DESCRIPTION OF MAP UNITS

	Description of materials	Distribution and thickness	Topography and drainage	Permafrost	Susceptibility to frost action	Suitability for construction	Special problems
Qt Thermokarst deposits	Lithology dependent upon the materials in which the thermokarst develops. Thermokarst deposits developed in units Qan, Qat, and QTas are fine to medium sand and silty sand; those in eolian sand (Qe) consist of fine sand; and lake deposits formed in the upland silt unit (Qus) are composed of silt to very fine sand. All of the deposits contain disseminated detrital organic matter and chunks of peat of various sizes. Unit includes the deposits of minor streams that cross or connect lake basins.	Occurs in surficial deposits throughout the quadrangle but not differentiated in alluvium. Generally less than 3 m thick.	Forms flat to moderately dissected areas within isolated, interlocking, or overlapping basins. Maximum surface relief within basins ranges from about 3 m to 10 m and is determined by the degree of dissection and presence of pingos. Pingos occur primarily in lake deposits developed in eolian sand (Galloway and Carter, 1978; Carter and Galloway, 1979) and attain a maximum height of about 10 m. Maximum relief between basin floors and surrounding areas ranges from about 5 m to 15 m. Drainage is poor except in those basins in the eolian sand unit that have been breached and deeply dissected.	Perennially frozen immediately below a thin active layer about 0.5 m thick. Amount of excess ice is largely dependent upon the age of the deposits; early Holocene deposits are ice-rich, whereas the deposits and subjacent strata of recently drained basins may have relatively low ice contents. However, wedge ice in the subjacent strata may have survived the lake episode if the lake was shallower than 2 m.	Highly frost susceptible where developed in marine silt and clay. Susceptibility in remainder of area varies within individual lake deposits depending upon silt content and amount of detrital organic matter; deposits in the central part of lake basins generally very susceptible due to concentration of silt and organic matter.	Generally unsuitable as a source of materials due to silt, organic and ice content and the seasonal flooding of the lake basins by snow melt. The older deposits are less suitable as construction sites due to increasing amount of excess ice with age.	Differential settlement may occur upon thaw of permafrost. Very poor drainage except where deeply incised. Pingos common where thaw-lake deposits developed in eolian sand.
Qal Alluvium	Stratified deposits of fine to medium sand, silty sand, gravel, and gravelly sand. Coarse sand and gravel occur along streams west of the Colville River, except in the Qe map unit. Gravel and gravelly sand common along streams in areas of bedrock, and along the Colville River and streams to the east. Contains detrital wood and peat. Includes deposits of flood-plain lakes and thaw lakes. Organic-rich silt occurs as thin overbank deposits and as thicker lacustrine deposits that fill abandoned channels. Small eolian dunes are common on modern point bars.	Occurs along all the major streams in the quadrangle, but is most extensive along the Colville, Chandler, Anaktuvuk, and Itkillik Rivers, which head in the Brooks Range. Includes flood-plain and alluvial terrace deposits as much as 8 m above modern streams. Probably not more than 5 m thick along modern channels, except along the Colville, Chandler, Anaktuvuk, and Itkillik Rivers where the deposits may be as thick as 20 m.	Forms channels and bars of the modern rivers and terraces of older river courses. Meander scrolls are well preserved on the lower terraces. Terrace drainage generally poor. Subject to flooding to 6 or 8 m above low water some streams.	Permafrost underlies the entire unit except for a 2 to 6 m thick unfrozen layer beneath some of the larger channels and lakes, and a thicker (perhaps perforating) unfrozen zone beneath the Colville River. Elsewhere, active layer about 0.5 m thick. Ice wedges are well developed in the terrace materials, and the silty deposits that form the filling material of abandoned channels contain abundant intergangular ice.	Organic-rich silty materials that fill abandoned channels and form overbank deposits are highly frost susceptible. Point bar and channel deposits with less than 6 percent silt are generally not frost susceptible.	Provides good foundations in channel and bar areas where material consists of medium to coarse sand, gravelly sand, and gravel; and moderately good to poor foundations on terraces and the older parts of flood-plains. Organic-rich lacustrine silt that fills abandoned channels is not suitable for foundations. Deposits with low silt content may be suitable for fill.	Subject to bank erosion, scour, channel shifting, and seasonal flooding. Wind erosion and dune building common on point bars and would occur on other parts of the flood plain and on terraces if surface vegetation is disturbed. Excavation of stream-bed materials may pose environmental problems.
Qat Alluvial terrace deposits	Fluvial deposits of interbedded silty sand, gravelly sand, and pebble to cobble gravel. Clast rock types include chert, sandstone, and chert-pebble conglomerate. Detrital wood and chunks of peat locally common. Overlain by thin eolian sand and peat. Penetrated and deformed by sand wedges.	Occurs on both sides of the Colville and Itkillik Rivers in northern map area. Thickness undetermined but in excess of 10 m. Overlying eolian sand and peat from 0.5 to 2 m thick.	Forms residual surfaces between thaw lake basins. Surfaces are fluvial terrace remnants that occur from 6 to 10 m above modern flood plains. Drainage generally good.	Permafrost present beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m.	Silty sand marginally frost susceptible depending on silt content.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand, and locally gravel, may be suitable for fill, base course, or surfacing.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Susceptible to wind erosion if surface vegetation is removed. Sand-wedge materials may be liquefiable when thawed and saturated.
Qe Eolian sand	Fine to very fine sand containing abundant quartz with minor dark minerals. Well sorted. Stratified, with large-scale cross bedding in places. Contains peat beds and wood in upper few m.	Occupies most of the northwestern part of the quadrangle. Thickness ranges from a few m to more than 30 m. This unit forms the eastern edge of a large sand sea (Carter, 1981).	Forms generally well drained linear dune ridges as much as 30 m high upon which are superimposed parabolic dunes that are generally less than 1 m high. Contains poorly drained depressions that are not part of an intergrated drainage system.	Permafrost underlies entire unit. Active layer less than 1.5 m thick on well drained slopes and summits and less than 0.5 m thick in poorly drained depressions. Ice wedges occur in the upper few m but the remainder of the deposits is generally free of excess ice in excess of natural voids. However, the presence of deep lakes (Sloan and Snyder, 1978) may indicate that the eolian sand overlies sediments that contain large amounts of massive ice.	Generally not frost susceptible, except where silt content exceeds 6 percent.	Adequate for natural foundations but requires stabilization for use as a surfacing material or fill. Relatively easy to excavate with a ripper on well drained dune ridges.	Extremely susceptible to wind erosion when protective vegetation is removed. Very sensitive to surface disturbances. Active blowouts present in places. Locally, sand may be liquefiable when thawed and saturated.
Qam Alluvial sand over marine silt and clay	Predominantly fluvial silty sand with scattered granules and pebbles, but includes minor sandy pebble gravel. Pebbles composed primarily of chert and quartz. Overlies marine silt and clay which is exposed at altitudes that range from 8 to 20 m. Overlying the fluvial sand is thin eolian sand and peat; sand wedges of fine to very fine eolian sand penetrate and deform the alluvial sand.	Occurs on both sides of Judy Creek in the northwest part of the quadrangle. Fluvial sand 3 to 6 m thick, marine silt and clay of unknown thickness. Eolian sand and peat 1 to 2 m thick.	Forms residual surfaces between thaw lake basins. Drainage generally good. Not subject to snowmelt flooding.	Permafrost present beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m, and interstitial ice in excess of natural voids probably is present in the marine silt and clay.	Silty sand generally frost susceptible. Silt and clay highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base course, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Susceptible to wind erosion if surface vegetation is removed. Materials forming the sand wedges may be liquefiable when thawed and saturated.
QTas Alluvial and eolian sand and marine sand and silt	Highly variable composition, but generally consists of stratified deposits of marine silty sand, gravelly sand, silt, and minor clay, overlain by fluvial silty sand, gravelly sand, and minor organic-rich silt, which in turn locally is overlain by eolian sand. In places, marine deposits do not occur, and only fluvial and eolian deposits are present. The base of the marine deposits is exposed only in bluffs along the right bank of the Colville River, where it is marked by a sparse lag of pebbles, cobbles, and boulders. Rock types in the lag include those characteristic of map units Tsg and Tg. The marine deposits commonly are fossiliferous, containing mollusks, foraminifers, ostracodes, and rare marine mammal remains. The deposits of two marine transgressions occur and locally may be superposed. Fluvial deposits locally contain buried peat beds, and logs of spruce, larch, and poplar. The lower part of the eolian sand contains ventifacted pebbles of chert and quartz derived from the fluvial deposits. Wedges of pebble-free eolian sand penetrate and deform the underlying deposits. Peat and/or peaty, silty sand occurs at the top of the unit.	Occurs on both sides of the Colville River in the northern part of the quadrangle. Thickness of marine deposits 1 to 6 m; fluvial deposits 10 to 20 m; eolian deposits 1 to 5 m; peat and peaty sand 1 to 2 m. Aggregate thickness 12 to 20 m.	Forms flat to gently rolling terrain broken by thaw-lake basins and ravines. Drainage good on slopes, fair to poor on flatter surfaces.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Ice wedges occur in the upper few m. Silt, organic-rich silt, and clay may have interstitial ice in excess of natural voids.	Silty sand generally frost susceptible. Silt and clay highly frost susceptible.	Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Sand may be suitable for fill, base course, or surfacing if silt content is appropriate and if stabilized to prevent deflation.	Easily eroded by running water if flow is concentrated by construction activities or if surface vegetation is removed. Sand-wedge filling subject to liquefaction if thawed and saturated. Susceptible to wind erosion if surface vegetation is removed.
Qc Colluvial deposits	Silt and very fine sand with dispersed pebbles and cobbles. Contains disseminated, fine-grained organic matter and, in places, chunks of peat of various sizes, and pieces of detrital wood. Bones of extinct Pleistocene mammals locally present. Includes gravelly alluvium in valley bottoms.	Occurs throughout the quadrangle except for the northwest quarter. Thickness from 1 to 10 m.	Forms valley and gully slopes and bottoms. Drainage good on upper slopes, poor on lower slopes and in valley and gully bottoms.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Contains ice wedges and moderate to high volumes of interstitial ice beneath lower slopes and valley bottoms.	Highly frost susceptible.	Generally unsuitable as a source for materials because of organic content. Not suitable for foundations on lower slopes and valley bottoms because of excessive differential settlement on thaw of ice-rich permafrost.	Easily gullied by running water. Disruption of surface vegetation on lower slopes and valley bottoms may cause melting of ground ice and lead to subsidence.
Qaf Alluvial fan deposits	Stratified to poorly stratified silty, gravelly sand to silty, sandy gravel. Common organic debris.	Occurs east of the Itkillik River in the northern half of the quadrangle. Thickness undetermined but perhaps a few tens of m.	Forms flat to gently undulating surfaces. Drainage poor to fair.	Perennially frozen beneath an active layer that is generally less than 0.5 m thick. Contains ice wedges and moderate to high volumes of interstitial ice.	Moderately to highly frost susceptible.	Generally unsuitable as a source for materials because of organic content. Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost.	-----
Qus Qus_1 Qus_2 Upland silt and sand	Predominantly wind blown very fine sand and silt. Includes some clay and layers and lenses of chert granules and pebbles. Stratification indistinct. Gravelly sand to sandy gravel locally composes lower part of deposit. Clasts predominatly pebble-sized, well rounded, and composed of chert and quartz. Very poorly exposed. The designation Qus_2 indicates that the deposit overlies a sheet of pebble, cobble, and boulder gravel 10 to 20 m thick that forms an extensive terrace of the Colville River. East of the Itkillik River, the northern part of this unit defines a former course of the Colville River that was abandoned as a result of stream piracy. The designation Qus_1 indicates that upland silt and sand overlies discontinuous deposits of pebble, cobble, and boulder gravel as much as 10 m thick in the southwestern part of the quadrangle that are the eroded remnants of ancient fluvial or glaciofluvial terraces which are much older than the gravel of Qus_2.	Occurs throughout much of the quadrangle except for the northwest and northcentral parts. Ranges from a few m to as much as 20 thick.	Forms flat to gently rolling terrain broken by deep thaw-lake basins, major stream valleys, and ravines. Drainage good on slopes, fair to poor on flatter surfaces.	Active layer generally less than 0.5 m thick. Ice wedges well developed and sediment may contain a high volume of interstitial ice.	Silt and silty sand are frost susceptible.	Not suitable for borrow except as binder material. Not suitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost.	Easily gullied by running water when water is channeled by construction activities or when surface vegetation is removed. Disruption of surface vegetation may cause melting of ice wedges and lead to subsidence. Locally deposits may be liquefiable when thawed and saturated.
Qm Younger morainal deposits	Deposits not exposed, but probably consist of unsorted, generally nonstratified compact till. Composition may range from muddy, sandy, bouldery gravel to a sandy, bouldery silt. Stratified ice-contact deposits composed of moderately sorted sand and sandy gravel locally may be present. Overlain by a continuous cover of organic silt from 1 to several m thick.	Occurs on both sides of the Itkillik River in the southeast corner of the quadrangle. Thickness variable but at least 75 m beneath the crest of the moraine.	Forms a broad moraine with irregular topography. Slopes well drained, depressions poorly drained.	Permafrost present beneath an active layer 0.5 to 1 m thick. Probably ice-rich in the upper few m, especially in depressions.	Till moderately to highly frost susceptible depending on silt content. Depression fillings probably highly frost-susceptible.	Depressions unsuitable for foundations because of excessive differential settlement on thaw of ice-rich permafrost. Slopes on silt and clay-rich till unsuitable because they are generally unstable. Construction materials generally not available.	Slopes subject to mass movements, especially solifluction and earth flows.
Tm Morainal deposits and drift of intermediate age	Unsorted, unstratified compact till composed of sandy, bouldery silt and clayey silt. Very poorly exposed. Stratified ice-contact deposits composed of moderately sorted sand and sandy gravel locally may be present. Overlain by a continuous cover of organic silt from 1 to several m thick.	Occurs on both sides of the Itkillik River in the southeast corner of the quadrangle. Thickness unknown but possibly as much as 100 m beneath the crest of the moraine.	Forms a morainal ridge west of the Itkillik River and formless drift east of the river. Drainage generally good.	Permafrost present beneath an active layer 0.5 to 1 m thick. Probably ice-rich in the upper few m.	Highly frost susceptible	Construction materials not generally available. Not suitable for foundations because of cover of organic silt and unstable slopes.	Slopes subject to mass movements, especially solifluction and earth flows.
Td Older drift	Materials not exposed but existence of glacial drift inferred from the arcuate pattern of the hilly terrain of this map unit west of the Itkillik River, the presence of erratics as lag accumulations in stream beds there, and the occurrence of erratics on ridge crests east of the Itkillik River. Erratics may indicate the presence of till or may have been incorporated in younger fluvial gravel. Continuous cover of organic silt several m thick.	Occurs on both sides of the Itkillik River in the southeast corner of the quadrangle. Thickness unknown but possible as thick as 30 m west of the Itkillik River.	Forms hilly terrain with gentle slopes that define an arcuate pattern west of the Itkillik River. Occurs on ridge crests east of the Itkillik River. Drainage generally good.	Permafrost present beneath an active layer 0.5 to 1 m thick. Organic silt cover is ice-rich.	Organic silt cover highly frost susceptible.	Unsuitable for foundations due to cover of ice-rich organic silt. Construction materials not generally available.	-----
Tgs Gravelly sand	Gravelly sand to sandy gravel. Clasts predominantly pebble-sized, well rounded, and composed of chert and quartz. Very poorly exposed.	Occurs on the east side of the Colville River - Itkillik River valley in the northeastern part of the quadrangle, where it underlies QTas. Thickness about 1 to 3 m.	Forms an indistinct bench on the valley side. Well drained.	Perennially frozen beneath an active layer that is probably less than 1 m thick. Ice content unknown but probably not in excess of natural voids.	Probably not frost susceptible.	Not suitable for borrow due to thickness of overburden (QTas).	-----
Tat Alluvial terrace deposits	Fluvial deposits of pebble, cobble, and boulder gravel overlain by eolian and colluvial silt. Clast rock types include chert, sandstone, and chert-pebble conglomerate.	Occurs on west side of Tuluga River in southern part of quadrangle.	Forms benches on valley side and caps the drainage divide.	Permafrost present beneath an active layer that is generally less than 0.5 m thick.	Silt cover highly frost susceptible; fluvial gravel not frost susceptible.	Generally unsuitable as a source of materials because of silt overburden, small volume of gravel, and topographic position.	-----
Tsg Sand, gravelly sand, conglomerate, and pebbly mud	Nonmarine, moderately to poorly consolidated deposits of variable composition, ranging from conglomerate to sandy gravel, gravelly sand, sand, and pebbly mud. Locally contains lignitized logs of large coniferous trees. Contains disseminated sulfur in places.	Exposed in river cut-banks in T7N, R8E in the northeastern part of the quadrangle. Exposed thickness (incomplete) ranges from 2 to 8 m; total thickness considerably greater but unknown. Overlain by 3 to 10 m of younger deposits.	Forms the lower parts of river cut-banks. Drainage generally good.	Perennially frozen. Generally low ice content but fine-grained units may contain ice in excess of natural voids.	Fine-grained beds susceptible to frost action.	Not suitable for borrow due to thickness of overburden and extensive weathering of some clasts.	-----
TKg Conglomerate	Pebble, cobble, and boulder conglomerate. Clasts predominantly of hard, resistant rock types common in nearby parts of the Brooks Range, including chert, quartz, sandstone, and chert-pebble conglomerate. Erratics to 1.5 m in diameter locally common. Poorly exposed; parts of deposit may have silty matrix and may be till. In the northern part of the area locally contains clasts composed of metamorphic, intrusive, and volcanic rock types which do not occur in nearby parts of the Brooks Range and which are distinct from the rock types found in younger glaciomarine deposits.	Occurs east of the Itkillik River in the northeast part of the quadrangle as interbeds in TKcs and as a sheet that underlies Qus in this area. Up to 40 m thick.	Forms bluffs on the upper and middle slopes of valleys. Well drained.	Entire unit is perennially frozen. Thickness of active layer is unknown but may be as much as 2 m on unvegetated, south-facing slopes. Ice content not known but probably not in excess of natural voids.	Susceptible to frost action where matrix is silty.	Suitable for fill, base course, and surface course (with proper grading), but unsatisfactory for aggregate because of chert content. Provides good foundations near bluff tops where silt cover is not excessive.	-----
TKcs Kc Rocks of the Sagavanirktok Formation undifferentiated (TKcs) and the Colville group (Kc)	Nonmarine and marine sandstone, siltstone, and shale with coaly beds and thin tephra layers. Thinly to thickly bedded; moderately to poorly indurated. Fine-grained beds are commonly bentonitic.	Underlies over much of the quadrangle exept for the northwest, northcentral, and eastcentral parts.	Forms rolling uplands and steep river bluff. Well drained.	Perennially frozen but ice content insignificant except in thoroughly weathered surficial zones and in the upper few m of shale on low gradient upland surfaces where ice wedges may be present.	Thin bedded and/or fine-grained units susceptible to frost action.	Locally suitable for borrow when not bentonitic.	Subject to debris flows, rock falls, and landslides (shown by hachures on map in extreme western part of map). Slopes may be inherently unstable where bentonitic beds are present.
Kn Rocks of Nanushuk group	Nonmarine and marine sandstone, siltstone, shale and conglomerate. Thinly to thickly bedded; well to poorly indurated.	Occurs in an east-west trending belt across the southwest part of the quadrangle.	Forms east-west trending hills and valleys and steep river bluffs.	Perennially frozen but ice content generally insignificant except in thorough weathered surficial zones.	Thin bedded and/or fine-grained units susceptible to frost action.	Locally suitable for borrow. Normally makes good foundations.	Subject to rock falls on steep slopes.

ENGINEERING-GEOLOGIC MAPS OF NORTHERN ALASKA, UMIAT QUADRANGLE

by

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