DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

MISCELLANEOUS FIELD STUDIES
MAP MF-995
MASONVILLE QUAD., CO.

Base from U.S. Geological Survey, 1962, photorevised, 1971

Geology mapped by P.W. Schmidt, 1977

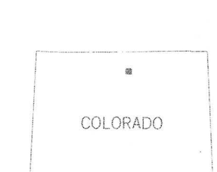
SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

UTM GRID AND 1962 MAGNETIC NORTH
DECLINATION AT CENTER OF SHEET



QUADRANGLE LOCATION

PREPARATION AND USE OF THIS MAP

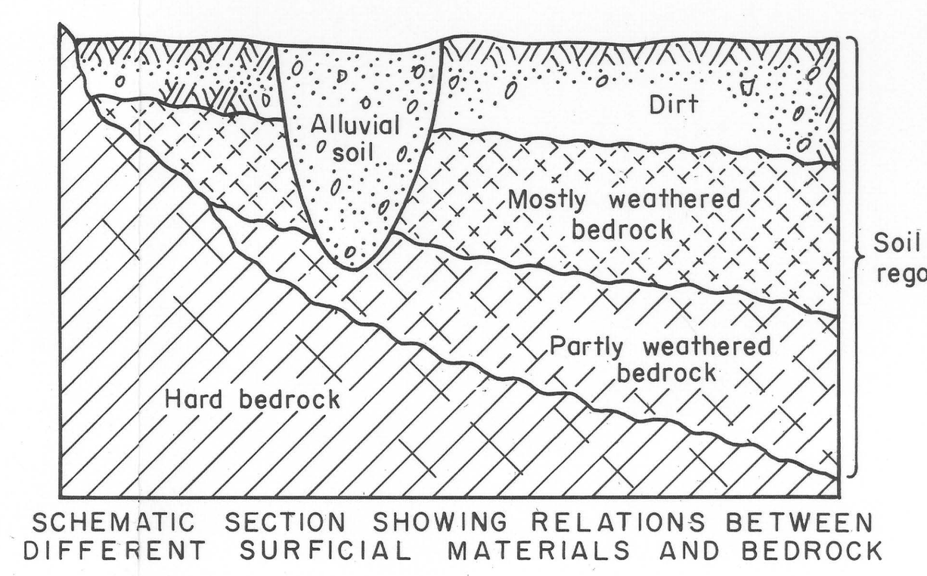
This map shows the relative amounts of soil and hard bedrock within the upper 6 feet (1.8 m) of the land surface. (See schematic section.) It provides information useful for broad-scale land-use decisions. The map is based on reconnaissance field studies and aerial-photograph interpretation. The depth of soil and weathered rock was measured directly in roadcuts and other excavations and was estimated from seismic profiles in areas of few or no excavations or outcrops. Secondary characteristics of map units, such as percentage of outcrop in a given area, steepness of slope, type and amount of vegetation cover, and general appearance of the landscape, were used in drawing the boundaries between map units. Localities were assigned to the different map units by field inspection; lines separating the different map units were then drawn by aerial-photograph interpretation and were transferred photogrammetrically to the base map.

The bedrock geology of the map area, including bedrock types and orientation of structural features, is shown on the geologic map of the Masonville quadrangle by Braddock and others (1970).

The U.S. Geological Survey has initiated a program of geologic and hydrologic studies of the Front Range Urban Corridor. This study of mountain soils is part of that ongoing program.

This map is not intended to replace on-site inspection of individual sites for specific purposes.

The readability of this map can be enhanced by coloring the different map units; Al-yellow, MS-brown, SR-orange, RS-green, and MR-red.



SCHEMATIC SECTION SHOWING RELATIONS BETWEEN DIFFERENT SURFICIAL MATERIALS AND BEDROCK

"Soil" is used here to include all unconsolidated or partly weathered material over hard bedrock.

"Dirt" is the upper part of the "soil" and here refers to an unconsolidated amorphous mixture of sand, silt, clay, and rock fragments above weathered bedrock. The upper part of the dirt commonly contains organic matter.

Mostly weathered bedrock is "rotted," and fragments of it can be crushed or broken by hand. Weathered bedrock still retains its original structure including such features as foliation, layering, and minor folds. Chemical weathering has produced moderate yellowish- or reddish-brown colors.

Partly weathered bedrock is firm but can be dug with a pick. Fragments can be broken with considerable effort by hand. When hit with a hammer, partly weathered bedrock makes a thud rather than a metallic ring like that of fresh rock.

FOOTHILL TERRAIN UNDERLAIN BY SEDIMENTARY ROCKS WITH CLAYEY INTERBEDS

The shaded area denotes foothill terrain that does not fit the classification used in the mountainous terrain to the west. Because this area is underlain by gently to steeply dipping, physically different beds of sedimentary rocks, the shaded area has different constraints for residential and recreational development. Furthermore, reconnaissance mapping methods used in making these maps are not readily applicable in the shaded area owing to the common veneer of surficial material that masks the different interbeds of the underlying bedrock.

The sedimentary bedrock ranges from hard and resistant conglomerates, sandstones, and limestones, to soft and less resistant highly weatherable siltstones and claystones. The interbedding of the hard and soft rock, especially on steep slopes, presents potentially hazardous conditions such as landslides and rockfalls. These hazardous conditions may be increased by an oversteepening of the metastable slopes by the excavation of roads and foundations.

On east-facing slopes or dip slopes, large blocks of rock and smaller debris are prone to sliding, especially where the beds dip into a deep cut. On steep west-facing slopes, rockfalls and debris slides may occur. These slope processes are commonly initiated by heavy rainfall, especially during periods of high soil moisture. On the thicker-soiled colluvial slopes, saturated soils may fail and be carried downslope as mudflows; this is especially true where the slope has been modified.

Swelling soils and bedrock occur locally in the eastern part of the foothills belt (Gardner and others, 1971) and in the alluvial soils of some valley bottoms. The shaded area may also include relatively small, local intrusions of igneous rock which was not delineated within this map unit.

DISCUSSION ON EASE OF EXCAVATION AND ON SUITABILITY FOR SEPTIC SYSTEMS WITH LEACH FIELDS

Although subdivision of the shaded area into units analogous to the mountain area has not been made, some general observations can be made about the ease of excavation and the suitability of septic systems with leach fields.

For further information on the engineering properties of the different sedimentary bedrock units see Gardner and others (1971).

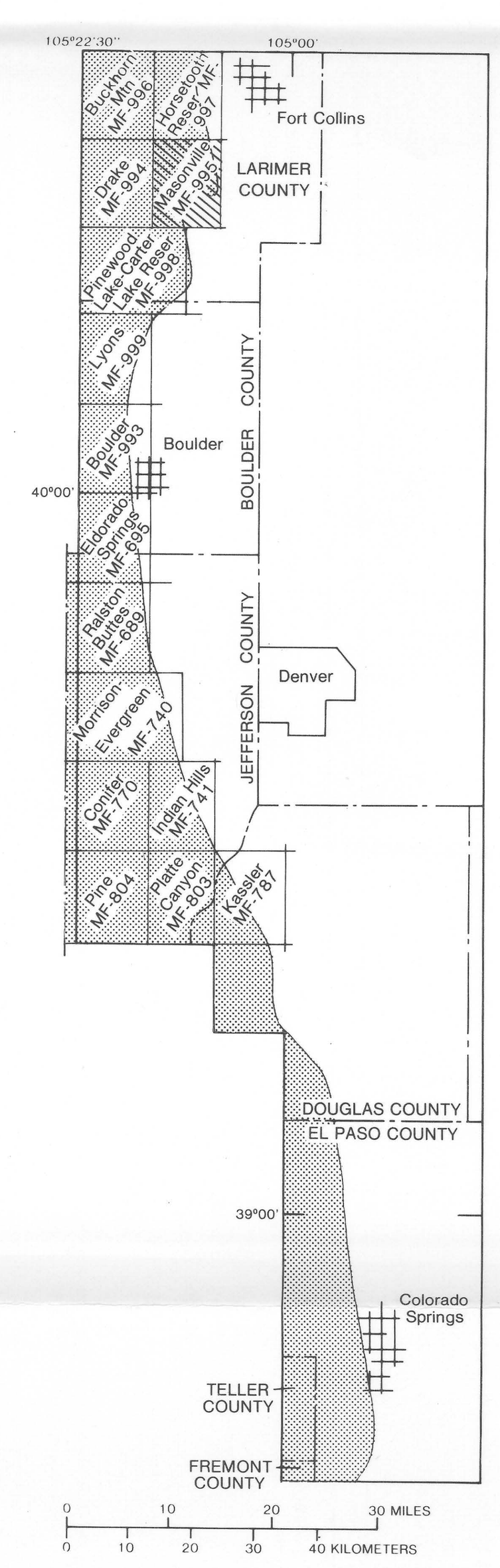
EXCAVATION.--Thick-soiled colluvial slopes and alluvial valley bottoms are easily excavated with light power equipment. Partly weathered bedrock can be excavated with most power equipment. Bedrock outcrops and unweathered rock can be excavated with some difficulty by heavy power equipment, although blasting may locally be required.

SEPTIC SYSTEMS WITH LEACH FIELDS.--The permeability of thick colluvial and alluvial soils may be low, and in the valley bottoms high water-table conditions may occur. Areas of outcrops or thin soils are generally considered unfavorable owing to impermeable beds at shallow depths or mainlining of leachate along fractures in the bedrock resulting in the contamination of the ground water.

REFERENCES

Braddock, W. A., Calvert, R. H., Gawarecki, S. J., and Nutalaya, Prinya, 1970, Geologic map of the Masonville quadrangle, Larimer County, Colorado: U.S. Geological Survey Geologic Quadrangle Map GQ-832, scale 1:24,000.

Gardner, M. E., Simpson, H. E., and Hart, S. S., 1971, Preliminary engineering geologic map of the Golden quadrangle, Jefferson County, Colorado: U.S. Geological Survey Miscellaneous Field Studies Map MF-308, scale 1:24,000 [1972].



Index map showing recently published U.S. Geological Survey Miscellaneous Field Studies Maps on mountain soils in the Front Range Urban Corridor, Colorado. The shaded area indicates the approximate extent of mountainous terrain within the corridor boundaries.

MAP UNIT	DESCRIPTION	LANDSCAPE CHARACTERISTICS	RELATIVE CONSTRAINTS REGARDING SEPTIC SYSTEMS WITH LEACH FIELDS	RELATIVE EASE OF EXCAVATION IN UPPER 6 FT (1.8 m) [Roads, utility corridors, foundations, etc.]
Al Alluvial Soil	More than 85 percent of area is covered by alluvial soil 5 ft (1.5 m) to more than 10 ft (3 m) thick with variation in average grain size depending on topographic position and local bedrock. In small upland basins consists primarily of silt, sand, and clay, which grades marginally into colluvium containing angular rock fragments. Beneath valley floors along major drainages, the upper 1-4 ft (0.3-1.2 m) generally is silty sand which overlies coarse sand and gravel, and at the base of valley slopes commonly includes colluvium with angular rock fragments. Fine-grained alluvium is commonly rich in organic matter	In upland areas, gently sloping valley bottoms are cut locally by small steep-walled gullies; commonly covered by lush grassy vegetation. On valley floors adjacent to larger drainages, narrow sinuous flats support coniferous and deciduous trees, shrubs, and grass	WATER-TABLE CONSTRAINTS--Although the unconsolidated materials in this area are easily excavated for septic systems with leach fields, the seasonal rise of the water table and local inundation of the surface make this area one of high potential constraint. Slopes are gentle. Only after careful site evaluation, especially during infiltration of the spring snowmelt, can this area be considered safe for septic systems with leach fields. Along major valleys, septic systems with leach fields may drain through highly permeable alluvial gravels and contaminate the ground water and nearby streams	EASY--Hard bedrock absent at or near the surface, which makes most shallow excavations easy. Machinery can get mired in areas of seasonally wet ground, especially in humus-rich sediment
MS Mostly soil	More than 70 percent of area is covered by dirt and weathered bedrock to a depth of at least 6 ft (1.8 m). The dirt at the surface averages 2-4 ft (0.6-1.2 m) in thickness. It generally overlies at least 3 ft (0.9 m) of mostly weathered bedrock which, in turn, overlies at least 2 ft (0.6 m) of partly weathered bedrock, which grades down into hard bedrock. This map unit includes scattered outcrops of hard bedrock (pegmatite dikes, corestones, quartzose metamorphic rock, and other rocks)	Nearly flat to gently rolling slopes covered mostly by grass and, locally, widely spaced coniferous trees. Scattered sparse bedrock outcrops, mostly pegmatite dikes, or boulders, locally protrude through the vegetation	FEWEST CONSTRAINTS--Fewest geologic constraints for septic systems with leach fields, except for possible water-table situations where sites near local drainages may be seasonally saturated, especially following spring snowmelt. Detailed site study should be made to determine if seasonal saturation will be a problem. Constraints are fewest because hard bedrock is only locally present within 6 ft (1.8 m) of ground surface and because slopes are gentle. With proper planning, this area can accommodate greatest, but still limited, density of septic systems with leach fields	EASY--Hard bedrock generally absent at or near the surface, which makes most shallow excavations easy
SR Soil with subordinate rock	From 40-70 percent of area is covered by dirt and weathered bedrock to a depth of at least 6 ft (1.8 m). The dirt at the surface averages 1-3 ft (0.3-0.9 m) in thickness. It generally overlies at least 4 ft (1.2 m) of mostly to partly weathered bedrock. At a depth of 6 ft (1.8 m), partly weathered bedrock is more common than mostly weathered bedrock. Hard bedrock occurs at or just beneath the ground surface in about 10-30 percent of the area	Gentle to moderate slopes covered by grass and (or) open coniferous forests. Slopes locally are steep; north-facing slopes have dense coniferous forests and south-facing slopes have scattered coniferous trees, grass, and shrubs. Bedrock outcrops are commonly small and scattered	FEW CONSTRAINTS--Few geologic constraints because hard bedrock is at or near the surface in less than 40 percent of the area and because slopes are mostly gentle to moderate. With proper planning, can accommodate a moderate density of septic systems with leach fields	MODERATELY EASY--Hard bedrock at or near the surface only locally, which makes most shallow excavations moderately easy if such hard bedrock areas are avoided
RS Rock with subordinate soil	From 10-50 percent of area is covered by dirt and weathered bedrock to depths of 6 ft (1.8 m). Where soil is 6 ft (1.8 m) deep, the dirt at the surface is commonly about 1 ft (0.3 m) thick but may be as much as 4 ft (1.2 m) thick. Much of this dirt has moved downslope and concentrated in pockets. This dirt generally overlies a few feet of partly weathered bedrock. The areas with soil as thick as 6 ft (1.8 m) commonly occur in pockets between rock outcrops or locally as thick colluvium along drainages at the base of steep slopes. Hard bedrock occurs at or very near the ground surface in more than 30 percent of the area	Moderate to steep slopes covered with a dense to scattered coniferous forest. Rubbly surfaces covered by shrubs and sparse grass are common on south-facing slopes and along the mountain front, whereas very dense coniferous forests that often mask the soil and bedrock surface are common on north-facing slopes. Bedrock outcrops are generally extensive, locally with large knobs or pinnacles	MANY CONSTRAINTS--Many geologic constraints because of the large amount of hard bedrock at or near the ground surface and because slopes are mostly moderate to steep. With proper site evaluation, this area can accommodate only a limited density of septic systems with leach fields	DIFFICULT--Hard bedrock common at or near the surface, which makes most shallow excavations difficult. Many hard bedrock areas may be avoided if local conditions are carefully studied and development is limited
MR Mostly rock	Less than 10 percent of area is covered by dirt and partly weathered bedrock to a depth of 6 ft (1.8 m). Soil, where present, fills small pockets where dirt and rock rubble have been concentrated by downslope movement. More than 50 percent of the area is hard bedrock outcrops; much of the remainder consists of rock fragments underlain by hard bedrock at shallow depths	Mostly rock outcrops on ridge crests and cliffs, covered with scattered trees and shrubs growing in cracks between rocks and on pockets of soil. Slopes between outcrops are commonly mantled by rock fragments	MOST CONSTRAINTS--Most geologic constraints because hard bedrock or coarse rock rubble is common at or near the ground surface and because slopes are mostly steep. Septic systems with leach fields should be restricted to those few areas where acceptable amounts of unconsolidated material can be located on suitable slopes or where pervious fill can be added	VERY DIFFICULT--Hard bedrock and rock fragments are nearly continuous at or near the surface, which makes most shallow excavations very difficult

RECONNAISSANCE MAP SHOWING RELATIVE AMOUNTS OF SOIL AND BEDROCK IN THE MOUNTAINOUS PART OF THE MASONVILLE QUADRANGLE, LARIMER COUNTY, COLORADO

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1978

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