NOTE:

The entire upper Crystal River area generally is susceptible to a number of geologic conditions that could influence the feasibility or design of building foundations or on-lot septic systems. These conditions include high ground-water levels, expansive soils, and shallow bedrock. Construction anywhere in the area should be undertaken only after detailed geotechnical investigations have determined the specific hazards present and the methods necessary to minimize or abate any adverse conditions.

Base from U.S. Geological Survey
Marble qudrangle (7½-minute)

Explanation of Map is Plate 2

UTM GRID AND 1960 MAGNETIC NORTH DECLINATION AT CENTER OF SHEET

SCALE 1:24000

CONTOUR INTERVAL 40 FEET
DATUM IS MEAN SEA LEVEL

GEOLOGIC HAZARDS
UPPER CRYSTAL RIVER AREA
GUNNISON COUNTY, COLORADO

by WALTER R. JUNGE

1978

DOI: https://doi.org/10.58783/cgs.of7811.ylsm2624

Colorado Geological Survey OF-78-11

Plate 1 of 2

OPEN-FILE REPORT 78-11

Plate 2 of 2

GEOLOGIC HAZARDS
UPPER CRYSTAL RIVER AREA
GUNNISON COUNTY, COLORADO

by WALTER R. JUNGE

1978

Colorado Geological Survey
Department of Natural Resources
State of Colorado
John W. Rold, Director

GENERAL DESCRIPTION

The upper Crystal River area is likely to experience increased growth related to future expansion of recreational activities and nearby coal mining. To aid in the planning for this anticipated growth, geologic conditions in the area were studied and mapped in accordance with House Bill 1041 (C.R.S. 1973, 24-65.1-101, et seq.) to determine areas of geologic hazard that could cause an economic loss or affect the safety of the citizens of Colorado. The mapped units used in this study conform to the terms and definitions given in Colorado House Bill 1041 and in the Colorado Geological Survey's "Guidelines and Criteria for Identification and Land Use Controls in Geologic Hazard and Mineral Resource Areas" (Rogers and others, 1974). As defined in House Bill 1041, a geologic hazard means "a geologic phenomenon which is so adverse to past, current, or foreseeable construction or land use as to constitute a significant hazard to public health and safety or to property." These geologic hazards may be intensified or decreased by human activity. Regardless of the intensity, the hazards should be recognized and considered prior to any land-use changes.

Previous studies in the Crystal River area include geologic mapping of the Marble quadrangle by Gaskill and Godwin (1966), an analysis of engineering geologic factors in the Marble area by Rogers and Rold (1972), and mapping of geologic hazards in the Marble Ski Area by Robinson and others (1972). Additionally, environmental and engineering geology factors in the general area were described by Olander and others (1974) and snow avalanche hazards were evaluated by Mears (1975). These studies were reviewed and, where applicable, incorporated into the present study.

SUGGESTIONS TO MAP USERS

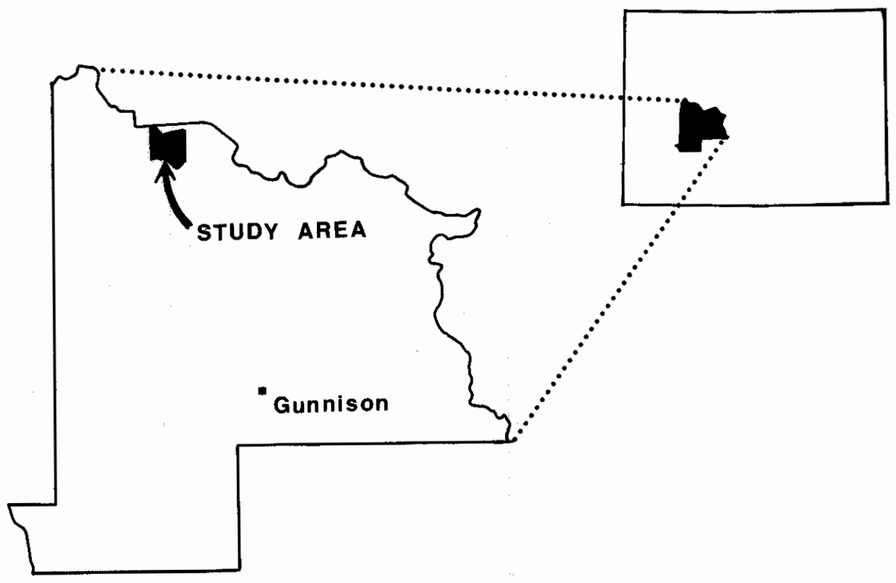
The upper Crystal River area is that part of the Crystal River valley in the 7.5-minute Marble quadrangle and includes the Yule Creek, Lost Trail Creek, Carbonate Creek, and Slate Creek drainages. Potentially hazardous geologic conditions in this area are related to normal dynamic processes such as transportation and depostion of material by water (fluvial processes) and by mass wasting (gravity related processes). These processes have been very active in the past and will be active in the future. The geologic hazards map at a scale of 1:24,000 shows only the most severe geologic condition in a specific area. Additional geologic conditions that could affect a particular development activity may be present locally.

Three conditions that have not been shown on the map are expansive soils, high ground-water levels, and shallow bedrock. These conditions affect the feasibility or design of building foundations and on-lot sewage disposal systems. Each of these conditions should be carefully evaluated for all construction activity by on-site geotechnical investigations.

In using this map, the reader should consult the accompanying Explanation of Map Units and the Geologic Hazards Assessment for Common Land Uses. These explanations define the geologic hazards, describe the conditions affecting those hazards, and estimate the degree of hazard for a specific land use. The degree of hazard will vary depending on the particular land use. Landslides, for example, may be a serious constraint to high-density residential development, whereas recreational areas may be only slightly affected. The map and accompanying descriptions and explanations are not intended as a detailed analysis of a particular site or land use and should not be used in place of detailed field investigations of specific areas. We recommend that the map serve as a basis for further, detailed investigations so that the safety and feasibility of specific projects can be adequately evaluated.

INDEX

GUNNISON COUNTY COLORADO



Drafting by: RAYMOND LOKKEN

EXPLANATION OF MAP UNITS

ls

Landslide Area: an area formed by the moderate to rapid downward and outward movement of rock and/or soil where a surface of failure or zone of weakness separates the landslide from more stable underlying material. Landslide areas include earthflows, translational slides, rotational slides, and debris slides. Man-caused disturbance of these landslide areas could initiate additional instability and mass movement of part or all of the slide mass. This movement could damage or destroy structures and possibly could affect adjacent downslope areas.

mf

Mudflow Area: an area subject to the rapid downslope movement of wet, viscous masses of fine-grained material following mobilization of the material by intense rainfall or snowmelt runoff. Mobilization usually includes the erosion and transport of poorly consolidated surficial materials that have accumulated in drainage channels and slide slopes. Physiographic features associated with the mapped mudflow areas indicate very recent activity and potential danger for any structures.

df

Debris-Flow Area: a triangular-shaped area formed by the accumulation of water-transported rock, soil, and vegetation debris. Debris accumulation usually occurs at the confluence of a tributary stream with a larger drainage and generally is associated with rapid flows caused by intense rainfall or rapid snowmelt runoff. These flows may cause severe damage to or destruction of man-made structures.

rf

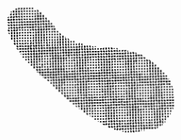
Rockfall Area: an area subject to rapid but intermittent rolling, sliding, or free-falling of detached bedrock of any size from a cliff or very steep slope. Rockfall most commonly occurs in sparsely vegetated areas having jointed bedrock cliffs and represents a serious hazard for residential or commercial development.

us

Unstable Slope: a slope where mass movement has occurred but where recent movement is not apparent or certain. The slope generally is characterized by landslide or soil-creep physiography and may be susceptible to landslide, earthflow, mudflow, or accelerated-creep processes, especially if disturbed.

pus

Potentially Unstable Slope: a slope that currently is in equilibrium and where past or present mass movement of the soil or rock is not apparent. Physical attributes, such as composition of surficial and bedrock materials or slope inclination and aspect, are similar to nearby areas that have failed. A potentially unstable slope may be susceptible to mass-movement failures if disturbed.



Snow-Avalanche Area: an area subject to the rapid downslope movement of snow, ice, and associated rock and vegetation debris. These areas include the avalanche starting zone, track, and runout zone and usually are very hazardous areas for most types of construction.

MAP SYMBOLS

- Map unit contact
- Snow avalanche: narrow avalanche paths that may be very destructive.
- Recent landslide scarp: hachures point in the direction of landslide movement.

NOTE

The entire upper Crystal River area generally is susceptible to a number of geologic conditions that could influence the feasibility or design of building foundations or on-lot septic systems. These conditions include high ground-water levels, expansive soils, and shallow bedrock. Construction anywhere in the area should be undertaken only after detailed geotechnical investigations have determined the specific hazards present and the methods necessary to minimize or abate any adverse conditions.

REFERENCES

Gaskill, D. L., and Godwin, L. H., 1966, Geologic map of the Marble quadrangle, Gunnison and Pitkin Counties, Colorado: U.S. Geol. Survey Geol. Quad. Map GQ-512.

Mears, A. I., 1975, Snow avalanche hazards in the Marble area, Gunnison County, Colorado: Colorado Geol. Survey open-file rept., 11 p.

Olander, H. C., Lamm, N. B., and Florquist, B. A., 1974, Roaring Fork and Crystal River valleys, an environmental and engineering geology study, Eagle, Garfield, Gunnison, and Pitkin Counties, Colorado: Colorado Geol. Survey Environmental Geol. Rept. 8, 30 p.

Robinson, C. S., Cochran, D. M., and Shaughnessy, J. G., 1972, Marble ski area engineering geologic map: Charles S. Robinson and Associates Rept., fig. 2.

Rogers, W. P., Ladwig, L. R., Hornbaker, A. L., Schwochow, S. D., Hart, S. S., Shelton, D. C., Scroggs, D. L., and Soule, J. M., 1974, Guidelines and criteria for identification and land-use controls of geologic hazard and mineral resource areas: Colorado Geol. Survey Special Pub. 6, 146 p.

Rogers, W. P., and Rold, J. W., 1972, Engineering geologic factors of the Marble area, Gunnison County, Colorado: Colorado Geol. Survey Misc. Rept., 44 p.

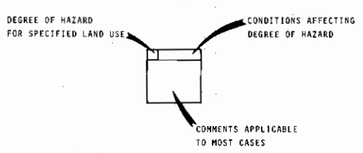
GEOLOGIC HAZARDS ASSESSMENT FOR COMMON LAND USES

Land-Use Activity

Geologic Hazard	Residential Development: High Density	Residential Development: Low Density	Commercial / Industrial Development	Roads	Utilities	On-Lot Effluent Disposal	Ranching	Open Space / Recreation
Landslide (ls)	4 | ABCG HAZARD MITIGATION TYPICALLY IS PROHIBITIVELY EXPENSIVE	4 | ABCG FEASIBLE ONLY WITH ELABORATE AND EXPENSIVE MITIGATION MEASURES	4 | ABCG USUALLY REQUIRES ELABORATE AND EXPENSIVE MITIGATION MEASURES	4 | ABCG NOT FEASIBLE WITHOUT CAREFUL PLANNING AND DESIGN; HIGH MAINTENANCE COSTS	3 | ABCG NOT FEASIBLE WITHOUT CAREFUL PLANNING AND DESIGN; VERY HIGH MAINTENANCE COSTS	4 | AC USUALLY NOT FEASIBLE; EFFLUENT (WATER) MAY REACTIVATE LANDSLIDE	1 | CD USUALLY MINOR PROBLEMS EXCEPT FOR BUILDINGS AND IRRIGATION DITCHES	2 | AD COMMONLY FEASIBLE; BUILDING SITES SHOULD BE CAREFULLY SELECTED
Unstable Slope (us)	4 | ABCG HAZARD MITIGATION USUALLY IS NECESSARY AND MAY BE PROHIBITIVELY EXPENSIVE	4 | ABCG NOT FEASIBLE WITHOUT CAREFUL PLANNING AND DESIGN	4 | ABCG NOT FEASIBLE WITHOUT CAREFUL PLANNING AND DESIGN	4 | ABCG HAZARD MITIGATION MAY BE NECESSARY AND EXPENSIVE; HIGH MAINTENANCE COSTS	3 | ABCG MAY BE FEASIBLE WITH CAREFUL PLANNING AND DESIGN	4 | AC NOT FEASIBLE WITHOUT CAREFUL PLANNING AND DESIGN; LANDSLIDES MAY BE REACTIVATED	1 | CD USUALLY MINOR PROBLEMS EXCEPT WHERE DITCH LEAKAGE CAUSES MASS WASTING	2 | AD COMMONLY FEASIBLE; MAINTENANCE COSTS LIKELY
Potentially Unstable Slope (pus)	3 | BCEG NOT FEASIBLE WITHOUT CAREFUL PLANNING AND DESIGN; MITIGATION MAY BE EXPENSIVE	3 | BCEG MAY BE FEASIBLE WITH CAREFUL PLANNING AND DESIGN	3 | BCEG HAZARD MITIGATION MAY BE NECESSARY AND EXPENSIVE; HIGH MAINTENANCE COSTS LIKELY	3 | ABCEG MAY BE FEASIBLE WITH CAREFUL PLANNING AND DESIGN	2 | BCEG HAZARD CAN BE MINIMIZED WITH CAREFUL PLANNING AND DESIGN	3 | AC MAY BE FEASIBLE WITH CAREFUL PLANNING AND DESIGN	1 | CDE USUALLY MINOR PROBLEMS EXCEPT IN AREAS OF INTENSE GRAZING ON STEEP SLOPES	1 | DE TYPICALLY NO DIFFICULTIES
Rockfall (rf)	4 | ABD FEASIBLE ONLY WITH ELABORATE AND EXPENSIVE MITIGATION; HIGH MAINTENANCE COSTS	4 | ABD HAZARD MITIGATION IS NECESSARY AND MAY BE PROHIBITIVELY EXPENSIVE	3 | ABD HAZARD MITIGATION IS NECESSARY AND MAY BE EXPENSIVE	4 | AB HAZARD MITIGATION IS NECESSARY; MAINTENANCE COST USUALLY VERY HIGH	3 | AB USUALLY FEASIBLE; HIGH MAINTENANCE COSTS	1 USUALLY FEW OR MINOR PROBLEMS	1 USUALLY FEW OR MINOR PROBLEMS; BUILDING SITES SHOULD BE CAREFULLY SELECTED	3 | AD COMMONLY FEASIBLE; BUILDING SITES SHOULD BE CAREFULLY SELECTED
Mudflow (mf); Debris Flow (df)	4 | CDEFG FEASIBLE ONLY WITH ELABORATE AND EXPENSIVE MITIGATION; HIGH MAINTENANCE COSTS	4 | CDEFG FEASIBLE ONLY WITH ELABORATE AND EXPENSIVE MITIGATION; HIGH MAINTENANCE COSTS	3 | CDEFG NOT FEASIBLE WITHOUT CAREFUL PLANNING AND DESIGN; MITIGATION MAY BE EXPENSIVE	4 | CDFG FEASIBLE ONLY WITH ELABORATE AND EXPENSIVE MITIGATION; HIGH MAINTENANCE COSTS	3 | CEFG MAY BE FEASIBLE WITH CAREFUL PLANNING AND DESIGN	1 USUALLY FEW OR MINOR PROBLEMS	2 | CEF USUALLY FEW OR MINOR PROBLEMS; BUILDING SITES SHOULD BE CAREFULLY SELECTED	3 | CDEF MAY BE FEASIBLE WITH CAREFUL PLANNING AND DESIGN; HIGH PERIODIC MAINTENANCE COSTS
Physiographic Flood Plain (pfp)	4 | FG SEVERE HAZARD AREA; HYDROLOGIC FLOOD PLAIN DETERMINATION NECESSARY	4 | FG SEVERE HAZARD AREA; HYDROLOGIC FLOOD PLAIN DETERMINATION NECESSARY	4 | FG SEVERE HAZARD AREA; HYDROLOGIC FLOOD PLAIN DETERMINATION NECESSARY	3 | FG HAZARD MITIGATION DIFFICULT AND EXPENSIVE; DAMAGE-PRONE AREA	3 | F HAZARD MITIGATION DIFFICULT AND EXPENSIVE; DAMAGE-PRONE AREA	4 | C COMMONLY NOT FEASIBLE; SEVERE POLLUTION OF NEAR-SURFACE GROUND WATER	2 | F COMMONLY FEASIBLE; PERIODIC MAINTENANCE COSTS	3 | F COMMONLY FEASIBLE; HIGH, PERIODIC MAINTENANCE COSTS
Snow Avalanche	4 | A MAY NOT BE FEASIBLE; MITIGATION MEASURES VERY EXPENSIVE	4 | A MAY NOT BE FEASIBLE; MITIGATION MEASURES VERY EXPENSIVE	4 | A MAY NOT BE FEASIBLE; MITIGATION MEASURES VERY EXPENSIVE	3 | A NOT FEASIBLE WITHOUT CAREFUL PLANNING AND DESIGN; HIGH MAINTENANCE COSTS	2 | A COMMONLY FEASIBLE WITH SUBSURFACE PLACEMENT	1 | A COMMONLY FEASIBLE	1 | A COMMONLY FEASIBLE	4 | A SEASONAL HIGH RISK; HAZARD MITIGATION TYPICALLY IS VERY EXPENSIVE

Explanation of Chart Symbols

Key



Degree of Hazard

- 4 HIGH: DETAILED GEOTECHNICAL STUDIES NECESSARY TO DETERMINE IF AREA IS COMPATIBLE WITH PROPOSED LAND USE
- 3 MODERATE: DETAILED GEOTECHNICAL STUDIES NECESSARY DURING PLANNING STAGES
- 2 LOW: GEOTECHNICAL STUDIES MAY BE NECESSARY DURING PLANNING STAGES
- 1 VERY LOW: GEOTECHNICAL STUDIES COMMONLY NOT NECESSARY

Conditions Affecting Hazard

- A HAZARD ESPECIALLY SEVERE ON STEEP SLOPES
- B OVERSTEEPENING OR CUTTING OF SLOPES CAN INCREASE HAZARD
- C ARTIFICIAL OR NATURAL INCREASE IN GROUND MOISTURE CAN INCREASE HAZARD
- D REMOVAL OF NATURAL VEGETATION CAN INCREASE HAZARD
- E HAZARD MAY DECREASE AS SLOPE DECREASES
- F HAZARD RELATED DIRECTLY TO METEOROLOGICAL EVENTS
- G DISTURBANCE OF NATURAL DRAINAGE SYSTEM CAN INCREASE HAZARD