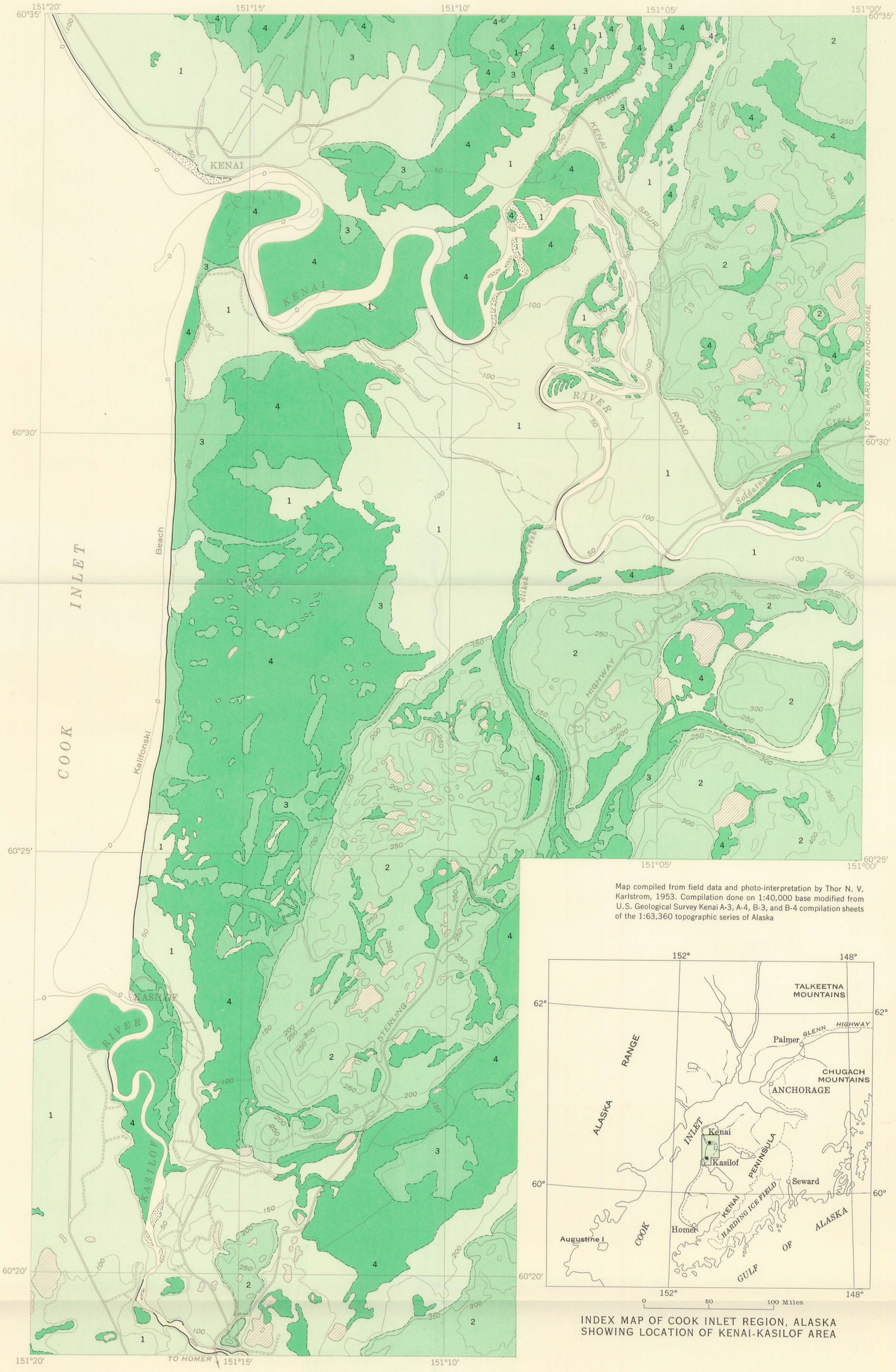
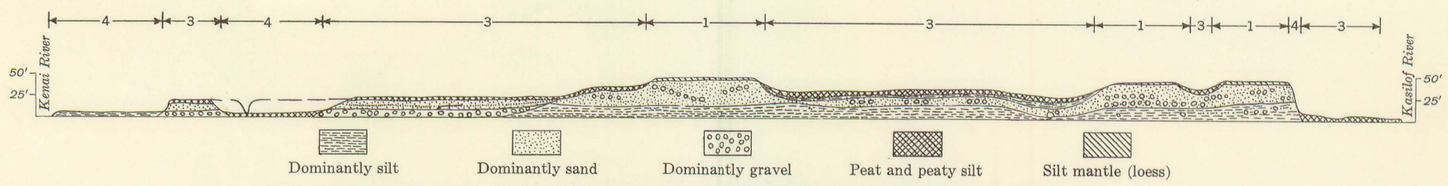
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS GEOLOGIC INVESTIGATIONS
MAP I-269



Map compiled from field data and photo-interpretation by Thor N. V. Karlstrom, 1953. Compilation done on 1:40,000 base modified from U.S. Geological Survey Kenai A-3, A-4, B-3, and B-4 compilation sheets of the 1:63,360 topographic series of Alaska

INDEX MAP OF COOK INLET REGION, ALASKA
SHOWING LOCATION OF KENAI-KASILOF AREA



GEOLOGIC SECTION EXPOSED IN BLUFF ALONG KALIFONSKI BEACH BETWEEN KENAI AND KASILOF RIVERS

MAP EXPLANATION

Map unit	Description	Suitability for land use
1 Terraces and alluvial plains	Moderately to well-drained, flat to undulating terrace and plain surfaces mantled with 1 to 3 feet of wind-blown silt (loess) and underlain by stratified silt, sand, and gravel of glaciolacustrine and glaciofluvial origin. Locally the character of the underlying deposits varies abruptly both vertically and horizontally. Fine- to coarse-grained sand, locally interstratified with gravel, predominates and in general underlies the surface to depths of 25 feet or more. A thick, finely laminated to massive, blue-gray silt with sand and gravel lenses, and containing scattered pebbles and cobbles, is generally present at depths greater than 25 feet along the coast and up the lower reaches of the Kenai and Kasilof Rivers. Vegetation consists generally of sparse stands of shallow-rooted trees with local patches of denser forest and shrub	Extensive flat well-drained surfaces and generally stable coarse granular subsurface materials provide the most suitable conditions for construction and land development in the area. Sand and gravel suitable for construction purposes is available in large amounts locally at the surface or at shallow depth. For stable foundations, the surface silt mantle should be scraped off. The underlying sand and gravel deposits generally comprise good subgrade material but will locally require covering with coarser grained material for base course and foundation purposes. Vegetation can be cleared readily by bulldozers. Special precautions are required to preserve the surficial silt mantle in areas cleared for farming
2 Morainal belts	Moderately to well-drained hummocky and terraced surfaces associated with numerous undrained depressions occupied by small lakes, ponds, and marshes. Stratified silt, sand, and gravel, predominantly of glaciolacustrine origin, are overlain by 1 to 3 feet of wind-blown silt (loess) and underlain at variable depths by unsorted glacial till and stratified, contorted, and faulted ice-contact deposits. The till consists generally of poorly sorted sandy silt matrix containing pebbles and cobbles and, locally, large granitic and graywacke boulders. The till lies closest to the surface beneath ridge tops and upper steeper slopes, on lower gentler slopes, and in depressions the till is generally overlain by thick deposits of stratified well-sorted silt, sand, and gravel. Fine- to coarse-grained sand is the primary component of the stratified deposits, but large deposits of sand and gravel are locally available. Vegetation consists of dense stands of mature, shallow-rooted trees with local areas of open forest and shrub	Same as for unit 1 except that flat to gently sloping areas are more restricted, and large boulders and till at shallow depth may present local construction and subsurface drainage problems
3 Better-drained parts of muskeg and swamp areas	Better-drained areas within and marginal to the poorly drained muskeg and swamp areas (unit 4). Unit includes low marginal terraces and islands of slightly higher ground within the muskeg and swamp areas with thin organic silt mantle, and areas marginal to terrace scarps underlain by thick but generally well-drained organic silt and peat deposits. Well-sorted silt, sand, and gravel generally of good permeability occur at shallow depth beneath marginal terraces. Sorted silt, sand and gravel, or till occur at greater depth beneath the muskeg and swamp surfaces. Vegetation consists generally of mosses; sedges, and grasses, with local groves of shrub and small trees	Poorly suitable for general land use, but comprises units within the extensive, poorly drained muskeg and swamp areas that are least objectionable for road alignments and construction sites. Some excavation and backfilling with coarse granular materials generally required to provide stable foundations for roads and buildings. In areas underlain by well-drained but thick organic deposits, extensive excavation and backfilling, piling or corduroy is required to maintain stable foundations. Ditching and other procedures are generally required to improve surface drainage
4 Muskeg, swamp, and elevated tidal flats	Poorly drained areas with deep unstable organic and mineral soils. Unit includes muskeg and swamp areas underlain generally by more than 5 feet of peat and organic silt and elevated tidal flats underlain generally by more than 10 feet of wet semiplastic blue-gray silt. Vegetation of muskeg and swamp areas consists dominantly of grasses, sedges, mosses, and heath plants with scattered small trees and groves of larger trees with shallow root systems. Vegetation of elevated tidal flats is generally sparse and made up predominantly of grasses and sedges with small scattered trees growing locally on better-drained sites	Mostly unsuitable for general land use because of extremely poor surface drainage and extremely unstable frost-susceptible soils

Actively retreating sea bluffs and terrace scarps

Beach and bar sand generally above high-tide mark

Map-unit boundary

Datum contour

INTRODUCTION

Increased homesteading, construction, and military activity in the Kenai-Kasilof area recently stimulated the need for expanding the secondary road net. In 1953 the author compiled an engineering soils and construction materials map of the area for the Alaska Road Commission to assist in preliminary planning of road location and alignment. The accompanying map is a modified version of this map and emphasizes the geologic, topographic, and hydrologic factors which affect general land utilization.

GEOGRAPHIC SETTING

The Kenai-Kasilof area is on the Cook Inlet coastal margin of the Kenai Peninsula, south-central Alaska, between the villages of Kasilof and Kenai,which are located at the mouths of the Kasilof and Kenai Rivers, respectively (see index map). The village of Kenai occupies the site of a Russian fortified post that was established in 1791 and is today an important supply point for fishing, cannery, and other commercial activity in Cook Inlet. Kasilof, also the site of an early settlement, is 11 miles south of the larger community of Kenai. The largest airfield on the Kenai Peninsula is at Kenai; it handles daily scheduled airline flights from Anchorage. An emergency landing strip is located near Kasilof. The area is crossed by the all-weather Sterling Highway with road connections to Anchorage and Seward,which are 175 and 125 road miles to the north and east, respectively, and to Homer which is the southernmost settlement in the Kenai Lowlands, 70 miles to the south.

Approximately half of the Kenai-Kasilof area is occupied by poorly drained, unstable soils (map units 3 and 4) that are generally unsuitable for construction materials and foundations or for agricultural and commercial development. The remainder of the area (map units 1 and 2) is generally suitable for land use and development. Subsurface drainage conditions largely determine land-use potential. The subsurface drainage characteristics in turn are determined mainly by nature of the underlying sediments and the topography. Vegetation, largely a function of subsurface drainage conditions, ranges from sedge-grass-moss cover on the wettest sites to mature stands of white spruce, white birch, aspen, and cottonwood on the drier sites. Trees are shallow rooted and, in general, readily cleared by bulldozers. Permafrost is usually absent but local bodies of relict permafrost may be present near the base of thick organic silt and peat deposits. It poses no special engineering problem.

GEOLOGY

The Kenai-Kasilof area is part of the Kenai Lowland, a broad coastal shelf 20 to 50 miles wide, between Cook Inlet and the Kenai Mountains to the east. The topography of this lowland shelf is characterized by irregular morainal ridges and knolls separated by swamp and muskeg in broad irregular depressions and abandoned drainage channels. Most of the lowland is below the 500-foot elevation; local relief is commonly less than 200 feet. The lowland is underlain by semiconsolidated coal-bearing formations of Tertiary age covered by a variable thickness of glacial, glaciolacustrine, glaciofluvial, fluvial, and eolian deposits of Quaternary and Recent age. The topography and surficial deposits are primarily products of repeated glaciations that completely or partly filled the Cook Inlet trough with ice emanating from the surrounding mountains (Karlstrom *in* Péwé, 1953; Karlstrom, 1957). Elevated strandline and related lake deposits of variable thickness locally mantle the primary glacial deposits to elevations at least as high as 500 feet and record the presence of ancient lakes that occupied the upper part of Cook Inlet during the later periods of maximum glacial advance.

Although the surface deposits are predominantly glaciolacustrine, glaciofluvial, and eolian, the underlying primary glacial deposits largely determine the major topographic character of the terrain. Till and associated ice-contact deposits of early glacial advances (the Eklutna and Knik) underlie, at shallow to moderate depth, the modified morainal belt that extends from the northeast to the southwest corner of the mapped area. This morainal belt marks in large part the interlobate zone along the line of coalescence, during Eklutna time, of ice from the Alaska and Talkeetna Ranges to the west and north, and ice from the Chugach and Kenai Ranges to the north and east. A somewhat less modified morainal belt in the extreme southeast corner of the area represents part of the end moraine of the piedmont glacial lobe of Naptowne age that fed from the Harding ice field of the Kenai Mountains to the east of the area.

This end moraine is associated with a strandline bench, underlain by beach silt, sand, gravel, that marks an important static level of the proglacial lake that fronted Naptowne ice and nearly covered the Kenai-Kasilof area. Remnants of strandlines at lower elevations throughout the lowland record successive lowerings of the proglacial lake during retreat of Naptowne ice. A major strandline is developed around the 125-foot elevation which in the Kenai-Kasilof area largely marks the boundary between higher areas of hummocky morainal terrain and the lower flat to undulating areas underlain by thick lake and fluvial deposits bordering the coast and extending upvalley as terraces along the lower reaches of the Kenai and Kasilof Rivers. Elevated tidal flats occur at the mouths of the Kenai and Kasilof Rivers below an elevation of 20 feet and above the present high-tide mark. These elevated tidal flats are considered to record the interval of maximum sea level rise in postglacial time which took place after the final drainage of the Naptowne proglacial lake from Cook Inlet.

No Tertiary bedrock is exposed above the high-tide mark in the sea bluffs that margin the area to the west. However, an exposure of Tertiary coal-bearing rocks is present in the banks of the Kasilof River in the southern part of the area, suggesting the local presence of Tertiary bedrock at relatively shallow depth elsewhere in the area.

REFERENCES CITED

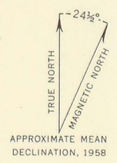
Karlstrom, T. N. V., *in* Péwé and others, 1953, Multiple glaciation in Alaska, A progress report: U. S. Geol. Survey Circ. 289, p. 3-5, 12-13.

Karlstrom, T. N. V., 1957, Tentative correlation of Alaskan glacial sequences, 1956: Science, v. 125, no. 3237, p. 73-74.

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D. C., MR 4517

GROUND CONDITIONS AND SURFICIAL GEOLOGY OF THE KENAI-KASILOF AREA KENAI PENINSULA, SOUTH-CENTRAL ALASKA

By
Thor N. V. Karlstrom



Scale 1: 63 360

1 0 1 2 3 Miles

Contour interval 50 feet
Datum is mean sea level

1958

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For sale by U. S. Geological Survey, price 50 cents