UNITED STATES DEPARTMENT OF AGRICULTURE

SOIL CONSERVATION SERVICE

Supplement to

SOIL SURVEY OF FAIRBANKS AREA, ALASKA

September 1963

containing

SOIL INTERPRETATIONS

for

NONAGRICULTURAL PLANNING AND DEVELOPMENT

Soil Conservation Service
April 1974

The soil survey of the Fairbanks Area, Alaska, published in September 1963, included some interpretations of soil properties for use by engineers and others involved in construction, but emphasized interpretations for agricultural use of the soils. This supplement contains additional interpretations for use by planners, contractors, engineers, home builders, and others concerned with nonfarm uses of soils. Detailed descriptions of the soils and soil maps are in the original report and are not repeated here.

Among properties of soils that are highly important in engineering are permeability, strength or bearing capacity, compaction characteristics, drainage condition, shrink-swell potential, particle-size distribution, plasticity, and reaction. Depth to the water table and to permafrost, and soil slope are also of considerable importance. These properties, in various degrees and combinations, affect construction and maintenance of roads, airstrips, pipelines, foundations for small buildings, embankments and dams, and systems for disposal of sewage and refuse.

The information in this supplement can be helpful to those who--

1. Select potential residential, industrial, commercial, and recreational areas.
2. Evaluate alternate routes for roads, pipelines, and underground cables.
3. Seek sources of gravel or sand.
4. Correlate performance of structures already built with properties of the kinds of soil on which they are built, for the purpose of

predicting performance of structures on the same or similar kinds of soil in other locations.

5. Predict the trafficability of soils for off-road movement of vehicles and construction equipment.

6. Develop preliminary estimates pertinent to construction in a particular area.

Much of the basic information on which the interpretations are based is presented in Table 1. This table of estimated physical properties is revised from the comparable table in the original report to reflect more recent information and new national standards for presentation of information of this kind. Interpretations for various engineering uses of soils are presented in Table 2. From the information given in the original publication and this supplement, along with the soil map, it is possible to make interpretations in addition to those given in Table 2 and to make other useful maps.

This information, however, does not eliminate the need for further investigations at sites selected for engineering works, especially works that involve heavy loads or that require excavations to depths greater than shown in the tables. Also, inspection of the sites, especially the small ones, is needed because the delineated areas of a given mapping unit may contain small areas of other kinds of soil that have strongly contrasting properties and different suitabilities or limitations for soil engineering.

How to Use this Report

The first step in using this supplement is to determine, from the soil map in the original report, the soil series and phases included in the area of interest and to read the descriptions of the soils in that report. It is then only necessary to consult Table 2 in this supplement to determine the degree of limitation for any specific use or uses. The table also indicates the principal reasons for any adverse rating. The criteria used in making assessments of soil limitations are discussed in this supplement. It should be noted that, in many cases, even severe limitations can be overcome by appropriate design of structure or installation, though costs of construction and maintenance may be considerably higher than average. For example, flood proofing of structures may overcome many of the hazards of building on flood plains.

For planners and others concerned with the entire soil survey area, it is possible to depict the location of soils that are suitable (or impractical) for a particular use by coloring or otherwise marking areas on the soil map according to their degree of limitation. For example, a list of mapping units and their symbols can be made of soils that have slight limitations for sanitary landfills. All areas with the listed symbols on the soil map can then be colored green. Similar lists can be made of soils with moderate and severe limitations for this use, and corresponding areas can be colored yellow and red. The completed colored map will then indicate at a glance where sanitary landfills are easily developed, where they are possible if moderate limitations are overcome, and where they are impractical because of severe limitations. Similar coloring or marking schemes are possible for any other potential use or combination of uses.

It is important to recognize that, because of the map scale used in most surveys, very small soil areas cannot be shown. Many mapped areas, therefore, include spots of soils of some other kind that are too small to delineate separately. Also, in this survey soils were examined only to a depth of 40 to 60 inches. Though the properties of material beneath this depth can commonly be inferred from the soil description, no actual observations were made. The soil map is a guide to probable soil conditions at any point, but <u>it cannot be used as a substitute for detailed investigations at the site of any proposed construction</u>.

Engineering Soil Classification Systems

Two systems most commonly used in classifying samples of soils for engineering purposes are the Unified system used by the Soil Conservation Service, Department of Defense (3), and other agencies, and the system adopted by the American Association of State Highway Officials (1).

The Unified system is used to classify soils according to those properties that affect use as a construction material for purposes other than highway construction and maintenance, and as a foundation material. In this system soils are classified according to particle-size distribution, plasticity, and organic matter content and are grouped in 15 classes. There are eight classes of coarse-grained soils, identified as GW, GP, GM, GC, SW, SP, SM, and SC; six classes of fine-grained soils, identified as ML, CL, OL, MH, CH, and OH; and one class of highly organic soils, identified as Pt. Soils with properties intermediate between two classes are designated by a hyphenated symbol; for example, CL-ML.

The AASHO system is used primarily to classify soils according to properties that are important in highway construction and maintenance. There are seven basic groups in this system, A-1 through A-7, defined by grain-size distribution, liquid limit, and plasticity index. In group A-1 are gravelly soils of high bearing strength, or the best soils for subgrades. At the other extreme, in group A-7, are clayey soils that are poor for subgrades. An additional group, A-8, is used to identify organic soils.

Both Unified and AASHO classifications are given in Table 1 for all soils mapped in the Fairbanks area. More detailed explanations of both systems are given in the PCA Soil Primer (2) and in standard textbooks on soil mechanics.

In addition to the engineering classifications, Table 1 gives soil textures according to the classification of the U.S. Department of Agriculture. The U.S.D.A. texture is determined by the relative proportions of sand, silt, and clay in soil material that passes the No. 10 (2 mm) sieve. If the soil contains gravel or other particles coarser than 2 mm, or large quantities of organic matter, a modifier such as "gravelly" or "mucky" is added to the textural class name. Definitions of some of the terms used in the U.S.D.A. textural classification are given in the original Fairbanks Area soil survey report.

Soil Properties Significant in Engineering

Estimates of several properties of soils that are significant in engineering are given in Table 1. These estimates are made for typical soil profiles, by layers sufficiently contrasting so that there are important engineering differences. They are based on field observations made in the course of mapping, on test data for these and similar soils, and on experience with similar soils in other areas.

Some of the properties estimated in Table 1 are discussed below.

Depth to seasonally high water table refers to distance from the surface of the mineral soil to the highest level reached by ground water in most years before clearing of the native vegetation. Temporary wetness during the spring thaw is not considered. In soils with free water perched above permafrost, the water table may be lower after the surface mat of vegetation is removed and the permafrost table drops.

Depth to the permafrost table refers to distance from the surface of the mineral soil to the upper level of perennially frozen soil--that is, soil in which the temperature does not exceed 32°F at any time during the year--under the native vegetation. When the vegetation and the mat of organic material on the soil surface is removed, the permafrost table recedes to much greater depths.

Liquid limit and plasticity index are measures of the effect of water on the strength and consistence of soil material. As the moisture content of a fine-grained soil is increased from a dry state, the soil at a particular moisture percentage changes from a noncohesive to a moldable or plastic state. This is the plastic limit. At a still higher moisture percentage the soil becomes sufficiently fluid to flow when lightly jarred. This is the liquid limit. The numerical difference between the plastic and liquid limits is called the plasticity index, and indicates the magnitude of the range of moisture contents over which the soil is in a plastic condition.

Permeability is the property of a soil that enables it to transmit water or air. The estimates in Table 2 are based largely on field observations of soil texture and structure, and are for soils that have not been compacted. For wet or frozen soils, the permeability is that to be expected after thawing of permafrost and removal of free water.

Available water capacity is defined as the difference between the amount of water the soil can hold against the force of gravity and the amount it contains at the wilting point of most crop plants. It represents the ability of the soil to furnish water for plants. In poorly drained soils, water in excess of this amount is normally present before drainage.

Reaction is the degree of acidity of alkalinity of a soil, expressed as pH values.

Shrink-swell potential is the relative change in volume of soil material to be expected with changes in moisture content; that is, the extent to which the soil shrinks as it dries or swells as it is moistened. A high shrink-swell potential indicates a hazard to maintenance of structures built in, on, or with soil having this rating.

Soil Limitation and Suitability Ratings

For most purposes, three degrees of limitation or suitability are recognized in Table 2. These are defined as follows:

Slight or Good - Soils are relatively free of limitations for the intended use, or the limitations are easy to overcome.

Moderate or Fair - Soils have some limitations for the intended use because of slope, texture, depth, wetness, flooding or some other property or environmental consideration. Normally, these limitations can be overcome by good planning, design, or management.

Severe or Poor - Soils with limitations that are difficult or not economically feasible to overcome. Reasons for this rating include steep slopes, flooding, and stoniness. In some cases, however, the soils may be made suitable for the intended purpose by major reclamation work or careful design.

A rating of unsuited is used only in evaluating soils as sources of sand or gravel.

Roadfill - Ratings for this purpose indicate how well a soil is expected to perform after it is removed from its original location and placed as a subgrade material elsewhere. They also are intended to evaluate soil characteristics that influence the difficulty of excavation of the soil. It is assumed, in the suitability ratings, that the whole soil to a depth of 5 or 6 feet will be thoroughly mixed and will be used in embankments that are less than 6 feet high. For higher embankments, roadfill requirements are more stringent.

Soils that are considered to be good sources of roadfill are at least moderately well drained, and dominantly sandy or gravelly with low plasticity, low susceptibility to frost action, and low shrink-swell potential. They have only a few large stones and have slopes of less than

15 percent. Poor sources of roadfill are soils that are clayey or plastic, highly organic, highly susceptible to frost action, very stony, or poorly drained, or that have slopes steeper than 30 percent. Fair sources have intermediate properties.

Gravel - Soils are considered to be suitable sources of gravel if they are underlain by or contain a layer at least 3 feet thick and the upper limit of this layer is no more than 6 feet deep. In soils with a rating of good, at least 50 percent of the material in the gravelly layer is coarser than 0.7 mm (approximately .03 inch), a significant portion of this is coarser than 4.8 mm (approximately 0.2 inch), and less than 5 percent of the material is silt or clay. A rating of poor is given where silt and clay comprise more than 12 percent of the soil. Soils that contain less than 25 percent gravel are rated as unsuited.

Sand - Suitability ratings for sand are similar to those for gravel, except that sand and gravel combined must make up at least 50 percent of the coarse-textured layer and significant portion of the layer must be of sand size (0.7 to 4.8 mm, or approximately 0.03 to 0.2 inch).

Topsoil - The term "topsoil", as used here, refers to soil material used to cover surfaces that are barren as a result of construction activities in order to create more suitable conditions for the establishment and maintenance of vegetation. The properties considered in rating soils as sources of topsoil are those that affect ease of handling and suitability as a seedbed for a new planting. Also considered are features that determine the difficulty of excavating and of reclaiming the site after excavation.

Soils that are good sources of topsoil have more than 16 inches of loamy, friable material, less than 3 percent by volume of gravel or stones, slopes of 7 percent or less, and are better than poorly drained. Poor soils are sands or clays, are less than 8 inches thick over unsuitable material, have more than 15 percent gravel or stones, have slopes steeper than 12 percent, or are poorly drained.

<u>Septic tank absorption fields</u> - These are soil absorption systems for sewage disposal, consisting of subsurface tile systems laid out in such a way that effluent from the septic tank is distributed with reasonable uniformity into the natural soil. Criteria used for rating soils for this purpose are based on their ability to absorb effluent. The portion of the soil that is rated is that which lies at and below the depth of the tile line. Factors that are considered are soil permeability, depth to impervious or slowly permeable layers, seasonal ground water levels, flooding, and slope.

Soils with slight limitations are those with permeability rate of more than 1 inch per hour (but see below), the water table and any impervious layer at least 4 feet below the tile level, and no permafrost. They may not be subject to flooding, and slopes must be 7 percent or less. For ease of construction, they should be free of large stones and boulders. Some sandy or very gravelly soils are so porous that unfiltered raw sewage may pass through them and contaminate the ground water or nearby lakes and streams. Although such soils are rated as having slight limitations for septic tank absorption fields, this hazard must be considered before installation.

Soils are considered to have severe limitations if permeability is less than 0.6 inches per hour, the water table or an impervious layer is less than 2 feet below the tile line, slopes are steeper than 12 percent, flooding is likely, or if they are perennially frozen at some depth.

Sewage lagoons - Sewage lagoons--constructed shallow ponds used to hold sewage for the time required for bacterial decomposition--require soils that are capable of holding water with minimum seepage and contamination of ground or surface water. Factors that are important in rating soils for this use are soil texture, organic matter content, permeability, depth to the water table, sesceptibility to flooding, and permafrost.

Soils with slight limitations are those with a deep water table, a permeability rate slower than 0.6 inches per hour, and a slope of 3 percent or less. For proper compaction, the soils should contain few large stones and the organic matter content should be less than 2 percent. They should have no permafrost and should never flood. Severe limitations exist where the water table is less than 40 inches deep, permeability is greater than 2 inches per hour, slopes are steeper than 7 percent, or organic matter content is higher than 15 percent. All very stony soils, soils subject to flooding, and soils with permafrost are also considered to have severe limitations.

Sanitary landfill (trench type) - A trench-type sanitary landfill is an excavated trench in which refuse is buried daily with a layer of soil material at least 6 inches thick. The material used for the daily cover is the soil excavated in digging the trench. Because the final cover should be material that is favorable for the growth of plants, the original surface layer of the soil should be set aside for this final blanketing of the fill. Slope is also important because it affects both the amount of earthwork needed to provide access to the landfill and the disposal of surface water, including that from adjacent higher elevations.

Soils with slight limitations have a water table deeper than 6 feet, permeability of 2 inches per hour or less, slopes of less than 12 percent, medium texture, and few stones. They have no permafrost and are not subject to flooding. Limitations are considered severe if a soil is poorly drained, underlain by permafrost, subject to flooding, very sandy, clayey, or stony, or if slopes are steeper than 30 percent.

Sanitary landfills (area type) - In an area-type sanitary landfill, refuse is placed on the surface of the soil in successive layers. Daily and final cover material generally is obtained from another site. Ratings of soils for this use are generally similar to those for trench-type sanitary fills except that soil texture and stoniness are less important because no extensive earthwork is involved.

Soils with slight limitations have a water table deeper than 5 feet, permeability of 2 inches per hour or less, and slopes of less than 7 percent. They are not subject to flooding. Severe limitations are shallow water tables or poor drainage, permeability rates in excess of 2 inches per hour, slopes greater than 12 percent, and occasional or frequent flooding.

Daily cover material for area-type sanitary landfills - The suitability ratings of a soil for use as cover material for landfills is based primarily on properties that affect its workability, or ease of digging, moving, and spreading, and its acceptability as a borrow site. Problems in reclamation of the site, including revegetation and erosion control, are important considerations.

Soils that are rated good for this use are medium-textured and easily worked, not gravelly or stony, more than 40 inches thick over unsuitable material, and have slopes of 7 percent or less. Poor soils include those with clay or sand textures, thick organic layers, depths of less than 20 inches over unsuitable material, more than 35% gravel, or many large stones, slopes steeper than 12 percent, or poor drainage.

Shallow excavations - The ratings for shallow excavations--those that require digging or trenching to depths no greater than 5 or 6 feet--are based on factors that influence ease of digging, maneuverability of machinery, and stability of the completed excavation. Among these are soil texture and stoniness, permafrost, slope, soil drainage and depth to the water table, and flooding.

Soils with slight limitations are deep, medium textured, free of stones, and well-drained. They have slopes of 7 percent or less, and are not subject to flooding. Soils are considered to have severe limitations if they are either dominantly stony or gravelly, poorly drained with water tables shallower than 30 inches, underlain by ice-rich permafrost, subject to flooding, or have slopes steeper than 12 percent.

Dwellings and small commercial buildings - Dwellings are defined as single-family structures with no more than three stories. They may or may not have basements. The emphasis in rating soils is on properties that affect stability of foundations, ease of excavation, installation of underground utility lines, and utility of the structure after construction.

These include soil texture and stoniness, permafrost, slope, soil drainage and depth to the water table, potential frost action, and susceptibility to flooding.

Soils with slight limitations are deep and free of stones, well-drained, not susceptible to expansion and contraction as a result of frost action or swelling clays, and not subject to flooding. They have slopes of 7 percent or less and are underlain by neither ice-rich permafrost or deeply buried masses of ice. Severe limitations are poor drainage, a water table shallower than 30 inches, high susceptibility to frost action, potential flooding, slopes steeper than 12 percent, and the presence of permafrost or buried masses of clear ice that can cause pitting or uneven subsidence below the foundation.

Limitations for dwellings without basements are essentially the same as for those with basements except that the hazard of frost action is of greater importance in that footings may not be as deep. For small commercial buildings, slope is of greater importance than for dwellings. Soils with slopes of 3 to 7 percent are considered to have moderate limitations. Slopes greater than 7 percent are severely limiting for those structures.

Local roads and streets - Ratings apply to the use of soils for construction and maintenance of local roads and streets with all-weather surfacing. The ratings are not intended to evaluate the suitability of soils for major highways, and in no case can they substitute for detailed investigation before actual construction.

Roads commonly consist of (1) the subgrade, or the underlying local soil material, (2) the base material placed above the subgrade during construction, and (3) the road pavement. Except for the pavement, local roads normally utilize materials from soils in the immediate vicinity, and cuts and fills are generally less than 6 feet thick. The factors used in the ratings are soil drainage, texture and stoniness, slope, susceptibility to frost action, and frequency of flooding.

Soils with slight limitations are at least moderately well drained, have few large stones, have little potential for frost action, and are free of permafrost. They are not subject to flooding and have slopes of 7 percent or less. Soils are considered to have severe limitations if they are poorly drained, made up of organic materials, underlain by ice-rich permafrost or buried masses of ice, highly susceptible to frost action, very stony, or if they are subject to frequent flooding or have slopes steeper than 12 percent.

Picnic areas - Picnic areas are attractive natural or landscaped tracts used primarily for preparing meals and eating outdoors. These areas are subject to heavy foot traffic, but most vehicular traffic is confined to access roads.

Soils with slight limitations for this use are at least moderately well drained, have neither excessively clayey nor sandy surface textures, are free of flooding during the season of use, have slopes of 7 percent or less, and are relatively free of stones. Those with severe limitations are poorly drained, have clay or sand surface layers, are subject to frequent flooding, have slopes steeper than 12 percent, or are stony.

Playgrounds - Playgrounds are areas that are used intensively for organized games such as baseball or football. Soils suitable for this use need to be able to withstand intensive foot traffic, and should require little grading and leveling.

Soils with slight limitations are at least moderately well drained, are not subject to flooding, have loamy textures, and have permeability rates greater than 0.6 inches/hour. Slopes may not exceed 3 percent, and the soils must be essentially free of stones. Severe limitations are poor drainage, frequent flooding, permeability of less than .06 inches/hour, very clayey or sandy surface textures, slopes greater than 7 percent, and coarse fragments covering more than 20 percent of the surface.

Pond reservoir areas - Soils over which water is impounded behind a dam or embankment must have low seepage rates. This is related to their permeability and to other soil features, such as subsurface ice masses subject to melting, that may result in loss of water through the soil.

Soils are not rated for this purpose, but those characteristics that may adversely affect use as a reservoir area are listed. These include rapid permeability, presence of permafrost or isolated buried ice masses, susceptibility to piping (underground tunneling) or pitting, steep slopes which can reduce the storage potential of the area, and high susceptibility to erosion.

Embankments, dikes, and levees - Earthfills intended to contain or hold back water require soil material that is stable after compaction and that is resistant to seepage. Soil properties that adversely affect use for this purpose are low shear strength, high permeability after compaction, susceptibility to piping, and poor compaction characteristics. The presence of stones or organic material in a soil are among factors that are unfavorable.

No ratings are given in Table 2 for this purpose, but the principal unfavorable features are listed for each soil.

Corrosivity - Structural materials, such as metal or concrete, corrode when buried in soil. The corrosivity potential is different for different soils and for different materials. In this report, soils are rated according to potential corrosivity of untreated steel and ordinary concrete. Protective coatings in the case of steel and special cements and manufacturing methods in the case of concrete may be used to reduce the rate of corrosion.

Corrosion of steel in soils is a physical-biochemical process that converts iron into soluble forms. Some of the factors that influence this process are soil moisture content, electrical conductivity of the soil solution, degree of soil acidity, oxygen concentration in the soil, and the activity of organisms capable of causing oxidation-reduction reactions. The potential corrosivity of soil for untreated steel pipe is commonly determined by measurements of electrical resistivity, soil acidity, and soil texture, and by evaluation of fluctuations of the water table. No single measure is adequate to determine potential corrosivity. Soils with low potential generally are well drained except that sandy soils may be somewhat poorly (imperfectly) drained, are moderately to rapidly permeable, have pH values higher than 6.0, and have an electrical resistivity when saturated of more than 5000 ohms/cm. Soils with high corrosion potential generally are either fine-textured or are somewhat poorly or poorly drained, have pH values of 5.0 or less, or resistivity of less than 1500 ohms/cm. Soils with textural stratification usually have a higher corrosion potential than soils with uniform textures throughout the profile. Similarly, the potential is higher at the boundary between different soils. Organic (peat) soils with fluctuating water tables generally have high corrosion potential; those with water tables at the surface throughout the year are generally rated as having moderate corrosivity for steel pipe.

The rate of deterioration of concrete buried in soil depends on soil texture, soil acidity, and the amount of soluble sulfates in the soil. Soils with low corrosion potential generally are those with pH values of 6.0 or higher and less than 1000 parts per million of soluble sulfates. Those with high corrosivity generally have pH values of 5.0 or less and more than 2000 parts per million of sulfates. In general, coarse-textured soils are more corrosive than medium- or fine-textured soils.

Construction of buildings, paving, fill and compaction, and additions to the surface that alter soil permeability can increase the corrosion probability. Any mechanical agitation or excavation that results in aeration and nonuniform mixing of soil layers of different textures may also accelerate the rate of corrosion.

References Cited

1. American Association of State Highway Officials. 1961. Standard Specifications for Highway Materials and Methods of Sampling and Testing. Ed. 8, 2 v., illus.

2. Portland Cement Association. 1962. PCA Soil Primer, 52 pp. and charts. Chicago, Ill.

3. U.S. Department of Defense. 1968. Unified Soil Classification System for Roads, Airfields, Embankments, and Foundations. MIL-STD-619B, 30 pp., illus.

Table 1. Brief description of soils and their estimated physical properties

Symbol on map	Soil name	Depth to seasonally high water table (feet)	Depth to permafrost table (feet)	Description of soil and site	Depth from surface (typical profile) (inches)	Soil Classification: USDA Texture	Soil Classification: Unified	Soil Classification: AASHO	Grain-size distribution: Percent coarser than 3 inches	Percent of material less than 3 inches passing sieve: No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (0.42mm)	No. 200 (0.074mm)	Liquid Limit	Plasticity index	Permeability (inches/hour)	Available water capacity in./in. of soil	Reaction pH values	Shrink-swell potential
Ad	Alluvial land	0-1	None	Thin silty mantle over rounded alluvial gravel; frequently flooded	0-60	Very gravelly sand	GW or GP	A-1	15-40	25-45	25-40	15-25	0-5	--	NP	6.0-20	.02-.04	6.1-6.5	Low
Br	Bradway very fine sandy loam	0-1	2-4	Poorly drained very fine sandy soils of flood plains; permafrost	0-2	Mucky silt loam	OL	A-5	0	100	100	95-100	60-70	--	NP	0.6-2.0	.20-.25	6.1-6.5	Low
					2-40	Very fine sandy loam with lenses of silt loam and fine sand	ML	A-4	0	100	95-100	90-100	50-60	--	NP	0.6-2.0	.12-.16	6.1-7.8	Low
Ch	Chena very fine sandy loam	>6	None	Excessively drained very shallow soils over rounded alluvial gravel	0-7	Stratified silt loam, very fine sandy loam, and fine sand	SM or ML	A-4	0	100	95-100	85-95	40-70	--	NP	0.6-2.0	.12-.16	5.1-6.5	Low
					7-40	Very gravelly sand	GW or GP	A-1	15-40	25-45	25-40	15-25	0-5	--	NP	6.0-20	.02-.04	6.1-6.5	Low
EsD	Ester silt loam, 12 to 20 percent slopes	0-1	<1	Poorly drained, shallow silty soils over shattered bedrock; occurs on north slopes	0-10	Silt loam	ML,CL-ML	A-4 or A-5	0-10	90-100	80-90	75-85	70-80	25-45	2-10	0.6-2.0	.25-.30	4.5-5.5	Low
EsE	Ester silt loam, 20 to 30 percent slopes				10-30	Very gravelly sandy loam and very gravelly silt loam	GM or GP-GM	A-1	45-55	10-35	10-30	10-25	5-20	--	NP	0.2-0.6	.03-.05	5.6-6.0	Low
EsF	Ester silt loam, 30 to 45 percent slopes																		
FaA	Fairbanks silt loam, 0 to 3 percent slopes	Deep	None	Well-drained, deep silty soils of uplands	0-40	Silt loam of silt	ML or CL-ML	A-4	0	100	95-100	90-100	85-100	25-40	2-10	0.6-2.0	.25-.30	5.6-6.5	Low
FaB	Fairbanks silt loam, 3 to 7 percent slopes																		
FaC	Fairbanks silt loam, 7 to 12 percent slopes																		
FaD	Fairbanks silt loam, 12 to 20 percent slopes																		
FaE	Fairbanks silt loam, 20 to 30 percent slopes	Deep	None	Well-drained, deep silty soils of uplands	0-40	Silt loam or silt	ML or CL-ML	A-4	0	100	95-100	90-100	85-100	25-40	2-10	0.6-2.0	.25-.30	5.6-6.5	Low
FaF	Fairbanks silt loam, 30 to 45 percent slopes																		
FmB	Fairbanks silt loam, moderately deep, 3 to 7 percent slopes	Deep	None	Well-drained, moderately deep silty soils of uplands	0-25	Silt loam or silt	ML or CL-ML	A-4	0	100	95-100	90-100	85-100	25-40	2-10	0.6-2.0	.25-.30	5.6-6.5	Low
FmC	Fairbanks silt loam, moderately deep, 7 to 12 percent slopes				25-40	Very gravelly sandy loam and very gravelly silt loam	GM or GP-GM	A-1	45-55	10-35	10-30	10-25	5-20	--	NP	0.2-0.6	.05-.10	6.1-6.5	Low
FmD	Fairbanks silt loam, moderately deep, 12 to 20 percent slopes																		
FmE	Fairbanks silt loam moderately deep, 20 to 30 percent slopes																		
FmF	Fairbanks silt loam, moderately deep, 30 to 45 percent slopes																		
GmB	Gilmore silt loam, 3 to 7 percent slopes	Deep	None	Well-drained shallow silty soils of uplands	0-17	Silt loam or silt	ML or CL-ML	A-4	0	100	95-100	90-100	85-100	25-40	2-10	0.6-2.0	.25-.30	5.6-6.5	Low
GmC	Gilmore silt loam, 7 to 12 percent slopes				17-40	Very gravelly sandy loam and very gravelly silt loam	GM or GP-GM	A-1	45-55	10-35	10-30	10-25	5-20	--	NP	0.2-0.6	.05-.10	6.1-6.5	Low
GmD	Gilmore silt loam, 12 to 20 percent slopes																		
GmE	Gilmore silt loam, 20 to 30 percent slopes																		
GmF	Gilmore silt loam, 30 to 45 percent slopes																		

Table 1. Brief description of soils and their estimated physical properties (Continued)

Symbol on map	Soil name	Depth to seasonally high water table (feet)	Depth to permafrost table (feet)	Description of soil and site	Depth from surface (typical profile) (inches)	Soil Classification: USDA Texture	Soil Classification: Unified	Soil Classification: AASHO	Grain-size distribution: Percent coarser than 3 inches	Percent of material less than 3 inches passing sieve: No. 4 (4.7mm)	No. 10 (2.0mm)	No. 40 (0.42mm)	No. 200 (0.074mm)	Liquid Limit	Plasticity index	Permeability (inches/hour)	Available water capacity in./in. of soil	Reaction pH values	Shrink-swell potential
GrB GrC GrD GrE GrF	Gilmore silt loam, very shallow, 3 to 7 percent slopes Gilmore silt loam, very shallow, 7 to 12 percent slopes Gilmore silt loam, very shallow, 12 to 20 percent slopes Gilmore silt loam, very shallow, 20 to 30 percent slopes Gilmore silt loam, very shallow, 30 to 45 percent slopes	Deep	None	Well-drained, very shallow silty soils of uplands	0-8	Silt loam or silt	ML or CL-ML	A-4	0	90-100	80-95	75-90	70-85	25-40	2-10	0.6-2.0	.25-.30	5.6-6.5	Low
					8-30	Very gravelly sandy loam and very gravelly silt loam	GM or GP-GM	A-1	45-55	10-35	10-30	10-25	5-20	--	NP	0.2-0.6	.05-.10	6.1-6.5	Low
GtA GtB GtC	Goldstream silt loam, 0 to 3 percent slopes Goldstream silt loam, 3 to 7 percent slopes Goldstream silt loam, 7 to 12 percent slopes	0-1	1-2	Poorly drained silty soils of flood plains and upland valleys	0-4	Silt loam	OL	A-5 or A-4	0	100	95-100	90-100	80-100	30-50	NP	0.6-2.0	.25-.30	4.5-5.5	Low
					4-30	Silt loam	ML	A-4 or A-5	0	100	95-100	90-100	80-100	30-50	0-10	0.6-2.0	.25-.30	5.1-5.5	Low
Lp	Lemeta peat	0-1	2-3	Very poorly drained peat soils	0-50	Peat	Pt	A-8	---	---	---	---	---	---	---	---	---	4.0-5.0	---
Me	Mine tailings	Deep	Deep	Coarse angular gravel	0-60		GW or GP	A-1	70-80	5-30	0-20	0-5	0	--	NP	6.0-20	.02-.04	--	Low
MnA MnB MnC	Minto silt loam, 0 to 3 percent slopes Minto silt loam, 3 to 7 percent slopes Minto silt loam, 7 to 12 percent slopes	3-5	Variable, discontinuous	Moderately well drained, deep silty soils on footslopes	0-40	Silt loam or silt	ML or CL-ML	A-4	0	100	95-100	90-100	85-100	25-40	2-10	0.6-2.0	.25-.30	5.0-7.8	Low
Sc	Salchaket very fine sandy loam	Deep	None	Well-drained, deep stratified sandy loam, fine sand, and silt loam; substratum of very gravelly sand	0-13	Very fine sandy loam	ML	A-4	0	100	95-100	90-100	75-100	--	NP	0.6-2.0	.18-.23	5.1-6.0	Low
					13-40	Stratified fine sand, fine sandy loam, and fine silt loam	SM or ML	A-4	0	100	90-100	85-100	40-70	--	NP	0.6-2.0	.12-.16	5.6-6.5	Low
Sm Ss	Salchaket very fine sandy loam, moderately deep 2/ Salchaket very fine sandy loam, shallow 2/	Deep	None	Well-drained, moderately deep and shallow stratified soils over very gravelly sand.	0-26	Stratified very fine sandy loam, silt loam, and fine sand	SM or ML	A-4	0	100	90-100	85-100	40-70	--	NP	0.6-2.0	.12-.16	5.1-6.5	Low
					26-40	Very gravelly sand	GW or GP	A-1	15-40	25-45	25-40	15-25	0-5	--	NP	6.0-20	.02-.04	6.1-6.5	Low
SuB SuC SuD	Saulich silt loam, 3 to 7 percent slopes Saulich silt loam, 7 to 12 percent slopes Saulich silt loam, 12 to 20 percent slopes	0-1	1-3	Poorly drained, deep silty soils over bedrock	0-30	Silt loam	ML	A-4 or A-5	0	100	95-100	90-100	85-95	30-50	3-10	0.6-2.0	.25-.30	6.1-6.5	Low
Ta	Tanana silt loam	0-1	2-4	Somewhat poorly drained deep silty soils of flood plains	0-40	Silt loam	ML	A-4 or A-5	0	100	100	95-100	90-100	30-65	5-10	0.6-2.0	.25-.30	6.1-7.3	Low

1/ Fairbanks silt loam, moderately deep, is now classified as Steese silt loam. The original name is retained in this supplement

2/ Moderately deep and shallow phases of Salchaket very fine sandy loam are now classified as phases of Jarvis very fine sandy loam. The original name is retained in this supplement.

Table 2. Interpretations of engineering properties of soils.

Soil series and map symbol(s)	Suscepti-bility to frost action	Suitability as source of			Degree of limitation rating for--												Features affecting use for--		Corrosivity	
		Road fill	Sand and gravel	Topsoil	Septic tank absorption fields	Site for sewage lagoon	Sanitary landfill (trench type)	Sanitary landfill (area type)	Daily cover for landfill	Shallow excavations	Dwellings Without basement	Dwellings With basement	Small commercial buildings	Local roads and streets	Picnic areas	Playgrounds	Pond reservoir area	Embankments, dikes, and levees	Untreated steel	Concrete
Alluvial land (Ad)	--	Poor-WET	Good	Poor-SST	Severe-WET	Severe-WET, PCR	Severe-WET, FLD	Severe-WET, FLD	Poor-WET,SST	Severe-WET, SST	Severe-WET, FLD	Severe-WET, FLD	Severe-WET, FLD	Severe-WET, FLD	Severe-WET, FLD	Severe-WET, FLD	PCR	PCR	High	Moderate
Bradway (Br)	High	Poor-WET, FST	Unsuited	Poor-WET	Severe-WET, FLD	Severe-FLD, PFT	Severe-WET, FLD	Severe-WET, FLD	Poor-WET	Severe-WET, PFT	Severe-WET, PFT	Severe-WET, PFT	Severe-WET, PFT	Severe-WET, PFT	Severe-WET	Severe-WET	PFT	LCO,PIP	High	Low
Chena (Ch)	Low	Good	Good	Poor-THN,SST	Severe-FLD	Severe-FLD, PCR	Severe-FLD, PCR	Severe-FLD, PCR	Poor-SST,LCO	Severe-FLD, SST	Severe-FLD	Severe-FLD	Severe-FLD	Moderate-FLD	Moderate-FLD	Moderate-FLD	PCR	PCR	Low	Low
Ester (EsD, EsE,EsF)	High	Poor-THN, LST	Sand; Unsuited Gravel; Poor-FIN	Poor-THN,LST	Severe-LST, PFT	Severe-LST, STP	Severe-PFT, BDR	Severe-STP, PFT	Poor-LST,PFT	Severe-STP, PFT	Severe-STP, PFT	Severe-STP, PFT	Severe-STP, PFT	Severe-STP, PFT	Severe-STP, WET	Severe-STP, WET	STP,PFT	THN,LST	Moderate	Moderate
Fairbanks (FaA,FaB,FaC, FaD,FaE,FaF)	High	FaA-FaD; Poor-FST FaE-FaF; Poor-FST, STP	Unsuited	FaA-FaB;Good FaC;Fair FaD-FaF; Poor-STP	FaA-FaB;Slight FaC;Moderate-STP FaD-FaF; Severe-STP	FaA;Moderate-PCR FaB;Moderate-PCR,STP FaC-FaF; Severe-STP	FaA-FaC;Slight FaD-Moderate-STP FaE-FaF; Severe-STP	FaA-FaB;Slight FaC;Moderate-STP FaD-FaF; Severe-STP	FaA-FaB;Good FaC;Fair-STP FaD-FaF;Poor-STP	FaA-FaB;Slight FaC;Moderate-STP FaD-FaF; Severe-STP	FaA-FaC; Severe-FST FaD-FaE; Severe-FST, STP	FaA-FaB; Moderate-LBC FaC;Moderate-LBC,STP FaD-FaF; Severe-STP	FaA-Moderate-LBC FaB;Moderate-LBC,STP FaC-FaF; Severe-STP	FaA-FaC; Severe-FST FaD-FaF; Severe-FST, STP	FaA-FaB;Slight FaC;Moderate-STP FaD-FaF; Severe-STP	FaA;Slight FaB;Moderate-STP FaC-FaF; Severe-STP	PIP,STP	LBC,PIP, LCO	Low	Moderate
Fairbanks, Moderately deep (FmB,FmC,FmD, FmE,FmF)	High	FmB-FmD; Poor-FST FmE-FmF; Poor-FST, STP	Sand; Unsuited Gravel; Poor-FIN	FmB;Good FmC;Fair-STP FmD-FmF; Poor-STP	FmB-FmC; Severe-PCS, LST FmD-FmF; Severe-PCS, STP	Severe-LST, STP	FmB-FmC; Severe-LST FmD-FmF; Severe-LST, STP	FmB;Slight FmC;Moderate-STP FmD-FmF; Severe-STP	FmB;Fair-THN FmC;Fair-THN, STP FmD-FmF;Poor-STP	FmB-FmC; Severe-LST, FmD-FmF; Severe-LST, STP	FmB-FmC; Severe-FST FmD-FmF; Severe-FST, STP	FmB;Slight FmC;Moderate-STP FmD-FmF; Severe-STP	FmB;Moderate-STP FmC-FmF; Severe-STP	FmB-FmC; Severe-FST FmD-FmF; Severe-FST, STP	FmB;Slight FmC;Moderate-STP FmD-FmF; Severe-STP	FmB;Moderate-STP FmC-FmF; Severe-STP	ERO,STP	LBC,LST	Low	Moderate
Gilmore (GmB, GmC,GmD,GmE, GmF)	Moderate	GmB-GmC; Fair-LST GmD;Fair LST,STP GmE-GmF; Poor-STP	Sand; Unsuited Gravel; Poor-FIN	Poor-THN,LST	GmB-GmC; Severe-PCS, LST GmD-GmF; Severe-PCS, STP	Severe-LST, STP	GmB-GmC; Severe-LST GmD-GmF; Severe-LST, STP	GmB;Slight GmC;Moderate, STP GmD-GmF; Severe-STP	GmB-GmC;Poor-LST GmD-GmF;Poor-LST,STP	GmB-GmC; Severe-LST GmD-GmF; Severe-LST, STP	GmB;Moderate-FST GmC;Moderate-FST,STP GmD-GmF; Severe-STP	GmB-GmC; Severe-LST GmD-GmF; Severe-LST, STP	GmB;Severe-LST GmC-GmF; Severe-LST, STP	GmB;Moderate-FST GmC;Moderate-FST,STP GmD-GmF; Severe-STP	GmB;Slight GmC;Moderate-STP GmD-GmF; Severe-STP	GmB;Moderate-STP GmC-GmF; Severe-STP	ERO,STP	LST	Low	Low
Gilmore, very shallow (GrB, GrC,GrD,GrE, GrF)	Low	GrB-GrD; Poor-LST GrE-GrF; Poor-LST, STP	Sand; Unsuited Gravel; Poor-FIN	Poor-THN,LST	GrB-GrC; Severe-PCS, LST GrD-GrF; Severe-PCS, STP	Severe-LST, STP	GrB-GrC; Severe-LST GrD-GrF; Severe-LST, STP	GrB;Slight GrC;Moderate-STP GrD-GrF; Severe-STP	GrB-GrC;Poor-LST GrD-GrF;Poor-LST,STP	GrB-GrC; Severe-LST GrD-GrF; Severe-LST, STP	GrB;Slight GrC;Moderate-STP GrD-GrF; Severe-STP	GrB-GrC; Severe-LST GrD-GrF; Severe-LST, STP	GrB;Severe-LST GrC-GrF; Severe-LST, STP	GrB;Moderate-LST GrC;Moderate-LST,STP	GrB;Slight GrC;Moderate-STP GrD-GrF; Severe-STP	GrB;Moderate-STP GrC-GrF; Severe-STP	STP	LST	Low	Low
Goldstream (GtA,GtB,GtC)	High	Poor-WET, PFT	Unsuited	Poor-WET	Severe-WET, PFT,FLD	Severe-FLD, PFT	Severe-WET, FLD	Severe-WET, FLD	Poor-WET	Severe-WET, PFT,FLD	Severe-WET, PFT,FLD	Severe-WET, PFT,FLD	Severe-WET, PFT,FLD	Severe-WET, PFT,FLD	Severe-WET	Severe-WET	PFT	LBC,PIP	High	Moderate
Lemeta (Lp)	High	Poor-HUM, LBC	Unsuited	Poor-WET	Severe-WET, PFT	Severe-PFT, HUM	Severe-WET, PFT,HUM	Severe-WET	Poor-WET, LCO	Severe-WET, PFT	Severe-WET, PFT,HUM	Severe-WET, PFT,HUM	Severe-WET, PFT,HUM	Severe-LBC, PFT,HUM	Severe-WET	Severe-WET	PFT	UNS,LCO, HUM		
Mine tailings (Me)	Low	Fair-LST	Good	Poor-LST	Severe-LST	Severe-PCR	Severe-LST, PCR	Severe-PCR	Poor-LST	Severe-LST	Severe-LST	Severe-LST	Severe-LST	Moderate-LST	Severe-LST	Severe-LST	PCR	LST	Low	Low
Minto (MnA, MnB,MnC)	High	Poor-FST	Unsuited	MnA-MnB;Good MnC;Fair-STP	MnA-MnB; Moderate-PIT MnC;Moderate-PIT,STP	MnA-MnB; Severe-PIT MnC;Severe-PIT,STP	Moderate-WET, PIT	MnA-MnB; Moderate-WET, PIT MnC;Moderate-WET,STP	MnA-MnB;Good MnC;Fair-STP	MnA-MnB; Moderate-WET MnC;Moderate-WET,STP	Severe-PIT, FST	Severe-PIT	MnA-MnB; Severe-PIT MnC; Severe-PIT, STP	Severe-FST, PIT	MnA-MnB; Moderate-WET MnC;Moderate-WET,STP	MnA;Moderate-WET MnB;Moderate-WET,STP MnC;Severe-STP	PIT,ERO, STP	LBC,PIP, LCO	Low	Moderate
Salchaket (Sc)	Moderate	Fair-FST	Good	Good	Severe-FLD	Severe-FLD	Severe-FLD	Severe-FLD	Good	Severe-FLD	Severe-FLD	Severe-FLD	Severe-FLD	Moderate-FLD	Moderate-FLD	Moderate-FLD	PCR	PCR	Low	Moderate
Salchaket, Moderately deep (Sm) Salchaket, shallow (Ss)	Moderate	Fair-FST	Good	Fair-THN,SST	Severe-FLD	Severe-FLD, PCR	Severe-FLD, PCR	Severe-FLD, PCR	Poor-SST,LCO	Severe-FLD, SST	Severe-FLD	Severe-FLD	Severe-FLD	Moderate-FLD	Moderate-FLD	Moderate-FLD	PCR	PCR	Low	Low
Saulich (SuB, SuC,SuD)	High	SuB-SuC; Poor-PFT, FST SuD;Poor-PFT,STP	Unsuited	SuB-SuC;Poor-PFT,WET SuD;Poor-PFT, STP	Severe-WET, PFT	SuB;Severe-WET,PFT SuC-SuD; Severe-PFT	Severe-WET, PFT	SuB-SuC; Severe-WET SuD;Severe-WET,STP	SuB-SuC; Severe-WET, PFT SuD;Severe-PFT,STP	SuB-SuC; Severe-WET, PFT SuD;Severe-PFT,STP	SuB-SuC; Severe-PFT, FST SuD;Severe-PFT,STP	SuB-SuC; Severe-PFT, FST SuD;Severe-PFT,STP	SuB;Severe-PFT,FST SuC-SuD; Severe-PFT, STP	SuB-SuC; Severe-PFT, FST SuD;Severe-PFT,STP	SuB-SuC; Severe-WET SuD;Severe-WET,STP	SuB;Severe-WET SuC-SuD; Severe-WET, STP	PFT,STP	LBC,PIP	High	Low
Tanana (Ta)	High	Poor-FST, PFT	Unsuited	Good	Severe-WET, PFT	Severe-FLD, PFT	Severe-WET, FLD	Severe-FLD	Moderate-PFT	Severe-WET, PFT	Severe-FLD, PFT	Severe-FLD, PFT	Severe-FLD, PFT	Severe-FST	Moderate-FLD, WET	Moderate-FLD, WET	PFT	LBC,PIP	High	Low

Limiting Features

BDR - Bedrock too shallow for the intended use
ERO - Soil is highly erodible
FIN - Excessive proportion of fine-grained material for the intended use
FLD - Soil is subject to flooding
FST - Soil is susceptible to frost action
HUM - Peat soil
LBC - Soil has low strength or bearing strength
LCO - Soil has poor compaction characteristics, is hard to pack
LST - Large stones limit suitability for the intended use
PCR - Permeability is too rapid for the intended use
PCS - Permeability is too slow for the intended use
PFT - Permafrost restricts use or is a hazard to structures
PIP - Soil is subject to underground tunneling or piping
PIT - Possible pitting beeause of thawing of buried ice masses
SST - Small stones limit suitability for the intended use
STP - Slopes are too steep for the intended use
THN - Soil is thin over a substratum not suitable for the intended use
UNS - Soil is unstable when used in embankments
WET - Soil is too wet, or too poorly drained for the intended use