges, and mosses

Typical profile:

- * 12 inches to 0 (30 cm to 0)—peat consisting of partially decomposed organic matter
- * 0 to 6 inches (0 to 15 cm)—black silt loam
- * 6 to 12 inches (15 to 30 cm)—dark gray silt loam
- * 12 to 22 inches (30 to 56 cm)—frozen dark gray silt loam

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting feature: permafrost

Runoff: ponded

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, slight to severe if the mat is removed, depending on drainage

Depth to permafrost: 10 to 20 inches (25 to 51 cm)

Depth to perched water table: in May through September—6 inches (15 cm) above the surface to a depth of 6 inches (15 cm) below the surface

Hazard of flooding: none

Included Areas

- * soils that have slopes of more than 3 percent
- * soils that have sand and gravel within a depth of 40 inches (102 cm)

Major Uses

Current uses: recreation and wildlife habitat

310—Gravel pits

Position on landscape: alluvial plains

Kind of material: unsorted sand, gravel, and cobbles

Use: source of gravel

Vegetation: generally barren, but willows and alders in areas that have not been actively mined recently

Special features: ponds of water in areas where gravel has been mined below the water table

311—Jarvis-Fubar complex, 0 to 7 percent slopes

Composition

Jarvis very fine sandy loam and similar inclusions: 60 percent

Fubar fine sandy loam and similar inclusions: 25 percent

Contrasting inclusions: 15 percent

Characteristics of Jarvis Soil

Position on landscape: floodplains (see Cover)

Slope range: 0 to 7 percent

Slope features: plane to convex

Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick

Native vegetation: white spruce, paper birch, alder, high bush cranberry, wild rose, and Labrador tea

Typical profile:

* 0 to 6 inches (0 to 15 cm)—dark brown very fine sandy loam

* 6 to 10 inches (15 to 25 cm)—dark grayish brown very fine sandy loam

* 10 to 18 inches (25 to 46 cm)—grayish brown fine sandy loam that has thin lenses of silt loam

* 18 to 60 inches (46 to 152 cm)—grayish brown extremely gravelly sand stratified with silt loam

Depth class: shallow and moderately deep (11 to 39 inches or 28 to 99 cm) to sand and gravel

Drainage class: well drained

Permeability: above the sand and gravel—moderate; below this—rapid

Available water capacity: moderate

Runoff: very slow

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: frequency—occasional; months—May to August

Characteristics of Fubar Soil

Position on landscape: alluvial plains (see Cover)

Slope range: 0 to 7 percent

Slope features: plane to convex

Organic mat on surface: 1 to 6 inches (3 to 15 cm) thick

Native vegetation: paper birch and willow

Typical profile:

- * 0 to 2 inches (0 to 5 cm)—dark grayish brown fine sandy loam
- * 2 to 60 inches (5 to 152 cm)—brown extremely gravelly sand that has thin lenses of silt

Depth class: very shallow (1 to 8 inches or 3 to 20 cm) to sand and gravel

Drainage class: moderately well drained

Permeability: in the upper part—moderate; below this—rapid

Available water capacity: very low

Runoff: slow

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, moderate if the mat is removed

Hazard of flooding: frequency—occasional; months—May to August

Included Areas

- * soils that have slopes of more than 3 percent
- * soils along channels that are frequently flooded

Major Uses

Current uses: recreation and wildlife habitat

312—Koyukuk silt loam, 0 to 3 percent slopes

Composition

Koyukuk silt loam and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Characteristics of Koyukuk Soil

Position on landscape: moraines and terraces ([Figure 4](#))

Slope range: 0 to 3 percent

Slope features: concave to convex

Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick

Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

- * 0 to 4 inches (0 to 10 cm)—dark brown silt loam
- * 4 to 24 inches (10 to 61 cm)—yellowish brown silt
- * 24 to 43 inches (61 to 109 cm)—light yellowish brown silt
- * 43 to 60 inches (109 to 152 cm)—light olive brown very gravelly sand

Depth class: deep (40 to 60 inches or 102 to 152 cm) to sand and gravel

Drainage class: well drained

Permeability: in the upper part—moderate; in the lower part—rapid

Available water capacity: high

Runoff: slow

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Included Areas

- * soils that have permafrost at a depth of 30 to 60 inches (76 to 152 cm)

- * soils that have slopes of more than 3 percent
- * soils in depressional areas that are poorly drained

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: wind erosion and frost heaving

Cropland, Hayland, and Pastureland

General management considerations:

- * Suitable crops for planting are small grain, cool-season row crops and adapted grasses.
- * Crops respond to fertilizer and lime.
- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; return crop residue to the soil; and grow cover crops to maintain and improve fertility and tilth.
- * Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, strip-crop, and limit the width of strips of unprotected soils to reduce wind erosion.
- * Use narrow grass barriers with strip-cropping.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

313—Koyukuk silt loam, 3 to 7 percent slopes

Composition

Koyukuk silt loam and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Characteristics of Koyukuk Soil

Position on landscape: moraines and terraces

Slope range: 3 to 7 percent

Slope features: concave to convex

Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick

Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

- * 0 to 4 inches (0 to 10 cm)—dark brown silt loam
- * 4 to 24 inches (10 to 61 cm)—yellowish brown silt
- * 24 to 43 inches (61 to 109 cm)—light yellowish brown silt
- * 43 to 60 inches (109 to 152 cm)—light olive brown very gravelly sand

Depth class: deep (40 to 60 inches or 102 to 152 cm) to sand and gravel

Drainage class: well drained

Permeability: in the upper part—moderate; in the lower part—rapid

Available water capacity: high

Runoff: slow

Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Included Areas

- * soils that have permafrost at a depth of 30 to 60 inches (76 to 152 cm)
- * soils that have slopes of more than 7 percent
- * soils in depressional areas that are poorly drained

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: wind erosion, water erosion, and frost heaving

Cropland, Hayland, and Pastureland

General management considerations:

- * Suitable crops for planting are small grain, cool-season row crops and adapted grasses.
- * Crops respond to fertilizer and lime.
- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; return crop residue to the soil; and grow cover crops to maintain and improve fertility and tilth.
- * Prepare seedbeds on the contour or across the slope, use conservation tillage, maintain crop residue on or near the surface, strip-crop, maintain tilth and organic matter content, include legumes and grasses in a rotation system, seed to cover crops, and shape waterways and seed them to perennial grasses to reduce water erosion.
- * Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, strip-crop, and limit the width of strips of unprotected soil to reduce wind erosion.
- * Use narrow grass barriers with strip-cropping.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

314—Koyukuk silt loam, 7 to 12 percent slopes

Composition

Koyukuk silt loam and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Characteristics of Koyukuk Soil

Position on landscape: moraines and terraces

Slope range: 7 to 12 percent

Slope features: concave to convex

Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick

Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

* 0 to 4 inches (0 to 10 cm)—dark brown silt loam

* 4 to 24 inches (10 to 61 cm)—yellowish brown silt

* 24 to 43 inches (61 to 109 cm)—light yellowish brown silt

* 43 to 60 inches (109 to 152 cm)—light olive brown very gravelly sand

Depth class: very deep (40 to 60 inches or 102 to 152 cm) to sand and gravel

Drainage class: well drained

Permeability: in the upper part—moderate; in the lower part—rapid

Available water capacity: high

Runoff: medium

Hazard of erosion: by water—slight if the organic mat is not removed, severe if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Included Areas

* soils that have permafrost at a depth of 30 to 60 inches (76 to 152 cm)

* soils that have slopes of more than 12 percent

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: wind erosion, water erosion, frost heaving, and slope

Hayland and Pastureland

General management considerations:

* Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

* Prepare seedbeds on the contour or across the slope, seed to cover crops, and shape waterways and seed them to perennial grasses to reduce water erosion.

* Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.

* Use windbreaks to limit soil losses, maintain optimum forage production, protect farm and ranch buildings, and provide cover for wildlife.

315—Koyukuk silt loam, 12 to 45 percent slopes

Composition

Koyukuk silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Koyukuk Soil

Position on landscape: moraines

Slope range: 12 to 45 percent

Slope features: concave to convex

Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick

Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

* 0 to 4 inches (0 to 10 cm)—dark brown silt loam

* 4 to 24 inches (10 to 61 cm)—yellowish brown silt

* 24 to 43 inches (61 to 109 cm)—light yellowish brown silt

* 43 to 60 inches (109 to 152 cm)—light olive brown very gravelly sand

Depth class: very deep (40 to 60 inches or 102 to 152 cm) to sand and gravel

Drainage class: well drained

Permeability: in the upper part—moderate; in the lower part—rapid

Available water capacity: high

Runoff: medium

Hazard of erosion: by water—slight if the organic mat is not removed, severe if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Included Areas

* soils that have sand and gravel at a depth of 20 to 60 inches (51 to 152 cm)

* soils that have slopes of more than 45 percent

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: rural homesites

Major Management Factors

Soil-related factors: slope and frost heaving

316—Minchumina peat, 0 to 3 percent slopes

Composition

Minchumina peat and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Minchumina Soil

Position on landscape: moraines

Slope range: 0 to 3 percent

Slope features: convex to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, white spruce, and paper birch

Typical profile:

* 10 inches to 0 (25 cm to 0)—peat

* 0 to 6 inches (0 to 15 cm)—black silt loam

* 6 to 16 inches (15 to 41 cm)—frozen very dark grayish brown silt loam

Drainage class: well drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: when frozen—low; when thawed—high

Root-restricting feature: permafrost

Runoff: very slow

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, severe if the mat is removed

Depth to permafrost: 2 to 20 inches (5 to 51 cm)

Depth to water table: more than 60 inches (more than 152 cm)

Hazard of flooding: none

Included Areas

* soils that have slopes of more than 3 percent

* soils that have an organic mat more than 16 inches (more than 41 cm) thick

Major Uses

Current uses: recreation and wildlife habitat

Potential uses if thawed: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: depth to permafrost, wind erosion, and frost heaving

Cropland, Hayland, and Pastureland

General management considerations:

* Suitable crops for planting are small grain, cool-season row crops and adapted grasses.

* Crops respond to fertilizer and lime.

* Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

* Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; and grow cover crops to maintain and improve fertility and tilth.

* Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, strip-crop, and limit the width of strips of unprotected soil to reduce wind erosion.

* Use narrow grass barriers with strip-cropping.

* Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.

- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

317—Minchumina peat, 3 to 7 percent slopes

Composition

Minchumina peat and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Minchumina Soil

Position on landscape: moraines

Slope range: 3 to 7 percent

Slope features: convex to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, white spruce, and paper birch

Typical profile:

* 10 inches to 0 (25 cm to 0)—peat

* 0 to 6 inches (0 to 15 cm)—black silt loam

* 6 to 16 inches (15 to 41 cm)—frozen very dark grayish brown silt loam

Drainage class: well drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: with permafrost—low; when thawed—high

Root-restricting feature: permafrost

Runoff: slow

Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Depth to permafrost: 2 to 20 inches (5 to 51 cm)

Depth to water table: more than 60 inches (more than 152 cm)

Hazard of flooding: none

Included Areas

* soils that have slopes of more than 7 percent

* soils that have an organic mat more than 16 inches (more than 41 cm) thick

Major Uses

Current uses: recreation and wildlife habitat

Potential uses if thawed: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: slope, depth to permafrost, wind erosion, water erosion, and frost heaving

Cropland, Hayland, and Pastureland

General management considerations:

* Suitable crops for planting are small grain, cool-season row crops and adapted grasses.

* Crops respond to fertilizer and lime.

- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; return crop residue to the soil; and grow cover crops to maintain and improve fertility and tilth.
- * Prepare seedbeds on the contour or across the slope, use conservation tillage, maintain crop residue on or near the surface, strip-crop, include legumes and grasses in a rotation system, seed to cover crops, and shape waterways and seed them to perennial grasses to reduce water erosion.
- * Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, strip-crop, and limit the width of strips of unprotected soil to reduce wind erosion.
- * Use narrow grass barriers with strip-cropping.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

318—Nenana silt loam, 0 to 3 percent slopes

Composition

Nenana silt loam and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Characteristics of Nenana Soil

Position on landscape: moraines and outwash plains

Slope range: 0 to 3 percent

Slope features: concave to convex

Organic mat on surface: 1 to 4 inches (3 to 10 cm) thick

Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

- * 0 to 2 inches (0 to 5 cm)—dark brown silt loam
- * 2 to 12 inches (5 to 30 cm)—brown silt loam
- * 12 to 27 inches (30 to 69 cm)—grayish brown silt loam
- * 27 to 60 inches (69 to 152 cm)—yellowish brown fine sand

Depth class: shallow and moderately deep (11 to 39 inches or 28 to 99 cm) to sand

Drainage class: well drained

Permeability: above the sand—moderate; below this—rapid

Available water capacity: low

Runoff: very slow

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Included Areas

- * soils that have permafrost and are poorly drained
- * soils that have slopes of more than 3 percent

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: wind erosion and frost heaving

Cropland, Hayland, and Pastureland

General management considerations:

- * Suitable crops for planting are small grain, cool-season row crops and adapted grasses.
- * Crops respond to fertilizer and lime.
- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; and grow cover crops to maintain and improve fertility and tilth.
- * Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, strip-crop, and limit the width of strips of unprotected soil to reduce wind erosion.
- * Use narrow grass barriers with strip-cropping.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

319—Nenana silt loam, 3 to 7 percent slopes

Composition

Nenana silt loam and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Characteristics of Nenana Soil

Position on landscape: moraines and outwash plains

Slope range: 3 to 7 percent

Slope features: plane to convex

Organic mat on surface: 1 to 4 inches (3 to 10 cm) thick

Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

- * 0 to 2 inches (0 to 5 cm)—dark brown silt loam
- * 2 to 12 inches (5 to 30 cm)—brown silt loam
- * 12 to 27 inches (30 to 69 cm)—grayish brown silt loam
- * 27 to 60 inches (69 to 152 cm)—yellowish brown fine sand

Depth class: shallow and moderately deep (11 to 39 inches or 28 to 99 cm) to sand

Drainage class: well drained

Permeability: above the sand—moderate; below this—rapid

Available water capacity: low

Runoff: slow

Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Included Areas

- * soils that have permafrost and are poorly drained
- * soils that have slopes of more than 7 percent

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: wind and water erosion and frost heaving

Cropland, Hayland, and Pastureland

General management considerations:

- * Suitable crops for planting are small grain, cool-season row crops and adapted grasses.
- * Crops respond to fertilizer and lime.
- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; return crop residue to the soil; and grow cover crops to maintain and improve fertility and tilth.
- * Prepare seedbeds on the contour or across the slope, use conservation tillage, maintain crop residue on or near the surface, strip-crop, maintain tilth and organic matter content, include legumes and grasses in a rotation system, seed to cover crops, and shape waterways and seed them to perennial grasses to reduce water erosion.
- * Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, strip-crop, and limit the width of strips of unprotected soil to reduce wind erosion.
- * Use narrow grass barriers with strip-cropping.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

320—Nenana silt loam, 7 to 12 percent slopes

Composition

Nenana silt loam and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Characteristics of Nenana Soil

Position on landscape: moraines and outwash plains ([Figure 3](#))

Slope range: 7 to 12 percent

Slope features: plane to convex

Organic mat on surface: 1 to 4 inches (3 to 10 cm) thick
Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

- * 0 to 2 inches (0 to 5 cm)—dark brown silt loam
- * 2 to 12 inches (5 to 30 cm)—brown silt loam
- * 12 to 27 inches (30 to 69 cm)—grayish brown silt loam
- * 27 to 60 inches (69 to 152 cm)—yellowish brown fine sand

Depth class: shallow and moderately deep (11 to 39 inches or 28 to 99 cm) to sand

Drainage class: well drained

Permeability: above the sand—moderate; below this—rapid

Available water capacity: low

Runoff: slow to medium

Hazard of erosion: by water—slight if the organic mat is not removed, severe if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Included Areas

- * soils that have permafrost and are poorly drained
- * soils that have slopes of more than 12 percent

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: wind and water erosion, frost heaving, and slope

Hayland and Pastureland

General management considerations:

- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Prepare seedbeds on the contour or across the slope, seed to cover crops, and shape waterways and seed them to perennial grass to reduce water erosion.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum forage production, protect farm and ranch buildings, and provide cover for wild life.

321—Nenana silt loam, 12 to 45 percent slopes

Composition

Nenana silt loam and similar inclusions: 85 percent

Contrasting inclusions: 15 percent

Characteristics of Nenana Soil

Position on landscape: moraines and outwash plains

Slope range: 12 to 45 percent

Slope features: concave to convex

Organic mat on surface: 1 to 4 inches (3 to 10 cm) thick

Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

* 0 to 2 inches (0 to 5 cm)—dark brown silt loam

* 2 to 12 inches (5 to 30 cm)—brown silt loam

* 12 to 27 inches (30 to 69 cm)—grayish brown silt loam

* 27 to 60 inches (69 to 152 cm)—yellowish brown fine sand

Depth class: shallow and moderately deep (11 to 39 inches or 28 to 99 cm) to sand

Drainage class: well drained

Permeability: above the sand—moderate; below this—rapid

Available water capacity: low

Runoff: medium to rapid

Hazard of erosion: by water—slight if the organic mat is not removed, severe if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Included Areas

* soils that are very shallow to sand or to sand and gravel

* soils that have slopes of more than 45 percent

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: rural homesites

Major Management Factors

Soil-related factors: slope and frost heaving

322—Riverwash

Position on landscape: floodplains

Kind of material: unsorted sandy, gravelly, and cobbly alluvial sediment

Vegetation: generally barren; but sparse willows, alder, and fireweed in some areas

Special features: sediment subject to constant change as a result of flooding in spring and summer; intense freezing causes flooding in winter

323—Salchaket-Riverwash association, 0 to 3 percent slopes

Composition

Salchaket very fine sandy loam and similar inclusions: 70 percent

Riverwash: 20 percent

Contrasting inclusions: 10 percent

Characteristics of Salchaket Soil

Position on landscape: floodplains

Slope range: 0 to 3 percent

Slope features: plane

Organic mat on surface: 1 to 4 inches (3 to 10 cm) thick

Native vegetation: willow, birch, and white spruce

Typical profile:

* 0 to 3 inches (0 to 8 cm)—dark brown very fine sandy loam

* 3 to 13 inches (8 to 33 cm)—dark grayish brown very fine sandy loam

* 13 to 42 inches (33 to 107 cm)—grayish brown very fine sandy loam that has thin lenses of silt loam

* 42 to 60 inches (107 to 152 cm)—dark grayish brown very gravelly sand

Depth class: deep (40 to 60 inches or 102 to 152 cm) to sand and gravel

Drainage class: well drained

Permeability: in the upper part—moderate; in the lower part—rapid

Available water capacity: moderate

Runoff: slow

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: frequency—occasional; months—May to September

Characteristics of Riverwash

Position on landscape: along numerous drainageways

Kind of material: sparsely vegetated and unvegetated gravelly sediment

Special features: subject to frequent shifting and flooding

Included Areas

* soils that have slopes of more than 3 percent

* soils that have permafrost at a depth of 60 inches (152 cm) or less

* soils that are gravelly between a depth of 20 and 40 inches (51 to 102 cm)

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: hayland and pastureland

Major Management Factors

Soil-related factors: flooding and frost heaving

Hayland and Pastureland (Salchaket Soil)

General management considerations:

* Grasses and legumes grow well if they are adequately fertilized.

* Occasional flooding may limit the production and harvesting of hay.

Suitable management practices:

* Seed only hay and pasture plants that tolerate periodic inundation and seasonal wetness.

324—Steese-Ester association, 12 to 45 percent slopes

Composition

Steese silt loam and similar inclusions: 55 percent

Ester peat and similar inclusions: 35 percent

Contrasting inclusions: 10 percent

Characteristics of Steese Soil

Position on landscape: hillsides and ridgetops (Figure 5)

Slope range: 12 to 45 percent

Slope features: concave to convex

Organic mat on surface: 1 to 5 inches (3 to 13 cm) thick

Native vegetation: white spruce, paper birch, and quaking aspen

Typical profile:

* 0 to 4 inches (0 to 10 cm)—very dark grayish brown silt loam

* 4 to 9 inches (10 to 23 cm)—dark brown silt loam

* 9 to 14 inches (23 to 36 cm)—brown silt loam

* 14 to 30 inches (36 to 76 cm)—dark yellowish brown very channery sandy loam

* 30 inches (76 cm)—fractured schist over consolidated schist

Depth class: moderately deep (20 to 40 inches or 51 to 102 cm) to unconsolidated bedrock

Drainage class: well drained

Permeability: in the loess mantle—moderate; below this—moderately rapid

Available water capacity: moderate

Runoff: medium

Hazard of erosion: by water—slight if the organic mat is not removed, severe if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Characteristics of Ester Soil

Position on landscape: hillsides (Figure 5)

Slope range: 12 to 45 percent

Slope features: concave to convex

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, and low-growing shrubs

Typical profile:

* 10 inches to 0 (25 cm to 0)—peat

* 0 to 2 inches (0 to 5 cm)—very dark gray silt loam

* 2 to 8 inches (5 to 20 cm)—olive gray silt loam

* 8 to 16 inches (20 to 41 cm)—frozen very dark grayish brown extremely gravelly silt loam

* 16 inches (41 cm)—weathered schist

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting features: permafrost and bedrock

Runoff: medium

Depth to permafrost: 7 to 14 inches (18 to 36 cm)

Depth to bedrock: 12 to 20 inches (30 to 51 cm)

Depth to perched water table: 0 to 12 inches (0 to 30 cm)
Hazard of erosion: by water—slight; by wind—slight
Hazard of flooding: none

Included Areas

- * soils that have slopes of more than 45 percent
- * soils that have hard bedrock within a depth of 20 inches (51 cm)

Major Uses

Current uses: recreation and wildlife habitat
Potential use: rural homesites

Major Management Factors

Soil-related factors: slope, permafrost, depth to perched water table, and frost heaving

325—Tanana silt loam, 0 to 3 percent slopes

Composition

Tanana silt loam and similar inclusions: 85 percent
Contrasting inclusions: 15 percent

Characteristics of Tanana Soil

Position on landscape: alluvial plains and outwash plains
Slope range: 0 to 3 percent
Slope features: plane
Organic mat on surface: 4 to 7 inches (10 to 18 cm) thick
Native vegetation: black spruce and low-growing shrubs

Typical profile:

- * 0 to 7 inches (0 to 18 cm)—very dark gray silt loam
- * 7 to 23 inches (18 to 58 cm)—dark gray silt loam
- * 23 to 33 inches (58 to 84 cm)—frozen dark gray silt loam

Drainage class: poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting feature: permafrost

Runoff: slow

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed;
severe if the mat is removed

Depth to permafrost: 21 to 40 inches (53 to 102 cm)

Depth to perched water table: 12 to 24 inches (30 to 61 cm)

Hazard of flooding: none

Included Areas

- * soils in drainageways that are subject to frequent periods of flooding
- * soils that have an organic mat more than 8 inches (more than 20 cm) thick, have permafrost at a shallower depth, and are very poorly drained
- * soils that have slopes of more than 3 percent

- * soils that do not have permafrost and are well drained.

Major Uses

Current uses: recreation and wildlife habitat

Potential uses if thawed and drained: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: depth to permafrost, wind erosion, depth to perched water table, and frost heaving

Cropland, Hayland, and Pastureland

General management considerations:

- * Clearing and subsequent thawing of soil results in lowering the water table if adequate drainage outlets are available and cleared areas are large enough to overcome seepage from adjacent uncleared areas.
- * On-site investigation is needed to determine if adequate drainage outlets are available before the soil is cleared.
- * The pattern of occurrence of the frequently flooded drainageways in this unit could limit its use for cropland, hayland, and pastureland.
- * Suitable crops for planting are small grain, cool-season row crops and adapted grasses.
- * Crops respond to fertilizer and lime.
- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; and grow cover crops to maintain and improve fertility and tilth.
- * Use conservation tillage and shape waterways and seed them to perennial grasses to reduce water erosion.
- * Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, strip-crop, and limit the width of strips of unprotected soil to reduce wind erosion.
- * Use narrow grass barriers with strip-cropping.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

326—Tanana, moderately wet-Goldstream complex, 0 to 3 percent slopes

Composition

Tanana silt loam, moderately wet, and similar inclusions: 70 percent

Goldstream peat and similar inclusions: 20 percent

Contrasting inclusions: 10 percent

Characteristics of Tanana, Moderately Wet, Soil

Position on landscape: alluvial plains

Slope range: 0 to 3 percent

Slope features: plane to convex
Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick
Native vegetation: white spruce, paper birch, and willow

Typical profile:

- * 0 to 7 inches (0 to 18 cm)—very dark gray silt loam
- * 7 to 13 inches (18 to 33 cm)—mottled dark gray silt loam
- * 13 to 43 inches (33 to 109 cm)—mottled dark grayish brown silt loam
- * 43 to 53 inches (109 to 135 cm)—frozen olive gray very fine sandy loam

Drainage class: altered—disturbance of the organic mat has resulted in lowering of the permafrost level and improved drainage.

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: high

Runoff: very slow

Depth to permafrost: 40 to 60 inches (102 to 152 cm)

Depth to perched water table: 30 to 60 inches (76 to 152 cm)

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Characteristics of Goldstream Soil

Position on landscape: alluvial plains

Slope range: 0 to 3 percent

Slope features: plane to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, low-growing shrubs, Labrador tea, sedges, and mosses

Typical profile:

- * 12 inches to 0 (30 cm to 0)—peat consisting of partially decomposed organic matter
- * 0 to 6 inches (0 to 15 cm)—black silt loam
- * 6 to 12 inches (15 to 30 cm)—dark gray silt loam
- * 12 to 22 inches (30 to 56 cm)—frozen dark gray silt loam

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting feature: permafrost

Runoff: ponded

Hazard of erosion: by water—slight; by wind—slight if the organic mat is not removed, slight to severe if the mat is removed, depending on drainage

Depth to permafrost: 10 to 16 inches (25 to 41 cm)

Depth to perched water table: 6 inches (15 cm) above the surface to a depth of 6 inches (15 cm) below the surface

Hazard of flooding: none

Included Areas

- * soils that have slopes of more than 3 percent
- * soils that have an organic mat more than 16 inches (41 cm) thick

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: depth to permafrost, depth to perched water table, wind erosion, and frost heaving

Cropland, Hayland, and Pastureland

General management considerations for the unit:

- * Clearing, and attempting to drain Goldstream soil, is not recommended because of poor drainage possibilities.
- * On-site investigation is needed to locate areas of Tanana soil if the unit is to be considered for agricultural use.

General management considerations for Tanana soil:

- * Suitable crops for planting are small grain, cool-season row crops and adapted grasses.
- * Crops respond to fertilizer and lime.
- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices for Tanana soil:

- * Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; and grow cover crops to maintain and improve fertility and tilth.
- * Use diversions and shaped waterways seeded to perennial grasses to reduce water erosion and improve surface drainage.
- * Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, strip-crop, and limit the width of strips of unprotected soil to reduce wind erosion.
- * Use narrow grass barriers with strip-cropping.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

327—Tanana, moderately wet-Goldstream complex, 3 to 7 percent slopes

Composition

Tanana silt loam, moderately wet, and similar inclusions: 70 percent

Goldstream peat and similar inclusions: 20 percent

Contrasting inclusions: 10 percent

Characteristics of Tanana, Moderately Wet, Soil

Position on landscape: alluvial plains

Slope range: 3 to 7 percent

Slope features: plane to convex

Organic mat on surface: 2 to 5 inches (5 to 13 cm) thick

Native vegetation: white spruce, paper birch, and willow

Typical profile:

- * 0 to 7 inches (0 to 18 cm)—very dark gray silt loam

- * 7 to 13 inches (18 to 33 cm)—mottled dark gray silt loam
- * 13 to 43 inches (33 to 109 cm)—mottled dark grayish brown silt loam
- * 43 to 53 inches (109 to 135 cm)—frozen olive gray very fine sandy loam

Drainage class: altered—disturbance of the organic mat has resulted in lowering of the permafrost level and improved drainage

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: high

Runoff: slow

Depth to permafrost: 40 to 60 inches (102 to 152 cm)

Depth to perched water table: 30 to 60 inches (76 to 152 cm)

Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the mat is removed; by wind—slight if the organic mat is not removed, severe if the mat is removed

Hazard of flooding: none

Characteristics of Goldstream Soil

Position on landscape: alluvial plains

Slope range: 3 to 7 percent

Slope features: plane to concave

Organic mat on surface: 8 to 16 inches (20 to 41 cm) thick

Native vegetation: black spruce, willow, low-growing shrubs, Labrador tea, sedges, and mosses

Typical profile:

* 12 inches to 0 (30 cm to 0)—peat consisting of partially decomposed organic matter

* 0 to 6 inches (0 to 15 cm)—black silt loam

* 6 to 12 inches (15 to 30 cm)—dark gray silt loam

* 12 to 22 inches (30 to 56 cm)—frozen dark gray silt loam

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Available water capacity: low

Root-restricting feature: permafrost

Runoff: ponded

Depth to permafrost: 10 to 16 inches (25 to 41 cm)

Depth to perched water table: May through September—6 inches (15 cm) above the surface to a depth of 6 inches (15 cm) below the surface

Hazard of erosion: by water—slight if the organic mat is not removed, moderate if the mat is removed; by wind—slight if the organic mat is not removed, slight to severe if the mat is removed, depending on drainage

Hazard of flooding: none

Included Areas

* soils that have slopes of more than 7 percent

* soils that have an organic mat more than 16 inches (41 cm) thick

Major Uses

Current uses: recreation and wildlife habitat

Potential uses: cropland, hayland, pastureland, and rural homesites

Major Management Factors

Soil-related factors: depth to permafrost, depth to perched water table, frost heaving, and wind and water erosion

Cropland, Hayland, and Pastureland

General management considerations:

- * Clearing and subsequent thawing of Goldstream soil results in lowering of the water table if adequate drainage outlets are available and cleared areas are large enough to overcome seepage from adjacent uncleared areas.
- * On-site investigation is needed to determine if adequate drainage outlets are available before Goldstream soil in this unit is cleared.
- * Suitable crops for planting are small grain, cool-season row crops and adapted grasses.
- * Crops respond to fertilizer and lime.
- * Grasses and legumes grow well if they are adequately fertilized.

Suitable management practices:

- * Use a cropping system that includes grasses, legumes, or grass-legume mixtures; rotate crops; use conservation tillage; return crop residue to the soil; and grow cover crops to maintain and improve fertility and tilth.
- * Prepare seedbeds on the contour or across the slope, use conservation tillage, maintain crop residue on or near the surface, strip-crop, maintain tilth and organic matter content, include legumes and grasses in a rotation system, seed to cover crops, and shape waterways and seed them to perennial grasses to reduce water erosion.
- * Use conservation tillage, maintain crop residue on the surface, keep soil rough and cloddy, strip-crop, and limit the width of strips of unprotected soil to reduce wind erosion.
- * Use narrow grass barriers with strip-cropping.
- * Leave strips of trees as windbreaks when clearing land or plant windbreaks using adapted tree species.
- * Use windbreaks to limit soil losses, maintain optimum crop yields, protect farm and ranch buildings, and provide cover for wildlife.

Figures



Figure 1—An area of Map Unit 307—Goldstream –Tanana complex, 0 to 3 percent slopes.



Figure 2—Map Unit 308—Goldstream and Histosols, 0 to 3 percent slopes. Black spruce is present on the Goldstream soils and the Histosols are unforested.



Figure 3—Map Unit 308—Goldstream and Histosols, 0 to 3 percent slopes is in the foreground, with Map Unit 320—Nenana silt loam, 7 to 12 percent slopes on the forested slopes to the rear.



Figure 4—Map Unit 312—Koyukuk silt loam, 0 to 3 percent slopes is forested and is adjacent to Map Unit 301—Cryorthents, flooded.



Figure 5—A mixed stand of black spruce and paper birch on Map Unit 324—
Steese-Ester association, 12 to 45 percent slopes.

Use and Management of the Soils

This soil survey is an inventory and evaluation of the soils in the Survey Area. Information in this section can be used to plan the use and management of soils for crops and pasture and wildlife habitat. It can also be used to adjust land uses to the limitations and potentials of natural resources and the environment and to help prevent soil-related failures caused by unfavorable soil properties.

In preparing a soil survey, soil scientists, conservationists, foresters, biological technicians, and others collect extensive field data on the nature and behavior characteristics of the soils. Field experience and data collected on soil properties (such as erosion, droughtiness, flooding, and other factors that affect various soil uses and management) are used as a basis for predicting soil behavior.

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

Crops and Pasture

Prepared by Roger Boyer, former District Conservationist, Natural Resources Conservation Service

In this section, crops and pasture plants best suited to the soils are identified, conservation practices and systems needed to protect the soils are discussed, and suitable land clearing practices are described.

Planners of management systems for individual fields or farms should consider the detailed information given in the description of each soil under "[Detailed Soil Map Units](#)". Specific information can be obtained from the local offices of the Natural Resources Conservation Service or the Alaska Cooperative Extension.

Agronomy Practices

The most suitable row crops for the Upper Tanana Area are frost-hardy vegetables such as cabbage, brussel sprouts, broccoli, cauliflower, lettuce, potatoes, and carrots. Adapted small grains include barley and oats. The best suited grasses for hay and pasture include smooth brome, timothy, red fescue, bluejoint reedgrass, Garrison creeping foxtail, and Kentucky bluegrass. Grass can also be grown for seed production. Wheat, rye, faba beans, peas, rapeseed, and buckwheat have been grown with limited success. To do well, roper varieties of annual crops and perennial grasses must be used ([Quarberg 1985](#); [Alaska Rural Development Council 1983](#)). Consult the Alaska Cooperative Extension for the latest recommendations.

Proper fertilization is essential for good production of crops. Large amounts of nitrogen, phosphate, potash, plus other soil amendments such as sulfur and boron, are needed for most soils. Newly cleared soils require extra nitrogen. Soil microorganisms

use much of the nitrogen to decompose organic matter. For detailed recommendations and planning assistance consult the local offices of the Natural Resources Conservation Service or the Alaska Cooperative Extension.

Continuous cultivation deteriorates the tilth of the soil. Preventative measures include application of livestock manure to the soil, seeding and plowing under green manure crops, and the incorporation of annual crop residue into the soil.

Conservation Practices

Soils suitable for annual crops or hay and pasture have yearly soil loss tolerances of between 1 and 5 tons per acre. Careful management using soil conservation practices is necessary to maintain long-term soil productivity. If native vegetation is removed, erosion is a hazard for nearly level to strongly sloping soils. Soils that occur on slopes of more than 12 percent are not recommended for annual crops or hayland and pastureland.

Wind erosion is most critical on nearly level to gently sloping soils. The Survey Area is subject to strong southerly winds in spring and summer. Winter winds shift to a more southeasterly direction. Windbreaks located at right angles to the prevailing winds can be used to help control wind erosion. If they are spaced more than 330 feet (101 m) apart, other practices, such as conservation tillage, are needed. This practice requires crop residue management that maintains at least 1,000 pounds per acre on the soil surface. Other practices that can be used include strip-cropping or closely spaced grassed barriers. Soils that have extreme wind erosion should be planted to permanent hay or pasture.

Water erosion is the main hazard on strongly sloping soils, although wind erosion can be a problem as well. Soils with slopes of 7 to 12 percent should be cleared only for use as hay or pasture. Soils with less than 7 percent slopes can be cultivated for annual crops, but they require carefully planned conservation systems that incorporate practices such as contour cropping, contour strip-cropping, and conservation tillage that maintains at least 1,500 pounds of crop residue per acre on the soil surface. Grassed waterways may be used in areas where water concentrates. Permanent hay or pasture may be needed in a crop rotation system 25 to 50 percent of the time. Poorly drained soils may require the use of surface drainage systems, surface ditches, diversions, or grassed waterways to manage the flow of water.

Land Clearing

Most soils in the Survey Area are forested and must be cleared prior to development. Timber should be harvested prior to clearing or salvaged after clearing for use as building poles and logs, dimension lumber, fence posts and rails, and fuel wood. Trees as small as two to three inches have value as fuel.

Two types of soils and forest conditions exist in the Interior—well drained soils dominated by aspen, paper birch, or white spruce; and poorly drained soils (that often contain permafrost) dominated by black spruce. Aspen and black spruce should be cleared in spring or summer when the soil is thawed to reduce the chance of breaking trees and avoid the possibility of large masses of roots being left imbedded in the soil. The size and strength of white spruce and paper birch allow these stands to be uprooted even in frozen soils. Clearing when the soil is saturated causes soil puddling and compaction.

Prior to the Delta Agricultural Project, the State of Alaska conducted clearing trials and concluded that land clearing was best accomplished by “chaining” ([Franklin, Quarberg, and Lewis 1978](#)). Trees are knocked down using a heavy anchor chain with 40-pound links pulled between two bulldozers, allowing the chain to form a large loop. In thick stands of aspen, a large weight may be attached to the middle of the loop to keep the chain from riding up the trees and breaking them before they are uprooted. For best

results, traction trails should be surveyed and cut through the timber prior to chaining. Cleared material may then be stacked in berm piles on the trails, resulting in total clearing even under the berms.

Whether to harvest timber before clearing or salvage it after clearing should be determined prior to "chaining." Chaining uses the weight of standing trees for leverage to uproot them. Topless trees may result in roots being left in the soil. Harvesting by salvage after clearing, however, may be more time consuming due to tangled treetops.

When the trees have been knocked down, shearing takes place by using a large bulldozer, or several bulldozers running in tandem, and various types of shearing blades. One blade shears organic material at the mineral soil surface, and another uses large teeth to sort out sticks and large clumps of moss from the soil. The latter blade may leave large amounts of moss behind and need to be followed up by a sweep-up, angle blade bulldozer. Excessive amounts of residual moss result in poor seedbeds and an unavailability of nutrients in the first few years following clearing. To prevent large amounts of soil from being pushed into the berms and inhibiting burning and berm disposal, shearing should take place in winter or when the mineral soil is frozen.

Following shearing and stacking the berms, the ground is worked with a breaking disk pulled by a bulldozer or 4-wheel drive tractor. A hydraulic powered root rake is then pulled over the newly cleared ground, kicking up roots, tree stumps, and moss into small windrows. The windrows are raked with succeeding passes into the berm piles. Berm piles are dried for 6 to 12 months, burned, rebunched with a bulldozer or root rake, and burned again. This process is repeated until the residue can be hauled away, buried, or spread onto the field in such a way that it does not interfere with field operations.

Berms may be present for many years following initial clearing. Exact placement of berms is essential to insure proper drainage of the soil. When flowing water reaches the berm, it is diverted and runs downslope along the berm pile possibly resulting in serious erosion or flooding of low spots. Berms should never be placed in or near standing timber due to the fire hazard at the time of burning.

Windbreaks should be left at the time of clearing, as windbreaks of natural timber are more effective than those that have been replanted. Effective windbreaks take 15 to 20 years to regrow. Leaving greenbelts of native vegetation along watercourses, ponds, or other bodies of water prevents erosion and sedimentation.

Land clearing on permafrost soils introduces vastly different thermal conditions into the soils due to the removal of trees and the insulating organic layer at the surface. Permafrost begins to thaw from the surface, releasing water that was in the form of ice. In order for permafrost soils to be suitable for agriculture, the excess water that is released must drain out of the soil to a degree that is desirable for the growth of most field crops. Drainage of a thawed permafrost soil is related to the degree of slope and the availability of drainage outlets. Thawed soils in gently sloping areas (3 to 12 percent) generally drain. Thawed soils that are nearly level (0 to 3 percent) may not drain due to a concave slope or lack of a drainage outlet, or both. Seepage from surrounding uncleared permafrost soils is also a consideration in the management of cleared and thawed permafrost soils. When drainable, permafrost soils are cleared, ample time is required for the soil to thaw and drain before field operations begin. Required time for soils to thaw and drain is variable.

Native Vegetation

Prepared by Darrell Kautz, Plant Ecologist, Natural Resources Conservation Service

The vegetation of the Upper Tanana Area consists of a mosaic of white spruce, paper birch, aspen, and black spruce forest, and treeless scrub characteristic of the boreal forest zone of Interior Alaska. The combined effects of landform, topographic position, soil type, and the occurrence of past wildfires determine the actual vegetation on a site.

The most extensive forest types in the area are white spruce, paper birch, and black spruce. White spruce occurs on moderately well drained and well drained moraines, outwash plains, hillsides, and alluvial plains. It is of value for house logs, lumber, and firewood. Paper birch also is on moderately well drained and well drained sites. It occurs on hillsides, moraines, outwash plains, and alluvial plains. It provides excellent firewood and can be used for lumber. Black spruce occurs on somewhat poorly drained to very poorly drained hillsides, alluvial plains, outwash plains, and moraines. It generally is indicative of permafrost within the soil profile. Black spruce can be used for posts and poles and as firewood.

The aspen forest type occurs on well drained, south-facing side slopes of mountains and moraines, but is not extensive. Although aspen can be burned as firewood, its heat is low compared to other trees in the area.

When topographic and edaphic conditions inhibit tree growth, the bog birch scrub type occurs. This type is moderately extensive on somewhat poorly drained to very poorly drained toe slopes and alluvial plains. Shallow permafrost generally occurs under the bog birch type.

Frequently recurring wildfires have had a major influence on the composition and structure of the vegetation. Natural fires tend to be high-intensity, crown fires that typically kill and replace entire stands. Following fires, a series of intermediate seral vegetation types inhabit a site until eventually succeeded by the potential vegetation. In the Upper Tanana Area, the tall willow type develops following fires on moderately well drained and well drained sites. Over time, paper birch and eventually white spruce replace the willow. On very poorly drained to somewhat poorly drained sites, post-fire succession typically leads directly to vegetation similar to the vegetation that grew before the fire.

Wildlife Habitat

Prepared by Roger Boyer, former District Conservationist, Natural Resources Conservation Service

Soils affect the kind and amount of vegetation that is available to wildlife as food and cover. They also affect the construction of water impoundments. The kind and abundance of wildlife depend largely on the amount and distribution of food, cover, and water. Wildlife habitat can be created or improved by planting appropriate vegetation, maintaining the existing plant cover, or promoting the natural establishment of desirable plants.

Soils, along with climate, determine the kind of vegetation that grows. Natural plant communities undergo gradual changes, called succession, starting at a pioneer stage and progressing to one of maturity, or climax. Fire can modify succession or can actually halt the process and cause it to revert back to any of the previous stages, depending upon the intensity of the burn ([Foote 1983](#)).

Habitat for openland wildlife generally consists of cropland, pasture, meadows, and areas that are overgrown with grasses, herbs, shrubs, and vines. Wildlife attracted to these areas include snowshoe hare, fox, coyote, vole, shrew, and other similar species.

Habitat for woodland wildlife generally consists of areas of deciduous plants or coniferous plants, or both, and associated grasses, legumes, and wild herbaceous plants. Wildlife attracted to these areas include marten, red squirrel, grouse, moose, and wolf.

Habitat for wetland wildlife consists of open, marshy, or swampy shallow water areas. Some of the wildlife attracted to such areas are waterfowl, beaver, otter, and mink.

Habitat for rangeland wildlife consists of brush, grass, and forbs. Wildlife attracted to these areas include caribou, moose, grizzly bear, wolf, and many kinds of birds. Rangeland wildlife tend to travel great distances searching for food, or migrate from breeding to wintering grounds.

Moose are the most visible of the species present in the Survey Area. They browse on

willows, aspen sprouts and shoots, and young birch in winter; and graze grasses, forbs, and aquatic plants in summer. Bulls usually migrate to higher elevations during the summer, leaving the cows behind to raise their calves. During the winter, both bulls and cows use lower elevations, where there is less snow, for food and shelter.

Bison use the riverbed area of the Delta River as calving grounds. The main calving area is about 10 miles south of the Survey Area near Donnely Dome. During the summer, the herd wanders throughout the area, especially along the river. In August, they begin their annual migration away from the summer range, and head for the agricultural areas east of Delta.

The Delta caribou herd calves near the Survey Area at the base of Mt. Hayes. Because of its large size, the herd spreads out and can occasionally be seen throughout the Survey Area, especially during years of high population. They are, however, not plentiful in any season, as lichens, their principal food, are not readily available in the Upper Tanana Area.

Grizzly bears may be found anywhere in the area, but they generally prefer the higher elevations near timberline. Black bears may be found in the forested areas along the Delta and Tanana Rivers, and are encountered more frequently than grizzly bears. Bears are omnivorous and feed on grasses, forbs, roots, berries, insects, small animals, and carrion.

Upland fur bearing animals in the Survey Area include wolf, coyote, fox, lynx, wolverine, and marten. These species are meat eaters that live in or near the aspen, birch, and spruce stands used by their prey. Common wetland furbearers include otter, mink, and beaver. Smaller mammals include red squirrel, porcupine, weasel, snowshoe hare, vole, and shrew.

Numerous species of birds use the Survey Area—some nest; others simply pass through during their long migration between nesting and wintering grounds. Raptorial birds include rough-legged hawk, bald eagle, peregrine falcon, great horned owl, and marsh hawk. Wetland birds include sandhill crane, mallard, Canada geese, loon, and grebe. Common perching birds include raven, black-billed magpie, white-crowned and tree sparrows, gray jay, black-capped chickadee, robin, Bohemian waxwing, and several species of warblers. Upland game birds include sharp-tailed, ruffed, and spruce grouse.

The many streams and small lakes in the Area support good populations of Arctic grayling, the most common fish in the Interior. Northern pike are in some of the larger lakes and in the slower channels of the Tanana River. Rainbow trout have been stocked and are readily caught in some lakes. Both chum and silver salmon migrate along the Tanana and Delta Rivers on their way to spawning grounds. The confluence of the Delta River and Tanana River has been designated "critical spawning habitat" for chum salmon by the Alaska Department of Fish and Game.

Like much of Interior Alaska, the Survey Area is a haven for many types of biting insects, such as mosquitoes, blackflies, and whitesock flies, plus other nonbiting flies, ants, and bees. These insects are often pests to humans; however, they are an important source of food for fish, birds, and many omnivorous mammals.

Rural Homesite Development

Rural homesites, as mentioned in the "[Detailed Soil Map Units](#)," refer to small acreages with simple rustic dwellings, typical of remote areas in Alaska. Design, construction, quality, and building materials vary widely. Uses range from permanent residences to recreational uses.

The limitations listed in the map units are slope, permafrost, depth to a perched water table, and frost heaving.

Slope is a limitation when it exceeds 12 percent. Excessive slope affects the stability of a structure and increases the hazard of erosion due to disturbance of the natural

vegetative cover. Revegetation of disturbed areas reduces erosion hazard.

Permafrost and depth to a perched water table is a limitation when permafrost is present in the soil and the water table is within 12 inches (30 cm) of the surface. These properties affect the stability of a structure and the hydrologic conditions around the site. Suitable methods for building on permafrost include preserving permafrost by minimizing disturbance of the surface vegetative cover to retain its insulating quality and building on pilings footed in the permafrost; or removing the vegetative cover, thawing and draining the soil, and building as if on a non-permafrost soil.

Frost heaving is a limitation when the volume of soil changes due to freezing and thawing. Frost heaving produces unstable conditions for structures. The depth to which annual frost penetrates should be considered when designing footings. Building on gravel pads reduces frost heaving.

Engineering

This section provides information for planning land uses related to urban development and water management. Soils are rated for various uses, and the most limiting features are identified. Ratings are given for building site development, sanitary facilities, construction materials, and water management. Ratings are based on observed performance of the soils and the estimated data and test data in the "[Soil Properties](#)" section.

Information in this section is intended for land use planning, evaluating land use alternatives, and planning site investigations prior to design and construction. However, the information has limitations. For example, estimates and other data generally apply only to that part of the soil within a depth of 5 or 6 feet (1.5 to 1.8 m). Because of the map scale, small areas of different soils may be included within the mapped areas of a specific soil.

The information is not site specific and does not eliminate the need for on-site investigation of the soils or for testing and analysis by personnel experienced in the design and construction of engineering works.

Government ordinances and regulations that restrict certain land uses or impose specific design criteria were not considered in preparing the information in this section. Local ordinances and regulations should be considered in planning, site selection, and design.

Soil properties, site features, and observed performance were considered in determining the ratings in this section. During the fieldwork for this soil survey, determinations were made about grain-size distribution, liquid limit, plasticity index, soil reaction, depth to bedrock, hardness of bedrock within 5 or 6 feet of the surface, soil wetness, depth to a seasonal high water table, slope, likelihood of flooding, natural soil structure aggregation, and soil density. Data were collected about kinds of clay minerals, mineralogy of the sand and silt fractions, and the kind of adsorbed cations. Estimates were made for erodibility, permeability, corrosivity, shrink-swell potential, available water capacity, and other behavioral characteristics affecting engineering uses.

This information can be used to make preliminary estimates of construction conditions; evaluate alternative routes for roads, streets, highways, pipelines, and underground cables; plan detailed on-site investigations of soils and geology; and locate potential sources of gravel, sand, earthfill, and topsoil.

The information in the [tables](#), along with the soil maps, soil descriptions, and other data provided in this survey, can be used to make additional interpretations.

Some of the terms used in this soil survey have a special meaning in soil science and are defined in the [Glossary](#).

Building Site Development

Table 5 shows the degree and kind of soil limitations that affect shallow excavations, dwellings with and without basements, small commercial buildings, and local roads and streets. Limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the intended use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required. Special feasibility studies may be required where soil limitations are severe.

Shallow excavations are trenches or holes dug to a maximum depth of 5 or 6 feet (1.5 or 1.8 m) for basements, graves, utility lines, open ditches, and other purposes. Ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock, permafrost, stone content, soil texture, and slope affect the ease of digging, filling, and compacting. Depth to a seasonal high water table and the susceptibility of the soil to flooding affect the time of year that excavations can be made. Soil texture and depth to the water table affect the resistance of the excavation walls or banks to sloughing or caving.

Dwellings and small commercial buildings are structures built on shallow foundations on undisturbed soil. The load limit is the same as that for single-family dwellings no higher than three stories. Ratings are made for small commercial buildings without basements, for dwellings with basements, and for dwellings without basements. Ratings are based on soil properties, site features, and observed performance of the soils. A high water table, flooding, melting of ground ice, and organic layers can cause the movement of footings. A high water table, depth to bedrock or permafrost, large stones, and flooding affect the ease of excavation and construction. Landscaping and grading that require cuts and fills of more than 5 to 6 feet (more than 1.5 to 1.8 m) are not considered.

Local roads and streets have an all-weather surface and carry automobile and light truck traffic all year. They have a subgrade of cut or fill soil material; a base of gravel, crushed rock, or stabilized soil material; and a flexible or rigid surface. Cuts and fills are generally limited to less than 6 feet (1.8 m). Ratings are based on soil properties, site features, and observed performance of the soils. Depth to bedrock or permafrost, a high water table, flooding, and slope affect the ease of excavating and grading. Soil strength (as inferred from the engineering classification of the soils), shrink-swell potential, frost action potential, and depth to a high water table affect the traffic supporting capacity.

Sanitary Facilities

Table 6 shows the degree and kind of soil limitations that affect septic tank absorption fields, sewage lagoons, and sanitary landfills. Limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design, significant increases in construction costs, and possibly increased maintenance are required.

The table also shows the suitability of the soils for use as daily cover for landfills. A rating of *good* indicates that soil properties and site features are favorable for the use and good performance and low maintenance can be expected; *fair* indicates that soil properties and site features are moderately favorable for the use and one or more soil properties or site features make the soil less desirable than the soils rated good; and *poor* indicates that one or more soil properties or site features are unfavorable for the use and overcoming the unfavorable properties requires special design, extra maintenance, or costly alteration.

Septic tank absorption fields are areas in which effluent from a septic tank is distributed into the soil through subsurface tiles or perforated pipe. Only that part of the soil between depths of 24 and 72 inches (61 to 183 cm) is evaluated. Ratings are based on soil properties, site features, and observed performance of the soils. Permeability, a high water table, depth to bedrock or permafrost, and flooding affect absorption of the effluent. Large stones and bedrock or permafrost interfere with installation.

Unsatisfactory performance of septic tank absorption fields, including excessively slow absorption of effluent, surfacing of effluent, and hillside seepage, can affect public health. Ground water can be polluted if highly permeable sand and gravel or fractured bedrock is less than 4 feet (less than 1.2 m) below the base of the absorption field, if slope is excessive, or if the water table is near the surface. Unsaturated soil material must be located beneath the absorption field to effectively filter the effluent. Many local ordinances require that this material be of a certain thickness.

Sewage lagoons are shallow ponds constructed to hold sewage while aerobic bacteria decompose the solid and liquid wastes. Lagoons should have a nearly level floor surrounded by cut slopes or embankments, and utilize compacted, relatively impervious soil material for the floor and sides to minimize seepage and contamination of local ground water. Generally, aerobic lagoons hold the sewage within a depth of 2 to 5 feet (0.6 to 1.5 m).

The table gives ratings for the natural soil that makes up the lagoon floor. The surface layer, and generally 1 or 2 feet (0.3 or 0.6 m) of soil material below the surface layer, are excavated to provide material for the embankments. Ratings are based on soil properties, site features, and observed performance of the soils. Slope, permeability, a high water table, depth to bedrock or permafrost, flooding, large stones, and content of organic matter are considered in the ratings.

Excessive seepage resulting from rapid permeability in the soil, or a water table that is high enough to raise the level of sewage in the lagoon, cause a lagoon to function unsatisfactorily and can result in pollution. A high content of organic matter inhibits aerobic activity and also is detrimental to proper functioning of the lagoon. Slope, bedrock, and permafrost can cause construction problems, and large stones can hinder compaction of the lagoon floor.

Sanitary landfills are areas where solid waste is disposed by burying it in soil. There are two types of landfill—trench and area. In a trench landfill, the waste is placed in a trench and spread, compacted, and covered daily with a thin layer of soil excavated at the site. In an area landfill, the waste is placed in successive layers on the surface of the soil and spread, compacted, and covered daily with a thin layer of soil from a source away from the site. Both types of landfill must be able to bear heavy vehicular traffic, and both involve a risk of ground water pollution. Ease of excavation and revegetation should be considered.

The ratings in the table are based on soil properties, site features, and observed performance of the soils. Permeability, depth to bedrock or permafrost, a high water table, slope, and flooding affect both types of landfill. Texture, highly organic layers, and soil reaction affect trench type landfills. Unless otherwise noted, ratings apply only to that part of the soil within a depth of 6 feet (1.8 m). For deeper trenches, a limitation rated as slight or moderate may not be valid. On-site investigation is needed.

Daily cover for landfill is the soil material that is used to cover compacted solid waste in an area type sanitary landfill. The soil material is obtained off-site, transported to the landfill, and spread over the waste. Soil texture, wetness, coarse fragments, and slope affect the ease of removing and spreading the material during wet and dry periods. Loamy or silty soils that are free of large stones or excess gravel are the best cover for a landfill. Clayey soils are sticky or cloddy and are difficult to spread; sandy soils are subject to wind erosion.

After soil material has been removed, the soil material remaining in the borrow area must be thick enough over bedrock, permafrost, or the water table to permit revegetation. The soil material used as final cover for a landfill should be suitable for plants. The surface layer generally has the best workability, more organic matter, and the best

potential for plants. Material from the surface layer should be stockpiled for use as the final cover.

Construction Materials

Table 7 gives information about the soils as a source of roadfill, sand, gravel, and topsoil. The soils are rated *good*, *fair*, or *poor* as a source of roadfill and topsoil. They are rated as a *probable* or *improbable* source of sand and gravel. Ratings are based on soil properties and site features that affect the removal of the soil and its use as construction material. Normal compaction, minor processing, and other standard construction practices are assumed. Each soil is excavated to a depth of 5 or 6 feet (1.5 or 1.8 m).

Roadfill is soil material that is excavated in one place and used in road embankments in another place. In this table, the soils are rated as a source of roadfill for low embankments, generally less than 6 feet (less than 1.8 m) high and less exacting in design than higher embankments.

Ratings are for the soil material below the surface layer to a depth of 5 or 6 feet (1.5 to 1.8 m). It is assumed that soil layers will be mixed during excavating and spreading. Many soils have layers of contrasting suitability within their profile. The table showing engineering index properties provides detailed information about each soil layer. This information can help determine the suitability of each layer for use as roadfill. The performance of soil after it is stabilized with lime or cement is not considered in the ratings.

Ratings are based on soil properties, site features, and observed performance of the soils. The thickness of suitable material is a major consideration. Large stones, a high water table, and slope affect the ease of excavation. How well the soil performs in place after it has been compacted and drained is determined by its strength (as inferred from the engineering classification of the soil) and shrink-swell potential.

Soils rated *good* contain significant amounts of sand or gravel, or both. They have at least 5 feet (1.5 m) of suitable material, a low shrink-swell potential, few cobbles and stones, and slopes of 15 percent or less. Depth to the water table is more than 3 feet (more than 0.9 m). Soils rated *fair* are more than 35 percent silt- and clay-sized particles and have a plasticity index of less than 10. They have a moderate shrink-swell potential, slopes of 15 to 25 percent, or many stones. Depth to the water table is 1 to 3 feet (0.3 to 0.9 m). Soils rated *poor* have one or more of the following characteristics: a plasticity index of more than 10, slopes of more than 25 percent, or a water table at a depth of less than 1 foot (less than 0.3 m). They may have layers of suitable material, but the material is less than 3 feet (less than 0.9 m) thick.

Sand and *gravel* are natural aggregates suitable for commercial use with a minimum of processing. They are used in many kinds of construction. Specifications for each use vary widely. In the table, only the probability of finding material in suitable quantity in or below the soil is evaluated. The suitability of the material for specific purposes is not evaluated, nor are factors that affect excavation of the material.

The properties used to evaluate the soil as a source of sand or gravel are gradation of grain sizes (as indicated by the engineering classification of the soil), the thickness of suitable material, and the content of rock fragments. Kinds of rock, acidity, and stratification are given in the soil series descriptions. Gradation of grain sizes is given in the table on engineering index properties.

A soil rated as a *probable source* has a layer of clean sand or gravel or a layer of sand or gravel that is as much as 12 percent silty fines. This material must be at least 3 feet (at least 0.9 m) thick and less than 50 percent, by weight, large stones. All other soils are rated as an *improbable source*. Coarse fragments of soft bedrock, such as shale and siltstone, are not considered to be sand and gravel.

Topsoil is used to cover an area so that vegetation can be established and maintained. The upper 40 inches (102 cm) of a soil is evaluated for use as topsoil. The reclamation potential of the borrow area is also evaluated.

Plant growth is affected by toxic material and by such properties as soil reaction, available water capacity, and fertility. Rock fragments, slope, a water table, soil texture, and thickness of suitable material affect the ease of excavating, loading, and spreading. Slope, a water table, rock fragments, and bedrock affect reclamation of the borrow area.

Soils rated *good* have friable, loamy material to a depth of at least 40 inches (at least 102 cm). They are free of stones and cobbles, have little or no gravel, and have slopes of less than 8 percent. They are naturally fertile or respond well to fertilizer, and are not so wet that excavation is difficult.

Soils rated *fair* are sandy soils, soils that have only 20 to 40 inches (51 to 102 cm) of suitable material, soils that have an appreciable amount of gravel, or soils that have slopes of 8 to 15 percent. They are not so wet that excavation is difficult.

Soils rated *poor* are very sandy, have less than 20 inches (less than 51 cm) of suitable material, have a large amount of gravel, have slopes of more than 15 percent, or have a seasonal high water table at or near the surface.

The surface layer of most soils generally is preferred for topsoil because of its organic matter content. Organic matter greatly increases the absorption and retention of moisture and nutrients for plant growth.

Water Management

Table 8 gives information on the soil properties and site features that affect water management. The degree and kind of soil limitations are given for pond reservoir areas; embankments, dikes, and levees; and aquifer-fed excavated ponds. The limitations are considered *slight* if soil properties and site features are generally favorable for the indicated use and limitations are minor and are easily overcome; *moderate* if soil properties or site features are not favorable for the indicated use and special planning, design, or maintenance is needed to overcome or minimize the limitations; and *severe* if soil properties or site features are so unfavorable or so difficult to overcome that special design and possibly increased maintenance are required, as well as significant increases in construction costs.

The restrictive features that affect drainage, irrigation, terraces and diversions, and grassed waterways are also given in this table.

Pond reservoir areas hold water behind a dam or embankment. Soils best suited to this use have low seepage potential in the upper 60 inches (152 cm). The seepage potential is determined by the permeability of the soil and the depth to fractured bedrock or other permeable material. Excessive slope can affect the storage capacity of the reservoir area.

Embankments, dikes, and levees are raised structures of soil material, generally less than 20 feet (less than 6 m) high, constructed to impound water or protect the land against overflow. In this table, the soils are rated as a source of material for embankment fill. Ratings apply to the soil material below the surface layer to a depth of about 5 feet (1.5 m). It is assumed that soil layers will be uniformly mixed and compacted during construction.

Ratings do not indicate the ability of the natural soil to support an embankment. Soil properties to a depth even greater than the height of the embankment can affect the performance and safety of the embankment. Generally, an in depth, on-site investigation is needed to determine these properties.

Soil material in embankments must be resistant to seepage, piping, and erosion and have favorable compaction characteristics. Unfavorable features include less than 5 feet (less than 1.5 m) of suitable material or organic matter. A high water table affects the amount of usable material, and trafficability.

Aquifer-fed excavated ponds are pits or dugouts that extend to a ground water aquifer or to a depth below a permanent water table. Excluded are ponds that are fed only by surface runoff or embankment ponds that impound water 3 feet (0.9 m) or more above the original surface. Depth to a permanent water table and permeability of the aquifer affect

excavated ponds. Depth to bedrock and permafrost affect the ease of excavation.

Drainage is the removal of excess surface and subsurface water from the soil. How easily and effectively the soil is drained depends on the depth to bedrock, permafrost, or other layers that affect the rate of water movement; permeability; depth to high water table or depth of standing water if the soil is subject to ponding; slope; susceptibility to flooding; subsidence of organic layers; and potential frost action. Depth to bedrock or permafrost, slope, and the hazard of cutbanks caving affect excavating and grading and the stability of ditchbanks. Extreme acidity or toxic substances in the root zone such as salts, sodium, or sulfur adversely affect the productivity of the soil after drainage. Availability of drainage outlets is not considered in the ratings.

Irrigation is the controlled application of water to supplement rainfall and support plant growth. Depth to the water table, the need for drainage, flooding, available water capacity, intake rate, permeability, erosion hazard, and slope affect the design and management of irrigation systems. Depth to bedrock or permafrost affects the construction of systems. Depth of the root zone and soil reaction affect the performance of systems.

Terraces and diversions are embankments, or a combination of channels and ridges, constructed across a slope to reduce erosion and conserve moisture by intercepting runoff. Slope, wetness, and depth to bedrock or permafrost affect the construction of terraces and diversions. A restricting rooting depth, a severe hazard of wind and water erosion, an excessively coarse texture, and restricted permeability adversely affect maintenance.

Grassed waterways are natural or constructed channels, generally broad and shallow that conduct surface water to outlets at a non-erosive velocity. Wetness, slope, and depth to bedrock or permafrost affect the construction of grassed waterways. Wind erosion hazard, low available water capacity, restricted rooting depth, and restricted permeability adversely affect the growth and maintenance of grass after construction.

Soil Properties

Data relating to soil properties are collected during the course of the soil survey. Soil properties are determined by field examination of the soils and laboratory index testing of some benchmark soils. Established standard procedures are followed. During the survey, many shallow borings are made and examined to identify and classify the soils and delineate them on the soil maps. Samples are taken from some typical profiles and tested in the laboratory to determine grain-size distribution, plasticity, and compaction characteristics. These results are reported in [Table 9](#).

Estimates of soil properties are based on field examinations, laboratory tests of samples from the Survey Area, and laboratory tests of samples of similar soils in nearby areas. Tests verify field observations, verify properties that cannot be estimated accurately by field observation, and help characterize key soils.

The estimates of soil properties shown in the tables include the range of grain-size distribution and Atterberg limits, the engineering classification, and the physical and chemical properties of the major layers of each soil. Pertinent soil and water features also are given.

Engineering Index Properties

[Table 9](#) gives estimates of the engineering classification and the range of index properties for the major layers of each soil in the Survey Area. Most soils have layers of contrasting properties within the upper 5 or 6 feet (1.5 or 1.8 m).

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given for each soil series under the heading "[Soil Series, Higher Taxa, and Their Morphology](#)."

Texture is given in the standard terms used by the U.S. Department of Agriculture. These terms are defined according to percentages of sand, silt, and clay in the fraction of the soil that is less than 2 millimeters in diameter. "Loam," for example, is soil that is 7 to 27 percent clay, 28 to 50 percent silt, and less than 52 percent sand. If the content of particles coarser than sand is as much as 15 percent, an appropriate modifier is added, for example, "gravelly." Textural terms are defined in the [Glossary](#).

Classification of the soils is determined according to the system adopted by the American Association of State Highway and Transportation Officials (AASHTO) ([American Association of State Highway and Transportation Officials 1982](#)) and the Unified soil classification system ([American Society for Testing and Materials 1988](#)).

The Unified system classifies soils according to properties that affect their use as construction material. Soils are classified according to grain-size distribution of the fraction less than 3 inches (less than 8 cm) in diameter and according to plasticity index, liquid limit, and organic matter content. Sandy and gravelly soils are identified as GW, GP, GM, GC, SW, SP, SM, and SC; silty and clayey soils as ML, CL, OL, MH, CH, and OH; and highly organic soils as PT. Soils exhibiting engineering properties of two groups can have a dual classification, for example, SP-SM.

The AASHTO system classifies soils according to those properties that affect roadway construction and maintenance. In this system, the fraction of a mineral soil that is less than 3 inches (less than 8 cm) in diameter is classified in one of seven groups from A-1 through A-7 on the basis of grain-size distribution, liquid limit, and plasticity index. Soils in group A-1 are coarse grained and low in content of fines (silt and clay). At the other extreme, soils in group A-7 are fine grained. Highly organic soils are classified in group A-8 on the basis of visual inspection.

Rock fragments larger than 10 inches (larger than 25 cm) in diameter and 3 to 10 inches (8 to 25 cm) in diameter are indicated as a percentage of the total soil on a dry-weight basis. The percentages are estimates determined mainly by converting volume percentage in the field to weight percentage.

Percentage (of soil particles) passing designated sieves is the percentage of the soil fraction less than 3 inches (less than 8 cm) in diameter based on an oven-dry weight. The sieves, numbers 4, 10, 40, and 200 (USA Standard Series), have openings of 4.76, 2.00, 0.420, and 0.074 millimeters, respectively. Estimates are based on laboratory tests of soils sampled in the Survey Area and in nearby areas and on estimates made in the field.

Liquid limit and plasticity index (Atterberg limits) indicate the plasticity characteristics of a soil. The estimates are based on test data from the Survey Area or from nearby areas and on field examination.

The estimates of grain-size distribution, liquid limit, and plasticity index are generally rounded to the nearest 5 percent. Thus, if the ranges of gradation and Atterberg limits extend a marginal amount (1 or 2 percentage points) across classification boundaries, the classification in the marginal zone is omitted in the table.

Physical and Chemical Properties

[Table 10](#) shows estimates of some characteristics and features that affect soil behavior. These estimates are given for the major layers of each soil in the Survey Area. The estimates are based on field observations and on test data for these and similar soils.

Depth to the upper and lower boundaries of each layer is indicated. The range in depth and information on other properties of each layer are given in the section "[Soil Series, Higher Taxa, and Their Morphology.](#)"

Clay as a soil separate, or component, consists of mineral soil particles that are less than 0.002 millimeter in diameter. In this table, the estimated clay content of each major soil layer is given as a percentage, by weight, of the soil material that is less than 2 millimeters in diameters.

The amount and kind of clay greatly affect the fertility and physical condition of the soil. They determine the ability of the soil to adsorb cations and retain moisture. They influence shrink-swell potential, permeability, plasticity, ease of soil dispersion, and other soil properties. The amount and kind of clay in a soil also affect tillage and earth-moving operations.

Moist bulk density is the weight of soil (oven-dry) per unit volume. Volume is measured when the soil is at field moisture capacity, that is, the moisture content at 1/3-bar moisture tension. Weight is determined after drying the soil at 105°C. In this table, the estimated moist bulk density of each major soil horizon is expressed in grams per cubic centimeter of soil material that is less than 2 millimeters in diameter. Bulk density data are used to compute shrink-swell potential, available water capacity, total pore space, and other soil properties. The moist bulk density of a soil indicates the pore space available for water and roots. A bulk density of more than 1.6 can restrict water storage and root penetration. Moist bulk density is influenced by texture, kind of clay, content of organic matter, and soil structure.

Permeability refers to the ability of a soil to transmit water or air. The estimates indicate the rate of downward movement of water when the soil is saturated. They are

based on soil characteristics observed in the field, particularly structure, porosity, and texture. Permeability is considered in the design of soil drainage systems and septic tank absorption fields.

Available water capacity refers to the quantity of water that the soil is capable of storing for use by plants. The capacity for water storage is given in inches of water per inch of soil for each major soil layer. The capacity varies, depending on soil properties that affect the retention of water and the depth of the root zone. The most important properties are the content of organic matter, soil texture, bulk density, and soil structure. Available water capacity is an important factor in the choice of plants or crops to be grown and in the design and management of irrigation systems. Available water capacity is not an estimate of the quantity of water actually available to plants at any given time.

Soil reaction is a measure of acidity or alkalinity and is expressed as a range in pH values. The range in pH of each major horizon is based on a variety of field tests. For many soils, values have been verified by laboratory analyses. Soil reaction is important in selecting crops and other plants, evaluating soil amendments for fertility and stabilization, and determining the risk of corrosion.

Shrink-swell potential is the potential for volume change in a soil with a loss or gain in moisture. Volume change occurs mainly because of the interaction of clay minerals with water and varies with the amount and type of clay minerals in the soil. The size of the load on the soil and the magnitude of the change in soil moisture content influence the amount of swelling of soils in place. Laboratory measurements of swelling of undisturbed clods were made for many soils. For others, swelling was estimated on the basis of the kind and amount of clay minerals in the soil and on measurements of similar soils.

If the shrink-swell potential is rated moderate to very high, shrinking and swelling can cause damage to buildings, roads, and other structures. Special design is often needed. Shrink-swell potential classes are based on the change in length of an unconfined clod as moisture content is increased from air-dry to field capacity. The classes are *low*, a change of less than 3 percent; *moderate*, 3 to 6 percent; and *high*, more than 6 percent. *Very high*, more than 9 percent, is sometimes used.

Erosion factor K indicates the susceptibility of a soil to sheet and rill erosion. Factor K is one of six factors used in the Universal Soil Loss Equation (USLE) to predict the average rate of soil loss by sheet and rill erosion in tons per acre per year. The estimates are based primarily on percentage of silt, very fine sand, sand, and organic matter (as much as 4 percent) and on soil structure and permeability. The estimates are modified by the presence of rock fragments. Values of K range from 0.02 to 0.69. The higher the value, the more susceptible the soil is to sheet and rill erosion.

Erosion factor T is an estimate of the maximum average rate of soil erosion by wind or water that can occur without affecting crop productivity over a sustained period. The rate is in tons per acre per year.

Wind erodibility groups are made up of soils that have similar properties affecting their resistance to wind erosion in cultivated areas. The groups indicate the susceptibility of soil to wind erosion. Soils are grouped according to the amount of stable aggregates more than 0.84 millimeter in size. Soils containing rock fragments can occur in any group. The groups are as follows:

1. *1 to 9 percent dry soil aggregates.* These soils are very highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
2. *10 to 24 percent dry soil aggregates.* These soils are highly erodible. Crops can be grown if intensive measures to control wind erosion are used.
3. *25 to 39 percent dry soil aggregates.* These soils are erodible. Crops can be grown if intensive measures to control wind erosion are used.
4. *25 to 39 percent dry soil aggregates with > 35 percent clay or > 5 percent calcium carbonate.* These soils are moderately erodible. Crops can be grown if measures to control wind erosion are used.
5. *40 to 44 percent dry soil aggregates.* These soils are slightly erodible. Crops can be grown if measures to control wind erosion are used.

6. *45 to 49 percent dry soil aggregates.* These soils are very slightly erodible. Crops can easily be grown.

7. *50 percent or more dry soil aggregates.* These soils are very slightly erodible. Crops can easily be grown.

8. *Stony, gravelly, or wet soils and other soils not subject to wind erosion.*

Organic matter is the plant and animal residue in the soil at various stages of decomposition. In [Table 10](#), the estimated content of organic matter is expressed as a percentage, by weight, of the soil material that is less than 2 millimeters in diameter.

Water Features

[Table 11](#) gives estimates of important water features used in land use planning that involves engineering considerations.

Hydrologic soil groups are groups of soils that, when saturated, have the same runoff potential under similar storm and ground cover conditions. The soil properties that affect runoff potential are those that influence the minimum rate of infiltration in a bare soil after prolonged wetting and when the soil is not frozen. These properties include depth to a seasonal high water table, intake rate, permeability after prolonged wetting, and depth to a very slowly permeable layer. The influences of ground cover and slope are treated independently and are not taken into account in hydrologic soil groups.

In the definitions of the hydrologic soil groups, the infiltration rate is the rate at which water enters the soil at the surface and is controlled by surface conditions. The transmission rate is the rate at which water moves through the soil and is controlled by properties of the soil layers.

The four hydrologic soil groups are:

Group A. Soils having a high infiltration rate (low runoff potential) when thoroughly wet. These consist chiefly of very deep, well drained to excessively drained sands or gravelly sands. These soils have a high rate of water transmission.

Group B. Soils having a moderate infiltration rate when thoroughly wet. These consist chiefly of moderately deep or deep, moderately well or well drained soils that have a moderately fine to moderately coarse texture. These soils have a moderate rate of water transmission.

Group C. Soils having a slow infiltration rate when thoroughly wet. These consist chiefly of soils having a layer that impedes the downward movement of water, or soils that have a moderately fine or fine texture. These soils have a slow rate of water transmission.

Group D. Soils having a very slow infiltration rate (high runoff potential) when thoroughly wet. These consist chiefly of soils that have a permanent high water table and soils that are shallow over nearly impervious material. These soils have a very slow rate of water transmission.

Flooding, the temporary covering of the soil surface by flowing water, is caused by overflow from streams or runoff from adjacent slopes. Shallow water standing or flowing for short periods after rainfall or snowmelt is not considered flooding. Standing water in marshes and swamps or in closed depressions is considered to be ponding.

The table gives the frequency and duration of flooding and the time of year when flooding is most likely to occur.

Frequency, duration, and probable dates of occurrence are estimated. Frequency is expressed as none, rare, occasional, and frequent. *None* means that flooding is not probable; *rare* that it is unlikely but possible under unusual weather conditions (the chance of flooding is nearly 0 to 5 percent in any year); *occasional* that it occurs, on the average, once or less in 2 years (the chance of flooding is 5 to 50 percent in any year); and *frequent*

that it occurs, on the average, more than once in 2 years (the chance of flooding is 50 percent in any year). *Common* is used when the occasional and frequent classes are grouped for certain purposes.

Duration is expressed as *very brief* (less than 2 days), *brief* (2 to 7 days), *long* (7 to 30 days), and *very long* (more than 30 days). Probable dates are expressed in months. About two-thirds to three-fourths of all flooding occurs during the stated period.

The information on flooding is based on evidence in the soil profile, namely thin strata of gravel, sand, silt, or clay deposited by floodwater; irregular decrease in organic matter content with increasing depth; and little or no horizon development.

Also considered are local information about the extent and level of flooding and the relation of each soil on the landscape to historic floods. Information on the extent of flooding based on soil data is less specific than that provided by detailed engineering surveys that delineate flood-prone areas at specific flood frequency levels.

High water table (seasonal) is the highest level of a saturated zone in the soil in most years. The estimates are based mainly on observations of the water table at selected sites and on the evidence of a saturated zone, namely grayish colors or mottles (redoximorphic features) in the soil. The table indicates the depth to the seasonal high water table; the kind of water table—perched or apparent; and the months of the year that the water table commonly is high. A water table that is seasonally high for less than one month is not indicated in the table.

An *apparent* water table is a thick zone of free water in the soil. It is indicated by the level at which water stands in an uncased borehole after adequate time is allowed for adjustment in the surrounding soil.

A *perched* water table is water standing above an unsaturated zone. The water table is determined to be perched if the water level in a borehole is observed to fall when the borehole is extended, or it may be determined by general knowledge of the area. Water is generally perched by bedrock, permafrost, or seasonal frost.

Two numbers in the column showing depth to the water table indicate the normal range in depth to a saturated zone. Depth is given to the nearest half foot. The first numeral in the range indicates the highest water level. A plus sign preceding the range in depth indicates that the water table is above the surface of the soil. "More than 6.0" indicates that the water table is below a depth of 6 feet or that it is within a depth of 6 feet for less than a month.

Hydric Soils

The three essential characteristics of wetlands are hydrophytic vegetation, hydric soils, and hydrology (*Cowardin et al. 1979; Environmental Laboratory 1987; National Research Council 1995; Tiner 1985*). Criteria for each of these characteristics must be met for areas to be identified as wetlands. Undrained hydric soils that have natural vegetation should support a dominant population of ecological wetland plant species. Hydric soils that have been converted to other uses should be capable of being restored to wetlands.

Hydric soils are defined by the National Technical Committee for Hydric Soils (NTCHS) as soils that formed under conditions of saturation, flooding, or ponding long enough during the growing season to develop anaerobic conditions in the upper part (*Federal Register 1994*). These soils are either saturated or inundated long enough during the growing season to support the growth and reproduction of hydrophytic vegetation.

The NTCHS definition identifies general soil properties that are associated with wetness. However, in order to determine whether a specific soil is hydric or nonhydric, more specific information, such as information about the depth and duration of the water table, is needed. Accordingly, criteria that identify the estimated soil properties unique to hydric soils have been established (*Federal Register 1995*) and should be used to identify a phase of a soil series that normally is associated with wetlands. These criteria are

selected estimated soil properties described in "Soil Taxonomy" (*Soil Survey Staff 1975*), "Keys to Soil Taxonomy" (*Soil Survey Staff 1994*), and in the "Soil Survey Manual" (*Soil Survey Division Staff 1993*).

If soils are wet for a long enough period to be considered hydric, they should exhibit certain visible properties that can be easily observed in the field. The indicators that can be used to make on-site determinations of hydric soils in the Upper Tanana Soil Survey Area are specified in "Field Indicators of Hydric Soils in the United States" (*United States Department of Agriculture 1996*).

Hydric soils are identified by examining and describing the soil to a depth of about 20 inches (or greater if required for determination of an appropriate indicator). Soils should always be excavated and described as deep as necessary to understand the redoximorphic processes. Then, using the completed soil description, soil scientists can compare the soil features required by each indicator and specify which indicators have been matched with the conditions observed in the soil. The soil can be identified as hydric if one or more of the approved indicators is present.

This survey can be used to locate probable areas of hydric soils. [Table 12](#) indicates the hydric soil status for each map unit. The criteria used to rate each soil component and inclusion is also given. This information can help in planning land uses; however, on-site investigation is recommended to determine the hydric soils on a specific site.

Soil Features

[Table 13](#) gives estimates of important soil features used in land use planning that involves engineering considerations. *Depth to bedrock* is given if bedrock is within a depth of 60 inches (152 cm). The depth is based on many soil borings and observations during soil mapping. The rock is either soft or hard. If the rock is soft or fractured, excavations can be made with trenching machines, backhoes, or small rippers. If the rock is hard or massive, blasting or special equipment generally is needed for excavation.

Subsidence is the settling of organic soils or saturated mineral soils of very low density. Subsidence generally results from either desiccation and shrinkage or oxidation of organic material, or both, following drainage. Subsidence takes place gradually, usually over a period of several years. The table shows the expected initial subsidence that usually is a result of drainage, and annual subsidence that usually is a result of oxidation. Subsidence caused by an imposed surface load or by the withdrawal of ground water throughout an extensive area as a result of lowering the water table is not shown in the table.

Potential frost action is the likelihood of upward or lateral expansion of the soil caused by the formation of segregated ice lenses (frost heave) and the subsequent collapse of the soil and loss of strength on thawing. Frost action occurs when moisture moves into the freezing zone of the soil. Temperature, texture, density, permeability, content of organic matter, and depth to the water table are the most important factors considered in evaluating the potential for frost action. It is assumed that the soil is not insulated by vegetation or snow and is not artificially drained. Silty soils that have a high water table in winter are the most susceptible to frost action. Well drained, very gravelly or very sandy soils are the least susceptible. Frost heave and low soil strength during thawing cause damage to pavements and other rigid structures.

A *low* potential for frost action indicates that the soil is rarely susceptible to the formation of ice lenses; a *moderate* potential indicates that the soil is susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength; and a *high* potential indicates that the soil is highly susceptible to formation of ice lenses, resulting in frost heave and the subsequent loss of soil strength.

Risk of corrosion pertains to potential soil-induced electrochemical or chemical action that dissolves or weakens uncoated steel or concrete. The rate of corrosion of uncoated steel is related to such factors as soil moisture, particle-size distribution, acidity, and

electrical conductivity of the soil. The rate of corrosion of concrete is based mainly on the sulfate and sodium content, texture, moisture content, and acidity of the soil. Special site examination and design may be needed if the combination of factors results in a severe hazard of corrosion. The steel in installations that intersect soil boundaries or soil layers is more susceptible to corrosion than steel in installations that are entirely within one kind of soil or within one soil layer.

For uncoated steel, the risk of corrosion, expressed as *low*, *moderate*, or *high*, is based on soil drainage class, total acidity, electrical resistivity near field capacity, and electrical conductivity of the saturation extract.

For concrete, the risk of corrosion is also expressed as *low*, *moderate*, or *high*. It is based on soil texture, acidity, and amount of sulfates in the saturation extract.

Classification of the Soils

The system of soil classification used by the National Cooperative Soil Survey has six categories (*Soil Survey Staff 1975*). Beginning with the broadest, these categories are the order, suborder, great group, subgroup, family, and series. Classification is based on soil properties observed in the field, or inferred from those observations, or from laboratory measurements. [Table 14](#) shows the classification of the soils in the Survey Area.

ORDER. Ten soil orders are recognized. The differences among orders reflect the dominant soil-forming processes and the degree of soil formation. Each order is identified by a word ending in *sol*. An example is Entisol.

SUBORDER. Each order is divided into suborders primarily on the basis of properties that influence soil genesis and are important to plant growth, or properties that reflect the most important variables within the orders. The last syllable in the name of a suborder indicates the order. An example is Fluvent (*Fluv*, meaning river, plus *ent*, from Entisol).

GREAT GROUP. Each suborder is divided into great groups on the basis of close similarities in kind, arrangement, and degree of development of pedogenic horizons; soil moisture and temperature regimes; and base status. Each great group is identified by the name of a suborder and by a prefix that indicates a property of the soil. An example is Cryofluvents (*Cryo*, meaning cold, plus *fluvent*, the suborder of the Inceptisols that flood).

SUBGROUP. Each great group has a typic subgroup. Other subgroups are intergrades or extragrades. The typic is the central concept of the great group; it is not necessarily the most extensive. Intergrades are transitions to other orders, suborders, or great groups. Extragrades have some properties that are not representative of the great group but do not indicate transitions to any other known kind of soil. Each subgroup is identified by one or more adjectives preceding the name of the great group. The adjective *Typic* identifies the subgroup that typifies the great group. An example is Typic Cryofluvents.

FAMILY. Families are established within a subgroup on the basis of physical and chemical properties and other characteristics that affect management. Generally, the properties are those of horizons below plow depth where there is much biological activity. Among the properties and characteristics considered are particle-size class, mineral content, temperature regime, thickness of the root zone, consistence, moisture equivalent, slope, and permanent cracks. A family name consists of the name of a subgroup preceded by terms that indicate soil properties. An example is coarse-loamy, mixed, nonacid, Typic Cryofluvents.

SERIES. The series consists of soils that have similar horizons in their profile. The horizons are similar in color, texture, structure, reaction, consistence, mineral and chemical composition, and arrangement in the profile. The texture of the surface layer or of the substratum can vary within a series.

Soil Series, Higher Taxa, and Their Morphology

In this section, characteristics of the soil and the material in which it formed are

identified for each soil series or taxon recognized in the Survey Area. A pedon, a small three-dimensional area of soil that is typical of the series in the Area, is described. The detailed description of each soil horizon follows standards in the "Soil Survey Manual" (*Soil Survey Division Staff 1993*). Many of the technical terms used in the descriptions are defined in "Soil Taxonomy" (*Soil Survey Staff 1975*). Unless otherwise stated, colors in the descriptions are for moist soil. Following the pedon description is the range of important characteristics of the soils in the series.

The map units of each soil series are described in the section "[Detailed Soil Map Units](#)."

Cryorthents

Taxonomic class: Cryorthents

Depth class: very shallow and shallow (2 to 18 inches or 5 to 46 cm) to gravelly sand

Drainage class: moderately well drained and well drained

Permeability: above the sand—moderate; below this—rapid

Position on landscape: lake borders

Parent material: loamy sediment over glacial till

Slope range: 0 to 3 percent

Elevation: 1,100 to 1,400 feet (335 to 427 m)

Sample Pedon

A—0 to 6 inches (0 to 15 cm); very dark grayish brown (2.5Y 3/2) very fine sandy loam; weak thin platy structure; very friable, nonsticky and nonplastic; slightly acid (pH 6.2); clear irregular boundary

2C1—6 to 18 inches (15 to 46 cm); grayish brown (2.5Y 5/2) very gravelly loamy sand; single grain; slightly acid (pH 6.3); gradual wavy boundary

2C2—18 to 60 inches (46 to 152 cm); mixed colors; very gravelly coarse sand; single grain; slightly acid (pH 6.5)

Sample Pedon Location

Map unit in which located: 301—Cryorthents, flooded ([Figure 4](#))

Location in survey area: on a nearly level slope, bordering a lake with a fluctuating water level on a rolling glacial moraine; in the SW 1/4 of Section 10, T.10S, R.9E, Fairbanks Meridian

Range in Characteristics

Profile: depth to underlying coarse material—2 to 18 inches (5 to 46 cm); gravel content—20 to 80 percent

Organic layer: 0 to 1 inch (0 to 3 cm) thick

Ester Series

Taxonomic class: loamy, mixed, acid, Histic Pergelic Cryaquepts

Depth class: very shallow and shallow (8 to 14 inches or 20 to 36 cm) to permafrost

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Position on landscape: hillsides

Parent material: loess over bedrock

Slope range: 7 to 45 percent
Elevation: 1,000 to 1,750 feet (305 to 533 m)

Typical Pedon

O_i—10 to 8 inches (25 to 20 cm); peat consisting of slightly decomposed organic matter
O_e—8 inches to 0 (20 cm to 0); peat consisting of partially decomposed organic matter
A—0 to 2 inches (0 to 5 cm); very dark gray (10YR 3/1) silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; many very fine and fine roots; strongly acid (pH 5.3); abrupt irregular boundary
B_g—2 to 8 inches (5 to 20 cm); olive gray (5Y 4/2) silt loam; weak fine subangular blocky structure; very friable, nonsticky and nonplastic; common fine roots decreasing to few fine roots with depth; strongly acid (pH 5.3); clear wavy boundary
2C_f—8 to 16 inches (20 to 41 cm); frozen very dark grayish brown (2.5Y 3/2) extremely gravelly silt loam; strongly acid (pH 5.3); gradual wavy boundary
2C_{rf}—16 inches (41 cm); weathered schist over consolidated bedrock

Typical Pedon Location

Map unit in which located: 324—Steese-Ester association, 12 to 45 percent slopes ([Figure 5](#))

Location in survey area: on a 12 percent slope under forest vegetation; in the SE 1/4 of Section 26, T.8S, R.6E, Fairbanks Meridian

Range in Characteristics

Profile: depth to weathered bedrock—12 to 20 inches (30 to 51 cm); depth to permafrost—7 to 14 inches (18 to 36 cm); reaction—extremely acid to strongly acid
Histic epipedon: thickness—8 to 16 inches (20 to 41 cm)

A horizon:
Color: hue—7.5YR, 10YR; value—2, 3; chroma—1, 2

B_g horizon:
Color: hue—2.5Y, 5Y; value—3, 4; chroma—1, 2

2C_f horizon:
Coarse fragments: 35 to 70 percent

Fubar Series

Taxonomic class: sandy-skeletal, mixed, Typic Cryofluvents
Depth class: very shallow (1 to 8 inches or 3 to 20 cm) to sand and gravel
Drainage class: moderately well drained
Permeability: in the upper part—moderate; in the lower part—rapid
Position on landscape: alluvial plains and terraces
Parent material: stratified silt, sand, and gravel alluvium
Slope range: 0 to 7 percent
Elevation: 850 to 1,200 feet (259 to 366 m)

Typical Pedon

O_i—3 inches to 0 (8 cm to 0); partially decomposed organic matter
A—0 to 2 inches (0 to 5 cm); dark grayish brown (10YR 4/2) fine sandy loam; weak fine subangular blocky structure; very friable, nonsticky and nonplastic; common very fine

and fine roots; slightly acid (pH 6.2); abrupt wavy boundary
2C—2 to 60 inches (5 to 152 cm); brown (10YR 5/3) very gravelly sand stratified with thin lenses of silt loam; single grain; loose, nonsticky and nonplastic; common fine roots decreasing to none with depth; 40 percent gravel and 10 percent cobbles; slightly effervescent; neutral (pH 7.2)

Typical Pedon Location

Map unit in which located: 303—Fubar soils and Riverwash, 0 to 3 percent slopes
Location in survey area: on a one percent slope under forest vegetation; in the SW 1/4 of Section 15, T.10S, R.10E, Fairbanks Meridian

Range in Characteristics

Profile: depth to sand and gravel—1 to 8 inches (3 to 20 cm); reaction—moderately acid to neutral

Organic layer: thickness—1 to 6 inches (3 to 15 cm)

A horizon:

Color: hue—10YR, 2.5Y; value—3, 4, 5; chroma—2, 3, 4

Texture: fine sandy loam and very fine sandy loam

2C horizon:

Color: hue—10YR, 2.5Y, 5Y; value—3, 4, 5; chroma—2, 3, 4;

Texture: very gravelly sand, extremely gravelly sand, very cobbly sand, and extremely cobbly sand stratified with lenses of silt loam

Coarse fragments: 35 to 70 percent

Goldstream Series

Taxonomic class: loamy, mixed, acid, Histic Pergelic Cryaquepts

Depth class: shallow (10 to 20 inches or 25 to 51 cm) over permafrost

Drainage class: very poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Position on landscape: alluvial plains and moraines

Parent material: silty alluvium

Slope range: 0 to 12 percent

Elevation: 850 to 1,250 feet (259 to 381 m)

Typical Pedon

O_i—12 to 4 inches (30 to 10 cm); peat consisting of slightly decomposed organic matter

O_e—4 inches to 0 (10 cm to 0); peat consisting of partially decomposed roots and moss

A—0 to 6 inches (0 to 15 cm); black (10YR 2/1) silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; many fine roots; very strongly acid (pH 4.8); clear smooth boundary

C_g—6 to 12 inches (15 to 30 cm); dark gray (10YR 4/1) silt loam; massive; friable, nonsticky and nonplastic; common fine roots; very strongly acid (pH 4.8); clear smooth boundary

C_{gf}—12 to 22 inches (30 to 56 cm); frozen dark gray (10YR 4/1) silt loam

Typical Pedon Location

Map unit in which located: 308—Goldstream and Histosols, 0 to 3 percent slopes ([Figures 2 and 3](#))

Location in survey area: on a nearly level slope under shrub vegetation; in the SW 1/4 of Section 26, T.10S, R.9E, Fairbanks Meridian

Range in Characteristics

Profile: depth to permafrost—10 to 20 inches (25 to 51 cm); reaction—extremely to strongly acid

Histic epipedon: thickness—8 to 16 inches (20 to 41 cm)

A horizon:

Color: hue—10YR, 2.5Y; value—2, 3; chroma—1, 2

Texture: silt loam and mucky silt loam

Cg horizon:

Color: hue—10YR, 2.5Y, 5Y; value—3, 4, 5; chroma—1, 2

Texture: silt loam and silt

Goodpaster Variant

Taxonomic class: coarse-silty over sandy or sandy-skeletal, mixed, nonacid, Pergelic Cryaquepts

Depth class: moderately deep (20 to 30 inches or 51 to 76 cm) to permafrost

Drainage class: poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Position on landscape: alluvial plains and terraces

Parent material: loess over alluvial sediment

Slope range: 0 to 3 percent

Elevation: 1,000 to 1,075 feet (305 to 328 m)

Typical Pedon

Oi—2 inches to 0 (5 cm to 0); slightly decomposed leaves and moss; abrupt smooth boundary

A—0 to 2 inches (0 to 5 cm); very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; many roots; strongly acid (pH 5.2); abrupt smooth boundary

Bw—2 to 7 inches (5 to 18 cm); dark brown (10YR 4/3) silt loam; weak fine subangular blocky structure; friable, nonsticky and nonplastic; many roots; moderately acid (pH 5.6); clear wavy boundary

Bg—7 to 15 inches (18 to 38 cm); dark grayish brown (2.5Y 4.2) silt loam; common medium prominent brown (7.5R 4/4) mottles; weak thin platy structure; friable, nonsticky and nonplastic; common roots; moderately acid (pH 5.8); clear wavy boundary

Cg—15 to 21 inches (38 to 53 cm); dark grayish brown (2.5Y 4/2) gravelly silt loam; common medium prominent dark yellowish brown (10YR 4/4) mottles; massive; friable, nonsticky and nonplastic; few roots; moderately acid (pH 5.8); abrupt wavy boundary

2Cf—21 to 31 inches (53 to 79 cm); frozen light olive brown (2.5Y 5/6) extremely gravelly coarse sand

Typical Pedon Location

Map unit in which located: 309—Goodpaster Variant-Goldstream complex, 0 to 3 percent slopes

Location in survey area: on a one percent slope under forest vegetation; in the NE 1/4 of Section 30, T.9S, R.8E, Fairbanks Meridian

Range in Characteristics

Profile: depth to permafrost—20 to 30 inches (51 to 76 cm); reaction—strongly acid to slightly acid

Organic layer: thickness—1 to 6 inches (3 to 15 cm)

A horizon:

Color: hue—10YR, 2.5Y; value—3, 4, 5; chroma—1, 2, 3

Bw horizon:

Color: hue—7.5YR, 10YR, 2.5Y; value—3, 4, 5; chroma—3, 4

Bg and Cg horizons:

Color: hue—7.5Y, 10YR, 2.5Y; value—3, 4, 5; chroma—1, 2, 3, 4

Texture: silt loam and gravelly silt loam

2Cf horizon:

Color: hue—10YR, 2.5Y, 5Y; value—3, 4, 5; chroma—3, 4, 5, 6

Texture: very gravelly sand, extremely gravelly sand, and extremely gravelly coarse sand

Coarse fragments: 35 to 65 percent

Histosols

Taxonomic class: Histosols

Depth class: shallow (10 to 20 inches or 25 to 51 cm) to permafrost

Drainage class: very poorly drained

Permeability: above the permafrost—assumed to be rapid; below this—impermeable

Position on landscape: alluvial plains

Parent material: thick organic deposits

Slope range: 0 to 3 percent

Elevation: 850 to 1,275 feet (259 to 389 m)

Sample Pedon

O_i—0 to 6 inches (0 to 15 cm); mat of undecomposed moss; clear smooth boundary

O_e—6 to 18 inches (15 to 46 cm); partially decomposed moss; clear smooth boundary

O_{ef}—18 to 28 inches (46 to 71 cm); frozen partially decomposed moss

Reference Pedon Location

Map unit in which located: 308—Goldstream and Histosols, 0 to 3 percent slopes ([Figures 2 and 3](#))

Location in survey area: on a nearly level slope, in a depressional area on a broad alluvial plain; in the NW 1/4 of Section 27, T.10S, R.9E, Fairbanks Meridian

Range in Characteristics

Profile: depth to permafrost—10 to 20 inches (25 to 51 cm); reaction—very strongly acid to strongly acid; fiber content—fibric to sapric

Jarvis Series

Taxonomic class: coarse-loamy over sandy or sandy-skeletal, mixed, nonacid, Typic Cryofluvents

Depth class: shallow and moderately deep (11 to 39 inches or 28 to 99 cm) to sand and gravel

Drainage class: well drained

Permeability: in the upper part—moderate; in the coarse underlying material—rapid

Position on landscape: floodplains

Parent material: stratified loamy and sandy alluvium over sand and gravel

Slope range: 0 to 7 percent

Elevation: 900 to 1,200 feet (274 to 366 m)

Typical Pedon

O_e—4 inches to 0 (10 cm to 0); mat of partially decomposed organic matter

A—0 to 6 inches (0 to 15 cm); dark brown (10YR 4/3) very fine sandy loam; weak fine granular structure; very friable, nonsticky and nonplastic; many very fine and fine roots; slightly acid (pH 6.2); clear smooth boundary

AC—6 to 10 inches (15 to 25 cm); dark brown (10YR 4/3) very fine sandy loam; weak medium subangular blocky structure; very friable, nonsticky and nonplastic; common very fine and fine roots; slightly acid (pH 6.2); abrupt smooth boundary

C—10 to 18 inches (25 to 46 cm); grayish brown (10YR 5/2) fine sandy loam stratified with thin lenses of silt loam; single grain; loose, nonsticky and nonplastic; few fine roots; slightly effervescent; neutral (pH 7.2); abrupt smooth boundary

2C—18 to 60 inches (46 to 152 cm); grayish brown (10YR 5/2) extremely cobbly sand stratified with thin lenses of silt loam; single grain; loose, nonsticky and nonplastic; slightly effervescent; neutral (pH 7.2)

Typical Pedon Location

Map unit in which located: 311—Jarvis-Fubar complex, 0 to 7 percent slopes (see Cover)

Location in survey area: on a three percent slope under forest vegetation; in the SE 1/4 of Section 16, T.10S, R.10E, Fairbanks Meridian

Range in Characteristics

Profile: depth to sand and gravel—11 to 39 inches (28 to 99 cm); reaction—strongly acid to neutral

Organic layer: thickness—1 to 5 inches (3 to 13 cm)

A horizon:

Color: hue—7.5YR, 10YR; value—3, 4, 5; chroma—2, 3

AC horizon:

Color: hue—10YR, 2.5Y, 7.5YR; value—3, 4, 5; chroma—2, 3

Texture: very fine sandy loam and silt loam

C horizon:

Color: hue—10YR, 2.5Y, 5Y; value—4, 5; chroma—2, 3, 4

Texture: stratified very fine sandy loam, fine sandy loam, sandy loam, very fine sand, and silt

2C horizon:

Color: hue—10YR, 2.5Y, 5Y; value—4, 5; chroma—2, 3, 4

Texture: very gravelly sand and extremely cobbly sand
Coarse fragments: 35 to 70 percent

Koyukuk Series

Taxonomic class: coarse-silty, mixed, Typic Cryochrepts

Depth class: deep (40 to 60 inches or 102 to 152 cm) to sand and gravel

Drainage class: well drained

Permeability: in the upper part—moderate; in the coarse underlying material—rapid

Position on landscape: moraines and terraces

Parent material: loess over glacial outwash or alluvium

Slope range: 0 to 45 percent

Elevation: 1,050 to 1,425 feet (320 to 434 m)

Typical Pedon

O_i—1 inch to 0 (3 cm to 0); partially decomposed organic matter

A—0 to 4 inches (0 to 10 cm); dark brown (10YR 3/3) silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; many very fine and fine roots; strongly acid (pH 5.2); abrupt smooth boundary

B_w—4 to 24 inches (10 to 61 cm); yellowish brown (10YR 5/4, 10YR 5/6) silt; weak medium platy structure; very friable, nonsticky and nonplastic; common very fine and fine roots decreasing to none with depth; moderately acid (pH 5.6); gradual wavy boundary

C₁—24 to 43 inches (61 to 109 cm); light yellowish brown (2.5Y 6/4) silt; weak medium platy structure; very friable, nonsticky and nonplastic; moderately acid (pH 5.8); abrupt smooth boundary

2C₂—43 to 60 inches (109 to 152 cm); light olive brown (2.5Y 5/4) very gravelly sand; single grain; loose, nonsticky and nonplastic; 30 percent gravel and 10 percent cobbles; slightly acid (pH 6.4)

Typical Pedon Location

Map unit in which located: 313—Koyukuk silt loam, 3 to 7 percent slopes

Location in survey area: on a four percent slope under forest vegetation; in the SW 1/4 of Section 3, T.9S, R.9E, Fairbanks Meridian

Range in Characteristics

Profile: depth to sand and gravel—40 to 60 inches (102 to 152 cm); reaction—strongly acid to neutral

Organic layer: thickness—1 to 5 inches (3 to 13 cm)

A horizon:

Color: hue—7.5YR, 10YR; value—3, 4; chroma—2, 3, 4

B_w horizon:

Color: hue—7.5YR, 10YR, 2.5Y; value—4, 5, 6; chroma—3, 4, 5, 6

Texture: silt loam and silt

C₁ horizon:

Color: hue—10YR, 2.5Y; value—4, 5, 6; chroma—3, 4, 5

Texture: silt loam and silt

2C2 horizon:

Color: hue—2.5Y, 5Y; value—4, 5; chroma—3, 4, 5
Texture: very gravelly sand, gravelly sand, and sand
Coarse fragments: 0 to 50 percent

Minchumina Series

Taxonomic class: loamy, mixed, nonacid, Pergelic Cryorthents
Depth class: very shallow and shallow (2 to 20 inches or 5 to 51 cm) to permafrost
Drainage class: well drained
Permeability: above the permafrost—moderate; below this—impermeable
Position on landscape: moraines
Parent material: silty loess
Slope range: 0 to 7 percent
Elevation: 1,200 to 1,425 feet (366 to 434 m)

Typical Pedon

O_i—10 to 6 inches (25 to 15 cm); peat consisting of slightly decomposed moss and roots;
clear smooth boundary
O_e—6 inches to 0 (15 cm to 0); partially decomposed moss and roots; clear smooth
boundary
A—0 to 6 inches (0 to 15 cm); black (2.5Y 2/0) silt loam; weak fine subangular blocky
structure; very friable, nonsticky and nonplastic; few fine roots; strongly acid (pH 5.2);
clear smooth boundary
C_f—6 to 16 inches (15 to 41 cm); frozen very dark grayish brown (10YR 3/2) silt loam

Typical Pedon Location

Map unit in which located: 317—Minchumina peat—3 to 7 percent slopes
Location in survey area: on a six percent slope under forest vegetation; in the SW 1/4 of
Section 19, T.10S, R.10E, Fairbanks Meridian

Range in Characteristics

Profile: depth to permafrost—2 to 20 inches (5 to 51 cm); reaction—very strongly acid to
moderately acid
Organic layer: thickness—8 to 16 inches (20 to 41 cm)

A horizon:

Color: hue—10YR, 2.5Y; value—2, 3; chroma—0, 1, 2, 3

C_f horizon:

Color: hue—10YR, 2.5Y; value—3, 4; chroma—2, 3, 4
Texture: silt loam and silt

Nenana Series

Taxonomic class: coarse-silty over sandy or sandy-skeletal, mixed, Typic Cryochrepts
Depth class: shallow and moderately deep (11 to 39 inches or 28 to 99 cm) to sand
Drainage class: well drained
Permeability: in the upper part—moderate; below this—rapid
Position on landscape: outwash plains and moraines

Parent material: loess over fluvial sediment
Slope range: 0 to 45 percent
Elevation: 1,000 to 1,200 feet (305 to 366 m)

Typical Pedon

Oi—4 inches to 0 (10 cm to 0); slightly decomposed leaves and moss; many roots; abrupt boundary
A—0 to 2 inches (0 to 5 cm); dark brown (10YR 3/3) silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; many roots; moderately acid (pH 6.0); clear smooth boundary
Bw—2 to 12 inches (5 to 30 cm); brown (10YR 4/3) silt loam; moderate medium platy structure; very friable, nonsticky and nonplastic; common roots; moderately acid (pH 6.0); clear smooth boundary
C—12 to 27 inches (30 to 69 cm); grayish brown (10YR 5/2) silt loam; weak thin platy structure; very friable, nonsticky and nonplastic; few roots; moderately acid (pH 6.0); abrupt smooth boundary
2C—27 to 60 inches (69 to 152 cm); yellowish brown (10YR 5/4) fine sand; single grain; loose, nonsticky and nonplastic; few roots to a depth of 33 inches (84 cm); slightly acid (pH 6.5)

Typical Pedon Location

Map unit in which located: 320—Nenana silt loam, 7 to 12 percent slopes (Figure 3)
Location in survey area: on an eight percent slope under forest vegetation; in the NW 1/4 of Section 35, T.9S, R.8E, Fairbanks Meridian

Range in Characteristics

Profile: depth to sandy substratum—11 to 39 inches (28 to 99 cm); reaction—strongly acid to slightly acid
Organic layer: thickness—1 to 4 inches (3 to 10 cm)

A horizon:

Color: hue—10YR, 2.5Y; value—2, 3, 4; chroma—2, 3

Bw horizon:

Color: hue—7.5YR, 10YR, 2.5Y; value—3, 4; chroma—2, 3, 5
Texture: silt loam and silt

C horizon:

Color: hue—10YR, 2.5Y; value—3, 4, 5; chroma—2, 3, 4
Texture: silt loam and silt

2C horizon:

Color: hue—10YR, 2.5Y, 5Y; value—3, 4, 5; chroma—2, 3, 4
Texture: fine sand and sand

Salchaket Series

Taxonomic class: coarse-loamy, mixed, nonacid, Typic Cryofluvents
Depth class: deep (40 to 60 inches or 102 to 152 cm) to sand and gravel
Drainage class: well drained
Permeability: in the upper part—moderate; in the coarse underlying material—rapid
Position on landscape: floodplains

Parent material: stratified silty and sandy alluvium
Slope range: 0 to 3 percent
Elevation: 850 to 1,150 feet (259 to 351 m)

Typical Pedon

O_i—2 inches to 0 (5 cm to 0); partially decomposed organic matter
A—0 to 3 inches (0 to 8 cm); dark brown (10YR 3/3) very fine sandy loam; weak fine granular structure; very friable, nonsticky and nonplastic; many very fine and fine roots; strongly acid (pH 5.3); clear wavy boundary
C₁—3 to 13 inches (8 to 33 cm); dark grayish brown (10YR 4/2) very fine sandy loam; common thin streaks and pockets of very dark brown (10YR 2/2) silt loam; massive; friable, nonsticky and nonplastic; common very fine and fine roots; moderately acid (pH 5.8); clear wavy boundary
C₂—13 to 42 inches (33 to 107 cm); grayish brown (10YR 5/2) very fine sandy loam stratified with thin lenses of silt loam; massive; friable, nonsticky and nonplastic; few fine roots; slightly acid (pH 6.1); clear wavy boundary
2C—42 to 60 inches (107 to 152 cm); dark grayish brown (2.5Y 4/2) very gravelly sand; massive; loose, nonsticky and nonplastic; 30 percent gravel and 10 percent cobbles; many olive stains; slightly acid (pH 6.5)

Typical Pedon Location

Map unit in which located: 323—Salchaket-Riverwash association, 0 to 3 percent slopes
Location in survey area: on a nearly level slope under forest vegetation; in the NW 1/4 of Section 2, T.8S, R.7E, Fairbanks Meridian

Range in Characteristics

Profile: depth to sand or to sand and gravel—40 to 60 inches (102 to 152 cm); reaction—strongly acid to neutral

Organic layer: thickness—1 to 4 inches (3 to 10 cm)

A horizon:

Color: hue—7.5YR, 10YR; value—3, 4; chroma—2, 3

C horizon:

Color: hue—10YR, 2.5Y, 5Y; value—2, 3, 4, 5; chroma—2, 3

Texture: stratified very fine sandy loam, fine sandy loam, silt loam, and very fine sand

2C horizon:

Texture: very gravelly sand and very gravelly fine sand

Coarse fragments: 40 to 60 percent

Steese Series

Taxonomic class: coarse-loamy, mixed, Typic Cryochrepts

Depth class: moderately deep (20 to 40 inches or 51 to 102 cm) to bedrock

Drainage class: well drained

Permeability: in the loess mantle—moderate; below this—moderately rapid

Position on landscape: hillsides, and ridgetops

Parent material: loess over bedrock

Slope range: 7 to 45 percent slopes

Elevation: 1,200 to 1,700 feet (366 to 518 m)

Typical Pedon

- Oi—1 inch to 0 (3 cm to 0); slightly decomposed roots, leaves, and mosses; abrupt smooth boundary
- A—0 to 4 inches (0 to 10 cm); very dark grayish brown (10YR 3/2) silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; many roots; strongly acid (pH 5.2); abrupt smooth boundary
- Bw1—4 to 9 inches (10 to 23 cm); dark brown (7.5YR 3/4) silt loam; weak thin platy structure; friable, nonsticky and nonplastic; many roots; moderately acid (pH 5.6); clear smooth boundary
- Bw2—9 to 14 inches (23 to 36 cm); brown (7.5YR 4/4) silt loam; weak thin platy structure; friable, nonsticky and nonplastic; common roots; moderately acid (pH 5.6); clear wavy boundary
- 2C—14 to 30 inches (36 to 76 cm); dark yellowish brown (10YR 4/4) very channery sandy loam; massive; friable, nonsticky and nonplastic; few roots; moderately acid (pH 5.6); abrupt wavy boundary
- 2Cr—30 inches (76 cm); fractured schist over consolidated schist bedrock

Typical Pedon Location

Map unit in which located: 324—Steese-Ester association, 12 to 45 percent slopes ([Figure 5](#))

Location in survey area: on a 12 percent slope under forest vegetation; in the NW 1/4 of Section 29, T.8S, R.7E, Fairbanks Meridian

Range in Characteristics

Profile: depth to unconsolidated bedrock—20 to 40 inches (51 to 102 cm); reaction—strongly acid to slightly acid

Organic layer: thickness—1 to 5 inches (3 to 13 cm)

A horizon:

Color: hue—7.5YR, 10YR; value—3, 4; chroma—2, 3, 4

Bw horizon:

Color: hue—7.5YR, 10YR; value—3, 4, 5; chroma—3, 4

Texture: silt loam and silt

2C horizon:

Color: hue—10YR; value—4, 5; chroma—3, 4, 5, 6

Texture: very channery sandy loam and extremely channery sandy loam

Coarse fragments: 35 to 70 percent

Tanana Series

Taxonomic class: loamy, mixed, nonacid, Pergelic Cryaquepts

Depth class: moderately deep (21 to 40 inches or 53 to 102 cm) to permafrost

Depth to permafrost: temporarily below a depth of 40 inches (102 cm) if the organic mat is disturbed by wildfire or clearing

Drainage class: poorly drained

Permeability: above the permafrost—moderate; below this—impermeable

Position on landscape: alluvial plains and outwash plains

Parent material: silty micaceous loess and alluvium

Slope range: 0 to 7 percent

Elevation: 850 to 1,150 feet (259 to 351 m)

Typical Pedon

Oi—5 inches to 0 (13 cm to 0); slightly decomposed mosses and leaves; abrupt smooth boundary

A—0 to 7 inches (0 to 18 cm); very dark gray (10YR 3/1) silt loam; weak fine granular structure; very friable, nonsticky and nonplastic; many roots; moderately acid (pH 5.6); clear smooth boundary

Bg1—7 to 13 inches (18 to 33 cm); dark gray (5Y 4/1) silt loam; common fine prominent dark yellowish brown (10YR 3/4) mottles; weak medium granular structure; very friable, nonsticky and nonplastic; common roots; moderately acid (pH 5.8); clear smooth boundary

Bg2—13 to 23 inches (33 to 58 cm); dark gray (10YR 4/1) silt loam; common medium distinct yellowish brown (10YR 5/6) mottles; weak subangular blocky structure; very friable, nonsticky and nonplastic; few roots; moderately acid (pH 5.8); abrupt smooth boundary

Cgf—23 to 33 inches (58 to 84 cm); frozen dark gray (10YR 4/1) silt loam

Typical Pedon Location

Map unit in which located: 325—Tanana silt loam, 0 to 3 percent slopes

Location in survey area: on a two percent slope under forest vegetation; in the SW 1/4 of Section 11, T.9S, R.9E, Fairbanks Meridian

Range in Characteristics

Profile: depth to permafrost—21 to 40 inches (53 to 102 cm); reaction—strongly acid to neutral

Organic layer: thickness—2 to 7 inches (5 to 18 cm)

A horizon:

Color: hue—7.5YR, 10YR; value—2, 3; chroma—1, 2

Bg or Cg horizon:

Color: hue—10YR, 2.5Y, 5Y; value—3, 4, 5; chroma—1, 2, 3

Texture: silt loam and very fine sandy loam with occasional thin lenses of fine sand

Formation of the Soils

Soil is a natural, three-dimensional body on the earth's surface that supports plants. It forms through weathering and other processes that act on deposited or accumulated geologic material. The kind of soil that forms depends on the type of parent material; the climate under which soil material has existed since accumulation; the relief, or lay of the land; the plant and animal life in and on the soil; and the length of time that the forces of soil formation have acted on the soil material. The relative importance of each of these factors differs from place to place; in some areas, one factor is more important, and in other areas another may dominate. A modification or variation in any of the factors results in a different kind of soil. The activities of man have had little effect on the formation of the soils in the Upper Tanana Area.

Climate and living organisms are the active factors of soil formation. They act on parent material and change it to a natural body with definite characteristics. The effects of climate and living organisms are conditioned by relief, which influences surface drainage, the amount of water that percolates through the soil, the rate of erosion, and the kind of vegetation that grows on the soil. The nature of the parent material also affects the kind of soil profile that is formed. Time is needed for the parent material to change into a soil. The development of a distinct soil horizon normally requires a long period of time.

Parent Material

In the Upper Tanana Area, soils formed primarily in micaceous loess and alluvium; many of the rocks in the area of origin contained significant amounts of mica.

Koyukuk and Nenana soils formed on loess mantled moraines, outwash plains, and alluvial plains. Since these surfaces have been stable for sufficient time to allow climate, relief, and organisms to interact, both of these soils exhibit a cambic horizon.

Salchaket and Fubar soils formed on alluvial plains that are subject to periodic flooding. Surface soil layers exhibit alternating textures and colors characteristic of material deposited by water.

Histosols formed in organic materials in abandoned drainageways and depressions. They vary widely in the degree of decomposition and thickness of layers.

Climate

Long, cold winters and short, warm summers characterize the climate of the Upper Tanana Area. The climate varies significantly throughout the Area. Annual precipitation is less than 12 inches (less than 30 cm). Climatic data is discussed in greater detail in the section "[General Nature of the Survey Area.](#)"

The low rainfall and dense forests on well drained and moderately well drained soils result in dry soils and poor percolation through the soil profile. As a consequence, less weathering occurs and cambic horizons are weakly expressed. In permafrost soils, such

as the poorly drained Ester and Goldstream soils, water perches on the shallow permafrost table, resulting in little water movement through the soil and little or no horizon development.

Wind velocity and direction are changeable and result in variable amounts of loess deposition over wide areas. Koyukuk and Nenana are soils that have different depths of loess deposition.

Relief

Relief influences the formation of soil through its effect on drainage, runoff, and erosion. The degree and aspect of slope, shape of the surface, and permeability of the soil determine the internal drainage and moisture content of soils, the rate of runoff, and the presence or absence of permafrost. In the Upper Tanana Area, the topography varies little except for the hills in the western part. Large flat areas and depressions generally are poorly drained, and accumulated water, received mainly as runoff from adjacent areas, slows the formation of soils. As slope increases, the hazard of erosion increases and runoff increases; but less water soaks into the soil and leaching decreases. In places, erosion nearly keeps pace with soil formation; therefore, soils on steep slopes are generally thin and weakly developed.

The aspect of slope affects the microclimate. Soils that have slopes facing the south or southwest warm up somewhat earlier in spring and generally reach a higher temperature each day than those slopes facing north. As a result, soils that have south-or southwest-facing slopes have accelerated chemical weathering. Soils that have north-facing slopes retain moisture longer because they are shaded for longer periods and have a lower temperature.

In the Upper Tanana Area, the level and nearly level Fubar and Salchaket soils occur on alluvial plains along the Delta and Tanana Rivers. These soils lack development and distinct horizonation. In areas subject to flooding additional sediment is deposited, and a new cycle of soil formation begins each time these areas are inundated.

Permafrost soils on alluvial plains (such as Goldstream soils) are impermeable to water, consequently hindering leaching and the soil development process.

The nearly level and gently sloping Koyukuk and Nenana soils occur on moraines and outwash plains that lack permafrost. These soils absorb more moisture and water percolates deeper into the profile, resulting in increased weathering, stronger development, and more distinct soil horizons than steeper soils.

On steep mountainsides, soil development is closely related to the degree and aspect of slope. Steese soils that have a southern aspect tend to be well drained and have horizon development. Ester soils that have a northern aspect tend to have more permafrost and therefore lack the water absorption and percolation traits essential for distinct horizon development.

Plants and Animals

Living organisms greatly influence the processes of soil formation and the characteristics of the soils. Trees, grasses, earthworms, rodents, fungi, bacteria, and other forms of plant and animal life are affected by the other soil-forming factors. Animal activity is largely confined to the surface layer of the soil. The soil is continually mixed by their activity, which improves water infiltration. Plant roots create channels through which air and water move more rapidly, thereby improving soil structure and increasing the rate of chemical reactions in the soil.

Microorganisms help to decompose organic matter, which releases plant nutrients and

chemicals into the soil. These nutrients are either used by the plants or are leached from the soil. Human activities that influence the plant and animal populations in the soil affect the future rate of soil formation.

In the Upper Tanana Area, soils have a surface organic mat consisting of an accumulation of forest litter from trees and from the various types of mosses and sedges that thrive on the cool shaded forest floor. Cool temperatures inhibit microbial activity, slowing down the rate of decomposition of the mat and its incorporation into the mineral soil. The organic mat provides a cover that reduces erosion and stabilizes the soil surface.

Well drained and moderately well drained soils, such as Koyukuk and Fubar, formed under mixed stands of paper birch, white spruce, and quaking aspen. Poorly drained and very poorly drained soils, such as Tanana and Ester, formed under stands of black spruce, occasionally including white spruce. The very poorly drained Histosols are nearly devoid of trees.

Time

If all other factors of soil formation are equal, the degree of soil formation is in direct proportion to time. If soil-forming factors have been active for a long time, horizon development is stronger than if these same factors have been active for a relatively short time.

Geologically, the soils in the Upper Tanana Area are young. The youngest soils are those that are flooded, and continue receiving deposits, in cycles, at the present time. There is no horizon development in these soils. Salchaket and Fubar soils are examples.

The oldest soils in the Area formed in the loess mantle or on the moraines, outwash plains, and mountains. They exhibit the most development, as evidenced by a dark humus-rich surface layer and subsoil with structure and altered color. Koyukuk, Nenana, and Steese soils are examples.

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Glossary

Aeration, soil. The exchange of air in soil with air from the atmosphere. The air in a well aerated soil is similar to that in the atmosphere; the air in a poorly aerated soil is considerably higher in carbon dioxide and lower in oxygen.

Aggrade. To build up the grade or slope (of the earth) by deposition of sediment.

Aggregate, soil. Many fine particles held in a single mass or cluster. Natural soil aggregates, such as granules, blocks, or prisms, are called peds. Clods are aggregates produced by tillage or logging.

Alluvial fan. A body of alluvium, with overflow of water and debris flow deposits, whose surface forms a segment of a cone that radiates downslope from the point where the stream emerges from a narrow valley onto a less sloping surface. Source uplands range in relief and areal extent from mountains to gullied terrains on hill slopes.

Alluvium. Material, such as sand, silt, or clay, deposited on land by streams.

Association, soil. A group of soils or miscellaneous areas geographically associated in a characteristic repeating pattern and defined and delineated as a single map unit.

Available water capacity (available moisture capacity). The capacity of soils to hold water available for use by most plants. It is commonly defined as the difference between the amount of soil water at field moisture capacity and the amount at wilting point. It is commonly expressed as inches of water per inch of soil. The capacity, in inches, in a 60-inch profile or to a limiting layer is expressed as:

Very low	0 to 3
Low	3 to 6
Moderate	6 to 9
High	9 to 12
Very high	more than 12

Base saturation. The degree to which material having cation-exchange properties is saturated with exchangeable bases (sum of Ca, Mg, Na, K), expressed as a percentage of the total cation-exchange capacity.

Bedrock. The solid rock that underlies the soil and other unconsolidated material or that is exposed at the surface.

Boulders. Rock fragments larger than 2 feet (0.6 m) in diameter.

Capillary water. Water held as a film around soil particles and in tiny spaces between particles. Surface tension is the adhesive force that holds capillary water in the soil.

Channery soil material. Soil material that is, by volume, more than 15 percent thin, flat fragments of sandstone, shale, slate, limestone, or schist as much as 6 inches (15 cm) along the longest axis. A single piece is called a channer.

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.

Climax plant community. The plant community on a given site that will be established if present environmental conditions continue to prevail and the site is properly managed.

Coarse fragments. Mineral or rock particles larger than 2 millimeters in diameter.

Coarse textured soil. Sand or loamy sand.

Cobble (or cobblestone). A rounded or partly rounded fragment of rock 3 to 10 inches (8 to 25 cm) in diameter.

Cobbly soil material. Material that is 15 to 35 percent, by volume, rounded or partially rounded rock fragments 3 to 10 inches (8 to 25 cm) in diameter. Very cobbly soil material is 35 to 60 percent of these rock fragments, and extremely cobbly soil material is more than 60 percent.

Colluvium. Soil material, rock fragments, or both, moved by creep, slide, or local wash and deposited at the base of steep slopes.

Complex, soil. A map unit of two or more kinds of soil or miscellaneous areas in such an intricate pattern or so small in area that it is not practical to map them separately at the selected scale of mapping. The pattern and proportion of the soils or miscellaneous areas are somewhat similar in all areas.

Conservation cropping system. Growing crops in combination with needed cultural and management practices. In a good conservation cropping system, the soil-improving crops and practices more than offset the effects of the soil-depleting crops and practices. Cropping systems are needed on all tilled soils. Soil-improving practices in a conservation cropping system include the use of rotations that contain grasses and legumes and the return of crop residue to the soil. Other practices include the use of green manure crops of grasses and legumes, proper tillage, adequate fertilization, and weed and pest control.

Conservation tillage. A tillage system that does not invert the soil and that leaves a protective amount of crop residue on the surface throughout the year.

Consistence, soil. Refers to the degree of cohesion and adhesion of soil material and its resistance to deformation when ruptured. Consistence includes resistance of soil material to rupture and penetration; plasticity, toughness, and stickiness of puddled soil material; and the manner in which the soil material behaves when subject to compression. 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—Readily deformed by moderate pressure but can be pressed into a lump; will form a "wire" when rolled between thumb and forefinger.

Sticky—Adheres to other material and tends to stretch somewhat and pull apart rather than to pull free from other material.

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

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

Cemented—Hard; little affected by moistening.

Control section. The part of the soil on which classification is based. The thickness varies among different kinds of soil, but for many it is that part of the soil profile between depths of 10 inches and 40 or 80 inches.

Corrosive. High risk of corrosion to uncoated steel or deterioration of concrete.

Cover crop. A close-growing crop grown primarily to improve and protect the soils between periods of regular crop production, or a crop grown between trees and vines in orchards and vineyards.

Cropping system. Growing crops using a planned system of rotation and management practices.

Crown. The upper part of a tree or shrub, including the living branches and their foliage.

Deep soil. A soil that is 40 to 60 inches (102 to 152 cm) deep over bedrock or to other material that restricts the penetration of plant roots.

Depth, soil. Generally, the thickness of soil over bedrock. Very deep soils are more than 60 inches (more than 152 cm) deep over bedrock; deep soils, 40 to 60 inches (102 to 152 cm); moderately deep, 20 to 40 inches (51 to 102 cm); shallow, 10 to 20 inches (25 to 51 cm); and very shallow, less than 10 inches (less than 25 cm).

Depth to rock (in tables). Bedrock is too near the surface for the specified use.

Drainage class (natural). Refers to the frequency and duration of wet periods under conditions similar to those under which the soil formed. Alterations of the water regime by human activities, either through drainage or irrigation, are not a consideration unless they have significantly changed the morphology of the soil. Seven classes of natural soil drainage are recognized:

Excessively drained—These soils have very high and high hydraulic conductivity and a low water-holding capacity. They are not suited to crop production unless irrigated.

Somewhat excessively drained—These soils have high hydraulic conductivity and a low water-holding capacity. Without irrigation, only a narrow range of crops can be grown and yields are low.

Well drained—These soils have an intermediate water-holding capacity. They retain optimum amounts of moisture, but they are not wet close enough to the surface or long enough during the growing season to adversely affect yields.

Moderately well drained—These soils are wet close enough to the surface or long enough that planting or harvesting operations or yields of some field crops are adversely affected unless a drainage system is installed. Moderately well drained soils commonly have a layer with low hydraulic conductivity, a wet layer relatively high in the profile, additions of water by seepage, or some combination of these.

Somewhat poorly drained—These soils are wet close enough to the surface or long enough that planting or harvesting operations or crop growth is markedly restricted unless a drainage system is installed. Somewhat poorly drained soils commonly have a layer with low hydraulic conductivity, a wet layer high in the profile, additions of water through seepage, or a combination of these.

Poorly drained—These soils commonly are so wet at or near the surface during a considerable part of the year that field crops cannot be grown under natural conditions. Poorly drained conditions are caused by a saturated zone, a layer with low hydraulic conductivity, seepage, or a combination of these.

Very poorly drained—These soils are wet to the surface most of the time. The wetness prevents the growth of important crops (except rice) unless a drainage system is installed.

Drainage, surface. Runoff, or surface flow of water, from an area.

Edaphic factor. A condition or characteristic of the soil (chemical, physical or biological) which influences organisms.

Eluviation. The movement of material in true solution or colloidal suspension from one place to another within the soil. Soil horizons that have lost material through eluviation are eluvial; those that have received material are illuvial.

Eolian. Of or pertaining to wind.

Eolian soil material. Earthy parent material accumulated through wind action; commonly refers to sandy material in dunes or to loess in blankets on the surface.

Erosion. The wearing away of the land surface by water, wind, ice, or other geologic agents and by such processes as gravitational creep.

Erosion (geologic). Erosion caused by geologic processes acting over long geologic periods and resulting in the wearing away of mountains and the building up of such landscape features as flood plains and coastal plains. Synonym: natural erosion.

Erosion (accelerated). Erosion much more rapid than geologic erosion, mainly as a result of human or animal activities or of a catastrophe in nature, such as a fire, that exposes the surface.

Escarpment. A relatively continuous and steep slope or cliff breaking the general continuity of more gently sloping land surfaces and resulting from erosion or faulting. The term is more often applied to cliffs resulting from differential erosion. Synonym: scarp.

Excess fines (in tables). Excess silt and clay in the soil. The soil does not provide a source of gravel or sand for construction purposes.

Fast intake (in tables). The rapid movement of water into the soil.

Fertility, soil. The quality that enables a soil to provide plant nutrients, in adequate

amounts and in proper balance, for the growth of specified plants when light, moisture, temperature, till, and other growth factors are favorable.

Fibric soil material (peat). The least decomposed of all organic soil material. Peat contains a large amount of well preserved fiber that is readily identifiable according to botanical origin. Peat has the lowest bulk density and the highest water content at saturation of all organic soil material.

Field moisture capacity. The moisture content of a soil, expressed as a percentage of the oven-dry weight, after the gravitational, or free, water has drained away; the field moisture content 2 or 3 days after a soaking rain; also called *normal field capacity*, *normal moisture capacity*, or *capillary capacity*.

Floodplain. A nearly level alluvial plain that borders a stream and is subject to inundation under flood-stage conditions unless protected artificially. It is usually a constructional landform built of sediment deposited during overflow and lateral migration of the stream.

Fluvial. Of or pertaining to rivers; produced by river action, as a fluvial plain.

Foot slope. The inclined surface at the base of a hill.

Forb. Any herbaceous plant not a grass or a sedge.

Forest cover. All trees and other woody plants (underbrush) covering the ground in a forest.

Frost action (in tables). Freezing and thawing of soil moisture. Frost action can damage roads, buildings and other structures, and plant roots.

Genesis, soil. The mode of origin of the soil. Refers especially to the processes or soil-forming factors responsible for the formation of the solum, or true soil, from the unconsolidated parent material.

Glacial outwash (geology). Gravel, sand, and silt, commonly stratified, deposited by glacial meltwater.

Glaciofluvial deposits (geology). Material moved by glaciers and subsequently sorted and deposited by streams flowing from the melting ice. The deposits are stratified and occur as kames, eskers, deltas, and outwash plains.

Gleyed soil. Soil that formed under poor drainage, resulting in the reduction of iron and other elements in the profile and in gray colors and mottles.

Gravel. Rounded or angular fragments of rock as much as 3 inches (2 millimeters to 8 cm) in diameter. An individual piece is a pebble.

Gravelly soil material. Material that is 15 to 50 percent, by volume, rounded or angular rock fragments, not prominently flattened, as much as 3 inches (8 cm) in diameter.

Ground water (geology). Water filling all the unblocked pores of underlying material below the water table.

Hard bedrock. Bedrock that cannot be excavated except by blasting or by the use of special equipment that is not commonly used in construction.

Hemic soil material (mucky peat). Organic soil material intermediate in degree of decomposition between the less decomposed fibric material and the more decomposed sapric material.

Hill. A natural elevation of the land surface, rising as much as 1,000 feet (305 m) above surrounding lowlands, commonly of limited summit area and having a well-defined outline; hillsides generally have slopes of more than 15 percent. The distinction between a hill and a mountain is arbitrary and dependent on local usage.

Horizon, soil. A layer of soil, approximately parallel to the surface, having distinct characteristics produced by soil-forming processes. In the identification of soil horizons, an uppercase letter represents the major horizons. Numbers or lowercase letters that follow represent subdivisions of the major horizons. The major horizons of mineral soil are as follows:

O horizon—An organic layer of fresh and decaying plant residue.

A horizon—The mineral horizon at or near the surface in which an accumulation of humified organic matter is mixed with the mineral material. Also, a plowed surface horizon, most of which was originally part of a B horizon.

B horizon—The mineral horizon below an A horizon. The B horizon is in part a layer of

transition from the overlying A to the underlying C horizon. The B horizon also has distinctive characteristics, such as (1) accumulation of clay, sesquioxides, humus, or a combination of these; (2) prismatic or blocky structure; (3) redder or browner colors than those in the A horizon; or (4) a combination of these.

E horizon—The mineral horizon in which the main feature is loss of silicate clay, iron, aluminum, or some combination of these.

C horizon—The mineral horizon or layer, excluding indurated bedrock, that is little affected by soil-forming processes and does not have the properties typical of the overlying soil material. The material of a C horizon may be either like or unlike that in which the solum formed. If the material is known to differ from that in the solum, the number 2 precedes the letter C.

Cr horizon—Sedimentary beds of consolidated sandstone and semiconsolidated and consolidated shale. Generally, roots can penetrate this horizon only along fracture planes.

R layer—Hard, consolidated bedrock beneath the soil. The bedrock commonly underlies a C horizon but can be directly below an A or a B horizon.

Humus. The well decomposed, more or less stable part of the organic matter in mineral soils.

Hydrologic soil groups. Refers to soils grouped according to their runoff potential. The soil properties that influence this potential are those that affect the minimum rate of water infiltration on a bare soil during periods after prolonged wetting when the soil is not frozen. These properties are depth to a seasonal high water table, the infiltration rate and permeability after prolonged wetting, and depth to a very slowly permeable layer. The slope and the kind of plant cover are not considered but are separate factors in predicting runoff. Soils are assigned to four groups. In group A are soils having a high infiltration rate when thoroughly wet and having a low runoff potential. They are mainly deep, well drained, and sandy or gravelly. In group D, at the other extreme, are soils having a very slow infiltration rate and thus a high runoff potential. They have a claypan or clay layer at or near the surface, have a permanent high water table, or are shallow over nearly impervious bedrock or other material. A soil is assigned to two hydrologic groups if part of the acreage is artificially drained and part is undrained.

Illuviation. The movement of soil material from one horizon to another in the soil profile. Generally, material is removed from an upper horizon and deposited in a lower horizon.

Infiltration. The downward entry of water into the immediate surface of soil or other material, as contrasted with percolation, which is movement of water through soil layers or material.

Infiltration rate. The rate at which water penetrates the surface of the soil at any given instant, usually expressed in inches per hour. The rate can be limited by the infiltration capacity of the soil or the rate at which water is applied at the surface.

Intake rate. The average rate of water entering the soil under irrigation. Most soils have a fast initial rate; the rate decreases with application time. Therefore, intake rate for design purposes is not a constant but is a variable depending on the net irrigation application.

Intermittent stream. A stream, or reach of a stream, that flows for prolonged periods only when it receives ground-water discharge or long, continued contributions from melting snow or other surface and shallow subsurface sources.

Large stones (in tables). Rock fragments 3 inches (8 cm) or more across. Large stones adversely affect the specified use of the soil.

Leaching. The removal of soluble material from soil or other material by percolating water.

Light textured soil. Sand and loamy sand.

Liquid limit. The moisture content at which the soil passes from a plastic to a liquid state.

Loam. Soil material that is 7 to 27 percent clay particles, 28 to 50 percent silt particles, and less than 52 percent sand particles.

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

Low strength. The soil is not strong enough to support loads.

Medium textured soil. Very fine sandy loam, loam, silt loam, or silt.

Mineral soil. Soil that is mainly mineral material and low in organic material. Its bulk density is more than that of organic soil.

Miscellaneous area. An area that has little or no natural soil and supports little or no vegetation.

Moderately coarse textured soil. Coarse sandy loam, sandy loam, or fine sandy loam.

Moderately fine textured soil. Clay loam, sandy clay loam, or silty clay loam.

Morphology, soil. The physical makeup of the soil, including the texture, structure, porosity, consistence, color, and other physical, mineral, and biological properties of the various horizons, and the thickness and arrangement of those horizons in the soil profile.

Mottling, soil. Irregular spots of different colors that vary in number and size. Mottling generally indicates poor aeration and impeded drainage. Descriptive terms are as follows: abundance--*few*, *common*, and *many*; size--*fine*, *medium*, and *coarse*; and contrast--*faint*, *distinct*, and *prominent*. The size measurements are of the diameter along the greatest dimension. *Fine* indicates less than 5 millimeters (about 0.2 inch); *medium*, from 5 to 15 millimeters (about 0.2 to 0.6 inch); and *coarse*, more than 15 millimeters (about 0.6 inch).

Mountain. A natural elevation of the land surface, rising more than 1,000 feet (305 m) above surrounding lowlands, commonly of limited summit area and generally having steep sides (slopes greater than 25 percent) and considerable bare-rock surface. A mountain can occur as a single, isolated mass or in a group forming a chain or range. Mountains are primarily formed by deep-seated earth movements or volcanic action and secondarily by differential erosion.

Muck. Dark, finely divided, well decomposed organic soil material. (See Sapric soil material.)

Munsell notation. A designation of color by degrees of three simple variables--hue, value, and chroma. For example, a notation of 10YR 6/4 is a color with hue of 10YR, value of 6, and chroma of 4.

Muskeg. Wetland in boreal regions dominated by Sphagnum moss, stunted black spruce, and low shrubs.

Nutrient, plant. Any element taken in by a plant essential to its growth. Plant nutrients are mainly nitrogen, phosphorous, potassium, calcium, magnesium, sulfur, iron, manganese, copper, boron, and zinc obtained from the soil and carbon, hydrogen, and oxygen obtained from the air and water.

Observed rooting depth. Depth to which roots have been observed to penetrate.

Organic matter. Plant and animal residue in the soil in various stages of decomposition. The content of organic matter in the surface layer is described as follows:

Low	0.5 to 2.0 percent
Medium	2.0 to 4.0 percent
High	4.0 to 8.0 percent

Outwash, plain. A landform of mainly sandy or coarse textured material of glaciofluvial origin. An outwash plain is commonly smooth; where pitted, it is generally low in relief.

Parent material. The unconsolidated organic and mineral material in which soil forms.

Peat. Unconsolidated material, largely undecomposed organic matter, that has accumulated under excess moisture. (See Fibric soil material.)

Pedon. The smallest volume that can be called "a soil." A pedon is three dimensional and large enough to permit study of all horizons. Its area ranges from about 10 to 100 square feet (1 square m to 10 square m), depending on the variability of the soil.

Percolation. The downward movement of water through the soil.

Percs slowly (in tables). The slow movement of water through the soil adversely affecting the specified use.

Permafrost. Layers of soil, or even bedrock, occurring in arctic or subarctic regions, in which a temperature below freezing has existed continuously for a long time.

Permeability. The quality of the soil that enables water to move downward through the profile. The rate at which a saturated soil transmits water is accepted as a measure of this quality. In soil physics, the rate is referred to as "saturated hydraulic conductivity," which is defined in the "Soil Survey Manual." In line with conventional usage in the engineering profession and with traditional usage in published soil surveys, this rate of flow continues to be expressed as "permeability." Terms describing permeability, measured in inches per hour, are as follows:

Very slow	0.01 to 0.06 inch
Slow	0.06 to 0.2 inch
Moderately slow	0.2 to 0.6 inch
Moderate	0.6 inch to 2.0 inches
Moderately rapid	2.0 to 6.0 inches
Rapid	6.0 to 20 inches
Very rapid	more than 20 inches

Phase, soil. A subdivision of a soil series based on features that affect its use and management. For example, slope, stoniness, and thickness.

pH value. A numerical designation of acidity and alkalinity in soil. (See Reaction, soil.)

Plasticity index. The numerical difference between the liquid limit and the plastic limit; the range of moisture content within which the soil remains plastic.

Plastic limit. The moisture content at which a soil changes from semisolid to plastic.

Ponding. Standing water on soils in closed depressions. The water can be removed only by percolation or by evapotranspiration.

Poor filter (in tables). Because of rapid or very rapid permeability, the soil may not adequately filter effluent from a waste disposal system.

Poorly graded. Refers to a coarse grained soil or soil material consisting mainly of particles of nearly the same size. Because there is little difference in size of the particles, density can be increased only slightly by compaction.

Productivity, soil. The capability of a soil for producing a specified plant or sequence of plants under specific management.

Profile, soil. A vertical section of the soil extending through all its horizons and into the parent material.

Puddling. The act of destroying soil structure; reducing porosity and permeability; sometimes used to reduce leakage of reservoirs and canals.

Reaction, soil. A measure of acidity or alkalinity of a soil, expressed in pH values. A soil that tests to pH 7.0 is described as precisely neutral in reaction because it is neither acid nor alkaline. The degrees of acidity or alkalinity, expressed as pH values, are:

Ultra acid	Below 3.5
Extremely acid	3.5 to 4.5
Very strongly acid	4.5 to 5.0
Strongly acid	5.1 to 5.5
Medium acid	5.6 to 6.0
Slightly acid	6.1 to 6.5
Neutral	6.6 to 7.3
Mildly Alkaline	7.4 to 7.8
Moderately alkaline	7.9 to 8.4
Strongly alkaline	8.5 to 9.0
Very strongly alkaline	9.1 and higher

Regolith. The unconsolidated mantle of weathered rock and soil material on the earth's surface; the loose earth material above the solid rock.

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

Residuum (residual soil material). Unconsolidated, weathered or partly weathered mineral material that accumulated as consolidated rock disintegrated in place.

Riparian. Pertaining to streamside environment.

Riverwash. Unstable areas of sandy, silty, clayey, or gravelly sediments. These areas are flooded, washed, and reworked by rivers so frequently that they support little or no vegetation.

Rock fragments. Rock or mineral fragments having a diameter of 2 millimeters or more; for example, pebbles, cobbles, stones, and boulders.

Rock outcrop. Exposures of bare bedrock other than lava flows and rock-lined pits.

Root zone. The part of the soil that can be penetrated by plant roots.

Runoff. The precipitation discharged into stream channels from an area. The water that flows off the surface of the land without sinking into the soil is called surface runoff. Water that enters the soil before reaching surface streams is called ground-water runoff or seepage flow from ground water.

Sand. As a soil separate, individual rock or mineral fragments from 0.05 millimeter to 2.0 millimeters in diameter. Most sand grains consist of quartz. As a soil textural class, a soil that is 85 percent or more sand and not more than 10 percent clay.

Sapric soil material (muck). The most highly decomposed of all organic soil material. Muck has the least amount of plant fiber, the highest bulk density, and the lowest water content at saturation of all organic soil material.

Seepage (in tables). The movement of water through the soil. Seepage adversely affects the specified use.

Seral. Nonclimax, i.e., a species or a community demonstrably susceptible to replacement by another species or community, usually within a few decades or a few centuries at most.

Series, soil. A group of soils that have profiles that are almost alike, except for differences in texture of the surface layer or of the underlying material. All the soils of a series have horizons that are similar in composition, thickness, and arrangement.

Shallow soil. A soil that is 10 to 20 inches (25 to 51 cm) deep over bedrock or to other material that restricts the penetration of plant roots.

Shrink-swell (in tables). The shrinking of soil when dry and the swelling when wet. Shrinking and swelling can damage roads, dams, building foundations, and other structures. It can also damage plant roots.

Silt. As a soil separate, individual mineral particles that range in diameter from the upper limit of clay (0.002 millimeter) to the lower limit of very fine sand (0.05 millimeter). As a soil textural class, soil that is 80 percent or more silt and less than 12 percent clay.

Slope. The inclination of the land surface from the horizontal. Percentage of slope is the vertical distance divided by horizontal distance, then multiplied by 100. Thus, a slope of 20 percent is a drop of 20 feet in 100 feet of horizontal distance.

Slope (in tables). Slope is great enough that special practices are required to ensure satisfactory performance of the soil for a specific use.

Slow intake (in tables). The slow movement of water into the soil.

Small stones (in tables). Rock fragments less than 3 inches (8 cm) in diameter. Small stones adversely affect the specified use of the soil.

Soil. A natural, three-dimensional body at the earth's surface. It is capable of supporting plants and has properties resulting from the integrated effect of climate and living matter acting on earthy parent material, as conditioned by relief over periods of time.

Soil amendment. Any material, such as lime, gypsum, sawdust, or synthetic conditioner, that is worked into the soil to make it more emenable to plant growth.

Soil separates. Mineral particles less than 2 millimeters in equivalent diameter and ranging between specified size limits. The names and sizes, in millimeters, of separates recognized in the United States are as follows:

Very coarse sand	2.0 to 1.0
Coarse sand	1.0 to 0.5
Medium sand	0.5 to 0.25

Fine sand	0.25 to 0.10
Very fine sand	0.10 to 0.05
Silt	0.05 to 0.002
Clay	less than 0.002

Solum. The upper part of a soil profile, above the C horizon, in which the processes of soil formation are active. The solum in soil consists of the A, E, and B horizons. Generally, the characteristics of the material in these horizons are unlike those of the underlying material. The living roots and plant and animal activities are largely confined to the solum.

Stones. Rock fragments 10 to 24 inches (25 to 61 cm) in diameter if rounded or 6 to 15 inches (15 to 38 cm) in length if flat.

Strip-cropping. Growing crops in a systematic arrangement of strips or bands that provide vegetative barriers to wind and water erosion.

Structure, soil. The arrangement of primary soil particles into compound particles or aggregates. The principal forms of soil structure are: *platy* (laminated), *prismatic* (vertical axis of aggregates longer than horizontal), *columnar* (prisms with rounded tops), *blocky* (angular or subangular), and *granular*. *Structureless* soils are either *single grain* (each grain by itself, as in dune sand) or *massive* (the particles adhering without any regular cleavage, as in many hardpans).

Subsoil. Technically, the B horizon; roughly, the part of the solum below plow depth.

Substratum. The part of the soil below the solum.

Subsurface layer. Technically, the E horizon. Generally refers to a leached horizon lighter in color and lower in content of organic matter than the overlying surface layer.

Surface layer. The soil ordinarily moved in tillage, or its equivalent in uncultivated soil, ranging in depth from 4 to 10 inches (10 to 25 cm). Frequently designated as the "plow layer," or the "Ap horizon."

Surface soil. The A, E, AB, and EB horizons. It includes all subdivisions of these horizons.

Texture, soil. The relative proportions of sand, silt, and clay particles in a mass of soil. The basic textural classes, in order of increasing proportion of fine particles, are *sand*, *loamy sand*, *sandy loam*, *loam*, *silt loam*, *silt*, *sandy clay loam*, *clay loam*, *silty clay loam*, *sandy clay*, *silty clay*, and *clay*. The sand, loamy sand, and sandy loam classes may be further divided by specifying "coarse," "fine," or "very fine."

Thin layer (in tables). Otherwise suitable soil material too thin for the specified use.

Tilth, soil. The physical condition of the soil as related to tillage, seedbed preparation, seedling emergence, and root penetration.

Toe slope. The outermost inclined surface at the base of a hill. Toe slopes are commonly gentle and linear in profile.

Topsoil. The upper part of the soil, which is the most favorable material for plant growth. It is ordinarily rich in organic matter and is used to topdress roadbanks, lawns, and land affected by mining.

Variant, soil. A soil having properties sufficiently different from those of other known soils to justify a new series name, but occurring in such a limited geographic area that creation of a new series is not justified.

Variation. Refers to patterns of contrasting colors assumed to be inherited from the parent material rather than to be the result of poor drainage

Weathering. All physical and chemical changes produced in rocks or other deposits at or near the earth's surface by atmospheric agents. These changes result in disintegration and decomposition of the material.

Well graded. Refers to soil material consisting of coarse grained particles that are well distributed over a wide range in size or diameter. Such soil normally can be easily increased in density and bearing properties by compaction. Contrasts with poorly graded soil.

Tables

TABLE 1--TEMPERATURE, WIND, RELATIVE HUMIDITY, AND GROWING DEGREE DAYS

(Data were recorded at the Big Delta, AK airport.)

Temperatures°F				Wind Speed and Direction			Relative humidity pct.			Avg. Grow Degree Days #				
Normal		Extremes		Mean Spd. MPH	Prev. Dir.	Fastest Spd. MPH	8AM	2PM	8PM					
Month	Daily Max.	Daily Min.	Month							Rec. High	Rec. Low	Yr.		
Jan.	0.8	-13.6	-6.4	48	81	-63	47	10.8	ESE	74	67	67	68	---
Feb.	11.0	-7.0	2.0	51	43	-60	47	9.9	ESE	60	70	65	71	---
Mar.	23.0	.0	11.5	58	81	-49	64	8.2	ESE	63	68	56	65	---
Apr.	40.5	20.8	30.7	72	79	-37	44	7.6	W	60	60	45	58	---
May	56.5	36.9	46.7	90	47	-1	45	7.9	SW	55	51	39	51	100.5
June	66.7	47.3	57.1	92	69	30	74	6.5	SW	51	61	49	57	510.0
July	69.4	50.6	60.0	91	58	32	71	6.0	SW	63	70	55	66	620.0
Aug.	65.0	46.4	55.7	88	77	22	48	6.6	S	47	74	56	71	486.7
Sept.	52.7	35.5	44.1	79	63	-2	83	7.3	ESE	66	78	58	73	20.5
Oct.	31.7	18.1	24.9	66	69	-39	75	8.5	ESE	58	80	72	79	---
Nov.	14.6	.6	7.6	52	79	-46	63	9.5	ESE	56	76	75	77	---
Dec.	2.3	-11.9	-4.8	48	43	-62	46	9.5	ESE	63	73	72	72	---
Year	36.2	18.6	27.4					8.2	ESE	74	69	59	67	1737.7*

Length of record, years, through 1983 unless otherwise noted, based on January data.

“NORMALS AND EXTREMES” TABLE NOTE(S):

1. Mean wind speed is for July 1944–August 1964.
2. Wind under “Fastest wind” heading is for July 1944–August 1964 and January 1969–May 1972. Years of Extremes not available.

A growing degree day is a unit of heat available for plant growth. It can be calculated by adding the maximum and minimum daily temperatures, dividing the sum by 2, and subtracting the temperature below which growth is minimal for the principal crops in the area (40°F).

* This figure includes only the growing degree days between May 15th and Sep 5th (114-day freeze free period).

TABLE 2--PRECIPITATION IN INCHES

(Data were recorded at the Big Delta, AK airport.)

Month	Water Equivalent						Snow, Ice Pellets				
	Normal	Max. Mon.	Year	Min. Mon.	Year	Max. in 24 Hrs.	Year	Max. Mon.	Year	Max. in 24 Hrs.	Year
January	0.31	1.35	1957	T*	1961	0.73	1957	20.9	1950	8.5	1957
February	0.27	1.33	1957	T	1975	0.44	1957	15.9	1967	5.5	1957
March	0.27	1.12	1967	T	1981	0.38	1963	24.9	1967	6.4	1950
April	0.24	1.98	1948	T	1976	0.94	1963	19.0	1948	10.0	1982
May	0.92	2.82	1955	0.02	1944	1.16	1962	7.0	1973	2.0	1964
June	2.38	4.92	1961	0.51	1944	2.14	1943	T	1974	T	1963
July	2.37	6.18	1945	0.71	1970	2.06	1975	0.0		0.0	
August	1.95	3.72	1975	0.62	1981	1.26	1961	T	1981	T	1969
September	1.10	3.01	1952	0.26	1974	1.17	1952	14.0	1981	8.0	1981
October	0.55	1.31	1983	T	1969	0.54	1952	19.8	1978	10.4	1981
November	0.39	1.12	1964	0.03	1953	0.43	1964	19.7	1964	5.3	1964
December	0.37	2.57	1955	T	1973	0.90	1955	29.0	1955	10.0	1965
	11.12	6.18	1945	T	Mar. 1981	2.14	1943	29.0	Dec. 1955	10.4	Oct/ 1981

Length of record, years, through 1983 unless otherwise noted, based on January data.

* Trace

NORMALS, MEANS, AND EXTREMES TABLE NOTES(S):

1. Mean Number of Days Precipitation .01 inch or more is for the period 1943-1953 and 1969 to approximate time of completion of this survey (1983).

TABLE 3--CLOUDINESS, PRECIPITATION, AND TEMPERATURE

MEAN NUMBER OF DAYS

Month	Daytime Cloudiness			Precip. .01 in. or more	Ice Plts. 1.0 in. or more	Temperatures°F			
	Clear	Partly cloudy	cloudy			Maximum		Minimum	
						90° and above	32° and below	32° and below	0° and below
January	14	8	9	5	2	0	29	31	22
February	5	6	17	4	1	0	25	28	18
March	8	8	15	4	1	0	22	30	15
April	2	8	20	4	1	*	7	26	3
May	2	11	18	7	*	2	*	8	*
June	4	9	17	12	0	10	0	*	0
July	*	9	22	13	0	15	0	*	0
August	2	8	21	12	0	8	0	1	0
September	5	7	18	9	1	1	1	10	*
October	4	4	23	8	4	0	16	28	3
November	7	6	17	6	3	0	26	30	14
December	7	7	17	6	2	0	30	31	22
	60	91	214	90	14	36	156	223	95

Length of record, years, through 1983 unless otherwise noted, based on January data.

* Data missing

NORMALS, MEANS, AND EXTREMES TABLE NOTE(S):

1. Mean Number of Days Precipitation .01 inch or more is for the period 1943-1953 and 1969 to approximate time of completion of this survey (1983).
2. Thunderstorms and Heavy Fog data are through 1973. Station operated less than 24 hours daily; data may be incomplete.

TABLE 4--ACREAGE AND PROPORTIONATE EXTENT OF THE SOILS

Map symbol	soil name	Acres	Percent
301	Cryorthents, flooded-----	1,015	0.5
302	Ester-Steese association, 7 to 12 percent slopes-----	3,432	1.8
303	Fubar soils and Riverwash, 0 to 3 percent slopes-----	6,154	3.4
304	Goldstream peat, 0 to 3 percent slopes-----	20,514	11.2
305	Goldstream peat, 3 to 7 percent slopes-----	3,661	2.0
306	Goldstream peat, 7 to 12 percent slopes-----	2,392	1.3
307	Goldstream-Tanana complex, 0 to 3 percent slopes-----	8,034	4.4
308	Goldstream and Histosols, 0 to 3 percent slopes-----	24,277	13.3
309	Goodpaster variant-Goldstream complex, 0 to 3 percent slopes-----	2,356	1.3
310	Gravel pits-----	113	0.1
311	Jarvis-Fubar complex, 0 to 7 percent slopes-----	11,592	6.3
312	Koyukuk silt loam, 0 to 3 percent slopes-----	990	0.5
313	Koyukuk silt loam, 3 to 7 percent slopes-----	9,664	5.3
314	Koyukuk silt loam, 7 to 12 percent slopes-----	1,223	0.7
315	Koyukuk silt loam, 12 to 45 percent slopes-----	599	0.3
316	Minchumina peat, 0 to 3 percent slopes-----	1,869	1.0
317	Minchumina peat, 3 to 7 percent slopes-----	3,466	1.9
318	Nenana silt loam, 0 to 3 percent slopes-----	5,135	2.8
319	Nenana silt loam, 3 to 7 percent slopes-----	5,523	3.1
320	Nenana silt loam, 7 to 12 percent slopes-----	1,836	1.0
321	Nenana silt loam, 12 to 45 percent slopes-----	2,776	1.5
322	Riverwash-----	6,310	3.5
323	Salchaket-Riverwash association, 0 to 3 percent slopes-----	5,461	3.0
324	Steese-Ester association, 12 to 45 percent slopes-----	10,146	5.6
325	Tanana silt loam, 0 to 3 percent slopes-----	30,807	16.9
326	Tanana, moderately wet-Goldstream complex, 0 to 3 percent slopes-----	2,360	1.3
327	Tanana, moderately wet-Goldstream complex, 3 to 7 percent slopes-----	1,369	0.7
w	Water-----	9,643	5.3
	Total-----	182,717	100.0

TABLE 5--BUILDING SITE DEVELOPMENT

(Some terms that describe restrictive soil features are defined in the [Glossary](#). See text for definitions of "slight," "moderate," and "severe." Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for on-site investigation.)

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
301: Cryorthents.					
302*: Ester-----	Severe: permafrost, depth to rock, wetness.	Severe: permafrost, wetness, low strength.	Severe: permafrost, wetness, depth to rock.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness.
Steese-----	Moderate: depth to rock, cutbanks cave, slope.	Moderate: slope.	Moderate: depth to rock, slope.	Severe: slope.	Moderate: slope, frost action.
303*: Fubar-----	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Riverwash.					
304, 305, 306: Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.
307*: Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.
Tanana-----	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, frost action.
308*: Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.
Histosols.					
309*: Goodpaster----- Variant	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, frost action.
Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.
310*: Gravel pits.					

* See footnote at end of table.

TABLE 5--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
311*: Jarvis-----	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Fubar-----	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
312: Koyukuk-----	Severe: cutbanks cave.	slight-----	slight-----	slight-----	Severe: frost action.
313: Koyukuk-----	Severe: cutbanks cave.	slight-----	slight-----	Moderate: slope.	Severe: frost action.
314: Koyukuk-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
315: Koyukuk-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
316, 317: Minchumina-----	Severe: permafrost.	Severe: permafrost.	Severe: permafrost.	Severe: permafrost.	Severe: permafrost, frost action.
318: Nenana-----	Severe: cutbanks cave.	slight-----	slight-----	slight-----	Severe: frost action.
319: Nenana-----	Severe: cutbanks cave.	slight-----	slight-----	Moderate: slope.	Severe: frost action.
320: Nenana-----	Severe: cutbanks cave.	Moderate: slope.	Moderate: slope.	Severe: slope.	Severe: frost action.
321: Nenana-----	Severe: cutbanks cave, slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope, frost action.
322*: Riverwash.					
323*: Salchaket-----	Severe: cutbanks cave.	Severe: flooding.	Severe: flooding.	Severe: flooding.	Severe: flooding.
Riverwash.					
324*: Steese-----	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.	Severe: slope.

* See footnote at end of table.

TABLE 5--BUILDING SITE DEVELOPMENT--Continued

Map symbol and soil name	Shallow excavations	Dwellings without basements	Dwellings with basements	Small commercial buildings	Local roads and streets
324*: (cont'd) Ester-----	Severe: permafrost, depth to rock, wetness.	Severe: permafrost, wetness, low strength.	Severe: permafrost, wetness, depth to rock.	Severe: permafrost, wetness, slope.	Severe: permafrost, wetness, slope.
325: Tanana-----	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, frost action.
326*, 327*: Tanana-----	Severe: permafrost.	Severe: permafrost.	Severe: permafrost.	Severe: permafrost.	Severe: permafrost.
Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.
W*: Water.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 6--SANITARY FACILITIES

(Some terms that describe restrictive soil features are defined in the [Glossary](#). See text for definitions of "slight," "good," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for on-site investigation.)

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
301: Cryorthents.					
302*: Ester-----	Severe: permafrost, depth to rock, wetness.	Severe: permafrost, depth to rock, slope.	Severe: permafrost, depth to rock, wetness.	Severe: permafrost, depth to rock, wetness.	Poor: permafrost, depth to rock.
Steese-----	Severe: depth to rock.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage.	Severe: depth to rock, seepage.	Poor: depth to rock.
303*: Fubar-----	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, small stones.
Riverwash.					
304, 305: Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, excess humus.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Poor: permafrost, wetness.
306: Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, slope, excess humus.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Poor: permafrost, wetness.
307*: Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, excess humus.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Poor: permafrost, wetness.
Tanana-----	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Poor: permafrost, wetness.
308*: Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, excess humus.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Poor: permafrost, wetness.
Histosols.					
309*: Goodpaster Variant-	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Poor: permafrost, wetness.

* See footnote at end of table.

TABLE 6--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
309*: (cont'd) Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, excess humus.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Poor: permafrost, wetness.
310*: Gravel pits.					
311*: Jarvis-----	Severe: flooding, poor filter.	Severe: seepage, flooding.	Severe: flooding, seepage, too sandy.	Severe: flooding, seepage.	Poor: seepage, too sandy, small stones.
Fubar-----	Severe: flooding, wetness, poor filter.	Severe: seepage, flooding, wetness.	Severe: flooding, seepage, wetness.	Severe: flooding, seepage, wetness.	Poor: seepage, too sandy, small stones.
312, 313: Koyukuk-----	Moderate: percs slowly.	Severe: seepage.	Severe: seepage.	Slight-----	Fair: thin layer.
314: Koyukuk-----	Moderate: percs slowly, slope.	Severe: seepage, slope.	Severe: seepage.	Moderate: slope.	Fair: slope, thin layer.
315: Koyukuk-----	Severe: slope.	Severe: seepage, slope.	Severe: seepage, slope.	Severe: slope.	Poor: slope.
316, 317: Minchumina-----	Severe: permafrost.	Severe: permafrost, excess humus.	Severe: permafrost.	Severe: permafrost.	Poor: permafrost.
318, 319: Nenana-----	Severe: poor filter.	Severe: seepage.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
320: Nenana-----	Severe: poor filter.	Severe: seepage, slope.	Severe: seepage, too sandy.	Severe: seepage.	Poor: seepage, too sandy.
321: Nenana-----	Severe: poor filter, slope.	Severe: seepage, slope.	Severe: seepage, slope, too sandy.	Severe: seepage, slope.	Poor: seepage, too sandy, slope.
322*: Riverwash.					

* See footnote at end of table.

TABLE 6--SANITARY FACILITIES--Continued

Map symbol and soil name	Septic tank absorption fields	Sewage lagoon areas	Trench sanitary landfill	Area sanitary landfill	Daily cover for landfill
323*: Salchaket----- Riverwash.	Severe: flooding.	Severe: seepage, flooding.	Severe: flooding, seepage.	Severe: flooding.	Fair: thin layer.
324*: Steese----- Ester-----	Severe: depth to rock, slope.	Severe: seepage, depth to rock, slope.	Severe: depth to rock, seepage, slope.	Severe: depth to rock, seepage, slope.	Poor: depth to rock, slope.
325: Tanana-----	Severe: permafrost, depth to rock, wetness.	Severe: permafrost, depth to rock, slope.	Severe: permafrost, depth to rock, wetness.	Severe: permafrost, depth to rock, wetness.	Poor: permafrost, depth to rock, slope.
326*, 327*: Tanana-----	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Poor: permafrost, wetness.
Goldstream-----	Severe: permafrost, wetness.	Severe: permafrost, excess humus.	Severe: permafrost, wetness.	Severe: permafrost, wetness.	Poor: permafrost, wetness.
W*: Water.					

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 7--CONSTRUCTION MATERIALS

(Some terms that describe restrictive soil features are defined in the [Glossary](#). See text for definitions of "good," "fair," and other terms. Absence of an entry indicates that the soil was not rated. The information in this table indicates the dominant soil condition but does not eliminate the need for on-site investigation.)

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
301: Cryorthents.				
302*: Ester-----	Poor: permafrost, depth to rock, wetness.	Improbable: permafrost, excess humus.	Improbable: permafrost, excess humus.	Poor: permafrost, depth to rock, excess humus.
Steese-----	Poor: depth to rock.	Improbable: excess fines.	Improbable: excess fines.	Fair: depth to rock, small stones, slope.
303*: Fubar-----	Fair: large stones.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
Riverwash.				
304, 305, 306: Goldstream-----	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, wetness.
307*: Goldstream-----	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, wetness.
Tanana-----	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost.
308*: Goldstream-----	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, wetness.
Histosols.				
309*: Goodpaster Variant-	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost.
Goldstream-----	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, wetness.
310*: Gravel pits.				

* See footnote at end of table.

TABLE 7--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
311*: Jarvis-----	Good-----	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
Fubar-----	Fair: large stones.	Probable-----	Probable-----	Poor: too sandy, small stones, area reclaim.
312, 313, 314: Koyukuk-----	Good-----	Probable-----	Probable-----	Poor: area reclaim.
315: Koyukuk-----	Poor: slope.	Probable-----	Probable-----	Poor: area reclaim, slope.
316, 317: Minchumina-----	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, excess humus.
318, 319: Nenana-----	Good-----	Probable-----	Improbable: too sandy.	Fair: small stones, thin layer.
320: Nenana-----	Good-----	Probable-----	Improbable: too sandy.	Fair: small stones, thin layer, slope.
321: Nenana-----	Poor: slope.	Probable-----	Improbable: too sandy.	Poor: slope.
322*: Riverwash.				
323*: Salchaket-----	Good-----	Probable-----	Probable-----	Poor: area reclaim.
Riverwash.				
324*: Steese-----	Poor: depth to rock, slope.	Improbable: excess fines.	Improbable: excess fines.	Poor: slope.
Ester-----	Poor: permafrost, depth to rock, wetness.	Improbable: permafrost, excess humus.	Improbable: permafrost, excess humus.	Poor: permafrost, depth to rock, excess humus.

* See footnote at end of table.

TABLE 7--CONSTRUCTION MATERIALS--Continued

Map symbol and soil name	Roadfill	Sand	Gravel	Topsoil
325: Tanana-----	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost.
326*, 327*: Tanana-----	Poor: permafrost.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost.
Goldstream-----	Poor: permafrost, wetness.	Improbable: permafrost, excess fines.	Improbable: permafrost, excess fines.	Poor: permafrost, wetness.
W*: Water.				

* See description of the map unit for composition and behavior characteristics of the map unit.

Table 8--Water Management

(The information in this table indicates the dominant soil condition but does not eliminate the need for on-site investigation. See text for definitions of terms used in this table. Absence of an entry indicates that no rating is applicable.)

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
301: Cryorthents--	---	---	---	---	---	---	---
302*: Ester-----	Severe: slope, permafrost, depth to rock.	Severe: excess humus, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, depth to rock.	Limitation: slope, wetness, permafrost.	Limitation: slope, permafrost, depth to rock.	Limitation: slope, wetness, permafrost.
Steese-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: slope, soil blowing, depth to rock.	Limitation: erodes easily, slope, depth to rock.	Limitation: erodes easily, slope, depth to rock.
303*: Fubar-----	Severe: seepage.	Severe: large stones, seepage.	Severe: cutbanks cave.	Limitation: deep to water.	Limitation: large stones, droughty.	Limitation: large stones, too sandy, soil blowing.	Limitation: large stones, droughty.
Riverwash----	---	---	---	---	---	---	---
304: Goldstream---	Severe: permafrost.	Severe: piping, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: wetness, permafrost.	Limitation: erodes easily, permafrost.	Limitation: wetness, permafrost.
305: Goldstream---	Severe: permafrost.	Severe: piping, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: slope, wetness, permafrost.	Limitation: erodes easily, permafrost.	Limitation: wetness, permafrost.
306: Goldstream---	Severe: slope, permafrost.	Severe: piping, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: slope, wetness, permafrost.	Limitation: erodes easily, slope, permafrost.	Limitation: slope, wetness, permafrost.
307*: Goldstream---	Severe: permafrost.	Severe: piping, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: wetness, permafrost.	Limitation: erodes easily, permafrost.	Limitation: wetness, permafrost.
Tanana-----	Severe: permafrost.	Severe: piping, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: wetness, permafrost.	Limitation: erodes easily, permafrost.	Limitation: wetness, permafrost.

* See footnote at end of table.

TABLE 8--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
308*: Goldstream---	Severe: permafrost.	Severe: piping, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: wetness, permafrost.	Limitation: erodes easily, permafrost.	Limitation: wetness, permafrost.
Histosols----	---	---	---	---	---	---	---
309*: Goodpaster--- Variant	Severe: permafrost.	Severe: piping, permafrost.	Severe: no water.	Limitation: frost action, permafrost.	Limitation: wetness, permafrost.	Limitation: erodes easily, wetness, permafrost.	Limitation: erodes easily, wetness, permafrost.
Goldstream---	Severe: permafrost.	Severe: piping, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: wetness, permafrost.	Limitation: erodes easily, permafrost.	Limitation: wetness, permafrost.
310*: Gravel pits--	---	---	---	---	---	---	---
311*: Jarvis-----	Severe: seepage.	Severe: seepage.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, slope, soil blowing.	Limitation: erodes easily, too sandy.	Limitation: erodes easily, large stones.
Fubar-----	Severe: seepage.	Severe: large stones, seepage.	Severe: cutbanks cave.	Limitation: deep to water.	Limitation: large stones, slope, droughty.	Limitation: large stones, too sandy, soil blowing.	Limitation: large stones, droughty.
312: Koyukuk-----	Severe: seepage.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, soil blowing.	Limitation: erodes easily, soil blowing.	Limitation: erodes easily.
313: Koyukuk-----	Severe: seepage.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, slope, soil blowing.	Limitation: erodes easily, soil blowing.	Limitation: erodes easily.
314: Koyukuk-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, slope, soil blowing.	Limitation: erodes easily, slope, soil blowing.	Limitation: erodes easily, slope.
315: Koyukuk-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, slope, soil blowing.	Limitation: erodes easily, slope, soil blowing.	Limitation: erodes easily, slope.

* See footnote at end of table.

TABLE 8--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
316: Minchumina---	Severe: permafrost.	Severe: piping, permafrost.	Severe: no water.	Limitation: deep to water.	Limitation: permafrost.	Limitation: erodes easily, permafrost.	Limitation: erodes easily, permafrost.
317: Minchumina---	Severe: permafrost.	Severe: piping, permafrost.	Severe: no water.	Limitation: deep to water.	Limitation: slope, permafrost.	Limitation: erodes easily, permafrost.	Limitation: erodes easily, permafrost.
318: Nenana-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, soil blowing.	Limitation: erodes easily, too sandy.	Limitation: erodes easily.
319: Nenana-----	Severe: seepage.	Severe: seepage, piping.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, slope, soil blowing.	Limitation: erodes easily, too sandy.	Limitation: erodes easily.
320: Nenana-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, slope, soil blowing.	Limitation: erodes easily, slope, too sandy.	Limitation: erodes easily, slope.
321: Nenana-----	Severe: seepage, slope.	Severe: seepage, piping.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, slope, soil blowing.	Limitation: erodes easily, slope, too sandy.	Limitation: erodes easily, slope.
322*: Riverwash----	---	---	---	---	---	---	---
323*: Salchaket----	Severe: seepage.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: erodes easily, flooding, soil blowing.	Limitation: erodes easily, soil blowing.	Limitation: erodes easily.
Riverwash----	---	---	---	---	---	---	---
324*: Steese-----	Severe: seepage, slope.	Severe: piping.	Severe: no water.	Limitation: deep to water.	Limitation: slope, soil blowing, depth to rock.	Limitation: erodes easily, slope, depth to rock.	Limitation: erodes easily, slope, depth to rock.
Ester-----	Severe: slope, permafrost, depth to rock.	Severe: excess humus, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, depth to rock.	Limitation: slope, wetness, permafrost.	Limitation: slope, permafrost, depth to rock.	Limitation: slope, wetness, permafrost.

* See footnote at end of table.

TABLE 8--WATER MANAGEMENT--Continued

Map symbol and soil name	Limitations for--			Features affecting--			
	Pond reservoir areas	Embankments, dikes, and levees	Aquifer-fed excavated ponds	Drainage	Irrigation	Terraces and diversions	Grassed waterways
325: Tanana-----	Severe: permafrost.	Severe: piping, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: wetness, permafrost.	Limitation: erodes easily, permafrost.	Limitation: wetness, permafrost.
326*: Tanana-----	Severe: permafrost.	Severe: piping, permafrost.	Severe: no water.	Limitation: permafrost, subsides.	Limitation: wetness, permafrost.	Limitation: erodes easily, wetness, permafrost.	Limitation: erodes easily, permafrost.
Goldstream---	Severe: permafrost.	Severe: piping, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: wetness, permafrost.	Limitation: erodes easily, permafrost.	Limitation: wetness, permafrost.
327*: Tanana-----	Severe: permafrost.	Severe: piping, permafrost.	Severe: no water.	Limitation: slope, permafrost, subsides.	Limitation: slope, wetness, permafrost.	Limitation: erodes easily, wetness, permafrost.	Limitation: erodes easily, permafrost.
Goldstream---	Severe: permafrost.	Severe: piping, wetness, permafrost.	Severe: no water.	Limitation: frost action, permafrost, subsides.	Limitation: slope, wetness, permafrost.	Limitation: erodes easily, permafrost.	Limitation: wetness, permafrost.
W: Water-----	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 9--ENGINEERING INDEX PROPERTIES

(The symbol < means less than; > means more than. Absence of an entry indicates that data were not estimated.)

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
301*: Cryorthents.											
302*: Ester-----	10-0	Peat	PT	A-8	0	---	---	---	---	---	---
	0-8	Silt loam	ML	A-4	0	100	100	90-100	70-90	25-30	NP-5
	8-16	Ice or frozen soil	---	---	---	---	---	---	---	---	---
	16	weathered bedrock	---	---	---	---	---	---	---	---	---
Steese-----	0-4	Silt loam	ML	A-4	0	100	100	90-100	80-90	25-35	NP-10
	4-14	Silt, silt loam	ML	A-4	0	100	100	90-100	80-90	25-35	NP-10
	14-30	Very channery sandy loam	GM, SM	A-1, A-2	15-20	50-70	30-50	25-45	20-35	---	NP
	30	weathered bedrock	---	---	---	---	---	---	---	---	---
303*: Fubar-----	0-2	Fine sandy loam	SM, ML	A-4	0-10	95-100	90-100	70-80	40-60	15-20	NP-5
	2-60	Stratified extremely cobbly sand to silt loam	GP, GP-GM, SP, SP-SM	A-1	15-45	50-75	30-55	15-35	0-10	---	NP
Riverwash.											
304, 305, 306: Goldstream-----	12-0	Peat	PT	A-8	0	---	---	---	---	---	---
	0-6	Silt loam, mucky silt loam	ML, OL	A-4, A-5	0	100	100	95-100	75-90	30-50	NP-10
	6-12	Silt loam, silt	ML	A-4	0	95-100	95-100	85-100	75-95	25-35	NP-10
	12-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---
307*: Goldstream-----	12-0	Peat	PT	A-8	0	---	---	---	---	---	---
	0-6	Silt loam, mucky silt loam	ML, OL	A-4, A-5	0	100	100	95-100	75-90	30-50	NP-10
	6-12	Silt loam, silt	ML	A-4	0	95-100	95-100	85-100	75-95	25-35	NP-10
	12-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---
Tanana-----	0-7	Silt loam	ML	A-4	0	100	100	95-100	75-90	30-40	NP-10
	7-23	Silt loam, very fine sandy loam	ML	A-4	0	100	100	95-100	75-90	30-40	NP-10
	23-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---
308*: Goldstream-----	12-0	Peat	PT	A-8	0	---	---	---	---	---	---
	0-6	Silt loam, mucky silt loam	ML, OL	A-4, A-5	0	100	100	95-100	75-90	30-50	NP-10
	6-12	Silt loam, silt	ML	A-4	0	95-100	95-100	85-100	75-95	25-35	NP-10
	12-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---

* See footnote at end of table.

TABLE 9--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
308*: (cont'd) Histosols.											
309*: Goodpaster Variant-----	0-15	Silt loam	ML	A-4	0	100	100	90-100	80-90	25-35	NP-10
	15-21	Gravelly silt loam, silt loam	ML	A-4	0	80-90	60-70	55-70	50-65	20-25	NP-5
	21-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---
Goldstream-----	12-0	Peat	PT	A-8	0	---	---	---	---	---	---
	0-6	Silt loam, mucky silt loam	ML, OL	A-4, A-5	0	100	100	95-100	75-90	30-50	NP-10
	6-12	Silt loam, silt	ML	A-4	0	95-100	95-100	85-100	75-95	25-35	NP-10
	12-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---
310*: Gravel pits.											
311*: Jarvis-----	0-6	Very fine sandy loam	ML	A-4	0	100	100	95-100	65-75	25-30	NP-5
	6-10	Very fine sandy loam, silt loam	ML	A-4	0	100	100	95-100	75-90	20-25	NP-5
	10-18	Stratified very fine sand to silt	ML, SM	A-4	0-5	95-100	90-95	70-90	45-65	20-25	NP-5
	18-60	Very gravelly sand, extremely cobbly sand	GP-GM, SP-SM	A-1, A-2	15-55	50-70	30-55	20-30	5-10	---	NP
Fubar-----	0-2	Fine sandy loam	SM, ML	A-4	0-10	95-100	90-100	70-80	40-60	15-20	NP-5
	2-60	Stratified extremely cobbly sand to silt loam	GP, GP-GM, SP, SP-SM	A-1	15-45	50-75	30-55	15-35	0-10	---	NP
312, 313, 314, 315: Koyukuk-----	0-4	Silt loam	ML	A-4	0	100	100	90-100	80-90	25-35	NP-10
	4-43	Silt loam, silt	ML	A-4	0	95-100	95-100	85-100	75-95	25-35	NP-10
	43-60	Very gravelly sand, sand	SP, GP	A-1	5-15	50-70	35-50	15-30	0-5	---	NP
316, 317: Minchumina-----	10-0	Peat	PT	A-8	0	---	---	---	---	---	---
	0-6	Silt loam	ML	A-4	0	100	100	90-100	80-90	25-35	NP-10
	6-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---
318, 319, 320, 321: Nenana-----	0-2	Silt loam	ML	A-4	0	100	100	90-100	80-90	25-35	NP-10
	2-27	Silt loam, silt	ML	A-4	0	100	100	90-100	80-95	25-35	NP-10
	27-60	Fine sand, sand	SP-SM, SM	A-2, A-3	0	90-100	75-100	60-80	5-15	---	NP

* see footnote at end of table.

TABLE 9--ENGINEERING INDEX PROPERTIES--Continued

Map symbol and soil name	Depth	USDA texture	Classification		Frag-ments > 3 inches	Percentage passing sieve number				Liquid limit	Plas-ticity index
			Unified	AASHTO		4	10	40	200		
	In				Pct					Pct	
322*: Riverwash.											
323*: Salchaket-----	0-3	Very fine sandy loam	ML	A-4	0	100	100	90-100	65-75	25-30	NP-5
	3-42	Stratified very fine sandy loam to silt loam	ML, SM	A-4	0	100	95-100	85-95	40-65	25-30	NP-5
	42-60	Very gravelly sand, very gravelly fine sand	GP-GM, SP-SM	A-1	15-35	50-70	30-55	20-30	5-10	---	NP
Riverwash.											
324*: Steese-----	0-4	silt loam	ML	A-4	0	100	100	90-100	80-90	25-35	NP-10
	4-14	Silt, silt loam	ML	A-4	0	100	100	90-100	80-90	25-35	NP-10
	14-30	Very channery sandy loam, extremely channery sandy loam	GM, SM	A-1, A-2	15-20	50-70	30-50	25-45	20-35	---	NP
	30	weathered bedrock	---	---	---	---	---	---	---	---	---
Ester-----	10-0	Peat	PT	A-8	0	---	---	---	---	---	---
	0-8	Silt loam	ML	A-4	0	100	100	90-100	70-90	25-30	NP-5
	8-16	Ice or frozen soil	---	---	---	---	---	---	---	---	---
	16	weathered bedrock	---	---	---	---	---	---	---	---	---
325: Tanana-----	0-7	Silt loam	ML	A-4	0	100	100	95-100	75-90	30-40	NP-10
	7-23	Silt loam, very fine sandy loam	ML	A-4	0	100	100	95-100	75-90	30-40	NP-10
	23-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---
326*, 327*: Tanana,----- moderately wet	0-7	Silt loam	ML	A-4	0	100	100	90-100	75-90	30-40	NP-10
	7-43	Silt loam	ML	A-4	0	100	100	90-100	75-90	30-40	NP-10
	43-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---
Goldstream-----	12-0	Peat	PT	A-8	0	---	---	---	---	---	---
	0-6	Silt loam, mucky silt loam	ML, OL	A-4, A-5	0	100	100	95-100	75-90	30-50	NP-10
	6-12	Silt loam, silt	ML	A-4	0	95-100	95-100	85-100	75-95	25-35	NP-10
	12-60	Ice or frozen soil	---	---	---	---	---	---	---	---	---

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 10--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS

(The symbol < means less than; > means more than. Entries under "Erosion factors--T" apply to the entire profile. Entries under "wind erodibility group" and "Organic matter" apply only to the surface layer. Absence of an entry indicates that data were not available or were not estimated.)

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		wind erodibility group	Organic matter
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
301*: Cryorthents.											
302*: Ester-----	10-0 0-8 8-16 16	0-2 5-10 --- ---	0.05-0.10 1.10-1.20 --- ---	2.0-6.0 0.6-2.0 --- ---	0.25-0.30 0.20-0.22 --- ---	<4.5 4.5-5.5 --- ---	Low----- Low----- ----- -----	0.05 0.37 ----- -----	1	8	80-95
Steese-----	0-4 4-14 14-30 30	0-5 0-5 0-5 ---	1.10-1.20 1.10-1.20 1.30-1.40 ---	0.6-2.0 0.6-2.0 2.0-6.0 ---	0.20-0.22 0.20-0.22 0.05-0.10 ---	5.1-6.0 5.1-6.0 5.6-6.5 ---	Low----- Low----- Low----- -----	0.37 0.43 0.15 -----	2	2	2-6
303*: Fubar-----	0-2 2-60	5-10 0-5	1.20-1.30 1.50-1.60	0.6-2.0 6.0-20	0.15-0.17 0.04-0.06	5.6-6.5 5.6-7.3	Low----- Low-----	0.28 0.05	1	3	2-4
Riverwash.											
304, 305, 306: Goldstream-----	12-0 0-6 6-12 12-60	0-2 5-10 5-10 ---	0.08-0.12 1.10-1.20 1.10-1.20 ---	2.0-6.0 0.6-2.0 0.6-2.0 ---	0.25-0.30 0.20-0.22 0.20-0.22 ---	<4.5 4.5-5.5 4.5-5.5 ---	Low----- Low----- Low----- -----	0.05 0.37 0.43 -----	1	8	85-95
307*: Goldstream-----	12-0 0-6 6-12 12-60	0-2 5-10 5-10 ---	0.08-0.12 1.10-1.20 1.10-1.20 ---	2.0-6.0 0.6-2.0 0.6-2.0 ---	0.25-0.30 0.20-0.22 0.20-0.22 ---	<4.5 4.5-5.5 4.5-5.5 ---	Low----- Low----- Low----- -----	0.05 0.37 0.43 -----	1	8	85-95
Tanana-----	0-7 7-23 23-60	5-10 5-10 ---	1.10-1.20 1.10-1.20 ---	0.6-2.0 0.6-2.0 ---	0.20-0.22 0.20-0.22 ---	5.6-7.3 5.6-7.3 ---	Low----- Low----- -----	0.37 0.43 -----	2	2	2-6
308*: Goldstream-----	12-0 0-6 6-12 12-60	0-2 5-10 5-10 ---	0.08-0.12 1.10-1.20 1.10-1.20 ---	2.0-6.0 0.6-2.0 0.6-2.0 ---	0.25-0.30 0.20-0.22 0.20-0.22 ---	<4.5 4.5-5.5 4.5-5.5 ---	Low----- Low----- Low----- -----	0.05 0.37 0.43 -----	1	8	85-95
Histosols.											
309*: Goodpaster----- Variant	0-15 15-21 21-60	5-10 0-5 ---	1.10-1.20 1.20-1.30 ---	0.6-2.0 0.6-2.0 ---	0.20-0.22 0.18-0.20 ---	5.1-6.0 5.6-6.5 ---	Low----- Low----- -----	0.37 0.37 -----	1	2	3-6

* See footnote at end of table.

TABLE 10--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		wind erodibility group	Organic matter group
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
309*: (cont'd) Goldstream-----	12-0	0-2	0.08-0.12	2.0-6.0	0.25-0.30	<4.5	Low-----	0.05	1	8	85-95
	0-6	5-10	1.10-1.20	0.6-2.0	0.20-0.22	4.5-5.5	Low-----	0.37			
	6-12	5-10	1.10-1.20	0.6-2.0	0.20-0.22	4.5-5.5	Low-----	0.43			
	12-60	---	---	---	---	---	-----	---			
310*: Gravel pits.											
311*: Jarvis-----	0-6	5-10	1.10-1.20	0.6-2.0	0.19-0.22	5.1-6.5	Low-----	0.37	1	2	3-6
	6-10	5-10	1.10-1.20	0.6-2.0	0.18-0.20	5.1-6.5	Low-----	0.43			
	10-18	0-10	1.10-1.20	0.6-2.0	0.15-0.18	5.6-7.3	Low-----	0.32			
	18-60	0-5	1.60-1.70	6.0-20	0.03-0.06	5.6-7.3	Low-----	0.05			
Fubar-----	0-2	5-10	1.20-1.30	0.6-2.0	0.15-0.17	5.6-6.5	Low-----	0.28	1	3	2-4
	2-60	0-5	1.50-1.60	6.0-20	0.04-0.06	5.6-7.3	Low-----	0.05			
312, 313, 314, 315: Koyukuk-----	0-4	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.1-6.0	Low-----	0.37	3	2	3-6
	4-43	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.6-7.3	Low-----	0.43			
	43-60	0-5	1.50-1.60	6.0-20	0.02-0.04	5.6-7.3	Low-----	0.05			
316, 317: Minchumina-----	10-0	0-2	0.25-0.50	2.0-6.0	0.25-0.30	4.5-5.5	Low-----	0.05	1	8	80-95
	0-6	5-10	1.10-1.20	0.6-2.0	0.20-0.22	4.5-6.0	Low-----	0.37			
	6-60	---	---	---	---	---	-----	---			
318, 319, 320, 321: Nenana-----	0-2	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.1-6.0	Low-----	0.37	2	2	3-6
	2-27	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.1-6.5	Low-----	0.43			
	27-60	0-5	1.30-1.40	6.0-20	0.04-0.06	5.6-6.5	Low-----	0.15			
322*: Riverwash.											
323*: Salchaket-----	0-3	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.1-6.0	Low-----	0.37	3	2	3-6
	3-42	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.6-6.5	Low-----	0.43			
	42-60	0-5	1.50-1.60	6.0-20	0.02-0.04	6.1-7.3	Low-----	0.05			
Riverwash.											
324*: Steese-----	0-4	0-5	1.10-1.20	0.6-2.0	0.20-0.22	5.1-6.0	Low-----	0.37	2	2	2-6
	4-14	0-5	1.10-1.20	0.6-2.0	0.20-0.22	5.1-6.0	Low-----	0.43			
	14-30	0-5	1.30-1.40	2.0-6.0	0.05-0.10	5.6-6.5	Low-----	0.15			
	30	---	---	---	---	---	-----	---			
Ester-----	10-0	0-2	0.05-0.10	2.0-6.0	0.25-0.30	<4.5	Low-----	0.05	1	8	80-95
	0-8	5-10	1.10-1.20	0.6-2.0	0.20-0.22	4.5-5.5	Low-----	0.37			
	8-16	---	---	---	---	---	-----	---			
	16	---	---	---	---	---	-----	---			

* See footnote at end of table.

TABLE 10--PHYSICAL AND CHEMICAL PROPERTIES OF THE SOILS--Continued

Map symbol and soil name	Depth	Clay	Moist bulk density	Permeability	Available water capacity	Soil reaction	Shrink-swell potential	Erosion factors		wind erodibility group	Organic matter group
								K	T		
	In	Pct	G/cc	In/hr	In/in	pH					Pct
325: Tanana-----	0-7	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.1-6.0	Low-----	0.37	2	2	2-6
	7-23	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.6-7.3	Low-----	0.43			
	23-60	---	---	---	---	---	-----	---			
326*, 327*: Tanana,----- moderately wet	0-7	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.1-6.0	Low-----	0.37	3	2	2-6
	7-43	5-10	1.10-1.20	0.6-2.0	0.20-0.22	5.6-7.3	Low-----	0.43			
	43-60	---	---	---	---	---	-----	---			
Goldstream-----	12-0	0-2	0.08-0.12	2.0-6.0	0.25-0.30	<4.5	Low-----	0.05	1	8	85-95
	0-6	5-10	1.10-1.20	0.6-2.0	0.20-0.22	4.5-5.5	Low-----	0.37			
	6-12	5-10	1.10-1.20	0.6-2.0	0.20-0.22	4.5-5.5	Low-----	0.43			
	12-60	---	---	---	---	---	-----	---			

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 11--WATER FEATURES

("Flooding" and "water table" and terms such as "occasional," "brief," "apparent," and "perched" are explained in the text. The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated.)

Map symbol and soil name	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
301*: Cryorthents.					Ft		
302*: Ester-----	D	None-----	---	---	0-1.0	Perched	Jan-Dec
Steese-----	B	None-----	---	---	>6.0	---	---
303*: Fubar-----	C	Occasional-----	Brief-----	May-Aug	3.0-6.0	Apparent	Jun-Aug
Riverwash.							
304, 305, 306: Goldstream-----	D	None-----	---	---	+0.5-0.5	Perched	Jan-Dec
307*: Goldstream-----	D	None-----	---	---	+0.5-0.5	Perched	Jan-Dec
Tanana-----	D	None-----	---	---	1.0-2.0	Perched	Jan-Dec
308*: Goldstream-----	D	None-----	---	---	+0.5-0.5	Perched	Jan-Dec
Histosols.							
309*: Goodpaster Variant-----	D	None-----	---	---	1.0-2.0	Perched	Jan-Dec
Goldstream-----	D	None-----	---	---	+0.5-0.5	Perched	Jan-Dec
310*: Gravel pits.							
311*: Jarvis-----	B	Occasional-----	Brief-----	May-Aug	>6.0	---	---
Fubar-----	C	Occasional-----	Brief-----	May-Aug	3.0-6.0	Apparent	Jun-Aug
312, 313, 314, 315: Koyukuk-----	B	None-----	---	---	>6.0	---	---
316, 317: Minchumina-----	D	None-----	---	---	>6.0	---	---
318, 319, 320, 321: Nenana-----	B	None-----	---	---	>6.0	---	---
322*: Riverwash.							

*See footnote at end of table.

TABLE 11--WATER FEATURES--Continued

Map symbol and soil name	Hydrologic group	Flooding			High water table		
		Frequency	Duration	Months	Depth	Kind	Months
323*: Salchaket----- Riverwash.	B	Occasional-----	Brief-----	May-Sep	Ft >6.0	---	---
324*: Steese----- Ester-----	B D	None----- None-----	--- ---	--- ---	>6.0 0-1.0	--- Perched	--- Jan-Dec
325: Tanana-----	D	None-----	---	---	1.0-2.0	Perched	Jan-Dec
326*, 327*: Tanana, moderately----- wet	C	None-----	---	---	2.5-5.0	Perched	Jan-Dec
Goldstream-----	D	None-----	---	---	+0.5-0.5	Perched	Jan-Dec

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 12--HYDRIC SOILS LIST

Map units are listed in alpha-numeric order by map unit symbol. The "Hydric soils criteria" columns indicate the conditions that caused the map unit component to be classified as "Hydric" or "Non-Hydric". These criteria are defined in "Hydric soils of the United States" (USDA Miscellaneous Publication No. 1491, June 1991). See the "Criteria for Hydric soils" endnote to determine the meaning of these columns. Spot symbols are footnoted at the end of the table.

Map symbol and map unit name	Component/inclusion	Hydric	Local landform	Hydric soils criteria			
				Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
301: Cryorthents, flooded	Cryorthents	No	---	---	---	---	---
	Aquepts	Yes	Terrace	2b3	Yes	No	No
	Deeper soils	No	---	---	---	---	---
	Gravelly soils	No	---	---	---	---	---
302: Ester-Steese association, 7 to 12 percent slopes	Ester	Yes	Hill	2b3	Yes	No	No
	Steese	No	---	---	---	---	---
	Shallower soils	No	---	---	---	---	---
	Steeper slopes	No	---	---	---	---	---
303: Fubar and Riverwash, 0 to 3 percent slopes	Fubar	No	---	---	---	---	---
	Riverwash	Yes	Flood plain	4	No	Yes	No
	Steeper soils	No	---	---	---	---	---
304: Goldstream peat, 0 to 3 percent slopes	Goldstream	Yes	Alluvial flat	2b3,3	Yes	No	Yes
	Steeper slopes	No	---	---	---	---	---
	Histosols	Yes	Alluvial flat	1	No	No	No
305: Goldstream peat, 3 to 7 percent slopes	Goldstream	Yes	Alluvial flat	2b3	Yes	No	No
	Steeper slopes	Yes	Alluvial flat	---	---	---	---
	Histosols	Yes	Alluvial flat	1	No	No	No
306: Goldstream peat, 7 to 12 percent slopes	Goldstream	Yes	Moraine	2b3	Yes	No	No
	Steeper slopes	No	---	---	---	---	---
	Histosols	Yes	Depression	1	No	No	No
307: Goldstream-Tanana complex 0 to 3 percent slopes	Goldstream	Yes	Alluvial flat	2b3	Yes	No	No
	Tanana	Yes	Alluvial flat	2b3	Yes	No	No
	Histosols	Yes	Depression	1	No	No	No

Table 12--Hydric Soils List--Continued

Map symbol and map unit name	Component/inclusion	Hydric	Local landform	Hydric soils criteria			
				Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
308: Goldstream and Histosols, 0 to 3 percent slopes	Goldstream	Yes	Alluvial flat	2b3,3	Yes	No	Yes
	Histosols	Yes	depression	1	No	No	No
	Aquepts	Yes	Alluvial flat	2b3	Yes	No	No
309: Goodpaster Variant- Goldstream complex, 0 to 3 percent slopes	Goodpaster Variant	Yes	Alluvial flat	2b3	Yes	No	No
	Goldstream	Yes	Depression	2b3	Yes	No	No
	Shallower soils	Yes	Alluvial flat	2b3	Yes	No	No
	Steeper slopes	No	---	---	---	---	---
310: Gravel pits	Gravel pits	No	---	---	---	---	---
311: Jarvis-Fubar complex, 0 to 7 percent slopes	Jarvis	No	---	---	---	---	---
	Fubar	No	---	---	---	---	---
	Steeper slopes	No	---	---	---	---	---
	Fluents	Yes	Flood plain	4,2b3	Yes	Yes	No
312: Koyukuk silt loam, 0 to 3 percent slopes	Koyukuk	No	---	---	---	---	---
	Aquepts	Yes	Moraine	2b3	Yes	No	No
	Permafrost soils	Yes	Moraine	2b3	Yes	No	No
	Steeper slopes	No	---	---	---	---	---
313: Koyukuk silt loam, 3 to 7 7 percent slopes	Koyukuk	No	---	---	---	---	---
	Aquepts	Yes	Moraine	2b3	Yes	No	No
	Permafrost soils	Yes	Moraine	2b3	Yes	No	No
	Steeper slopes	No	---	---	---	---	---
314: Koyukuk silt loam, 7 to 12 percent slopes	Koyukuk	No	---	---	---	---	---
	Permafrost soils	Yes	Moraine	2b3	Yes	No	No
	Steeper slopes	No	---	---	---	---	---
315: Koyukuk silt loam, 12 to 45 percent slopes	Koyukuk	No	---	---	---	---	---
	Steeper slopes	No	---	---	---	---	---
	Shallower soils	No	---	---	---	---	---

Table 12--Hydric Soils List--Continued

Map symbol and map unit name	Component/inclusion	Hydric	Local landform	Hydric soils criteria			
				Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
316: Minchumina peat, 0 to 3 percent slopes	Minchumina	No	---	---	---	---	---
	Steeper slopes	No	---	---	---	---	---
	Histosols	Yes	Depression	1	No	No	No
317: Minchumina peat, 3 to 7 percent slopes	Minchumina	No	---	---	---	---	---
	Steeper slopes	No	---	---	---	---	---
	Histosols	Yes	Depression	1	No	No	No
318: Nenana silt loam, 0 to 3 percent slopes	Nenana	No	---	---	---	---	---
	Permafrost soils	Yes	Depression	2b3	Yes	No	No
	Steeper slopes	No	---	---	---	---	---
319: Nenana silt loam, 3 to 7 percent slopes	Nenana	No	---	---	---	---	---
	Permafrost soils	Yes	Depression	2b3	Yes	No	No
	Steeper slopes	No	---	---	---	---	---
320: Nenana silt loam, 7 to 12 percent slopes	Nenana	No	---	---	---	---	---
	Permafrost soils	Yes	Depression	2b3	Yes	No	No
	Steeper slopes	No	---	---	---	---	---
321: Nenana silt loam, 12 to 45 percent slopes	Nenana	No	---	---	---	---	---
	Shallower soils	No	---	---	---	---	---
	Steeper slopes	No	---	---	---	---	---
322: Riverwash	Riverwash	Yes	Flood plain	4	No	Yes	No
323: Salchaket-Riverwash association, 0 to 3 percent slopes	Salchaket	No	---	---	---	---	---
	Riverwash	Yes	Flood plain	4	No	Yes	No
	Permafrost soils	Yes	Flood plain	2b3	Yes	No	No
	Gravelly soils	No	---	---	---	---	---
	Steeper slopes	No	---	---	---	---	---
324: Steese-Ester association, 12 to 45 percent slopes	Steese	No	---	---	---	---	---
	Ester	Yes	Hill	2b3	Yes	No	No

Table 12--Hydric Soils List--Continued

Map symbol and map unit name	Component/inclusion	Hydric	Local landform	Hydric soils criteria			
				Hydric criteria code	Meets saturation criteria	Meets flooding criteria	Meets ponding criteria
324: Steese-Ester association, 12 to 45 percent slopes (cont'd)	Shallower soils	No	---	---	---	---	---
	Steeper slopes	No	---	---	---	---	---
325: Tanana silt loam, 0 to 3 percent slopes	Tanana	Yes	Alluvial flat	2b3	Yes	No	No
	Steeper slopes	No	---	---	---	---	---
	Fluvents	Yes	Flood plain	4	No	Yes	No
326: Tanana, moderately wet- Goldstream complex, 0 to 3 percent slopes	Tanana	No	---	---	---	---	---
	Goldstream	Yes	Depression	2b3,3	Yes	No	Yes
	Histosols	Yes	Depression	1	No	No	No
	Steeper slopes	No	---	---	---	---	---
327: Tanana, moderately wet- Goldstream complex, 3 to 7 percent slopes	Tanana	No	---	---	---	---	---
	Goldstream	Yes	Alluvial flat	2b3	Yes	No	No
	Histosols	Yes	Depression	1	No	No	No
	Steeper slopes	No	---	---	---	---	---
W: Water	Water	No	---	---	---	---	---

FOOTNOTE: There may be small areas of included soils or miscellaneous areas that are significant to use and management of the soil yet are too small to delineate on the soil map at the map's original scale. These may be designated as spot symbols and are defined in the published Soil Survey Report or the USDA-NRCS Technical Guide, Part II.

ENDNOTE: HYDRIC SOILS CRITERIA CODES AND DEFINITIONS

1. All Histosols, except Folists, or
2. Soils in Aquic suborder, Aquic subgroup, Albolls suborder, Salorthids great group, Pell great group of Vertisols, Pachic subgroup, or Cumulic subgroups that are:
 - a. somewhat poorly drained and have a frequently occurring water table less than 0.5 feet from the surface for a significant period (usually 14 consecutive days or more) during the growing season, or
 - b. poorly drained or very poorly drained and have either:
 - (1) a frequently occurring water table less than 0.5 feet from the surface for a significant period (usually 14 consecutive days or more) during the growing season if textures are coarse sand, sand, or fine sand in all layers within 20 inches, or for other soils,
 - (2) a frequently occurring water table less than 1.0 feet from the surface for a significant period (usually 14 consecutive days or more) during the growing season if permeability is equal to or greater than 6.0 in/hr in all layers within 20 inches, or
 - (3) a frequently occurring water table less than 1.5 feet from the surface for a significant period (usually 14 consecutive days or more) during the growing season if permeability is less than 6.0 in/hr in any layers within 20 inches, or
3. Soils that are frequently ponded for long or very long duration during the growing season, or
4. Soils that are frequently flooded for long or very long duration during the growing season.

TABLE 13--SOIL FEATURES

(The symbol < means less than; > means more than. Absence of an entry indicates that the feature is not a concern or that data were not estimated)

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	in		Initial	Total		Uncoated steel	Concrete
301*: Cryorthents.							
302*: Ester-----	12-20	Soft	1-3	2-3	High-----	High-----	High.
Steese-----	20-40	Soft	---	---	Moderate-----	Moderate-----	Moderate.
303*: Fubar-----	>60	---	---	---	Low-----	Moderate-----	Moderate.
Riverwash.							
304, 305, 306: Goldstream-----	>60	---	1-6	6-12	Moderate-----	High-----	High.
307*: Goldstream-----	>60	---	1-6	6-12	Moderate-----	High-----	High.
Tanana-----	>60	---	1-3	3-6	High-----	Moderate-----	Moderate.
308*: Goldstream-----	>60	---	1-6	6-12	Moderate-----	High-----	High.
Histosols.							
309*: Goodpaster Variant-----	>60	---	1-3	3-6	High-----	Moderate-----	Moderate.
Goldstream-----	>60	---	1-6	6-12	Moderate-----	High-----	High.
310*: Gravel pits.							
311*: Jarvis-----	>60	---	---	---	Moderate-----	Moderate-----	Moderate
Fubar-----	>60	---	---	---	Low-----	Moderate-----	Moderate
312, 313, 314, 315: Koyukuk-----	>60	---	---	---	High-----	Moderate-----	Moderate
316, 317: Minchumina-----	>60	---	0-5	5-10	High-----	High-----	High
318, 319, 320, 321: Nenana-----	>60	---	---	---	High-----	Moderate-----	Moderate.
322*: Riverwash.							

* See footnote at end of table.

TABLE 13--SOIL FEATURES--Continued

Map symbol and soil name	Bedrock		Subsidence		Potential frost action	Risk of corrosion	
	in		Initial	Total		Uncoated steel	Concrete
323*: Salchaket----- Riverwash.	>60	---	---	---	Moderate-----	Moderate-----	Moderate.
324*: Steese----- Ester-----	20-40	Soft	---	---	Moderate-----	Moderate-----	Moderate.
	12-20	Soft	1-2	2-3	High-----	High-----	High.
325: Tanana-----	>60	---	1-3	3-6	High-----	Moderate-----	Moderate.
326*, 327*: Tanana, moderately wet	>60	---	0-1	1-3	Moderate-----	Moderate-----	Moderrate
Goldstream-----	>60	---	1-6	6-12	Moderate-----	Moderate-----	Mopderate

* See description of the map unit for composition and behavior characteristics of the map unit.

TABLE 14--CLASSIFICATION OF THE SOILS

Soil name	Family or higher taxonomic class
Cryorthents-----	Cryorthents
Ester-----	Loamy, mixed, acid Histic Pergelic Cryaquepts
Fubar-----	Sandy-skeletal, mixed Typic Cryofluvents
Goldstream-----	Loamy, mixed, acid Histic Pergelic Cryaquepts
Goodpaster Variant-----	Coarse-silty over sandy or sandy-skeletal, mixed, nonacid Pergelic Cryaquepts
Histosols-----	Histosols
Jarvis-----	Coarse-loamy over sandy or sandy-skeletal, mixed, nonacid Typic Cryofluvents
Koyukuk-----	Coarse-silty, mixed Typic Cryochrepts
Minchumina-----	Loamy, mixed, nonacid Pergelic Cryorthents
Nenana-----	Coarse-silty over sandy or sandy-skeletal, mixed Typic Cryochrepts
Salchaket-----	Coarse-loamy, mixed, nonacid Typic Cryofluvents
Steese-----	Coarse-loamy, mixed Typic Cryochrepts
Tanana-----	Loamy, mixed, nonacid Pergelic Cryaquepts