DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF– 670B

BASE BY U.S. GEOLOGICAL SURVEY, 1966

SCALE 1:24 000

CONTOUR INTERVAL 20 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1966 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

QUADRANGLE LOCATION

MAP SHOWING GROUND WATER CONDITIONS IN THE FAIRBANKS D-2 NE QUADRANGLE, ALASKA

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1975

INTRODUCTION

The primary factors that determine ground-water conditions in the Fairbanks D-2 NE quadrangle are (1) topographic position, (2) water-bearing characteristics of the rocks, and (3) distribution of permafrost. These interrelated factors generally limit the conditions in any particular area.

Basic data from the geologic map of the Fairbanks D-2 NE quadrangle (Map I-950, Péwé and others, in press), the map showing distribution of permafrost in the Fairbanks D-2 NE quadrangle (Map MF-670A, Péwé and Bell, 1975a), and the map showing foundation conditions in the Fairbanks D-2 NE quadrangle (Map MF-670D, Péwé and Bell, 1975c) have been used in conjunction with well data to establish generalized potential ground-water conditions.

OCCURRENCE OF GROUND WATER

Upland hills

Adjacent to the Tanana-Chena River flood plain are gently rolling bedrock hills covered by 3-200 feet of loess (windblown silt). The topographic relief of the hills and the fair to good vertical permeability of the unfrozen loess make the loess well drained, and no wells tapping ground water in the loess have been reported.

Ground water in the schist bedrock is primarily controlled by fractures, joints, and fractured quartz veins. Ground water percolates through these zones, and it is usually these zones that drillers attempt to tap. The location and frequency of the zones are random and it is difficult to estimate where they might be found.

In general, the water table in the upland hills is deep because of the great relief relative to the valley bottoms. In some areas, perched water tables occur in the hills along fracture zones or above permafrost zones. In most places, the water table can be expected to lie a maximum of 100 to 200 feet above the valley floor. On higher hills and ridges, the depth to the water table may be 400-500 feet or more.

Although the loess-covered bedrock is generally free of permafrost, perennially frozen silt occurs along the base of most hills. Ground water is commonly dammed by the impermeable frozen material on the lower hill slopes, and the water table in the hills is at or slightly above the uppermost permafrost elevation. Above this elevation, the water table surface (piezometric surface) tends to flatten.

Creek valley bottoms

As much as 300 feet of organic silt has accumulated in the valley bottoms of the upland and serves as a very poor water-bearing formation. Because of the high organic content and low permeability of the silt, ground water obtained from the silt is undesirable.

Occurrence of ground water is primarily controlled by permafrost distribution. Nearly all the valley-bottom muck contains continuous permafrost with maximum known thicknesses of more than 175 feet; depth to permafrost is generally 1 1/2 - 3 feet but may be as much as 25 feet under cleared areas. Ground water can be found above and below permafrost and occasionally within permafrost.

Because the frozen zone commonly extends up the lower hill slopes, percolating ground water is forced to flow under the permafrost as it moves downhill. This produces a hydraulic head that can cause the formation of springs and icings, pingos, and frost blisters in the valley bottoms. Wells drilled in such areas are commonly artesian and may present difficult problems unless properly constructed.

In many of the major upland creek valleys, the valley-bottom muck is underlain by coarse creek-gravel deposits as much as 100 feet thick. The gravel, which usually lies beneath 30-300 feet of valley-bottom silt, can provide abundant quantities of water if not perennially frozen. Permafrost commonly extends from the silt through the gravel into bedrock, preventing the gravel from serving as an aquifer.

Because the water percolates through the organic silt before reaching the gravel, water obtained from the gravel may be of poor quality. To obtain better quality water, the wells generally are drilled through the buried creek gravel into bedrock. Water extracted from fractures and quartz veins, while usually of better quality, may also be of poor quality.

Tailings

Placer-mine dredge operations have removed the valley-bottom silt from several of the major upland valleys, and the dredged creek gravel is now exposed at the surface as tailing deposits as much as 75 feet thick. In these abandoned mine areas, ground water circulates near the base of the tailings on the underlying bedrock. The only two wells known to tap the water from this zone are located on the tailings at Gold Hill. Although this water may be abundant, contamination is possible not only from present pollutants but also from chemicals formerly used in the placer-mine processing operations.

Normally, wells located on the tailings are drilled through the tailings into bedrock to obtain better quality water.

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EXPLANATION

The ground-water units described below have been defined on the basis of occurrence, yield, recharge, and quality of ground water and type of aquifer. These units represent generalized conditions, and local variations may occur, especially near contacts between units.

I

UPLAND HILLS

Bedrock hills covered by 3-200 feet of windblown silt; generally deep water table; maximum height of water table 100-200 feet above valley bottoms; water table influenced by permafrost along lower slopes. Water restricted to fractures, joints, and quartz veins. Good to very good quality; high hardness (100-400 ppm) but low iron content. Yields are generally low (2-10 gpm), recharge slow, and drawdown large

II

CREEK VALLEY BOTTOMS

Valley-bottom organic silt overlies creek gravel in major stream valleys of upland. Material perennially frozen; ground water available under permafrost. Ground water available locally beneath loess on permafrost-free loess-covered low hills (for example, Gold Hill). Unfrozen gravel 30-300 feet below the surface can yield moderate to high quantities (75-200 gpm). Very poor quality because of high organic content; very high iron content. Water quality probably better if water obtained from bedrock beneath muck and gravel. Artesian wells have moderate and continuous yields

III

TAILINGS

Exposed placer-mine dredge tailings as much as 75 feet thick; ground water present near base. Water-bearing characteristics similar to buried creek gravels; yield moderate to high. Poor quality because of possible organic contamination from adjacent muck. Better quality water obtained by penetrating underlying bedrock. Yield from bedrock 2-15 gpm

SYMBOLS

Contact
Generally indefinite or gradational

O $\frac{91}{150}$ (10)

Well

Top number, static water level; bottom number, total depth of well; number in parentheses, yield (gallons per minute) if known. ND, no data; A , artesian well. Only representative or available wells shown

♦

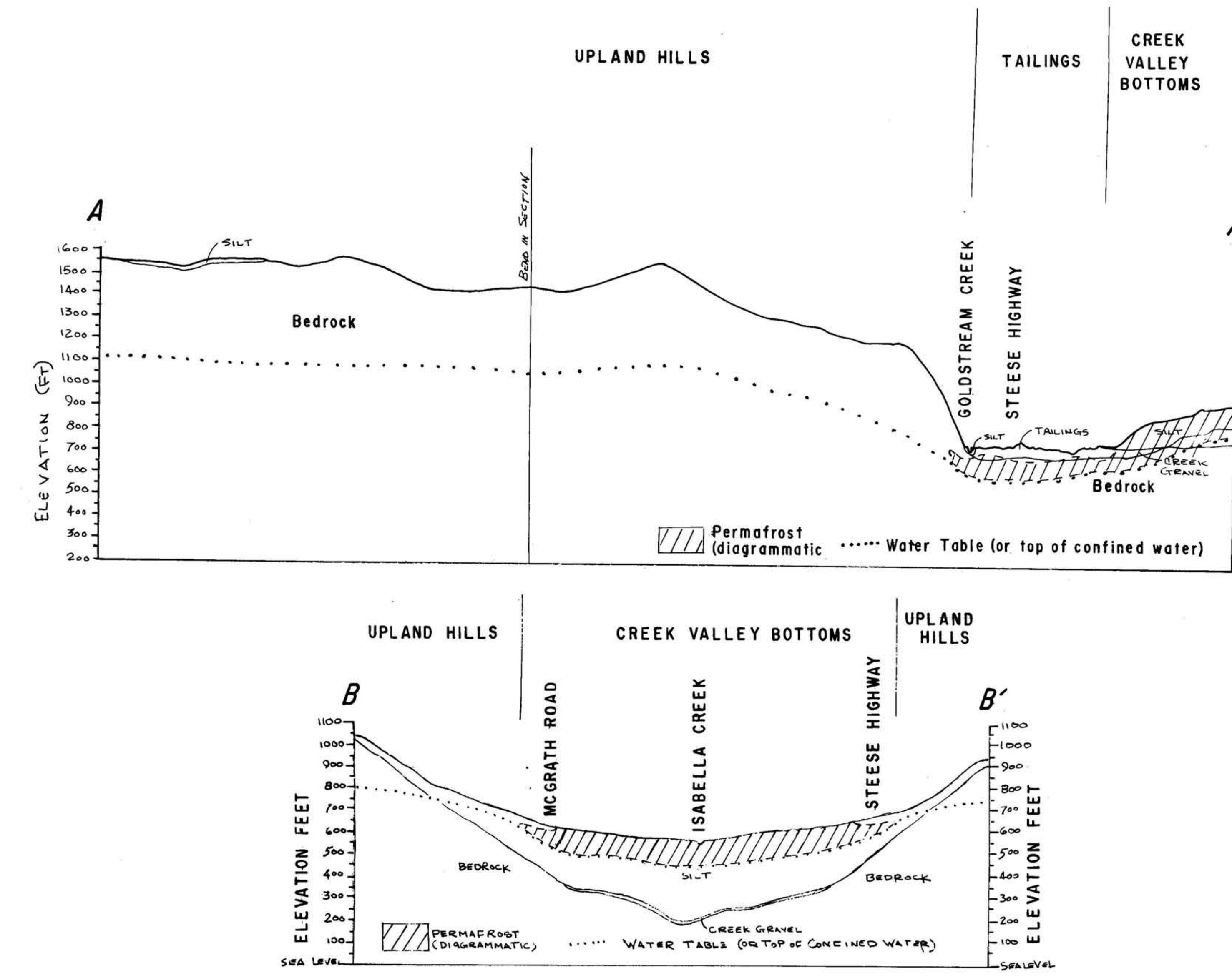
Icing

Clear ice mass formed on the surface from freezing streams and springs

Pingo

Ice-cored mound formed where water trapped under permafrost develops hydraulic head, forces its way to surface, and freezes

Spring



VERTICAL EXAGGERATION X 4

GENERALIZED CROSS SECTIONS

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

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