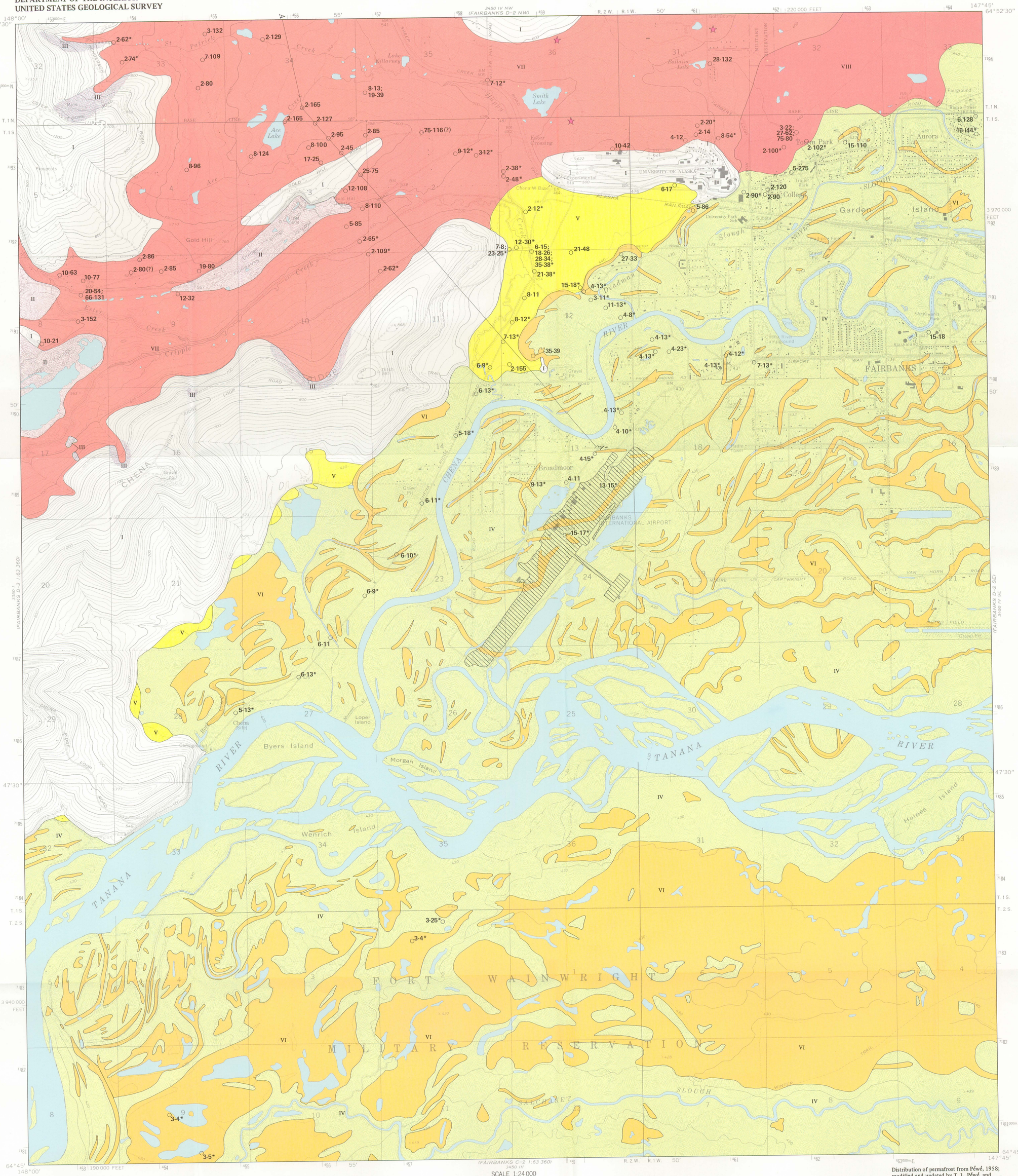
DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

FOLIO OF THE
FAIRBANKS D-2 SW QUADRANGLE
MAP I-829-B



EXPLANATION

The permafrost classification presented below is in order of increasing ice content from map unit I through VIII. It should be noted that local variations in extent, thickness, and ice content occur. "Permafrost" is here defined as any material that remains at or below 32°F continuously for more than 2 years; ice may or may not be present.

Ice content is defined as follows:

1 Low—Ice generally restricted to pore spaces between particles and to thin seams less than 1/16 inch thick in silt and clay.

2 Moderate—Ice generally restricted to pore spaces between particles and to thin seams greater than 1/16 inch and less than 1/4 inch thick in silt and clay.

3 High—Ice generally in form of seams greater than 1/4 inch thick and (or) large ice masses. Up to 50 percent of the ground by volume may be ice (confined to upper 30 feet).

I

Permafrost free

II

Tailings
Permafrost with low ice content

Sand and gravel tailings are generally unfrozen but may be frozen locally. If frozen, ice content very low and mainly restricted to pore spaces. No seasonal frost action and no subsidence upon thawing

III

Bedrock
Permafrost with low ice content

Fresh and decayed bedrock is perennially frozen on slopes facing directly north; probably discontinuous on northwest- and northeast-facing slopes. Ice content is low or absent; it may be higher in fractured or decayed bedrock. Ice is mainly restricted to pore spaces. Depth to permafrost 1-4 feet. Thickness of permafrost 1-100 feet. Seasonal frost action absent in fresh bedrock but may be moderate in decayed material. No subsidence upon thawing of fresh bedrock but may be slight upon thawing of decayed material. Locally, frozen bedrock may be overlain by loess that may also be perennially frozen with little or no ice content

IV

Flood-plain silt, sand, and gravel
Permafrost with low ice content

Permafrost is discontinuous in many areas such as beneath lakes, rivers, and creeks. If frozen, 1-15 feet of silt overlying sand and gravel may have low to moderate ice content in the form of thin seams; underlying sand and gravel have low ground-ice content which is primarily restricted to pore spaces. Depth to permafrost 2-4 feet in older parts of flood plain and more than 4 feet on inside of meander curves near river. Depth to permafrost 25-40 feet in cleared areas. Seasonal frost layer 2-9 feet thick. Permafrost 5-275 feet thick. Silt will show some subsidence upon thawing; sand and gravel will show no subsidence upon thawing. Silt may undergo intense frost action, but sand and gravel will undergo none

V

Alluvial silt fans
Permafrost with moderate ice content

Alluvial silt fans overlying flood-plain sand and gravel have discontinuous permafrost with moderate to low ice content primarily as pore ice but may contain ice seams and lenses. No large ice masses. Depth to permafrost 3-25 feet; seasonal frost layer 3-4 feet; thickness of permafrost 2-155 feet. Little to moderate subsidence upon thawing. Seasonal frost action moderate to intense

VI

Flood-plain slough and swale deposits
Permafrost with moderate-high ice content

Broad basinlike areas and elongate, sinuous meander scars may be perennially frozen. Permafrost is discontinuous; young sloughs and swales, especially those with intermittent streams, generally contain no permafrost. If frozen, thickness of permafrost 5-30 feet with moderate to high ice content as thin seams and small lenses. Depth to permafrost 1½-4 feet; seasonal frost layer 1½-4 feet. Seasonal frost action intense. Moderate to great subsidence upon thawing

VII

Valley-bottom muck
Permafrost with high ice content

Silt on lower slopes and in valley bottoms is perennially frozen. Top layer (3-30 feet thick) has moderate to high ice content in the form of seams and lenses; lower layer contains abundant ice as seams, horizontal sheets, vertical sheets, wedges, and saucer-shaped and irregular masses, all of which range from 1 to 50 feet in diameter. Near the contact with the unfrozen silt zone upslope, ice content may be low and permafrost sporadic. Depth to permafrost 1½-3 feet on lower slopes and valley bottoms; 5-10 feet near the contact with the unfrozen silt zone; 10-25 feet under cleared areas. Seasonal frost layer 1½-3 feet thick. Thickness of permafrost 3-175 feet. Seasonal frost action intense. Great subsidence upon thawing of permafrost

VIII

Valley-bottom peat-muck
Permafrost with high ice content

Organic silt containing peat beds in valley bottoms and low, flat areas is perennially frozen. Ground ice is abundant as seams, horizontal sheets, vertical sheets, wedges, and saucer-shaped and irregular masses, all of which range from 1 to 50 feet in diameter. Massive ice close to the surface results in large (25-100 feet in diameter) polygonal pattern on the surface. Depth to permafrost 1½-3 feet. Seasonal frost layer 1½-3 feet thick. Thickness of permafrost 1-140 feet. Seasonal frost action intense. Great subsidence upon thawing

Artificial fill

Fill obtained locally. Color indicates underlying permafrost conditions

Contact

Contacts generally indefinite or gradational; dotted where concealed

2-62*

Borehole location

First number indicates depth to top of permafrost; second number indicates depth to bottom of permafrost or to bottom of hole if bottomed in permafrost(in feet)

* *Indicates that hole bottomed in permafrost*

Detailed subsurface information may be obtained from the geologic map of the Fairbanks D-2 SW quadrangle, Alaska, and from the map showing foundation conditions in the Fairbanks D-2 SW quadrangle, Alaska

Thermokarst pits

Collapse pits 2-30 feet in diameter and 5-10 feet deep are caused by thawing of large masses of ground ice

SELECTED BIBLIOGRAPHY

Ferrians, O. J., Jr., Kachadoorian, R., and Greene, G. W., 1969, Permafrost and related engineering problems in Alaska: U.S. Geol. Survey Prof. Paper 678, 37 p.

Muller, S. W., 1945, Permafrost or permanently frozen ground and related engineering problems: U.S. Geol. Survey Special Rept., Strategic Eng. Study 62, 2d ed., Mil. Intelligence Div., Office, Chief of Engineers, U.S. Army. Also litho-printed by Edwards Brothers, Ann Arbor, Mich., 1947, 231 p.

Péwé, T. L., 1954, Effect of permafrost on cultivated fields, Fairbanks area, Alaska: U. S. Geol. Survey Bull. 989-F, p. 315-351.

_____ 1958, Geology of the Fairbanks D-2 quadrangle, Alaska: U.S. Geol. Survey Geol. Quad. Map GQ-110.

_____ 1966, Permafrost and its effects on life in the north: Corvallis, Oregon State Univ. Press, 40 p.

_____ 1974, Permafrost: Encyclopedia Britannica (in press).

Péwé, T. L., Bell, J. W., Forbes, R. B., and Weber, F. R., 1974, Geologic map of the Fairbanks D-2 SW quadrangle, Alaska: U.S. Geol. Survey Misc. Geol. Inv. Map I-829-A (in press).

Péwé, T. L., and Paige, R. A., 1963, Frost heaving of piles with an example from Fairbanks, Alaska: U.S. Geol. Survey Bull. 1111-I, p. 327-407.

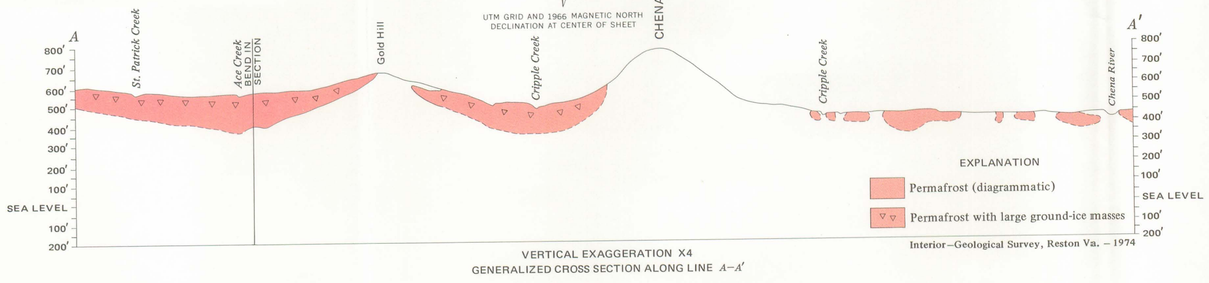
Base from U.S. Geological Survey, 1966
10,000-foot grid based on Alaska coordinate system, zone 3
1000-meter Universal Tranverse Mercator grid ticks, zone 6

SCALE 1:24 000

1 MILE
1000 0 1000 2000 3000 4000 5000 6000 7000 FEET
1 KILOMETER

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET



VERTICAL EXAGGERATION X4
GENERALIZED CROSS SECTION ALONG LINE A–A'

Interior–Geological Survey, Reston Va. – 1974

Distribution of permafrost from Péwé, 1958; modified and updated by T. L. Péwé and J. W. Bell, 1972

QUADRANGLE LOCATION

MAP SHOWING DISTRIBUTION OF PERMAFROST IN THE FAIRBANKS D-2 SW QUADRANGLE, ALASKA

By

Troy L. Péwé and John W. Bell

1974

For sale by U.S. Geological Survey, Fairbanks, Alaska 99701; Denver, Colo. 80225; or Reston, Va. 22092, price $1.00