DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

Prepared in cooperation with the
MUNICIPALITY OF ANCHORAGE

FOLIO OF ANCHORAGE AND VICINITY, ALASKA
MAP I–787–F

## INTRODUCTION

Knowledge of the physical characteristics of surficial geologic materials is an important factor in the land-use planning process. This is especially so in the Anchorage area where urbanization is creating an ever-increasing demand for the remaining undeveloped land.

Permeability of a geologic material is a measure of the rate of movement of a fluid through that material. Thus information on permeability is important, for example, in the design of wetland reclamation projects and as an indicator of probable success of the disposal of septic-system effluent or other waste water in surficial material.

## FACTORS INFLUENCING PERMEABILITY

The rate at which a fluid moves through a geologic material depends in part on the size, the shape, and the extent of interconnection of the pores of the medium. Specifically, the nature of these pores depends largely on the particle size and the particle distribution in the material. A sand or gravel containing few silt- or clay-size particles normally has high permeability, allowing relatively rapid migration of fluids through the pore spaces. If a material consists largely of silt- and clay-size particles, pores are small, and little fluid movement may occur. Normally, as the amount of silt- and clay-size particles increases in a medium, pore size decreases and fluid movement becomes increasingly restricted.

## PERMEABILITY MAP

This map shows relative permeability ranges assigned to the surficial geologic materials in the Anchorage area. The limits of the permeability ranges were determined from the relationship of grain-size parameters and laboratory-determined permeabilities reported from other studies (Anderson, 1971; Morris and Johnson, 1967; H. R. Schmoll and Ernest Dobrovolny, oral and written commun., 1974; Wenzel, 1942). Under field conditions, the permeability of material depends on water temperature, tightness of packing, and degree of saturation. Thus, field permeabilities probably vary from laboratory permeabilities.

This map is interpretive and was prepared on the basis of grain-size parameters obtained from a small number (128) of samples collected within the map area. The relative-permeability map units presented here were derived from geologic units mapped and described by Schmoll and Dobrovolny (1972). Samples were not obtained from four of the geologic materials—bedrock, landslides, colluvium, and manmade fill. Bedrock at the Chugach Mountains front is considered to have low to very low permeability. Weathering and the presence of fractures may increase permeability locally. Colluvium downslope from exposed bedrock was assigned a moderate permeability because the unconsolidated structure gives it a higher permeability than the original bedrock. Other slope deposits, man-made fill, and landslides downslope from unconsolidated material were assigned the same permeability as the material from which they originated and thus may be found in different relative permeability ranges at different map locations.

Permeability may vary considerably within a given geologic material or mapped unit. This map should be used only as a guide; onsite testing is suggested for most types of construction or land-surface modification.

*Acknowledgments.* – The preparation of this map was greatly aided by use of an unpublished grain-size parameter and permeability study by H. R. Schmoll and Ernest Dobrovolny.

| RELATIVE PERMEABILITY | DESCRIPTION OF MAPPED UNITS |
|---|---|
| High to Very High | Principally alluvial gravel in the eastern part of the map area grading to predominantly sandy gravel in the western part of the map area. Alluvial deposits in streams, abandoned stream channels, and stream terraces |
| Moderate to High | Alluvial deposits where significant amounts of silt and clay are present. Alluvial fans and cones, emerged deltas, dunes, kames and kame terraces, and eskers. Chiefly sand, silty sand, and gravel |
| Moderate | Sand and silty sand deposits in broad, low hills, and morainal and glacio-marine deposits. Mostly mixed deposits with a silty matrix, but includes some beds of fine sand and silt and rare thin beds of gravel and sand |
| Moderate to Low | Lake and pond sediments, but includes some glacio-marine deposits. Chiefly silt, clay, and fine sand occurring in irregular hills or in broad, low areas adjacent to hills |
| Low to Very Low | Silt and clay in the tidal zone and adjacent areas, and older clay and silt deposits which locally contain pebbles, cobbles, and boulders |
| | Areas overlain by peat. Circled figure represents the thickness of peat at that point in feet (1 foot = 0.3 metre) |
| | Exposed bedrock (metmorphosed siltstone, graywacke, arkose, conglomeratic sandstone, and greenstone) |
| | Material sampling site (figure represents the number of sediment samples collected for grain-size analysis at this site) |

## REFERENCES

Anderson, G. S., 1971, Ground-water exploration, Beaver Creek valley near Kenai, Alaska: U.S. Geol. Survey open-file report, 27 p.

Morris, D. A., and Johnson, A. I., 1967, Summary of hydrologic and physical properties of rock and soil materials, as analyzed by the Hydrologic Laboratory of the U.S. Geological Survey, 1948–60: U.S. Geol. Survey Water-Supply Paper 1939–D, p. D1–D42.

Schmoll, H. R., and Dobrovolny, Ernest, 1972, Generalized geologic map of Anchorage and vicinity, Alaska: U.S. Geol. Survey Map I–787–A.

Wenzel, L. K., 1942, Methods for determining permeability of water-bearing materials, with special reference to discharging well methods: U.S. Geol. Survey Water-Supply Paper 887, 192 p.

ALASKA
Area of this report
COOK INLET
MAP LOCATION

Base from U.S. Geological Survey, 1962; modified in 1971
10,000-foot grid based on Alaska coordinate system, zone 4
1000-metre Universal Transverse Mercator grid ticks, zone 6, shown in blue

APPROXIMATE MEAN DECLINATION, 1976

SCALE 1:24 000
1 MILE
1 KILOMETRE

CONTOUR INTERVAL 20 FEET
DOTTED LINES REPRESENT 10-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS MEAN LOWER LOW WATER
SHORELINE SHOWN REPRESENTS THE APPROXIMATE LINE OF MEAN HIGH WATER
THE MEAN RANGE OF TIDE IS APPROXIMATELY 27 FEET

# RELATIVE PERMEABILITY OF SURFICIAL GEOLOGIC MATERIALS, ANCHORAGE AND VICINITY, ALASKA

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