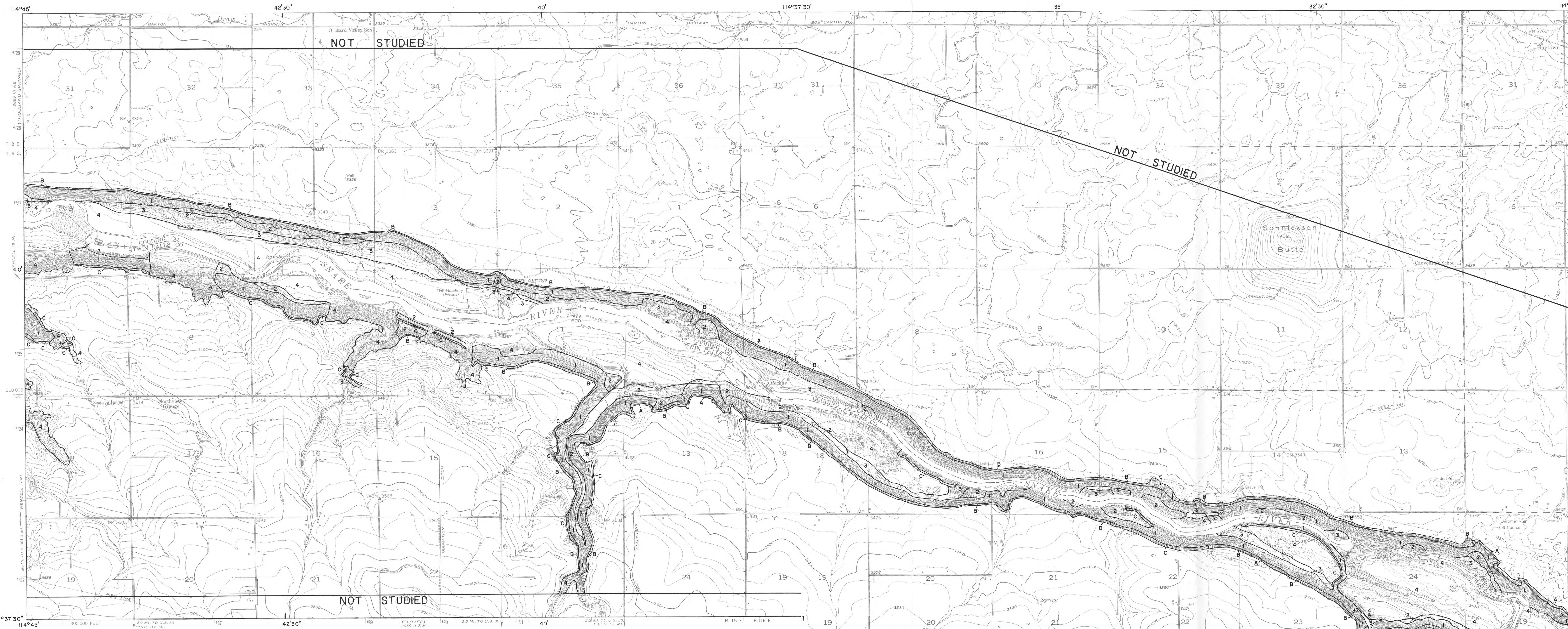
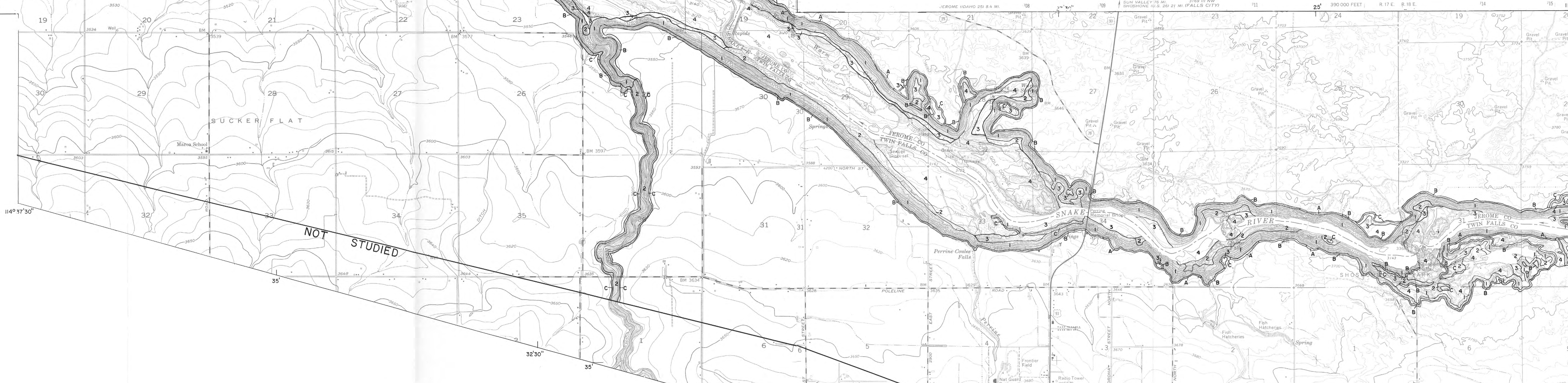




EXPLANATION

RELATIVE ROCKFALL POTENTIAL--Cracks adjacent to the rim of the Snake River canyon are a prime indicator of impending rockfalls. The width of these cracks and their distance from the rim of the canyon were used to develop a scale of relative rockfall potential for the source areas. Ground motion caused by an earthquake may substantially increase the rockfall potential by widening existing cracks or opening new cracks. Rockfalls may occur, even in areas of low potential, as a result of earthquake-induced ground motion

C Low--Cracks less than 20 cm (8 in.) wide and less than 2 m (7 ft) from rim

B Moderate--Cracks as much as 60 cm (24 in.) wide and as much as 5 m (16 ft) from rim

A High--Cracks as much as and greater than 60 cm (24 in.) wide and may be more than 5 m (16 ft) from rim

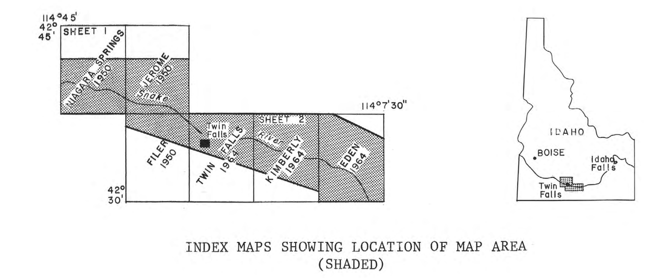
RELATIVE HAZARD FROM ROLLING OR BOUNDING ROCK--Hazard exists from rolling and bounding rocks that originate from rockfalls within the canyon. Areas of relative hazard were delineated using presence of cliffs, slope angle, slope length, and location of natural and manmade obstructions. The boundaries are only approximate as they are not clearly defined in nature and may change seasonally

4 No hazard--Rolling and bounding rock originating in a rockfall; inferred to have no hazard

3 Low hazard--Slopes generally less than 10 degrees; may be steeper below natural or manmade obstructions

2 Moderate hazard--Slopes generally less than 20 degrees; may be steeper below natural or manmade obstructions

1 High hazard--Slopes generally greater than 20 degrees



INDEX MAPS SHOWING LOCATION OF MAP AREA (SHADED)

This map is intended only for use as a guide in land-use planning. The map units represent a relative assessment of the potential geologic hazard. Its use should not preclude the need for detailed geologic and engineering studies of a site prior to design and construction.

Base from U.S. Geological Survey, Niagara Springs, Jerome, and Filer, 1950, and Twin Falls, 1964

INTRODUCTION

In south-central Idaho near Twin Falls[1] the Snake River has cut a canyon into basalts of the Snake River plain to a present maximum depth of 152 m (500 ft). The walls of the canyon in most places are cliffs with talus deposits of rockfall material of various sizes beneath. The rate at which blocks and slabs of rock fall into the canyon from the cliffs varies throughout the canyon.

The relative potential for rockfalls and the character of rockfall-runout areas within the Snake River canyon were investigated during the summer of 1975. These investigations resulted in the classification of the canyon rim into three categories of rockfall potential and the slopes and floor of the canyon into four categories, three of downslope runout areas and one inferred to have no hazard from rolling and bounding rock originating in rockfalls.

In cooperation with Twin Falls County and J.U.B. Engineers of Twin Falls, a map using these categories was prepared as an aid in evaluating the suitability of the canyon and adjacent upland plain for development. The mapping was done on 1:24,000 topographic maps with the aid of 1:20,000 black-and-white aerial photographs and aerial oblique stereo 35 mm color slides taken in June 1975. (Walsh, 1975).

ROCKFALLS

A rockfall is the relatively free falling or precipitous movement of a newly detached segment of bedrock of any size from a cliff or other very steep slope (Am. Geol. Inst., 1973, p. 641). Movement may be straight down or a series of leaps and bounds down the slope. Rockfalls are the fastest moving form of landslide.

Rockfalls are generally sudden and without warning, crashing down cliffs and steep slopes, bounding or rolling great distances and occasionally hurdling high walls or highways. The distance traveled by a rockfall is the result of height of free fall, slope length, slope angle, obstructions encountered during movement, and size and shape of the rocks involved. Cracks or joints in the rock, support provided by underlying material, lateral forces either confining the rock or pushing it away from the cliff, and gravity are the main factors that influence the stability of a rock mass at a cliff face. The very sudden occurrence and short duration of rockfalls belies the slow process that lead to them.

Natural cracks or joints formed in the basaltic lavas of the Snake River plain as a result of contraction during cooling of the once hot lavas. The cracks bounding a block of basalt may widen as a result of weathering, but no movement of the block will occur as long as it is confined within a lava flow. Exposure of the block on a cliff face, however, removes lateral support and the cracks will expand as the block moves away from the cliff face. This movement can result from the removal of underlying support by either man or natural processes, or by a wedging process that forces the rock away from the cliff face. Wedging takes place along a crack when water from melting snow or rain trickles into the crack and freezes. This wedge of ice forces the two blocks of rock apart and expands the crack between them. Smaller rocks and soil fall into the crack preventing closure when the ice melts. In time this process repeats itself until the block has been wedged far enough from the cliff face that the force of gravity acting on the block exceeds the forces holding the block in place and a rockfall occurs. If the fallen rock is not removed by man or natural processes a talus deposit develops at the base of the cliff. As the talus deposit grows it begins to add more lateral stability to the cliff until it reaches the top, at which point no more rockfalls will occur.

[1]In an attempt to avoid confusion over the usage of Twin Falls, the city is referred to as Twin Falls while the falls are referred to as The Twin Falls.

ROCKFALLS IN THE SNAKE RIVER CANYON

The Snake River canyon begins at Milner Dam, east of the study area, and trends generally west-northwest 68 km (42 mi) to Clear Lakes just west of the study area where the canyon turns north and becomes a broad valley. The canyon is cut entirely in basalt except for a 10 km (6 mi) stretch between the foot of The Twin Falls and Blue Lakes alcove where the river has cut into rhyolite beneath the basalt (Covington, (1976).

On the basis of geomorphic features the canyon can be divided into three distinct segments within the study area: an eastern section of gorge 16 km (10 mi) long, a middle section of falls and alcoves 13 km (8 mi) long, widening out to a western section of broad canyon floor and high talus-covered slopes 24 km (15 mi) long.

Basalt flows were mapped along the canyon (Covington, 1976) in an attempt to relate individual basalt flows to rockfall potential, but no correlation was found. A general relationship between cliff height and rockfall potential was observed (high cliffs, high rockfall potential), but this relationship may not hold true for specific sites.

The Snake River enters a narrow canyon cut in basalt at Milner Dam east of the study area. The canyon is 67 m (220 ft) deep at the east edge of the study area 13 km (8 mi) downstream from its beginning. The river continues in a narrow canyon 16 km (10 mi) from the east edge of the study area to a point 1.6 km (1 mi) east of The Twin Falls where it has cut to a depth of 90 m (290 ft). Along this segment, the river has a gradient of 5.9 m/km (31 ft/mi) and the canyon varies from 240 m (800 ft) to 370 m (1,200 ft) in width. The narrow canyon allows the swift-flowing river to remove debris as it falls in, keeping the canyon walls steep and comparatively free of talus. This results in a lack of lateral support for the canyon walls allowing a high rate of rockfall activity to occur. Cracks along this segment of the canyon rim are commonly greater than 60 cm (24 in.) wide and extend to more than 5 m (16 ft) from the rim. East of Hansen Bridge open cracks are present along the south canyon rim 23 m (75 ft) from the rim.

The central section of the canyon extends from 1.6 km (1 mi) east of The Twin Falls to 1.6 km (1 mi) west of Blue Lakes alcove. This section displays many alcoves on both sides of the river, some of which extend more than 1,100 m (3,500 ft) from the main canyon, and has three waterfalls on the canyon floor. The canyon averages 460 m (1,500 ft) in width and attains a depth of 152 m (500 ft) at Perrine Memorial Bridge; the river gradient, excluding the three falls, however, is only 0.27 m/km (1.25 ft/mi). This allows talus deposits to accumulate and increase the lateral stability of the canyon walls. Pink- to tan-colored soils can be seen in the canyon walls buried beneath basalt flows. These soils, generally less than 1 m (3 ft) thick, are soft and easily eroded; if wet, they may become "plastic" allowing the removal of support for overlying basalt thus enhancing the rockfall potential. This section also contains many springs, but they emerge low in the canyon walls or through talus. The effect that these springs have on rockfalls along the canyon is not known at present. In general, cracks along the rim of this central section are less than 5 m (16 ft) from the rim and lwee than 60 cm (24 in.) in width.

The western section of the canyon begins 1.6 km (1 mi) west of Blue Lakes alcove and runs 24 km (15 mi) west to Clear Lakes. This section is a broad canyon from 460 m (1,500 ft) to 1,500 m (5,000 ft) in width, with a flat bottom and canyon walls ranging in height from 145 m (480 ft) at the east end to 60 m (200 ft) at the west end. The river gradient along this section is 2.3 m/km (12 ft/mi), but due to the width of the canyon the talus deposits are not affected by the river. This has allowed a much greater accumulation of talus than along the other sections of the canyon and as a result the canyon walls are more stable. Cracks can be found at most sites along the rims of this section, but few extend more than 2 m (7 ft) from the rim or are greater than 20 cm (8 in.) in width.

ROCKFALLS AND PLANNING

The rim of the Snake River canyon is unstable almost everywhere, as witnessed by open cracks that occur along the rim. The opening of these cracks and the rockfalls that eventually occur create two very different problems. Structures can be disturbed or damaged by the opening of cracks near or beneath them as well as falling, rolling, and bounding rock. Pinning or somehow securing a rock may slow the opening of a crack or delay a rockfall for the useful life of the threatened structure. The only way, however, to eliminate the problem of opening cracks is to place structures well back from the canyon rim. A site analysis should be made for structure to be built within 30 m (100 ft) of the canyon rim inasmuch as open cracks do occur 23 m (75 ft) from the rim and can be obscured by windblown silt and sand. The problem of damage by falling, rolling, and bounding rock can be reduced by building away from runout areas or behind natural barriers. Construction of barriers to stop or deflect rock may be necessary in some areas.

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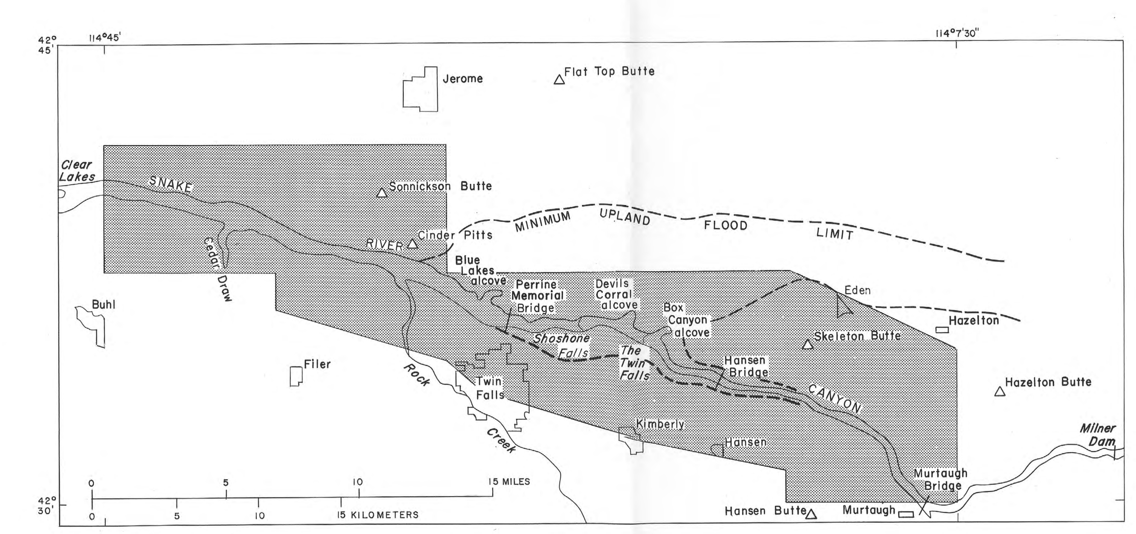

INDEX MAP SHOWING MAPPED AREA (SHADED) AND MAJOR PHYSIOGRAPHIC FEATURES

SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

Assessment made in 1975

MAP SHOWING AREAS OF POTENTIAL ROCKFALLS IN THE SNAKE RIVER CANYON NEAR TWIN FALLS, IDAHO

By
Harry R. Covington
1977

Interior—Geological Survey, Reston, Va.—1977

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