## GEOLOGY

## FAIRBANKS (D-1) QUADRANGLE, ALASKA

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INTRODUCTION  The Fairbanks (D-1) quadrangle, an area of about 255 square miles, is in central Alaska approximately 100 miles south of the Arctic Circle and 6 miles east of Fairbanks, the second largest city in Alaska and the commercial center for the interior. Ladd Air Force Base is 3 miles west and Eielson Air Force Base is 6 miles south of the quadrangle boundary. Except for the homesteads and homesites along the road net, most of the land is unpopulated public domain.  Gold mining and prospecting for placer and lode deposits have been of great importance to the economy of the Fairbanks area since the discovery of gold in 1902. Placer gold has been mined in several of the creeks in the northwestern part of the quadrangle, but to date only small-scale mining operations have been undertaken. Placer and lode tungsten	tures, the source of commaterials, and the parent for agricultural soils. The tion briefly summarizes logic character of the geol The description of geologiven below summarizes bution and thickness, tenatural slopes, drainage a ability, permafrost, suscepfrost action, bearing streslope stability, ease of exca compaction, and possible materials in each unit. So data presented on the mapfurnished by local residenthe Alaska Road Commis a part of the Bureau of Pul (holes 28-41 inclusive), a District, Corps of Engin Army (holes 52, and 63 records are the only basis standing the vertical dist the geologic units and of within these units in the natural or artificial ex
deposits, chiefly of scheelite, are in the northwestern part of the quad-	Data on properties of mat

deposits, chiefly of scheelite, are in the northwestern part of the quadrangle (Mertie, 1918) and have been mined intermittently since 1915. The

Data on properties of materials were obtained from field observations of various engineering and agricultural mined intermittently since 1915. The

Data on properties of materials were valley bottoms widen into poorly drained gently sloping alluvial fans which merge with the valley floors

The widely scattered exposures of which merge with the valley floors

The minimum of the region has a continuence of the region has a con value of sand and gravel used in rail- projects in this and adjacent quad- of the larger rivers. Scattered conroad, highway, and other types of rangles. Tests were performed on centrations of small lakes occur on recorded temperature at nearby Fairconstruction, both civil and military, representative samples by the Fair- the silt fans and creek-valley banks is -66° F, and the maximum is has steadily increased in recent years, until today sand and gravel are wission (now Bureau of Public mission (now Bureau of P among the most important mineral Roads), by Alaska District and the between 445 and 500 feet above sea in every month except July. Mean posited in a marine or estuarine products of the area. These deposits

Rock Island, Ill. office, Corps of level, consists of the woodland- and annual temperature is 26.1° F (U.S. are near the surface and readily Engineers, U.S. Army, and by Frost brush-covered flood plains and low Weather Bureau, 1943). accessible in the southern part of Effects Laboratory, Corps of Enginterraces, (Qal, Qts) of the Chena, Interior Alaska has warmer sumthe quadrangle and along the Chena eers, U. S. Army. Generalizations Little Chena, and Tanana Rivers. mers and more hours of possible sunand Little Chena Rivers in the northpresented on the engineering Silt-filled swales (Qs) and oxbow shine than any other established ion which accompanied later Tertiary ern and eastern parts. Elsewhere, properties of unconsolidated and bed- lakes mark the former positions of agricultural area in the Territory. sand and gravel are absent or so rock units may be useful in preparing the rivers on flood plains and some The growing season averages 97 days

A complex group of Quaternary deeply duried by perennially frozen preliminary plans and designs, but low terraces (Qal). Spring runoff and for field crops on the flood plain at silt that they cannot be economically are not intended to replace standard heavy summer rains cause periodic are not intended to replace standard heavy summer rains cause periodic are not intended to replace standard heavy summer rains cause periodic fairbanks, but is 123 days on the The quadrangle includes a part of required for design of engineering master stream, the Tanana River, is the upland.

the Tanana Valley agricultural area, structures. which ranks second in crop value among Alaskan farming districts.

Running water has been dominant in molding the landscape. It has of which 63 percent falls as rain from molding the landscape. It has of which 63 percent falls as rain from molding the landscape. Farming dates from the early days

One colder than the present to provides dairy products, livestock,

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One colder than the present to days presumably related to the Wisconsin, and is presumably related to the Wisconsin, and the p provides dairy products, livestock, major physiographic units: (1) deposition, formed the flat alluvial period from September to May is one colder than the present (Péwé, oats, barley, spring wheat, potatoes, Tanana Lowland in the southern part surface of the Tanana Lowland and generally calm but broken by occasgarden vegetables, and other prodwater (Gasson 1946)

Wahrhaftig, Clyde, 1950, Physiobottom deposits. The record of alterand became perennially frozen. In a

bottom deposits. The record of alterand became perennially frozen. In a

bottom deposits, and the

sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections, surficial deposits, and the sections are sections, surficial deposits, and the sections are sections, surficial deposits, and the sections are sections. ucts (Gasser, 1946).

Tanana Upland. These are both part the Yukon-Tanana Upland. Although summer months from June through forms of the Fairbanks (D-1) and subsequent erosional period, prob-The geologic map shows the areal of the central Alaska uplands and Pleistocene glaciers formerly extend
August are slightly windier.

Once the alluvial fill since Wisconsin time above the authors above the alluvial fill since Wisconsin the al distribution of rock units with emphasis on the widespread mantle between and parallel to the Brooks ed northward from the Alaska Range and glaciers occurred locally in the of unconsolidated deposits. This and Alaska Ranges. The Yukon- mountainous sections of mantle is important because it is the Tanana Upland between the Yukon Tanana Upland (Mertie, 1937), the the Fairbanks (D-1) quadrangle is of adequate subsurface data in the thawed, perhaps completely, by the Little Chena, Chena, and Tanana frost are known, it is possible to the Edwards Bros., Ann Arbor, Mich., area, Alaska [abs.]: Geol. Soc. foundation for engineering struc- and Tanana Rivers is a maturely land within the quadrangle was not the Birch Creek schist of Precam- Fairbanks (D-1) quadrangle, much accompanying mild climate. With Rivers with respect to one another.

ceptibility to Range.

aterials were but in their lower courses the creek- middle slopes.

Running water has been dominant Weather Bureau, 1943) is 11.7 inches, erosion of silt, sand, and gravel, for-

construction dissected area of accordant, rounded glaciated. However, much of the brian age (Mertie, 1937) which under- of the advent of the more severe client material summits 2,000 to 3,000 feet in altitude summits 2,000 feet in altitude sum 'he explana- and is broken by scattered groups of Lowland was deposited as huge of a complex group of metamors the litho- mountains which project above the alluvial fans by heavily loaded, north- phosed water-laid sedimentary rocks. eologic units. upland ridges to altitudes of 5,000 to flowing tributaries of the Tanana With it are associated extrusive and ologic units 6,500 feet. South of the upland lies River, which were fed by Alaska intrusive meta-igneous rocks, which s the distri- the broad Tanana Lowland, a sedi- Range glaciers. Deposition of these are, for convenience, mapped with terrain and ment-filled trough between the up- fans forced the Tanana River to the Birch Creek schist. Except for and perme- land on the north and the Alaska aggrade and flow along the northern the metamorphism of the Precamedge of the lowland. Aggradation brian sedimentary rocks at least one rength and Within the quadrangle, the Yukon- caused by overloaded glacial streams episode of diastrophism and emplacecavation and Tanana Upland consists of hills and was doubtlessly superimposed on ment of the associated extrusive and e uses of the valleys between 500 and 2,400 feet aggradation caused by Pleistocene intrusive rocks, little is known of the Subsurface above sea level. Relief is less than uplift of the Alaska Range relative geologic history of the quadrangle ap page were 2,000 feet and most commonly ranges to the Tanana Lowland (Wahrhaftig, until intrusion of granite stocks and

ents, drillers, between 400 and 800 feet. Slopes are 1950). Aggradation of the Tanana dikes in Mesozoic time (Prindle and nission (now locally gullied and are covered with River raised base level for the tribu- Katz, 1913). Gold quartz and sche-Public Roads) dense spruce-birch forest and second- taries flowing southward from the elite mineralization in the schist are , and Alaska growth birch, aspen, and willow Yukon-Tanana Upland and forced probably genetically related to the ineers, U.S. brush. Steep rock bluffs occur where them to aggrade their valleys and to Mesozoic intrusives (Prindle and 63). These the Chena, Little Chena, or Tanana deposit hundreds of feet of silt, sand, Katz, 1913; Mertie, 1937). s for under- Rivers have eroded the valley sides and gravel. Loess blown from the After the intrusion of Mesozoic stribution of as they migrated back and forth braided river channels of the lowland granitic rocks, little is known until f permafrost across the valley bottom. Tributaries to the upland ridges ranges in thick-deposition of Tertiary lavas (Prindle absence of to these rivers occupy narrow, steep- ness from a few inches on the higher and Katz, 1913; Péwé, 1955b, 1958) excavations. walled valleys in their upper courses, summits to more than 100 feet on and the overlying Tertiary continfield and laboratory investigations floods over part of the lowland. The sunny, southward-facing slopes of exposed placer-mining cuts in the a tributary of the Yukon River. Mean annual precipitation (U.S. record alternating deposition and

ental deposits (which are not exposed tensive cover over a large part of the Yukon-Tanana Upland. Fragmentary fossil evidence suggests that some of

central Alaska as far east as Fairbanks (Péwé, 1954a). The cover of Tertiary rocks was removed by erosadjacent Fairbanks (D-2) quadrangle

vations made in the Fairbanks (D-2)

quadrangle (Péwé, 1958). See also

(Qf) was accelerated, and the Little

quadrangle (Péwé, 1958). See also

(Qf) was accelerated, and the Little

mates, the effect of permafrost and

Paragraphy (1969). Tuck (1940), and Taber (1943).

Chena, Chena, and Tanana Rivers

In early Quaternary time, sand and gravel were deposited in the creek valleys of the Yukon-Tanana loss was deposited, some of the creek valleys of the Yukon-Tanana loss was deposited, some of the creek valleys of the Yukon-Tanana loss was deposited, some of the creek valleys of the Yukon-Tanana loss was deposited, some of the creek valleys of the Yukon-Tanana loss was deposited, some of the creek valleys of the Yukon-Tanana loss was deposited, some of the creek valleys of the Yukon-Tanana loss was deposited in the Fairbanks (D-1) quadrangle consists of two types: (1) the fine-grained sediments of the williams, 1955). Foundation consultation of the constant of the fine-grained sediments of the fine-grained sediments of the constant of the fine-grained sediments of the fine-grained sediments of the constant of the fine-grained sediments of the fine-grained sediments of the fine-grained sediments of the fine-grained sediments of the constant of the fine-grained sediments of

land as part of the alluvial fill to the valleys where more creek rocks and basalt (gr, ad, Tb) and fair ground ice ranging in size from p. 2222-2225. during a period of aggradation. In were formed in the perennially to removing the fine-grained mater- deposits.

two cycles of erosion, but eviremains, and loess deposited in the to good foundations if in a mild clifew percent by weight to almost
Survey Bull. 989-F, p. 315-351. dence for similar trenching of the hundreds of feet of alluvium of the hundreds of feet of alluvium of the hundreds of feet of alluvium of the some of this material, carried it mate, but in this area the widespread mate, but in this area the widespread some of the material, carried it matter of silt is subject to intense silt, sand, and gravel of the "Qsf," process of the some of the material, carried it materials, Tanana Lowland is lacking. In the downstream, and deposited it in coalseasonal frost action, especially "Qal," "Qts," units are discontinuupland, where placer-mine excavaescent alluvial fans built at the marwhere poorly drained. Special preously frozen and have a relatively tions are available for study in the gins of the Little Chena, Chena, and cautions, therefore, must be taken low ice content; they contain no Fairbanks (D-2) quadrangle, gold- Tanana Valleys. The creek-valley fill in construction of roads, airfields, large ice masses. The discontinuously Péwé, T. L., 1955b, Basalt near Fairplacer deposits formed in stream and alluvial-fan deposits were fro- bridges, unheated buildings, and frozen unconsolidated deposits and banks, Alaska [abs.]: Geol. Soc. channels were buried by a thick, zen under the prevailing severe structures on piers and piling to bedrock cause relatively little trouble America Bull., v. 66, p. 1708. coarse, angular gravel of local origin cilmate. Large masses of ground-ice prevent frost heaving. In addition compared to the ice-rich, fine-grained Péwé, T. L., 1958, Geology of the the succeeding cycle of erosion, frozen silt. About 5,000 to 6,000 years ial to a depth beyond the effect of The Fairbanks (D-1) quadrangle streams eroded most of the coarse ago a slight amelioration of the cliseasonal frost or improving the lies in a major earthquake zone. In Map GQ 110. gravel and reconcentrated much of mate caused thawing of the upper drainage, it is in some places posthe early placer gold into new placer part of the perennially frozen sedi-by severe earthquakes. In 1937 the the early placer gold into new placer deposits. During this cycle of erosion, many streams occupied different channels from those in which the placer gold was first deposited, and, therefore, some of the early placer was of the early placer of the early placer was of the early placer of the early placer was of the early placer of the early placer was at the placer of the early placer was 20 miles south of the epicenter was 20 miles south of the epicenter was 20 miles south of the quadrangle boundary (Bramhall, 1938), and in 1947 it was at Clear, for perennially frozen ground, is defined (Muller, 1947, p. 3) as "thickness of soil, or other super-like was at Clear, for perennially frozen ground, is defined (Muller, 1947, p. 3) as "thickness of soil, or other super-like was 20 miles south of the epicenter was 20 miles south of the quadrangle boundary (Bramhall, 1938), and in 1947 it was at Clear, for miles southwest of the quadrangle boundary (Bramhall, 1938), and in 1947 it was at Clear, for miles southwest of the quadrangle boundary (Bramhall, 1938), and in 1947 it was at Clear, for miles southwest of the quadrangle boundary (Bramhall, 1938), and in 1947 it was at Clear, for miles southwest of the quadrangle boundary (Bramhall, 1938), and in 1947 it was at Clear, for miles southwest of the quadrangle boundary (Bramhall, 1938), and in 1947 it was at Clear, for miles southwest of the epicenter was 20 miles south o deposits are still preserved as fragvalleys and associated valley-mouth
deposits are still preserved as fragvalleys and associated valley-mouth
ficial deposit, or even of bedrock,
(St. Amand, 1948). Intensity of the mentary bench placers, which are alluvial fans and refreezing of the . . . in which a temperature below 1947 earthquake at Clear was 8+ now largely buried by younger silt previously thawed deposits. freezing has existed continually (Mercalli scale); at Fairbanks it was deposits. Aggradation following the The later Quaternary history of . . . for two to tens of thousands of intensity 7 with aftershocks estifirst cycle of erosion was interrupted the Little Chena, Chena, and Tanana years." It is "defined exclusively on mated at intensity 5. The history of by a second episode of erosion. These Valleys is obscure. Tributary alluvthe basis of temperature, irrespectively strong earth movements requires

level of the Tanana River.

In letter Outton any terrace deposits that may be present with the exception ter." Engineering structures in earth movements. In later Quaternary time, the upof the sand deposits of the 50-foot interior Alaska have been extensively LITERATURE CITED Loess (Qf) (Péwé, 1955a, 1958) blown northward from the flood plains of the Tanana River and its glacier—may be eolian in part. This terrace morth of the Chena River at the eastern edge of the quadrangle.

The sand is probably alluvial, but may be eolian in part. This terrace may be even frozen ground in the eastern edge of the quadrangle. Stripping of the insulating vegetation may over frozen ground in the eastern edge of the quadrangle. Stripping of the insulating vegetation may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is probably alluvial, but may be even frozen ground in the eastern edge of the quadrangle. The sand is land was blanketed with Fairbanks terrace north of the Chena River at damaged because the existence and fed southern tributaries. Much of represents the highest recognizable tation mat over frozen ground in v. 28, p. 71-75. the upland loess was washed from remnant of an old valley floor, and is preparation for construction or Gasser, G. W., 1946, The Tanana incorporated with much organic debris including vertebrate remains

the Little Chena, Chena, and Tanana Rivers began trenching their valleyto believe that the Quaternary his- glacial stage, much of the loess and is complicated by the numerous low fine-grained sediments which con- Muller, S. W., 1947, Permafrost or America Bull., v. 61, p. 1532. tory of the two areas is essentially most of the creek valley silt deposits terraces (part of Qal) apparently tain large ground-ice masses. If the perennially frozen ground and Williams, J. R., 1955, Preliminary

Permafrost in the Fairbanks (D-1) 1289-1290.

Upland, and also in the Tanana Low- younger and older loess was washed ditions are generally good on granitic ously frozen and contain abundant Petroleum Geologists Bull., v. 38, beneath the present flood plain. valley fill (Qsu) was formed of the to good on Birch Creek schist (pCbc). granules, thin veins, and stringers, Péwé, T. L., 1954b, Effect of perma-Gravel deposition in the upland creek retransported silt, organic material Most of the Quaternary unconsol- to huge tabular and polygonal masvalleys was interrupted by at least including both carcasses and plant idated sediments would provide fair ses and ranging in amount from a banks area, Alaska: U. S. Geol. Geol. Soc. America Bull., v. 66, p.

> Fairbanks D-2 quadrangle, Alaska: U. S. Geol. Survey Geol. Quad. St. Amand, Pierre, 1948, The central Alaska earthquake swarm of October 1947: Am. Geophys. Union

Trans., v. 29, p. 613-623. cycles of erosion and aggradation are ial fans at the valley margins have tive of texture, degree of induration, that buildings and other structures that buildings are the control of the structure of probably related to changes in base covered any terrace deposits that water content, or lithologic character be designed to withstand severe frozen ground in Alaska—its origin and history: Geol. Soc. America Bull., v. 54, p. 1433-1548. deposits at Fairbanks, Alaska: Geol. Soc. America Bull., v. 51, p. U. S. Weather Bureau, 1943, Climatic supplement of the Weather Information Branch, Headquarters,

a hypothesis [abs.]: Geol. Soc.

## DESCRIPTION OF GEOLOGIC UNITS

(See explanation on facing page for description of materials)

GEOLOGIC UNIT	DISTRIBUTION and	TERRAIN and	DRAINAGE and PERMEABILITY	PERMAFROST	SUSCEPTIBILITY TO FROST ACTION	BEARING STRENGTH and SLOPE STABILITY	EXCAVATION and COMPACTION	POSSIBLE USES
Flood-plain alluvium (Qal)	Covers southwestern third of quadrangle and borders Chena and Little Chena Rivers elsewhere. Surficial alluvial silt 1 foot-15 feet thick covers river sand and gravel. Thickness of alluvial deposits not known, but probably 1 foot-20 feet in upper Little Chena and Chena Valleys and as much as 700 feet near Tanana River.	Flat plain broken by low terrace escarpments as much as 10 feet high, a few ponds, meandering stream courses, and a complex network of shallow swales and sloughs (Qs), which mark former positions of braided and meandering river channels.	Drainage excellent and permeability high except locally in surficial silt or where granular deposits are frozen at shallow depth. Drainage is improved by removing vegetation mat, thus lowering permafrost table. Subject to periodic river flooding. Water table 1 foot-15 feet deep where permafrost is absent or deep.	Depth to permafrost 2-4 feet in older, higher parts of flood plain and on low terraces and more than 4 feet on inside of meander curves near rivers and in other especially well drained sites. Depth to permafrost 25-40 feet in some cleared areas, and absent beneath some of the lakes and streams. Active layer 2-8 feet thick. Permafrost is 5 to more than 250 feet thick. It is discontinuous horizontally and vertically with thawed layers, lenses and vertical zones. Low ground-ice content, chiefly interstitial.	In silt: frost action moderate to intense.  In sand and gravel: not susceptible to frost action.	Sand and gravel have high bearing strength at all seasons. Surficial silt has high strength when frozen or when thawed and well drained, but low bearing strength when poorly drained. Slopes stand at 1:1 to 2/3:1 except in sand.	Easily excavated with power equipment except where perennially frozen. Difficult to compact. Little or no subsidence of ground upon thawing of permafrost.	Good foundation for structures, except in marshy silt areas. Silt mantle should be removed before construction to eliminate frost-susceptible foundation material. Gravel good for subgrade, base course, and if crushed and screened, for road metal, concrete aggregate, and railroad engine sand. Source of moderate to large supplies of water from permafrost-free alluvium, or from below permafrost. Surface silt fair to good agricultural soil if fertilized.
Flood-plain swale and slough deposits (Qs)	Widely distributed in meander and braided stream scars which mark former river channels on the flood plain and low terraces of the Little Chena, Chena and Tanana Rivers. Thickness generally less than 10 feet, and only rarely between 10 and 25 feet.	Elongate, branching, sinuous, and flat-floored meander and braided channel scars and flat, wide, basinlike areas with indefinite boundaries. Some of channel scars occupied by ponds, creeks, and intermittent streams.	Silt, locally mixed with organic material, is poorly permeable when thawed, and impermeable when frozen. Impermeable soils cause marshy and boggy conditions throughout the summer. Drainage may be improved by stripping vegetation mat and lowering permafrost table where water table is low. Subject to local snow melt and river floods. Water table ranges from surface to 15 feet deep.	In the broad basinlike swales grown over with stunted spruce, thick moss, and sedge tussocks, permafrost at 1.5-2 feet deep, and active layer 1.5-2 feet thick; permafrost is 5-25 feet thick and laterally continuous. Contains many small ice segregations. Permafrost may extend into underlying alluvium (Qal). In filled meander scars, permafrost may be absent to within 2-4 feet of surface; active layer is 2-4 feet.	Susceptible to intense frost action.	High bearing strength when frozen, but only moderate to very low bearing strength when thawed, depending on height of water table and vegetation cover. Slopes bordering sloughs and swales subject to slumping unless thawed and well drained.	Difficult to excavate when frozen. When thawed below water table, saturated silt flows back into excavation. Subsidence of ground upon thaw of permafrost is common, and degree of sinking depends on volume of ice in excess of void ratio of sediment and depth of thaw during and after construction.	Poor for construction foundation or fill. Should be removed if possible prior to construction. Possible source of clayey silt for use as binder, but source would be thin, small in volume and probably contaminated with organic material.
Silt composing alluvial fans (Qsf)	Alluvial-fan and colluvial deposits generally located at the base of river-cut escarpments. Deposits form a veneer as much as 30 feet thick over river sand and gravel.	Alluvial fans of intermit- tent streams and steep colluvial slopes. Aver- age slope of fans ap- proximately 25 feet per mile; local relief 5 feet.	Surface drainage generally poor to fair on silt alluvial fans, but generally fair to good on steeper colluvial slopes. Drainage of silt generally improved by clearing of vegetation and lowering of permafrost table. Permeability low in frozen silt, but relatively high in thawed silt and mixed silt and rock fragments of the colluvial deposits.	Depth to permafrost to 2 to 25 feet; active layer 2 to 4 feet thick. Permafrost ranges from 2 to 30 feet thick and may be in contact with permafrost of underlying sand and gravel (Qal). Discontinuous. Ground-ice content low, chiefly of interstitial grains rather than large ice masses.	Frost action moderate where well drained to intense where poorly drained.	When frozen or dry and well drained, silt and colluvial deposits have high bearing strength, but when wet and thawed the silt has low bearing capacity. Frozen silt is subject to slumping until thawed and drained and then is stable at 2/3:1 to 1:1. Very susceptible to gullying.	Silt easily excavated with hand or power tools except where frozen. Difficult to compact. Little to moderate ground subsidence upon thawing of permafrost. Mixed silt and bedrock fragments of colluvial deposits locally difficult to excavate where bedrock is resistant type of schist, but relatively easy to excavate where bedrock fragments are soft, weathered schist.	Fair foundations for structures. Unimproved roads on silt are dusty when dry, and soft and muddy when wet.  Fair to good agricultural soil if fertilized.
Terrace sand (Qts)	Limited to 30- to 50-foot terrace along the north bank of Chena River at eastern edge of quadrangle. Surficial sand deposits probably more than 6 feet thick but maximum thickness unknown.	Flat terrace, slopes about 6 feet per mile to west, with local relief less than 5 feet. Bordered by gently sloping alluvial fans on north and locally steep river-cut escarpment on south.	Drainage excellent in central and southern part, but poorer in northern part where silt mantle thickens at toe of alluvial fans and at sites of former ponds. Permeability of terrace sand generally high, but that of silt mantle in poorly drained areas is less.	Permafrost conditions not known. Permafrost probably deep or absent in well-drained southern edge of terrace, but may be at shallow depths along northern border of unit. Large ice masses probably not present.	Sand not susceptible to frost action.  Local silty sand deposits at surface and at depth slightly susceptible to frost action.	Bearing strength generally high at all seasons, but low in summer in the scattered swales or former ponds along north border of unit. Sand stands in slopes of about 1:3.	Easily excavated with hand and power tools. Possible permafrost at depth in northern part of unit would make excavation more difficult.	Possibly suitable for fill and subgrade in absence of coarser material. Offers good to fair foundations and provides sandy, well-drained agricultural soils which require fertilization.
Fairbanks loess (Qf)	Forms widespread silt mantle on hills of northern and eastern part of quadrangle. Thickness ranges from a few inches on higher hilltops to about 100 feet on middle slopes. Mapped only where more than 3 feet thick.	Occurs on slopes and summits of gently rolling hills. Slopes are cut by subparallel gullies as much as 40 feet deep.	good. Water table generally deep in the		Mild to unsuscepti- ble, except in poorly drained places where frost action is severe.	High bearing strength when dry and undisturbed. Low bearing strength when wet. Will stand in near-vertical slopes. Very susceptible to gullying. Freshly exposed surfaces subject to wind erosion. Natural dry density less than 85 lbs/cu ft.	Easily excavated with hand and power tools. Difficult to compact.	Possible source of fines and a possible source for impervious fill. Good foundation for heated structures if protection provided against gullying. Unsurfaced roads built on loess are dusty when dry and muddy when wet. Good agricultural soil if fertilized.
Undifferentiated perennially frozen silt (Qsu)	Widespread surface deposits of lower hill slopes and creek valleys of Yukon-Tanana Upland. Thickness 3 to 100 feet.	Gently sloping coalescent alluvial fans with average slope 25 feet per mile or more and steeper lower hill-slopes. Flat to gently sloping creek valley bottoms. Locally dotted with lakes.	meable by underlying permafrost at shallow depth. Drainage poor except near contact with Qf and pCbc. Surface boggy and marshy in summer. Clearing near contact with Qf and pCbc may improve drainage but clearing in valley bottoms and on fans forms quagmire.	Depth to permafrost 1.5-4 feet on lower slopes and creek-valley bottoms; 5-20 feet near contact with Qf and pcbc and at well drained knolls within unit. Active layer 1.5-4 feet thick. Permafrost 3 to at least 100 feet thick, pinches out upslope, and is laterally continuous except possibly under lakes and near contact with Qf and pcbc. Ground ice abundant as horizontal sheets, vertical wedges, sheets, saucer-shaped and irregular masses 1 foot to 50 feet across. Ice commonly in polygonal pattern. Depth to ice 5-25 feet.	Mild to unsusceptible where dry near contact with Qf, but generally poorly drained and susceptible to intense frost action elsewhere.	High bearing strength when frozen or dry; low when wet and thawed. Near contact with Qf may stand in vertical shallow cuts. Elsewhere subject to slumping until thawed and drained, then stable at 2/3:1 to 1:1. Very susceptible to gullying.	Very difficult to excavate unless thawed; blasting only moderately effective. When thawed, viscous mud slides back into excavation except near contact with Qf or low well-drained knolls. Difficult to compact. Great differential settlement and ground subsidence upon thawing of permafrost forms mounds about 10-50 feet across and thermokarst pits 3-30 feet in diameter and 5-20 feet deep.	near contact with Qf with lowering of permafrost.
Creek gravel (Qg)	Exposed only as placer mine tailings on Last Chance, Pearl, and Gilmore Creeks. Borings indicate buried gravel under Qsu in many creek valleys in quadrangle. Thickness 3 to 200 feet.	Steep-sided gravel piles stacked by mining	Material loose, porous, and only slightly compacted. Excellent drainage and permeability except locally where perennially frozen.	Locally perennially frozen. Low ground-ice content.	Not susceptible to frost action.	High bearing strength. Slopes gentler than 1:1 generally stable.	Difficult to excavate with hand tools because of coarse texture, but easily excavated with power tools. Difficult to compact.	Good foundations for any sort of structure, if the tailings piles are leveled. Good for subgrade, ballast, rip rap, pervious fill, and if crushed and screened, good for base course and aggregate.
Basalt (Tb)	Three small exposures in sections 11, 13, and 14 of T. 1 S., R. 1 E. Maximum thickness probably about 200 feet.	Exposed in river-cut bluffs in isolated knolls projecting through the alluvial fill of Tanana Lowland.	systems allow fair permeability.	Probably no permafrost.	Where rock is locally highly weathered it is mildly susceptible to frost action. Elsewhere generally not susceptible.	Generally high bearing strength. Stands in vertical cuts, which are subject to some sliding or frost riving along columnar joint planes.		pervious fill, rip rap, and, if crushed, for concrete aggregate.
Altered dike rock (ad)	Exposed as small isolated weathered dikes on hills at head of Steele and Smallwood Creeks.	Occurs in gently rolling to hilly terrain.	Good surface drainage. Low permeability.	Possibly local permafrost, especially where it crops out on lower slopes or is buried by Qsu.	Generally not susceptible to frost action.	Generally high bearing strength. Stands in vertical cuts which may be subject to some sliding or frost riving along joint planes.	Weathered dike rock easily excavated with power tools. Fresh rock requires blasting. Difficult to compact.	Possible local source of road-base-course material and road metal.
Granite (gr)	Exposed in hilltops and slopes of two areas in the northwestern part of the quadrangle.	Exposed in rounded ridges and hill tops.	Good surface drainage. Low permeability.	Possibly local permafrost, especially where it crops out on lower slopes or is buried by Qsu.	Not susceptible to frost action.	Generally high bearing strength. Stands in vertical cuts which may be subject to some sliding or frost riving along joint planes.	Weathered rock may be excavated with power tools, but fresh rock requires blasting. Difficult to compact.	Weathered rock good for base course, road metal and concrete aggregate without crushing. Fresh rock good for rip rap or previous fill.
Birch Creek schist (pCbc)	Unweathered schist exposed in steep, river-cut bluffs along trunk streams. Weathered schist occurs on slopes. Mapped in northern part of quadrangle where covered with less than 3 feet of Qf. Thickness unknown, probably several thousand feet.	valleys. Steep bluffs cut by rivers at edge of	developed jointing, fracture cleavage, and	or Qg in creek-valley bottoms or on north facing hillslopes.  Low ground-ice content.		quartzitic schists. Stands in vertical cuts. Micaceous schist types have high bearing strength if cleavage is horizontal or vertical. If cleavage or bedding is inclined, the schist has only moderate bearing strength Susceptible to rock sliding and slumping along joint, cleavage, and foliation planes, especially those planes in sericite-rich schist.	considerable blasting. Resistant layers more easily excavated when interbedded with soft mica schist Difficult to compact.	rip rap and ballast, and for coarse aggregate. If crushed good for base course, and road metal; only fair to poorly suited for use as concrete aggregate. Mica schist fair

