

FIGURE 1. — Damage to Bennett-Clarkson Hospital area in Rapid City.

FIGURE 2. — Damage to new automobiles stored on flood plain at East Boulevard in Rapid City.

FIGURE 4. — Damage to Canyon Lake dam in Rapid City.

FIGURE 3. — Damage to trailer homes at Campbell Street in Rapid City.

INTRODUCTION

Rapid City, the second largest city in South Dakota, is located at the eastern edge of the Black Hills about 9 miles downstream from Pactola Dam. It is bisected laterally by Rapid Creek and longitudinally by the eastern flank of the Black Hills. Canyon Lake, a small recreation reservoir having a surface area of 35 to 40 acres, is located near the west city limits on Rapid Creek.

The floods of June 9-10, 1972, covered a relatively small area of the eastern Hills, extending from Sargent on the north to Hermosa on the south and on the west to Pactola Dam. The area is mountainous with very steep heavily wooded slopes. Channels are shallow and generally are confined in narrow, winding canyons.

The flood along Rapid Creek gained national attention because of damage to property and the loss of life in Rapid City. It has been called the greatest disaster in the history of South Dakota. The flood map and stage graphs show the results of analyses of data on the extent and frequency of the flood. These data provide a basis for making decisions concerning future development of the flood-prone area.

The deluge in the Black Hills west of Rapid City was the result of meteorological conditions consisting of a strong low-level easterly flow which forced moist unstable air uplope on the Hills. This strong and sustained orographic effect caused air to rise, cool, and release its moisture in thunderstorms. The high winds also prevented the thunderstorms from moving away from their area of formation (Elroy Balke, National Weather Service, written commun., 1972). Rainfall began the afternoon of June 9 and ended about midnight. Precipitation totals varied from 4 inches to more than 12 inches in the watershed between Pactola Dam and Rapid City. Fifteen inches of rainfall was measured at Nemo, about 8 miles north of Pactola Reservoir. Pactola Reservoir effectively stored all runoff originating upstream from Pactola Dam. All flow passing through the city originated in the 60 square miles of drainage area between Canyon Lake and Pactola Dam.

ACKNOWLEDGMENTS

This atlas was prepared under the direction of John E. Powell, district chief, in charge of water-resources investigations in South Dakota. The atlas was prepared to describe the floods of June 9-10, 1972, in the immediate vicinity of Rapid City as part of the U.S. Geological Survey program to document information in areas mandated by outstanding floods. Experienced personnel from five other States assisted with the field surveys.

THE FLOOD

The flood after the intense rainfall was short-lived. Overbank flow generally lasted less than 10 hours; however, the city sustained an unbelievable amount of damage in that short period (figs. 1, 2, 3). Stream velocities were high. Field surveys indicate that velocities as high as 25 feet per second were experienced (channel slope downstream from Canyon Lake exceeds 30 ft. per mile). Tremendous quantities of debris and sediment were transported by the floodwaters. Buildings were torn from their foundations and became battering rams to dislodge other buildings. Trailer homes became boats and floated downstream to lodge in bridge openings. Stream channels and banks were severely eroded and sediment was transported downstream and deposited on the flood plain. The blocking of culvert and bridge openings caused additional submergence of the flood plain.

Flood damage to Rapid City has been estimated by the U.S. Army Corps of Engineers to be in excess of \$79,000,000. More than 1,335 homes and trailers were destroyed as were over 5,000 automobiles. The latest official count as of this writing (Oct. 1972) places the number of dead at 237 and the number of missing persons at eight. The dam creating Canyon Lake, a recreation reservoir of 35 to 40 acres surface area, was overtopped and partly destroyed (fig. 4). Failure of the dam, however, was not considered to have a major effect on the peak discharge (M. S. Petersen, written commun., 1972).

FLOOD DISCHARGE

Discharge is the rate of flow of a stream usually expressed in cubic feet per second (cfs). The peak stage (height of water) of 15.77 feet at the gaging station above Canyon Lake was 7.69 feet higher for the June 9-10, 1972, flood than the previous peak stage of record of May 23, 1952; the peak discharge of 31,200 cfs was 12 times that of the flood of May 23, 1952, the previous maximum peak discharge in 26 years of record.

The gaging station was inundated but not destroyed. Figure 5 is the stage graph for the station for June 9-10, 1972.

At the gaging station in Rapid City, the peak of June 9-10, 1972, was 50,000 cfs, more than 15 times the previous maximum of 3,300 cfs on July 13, 1962. The stage of 15.45 feet was 7.08 feet higher than the previous peak of record on July 13, 1962. Computed peak discharges on two tributary streams in Rapid City are:

1. Claghorn Canyon, 0.5 mile upstream from mouth, discharge, 12,600 cfs.
2. Lime Creek at 36th St. and West Main, discharge, 481 cfs.

FLOOD PROFILES

The extent of inundation from Rapid Creek in and around Rapid City is shown on the topographic base map. Inundation boundaries were identified from field inspection.

The high-water profile was determined by spirit leveling to high-water marks on both banks. The profile shown (fig. 6) is a composite drawn from these high-water marks. Stream miles used as a base for plotting the profile are actual stream miles measured along the low-water channel, the initial point being the mouth of Rapid Creek. Distances are marked along the channel at 1-mile intervals. Abrupt changes in the profile indicate the difference in water-surface elevations at the upstream and downstream side of bridges and road crossings.

FLOOD FREQUENCY

The relation of the 50-year flood to drainage area for the Rapid City region (fig. 7) is based on the flood frequency report by Patterson (1966). Also plotted in figure 7 are the peak discharges for the flood of June 9-10, 1972, at all points measured. These peaks exceed the 50-year discharge by several orders of magnitude but are less than maximum known floods from other regions as indicated by the enveloping curves of Matthai and Hoyt and Langbein. The true frequencies of these floods cannot be determined from present streamflow records, which are relatively short.

ADDITIONAL DATA

Additional information pertaining to floods in the Black Hills area can be obtained at the district office of the U.S. Geological Survey, Huron, South Dakota.

REFERENCES CITED

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Photographs courtesy of Rapid City Journal.

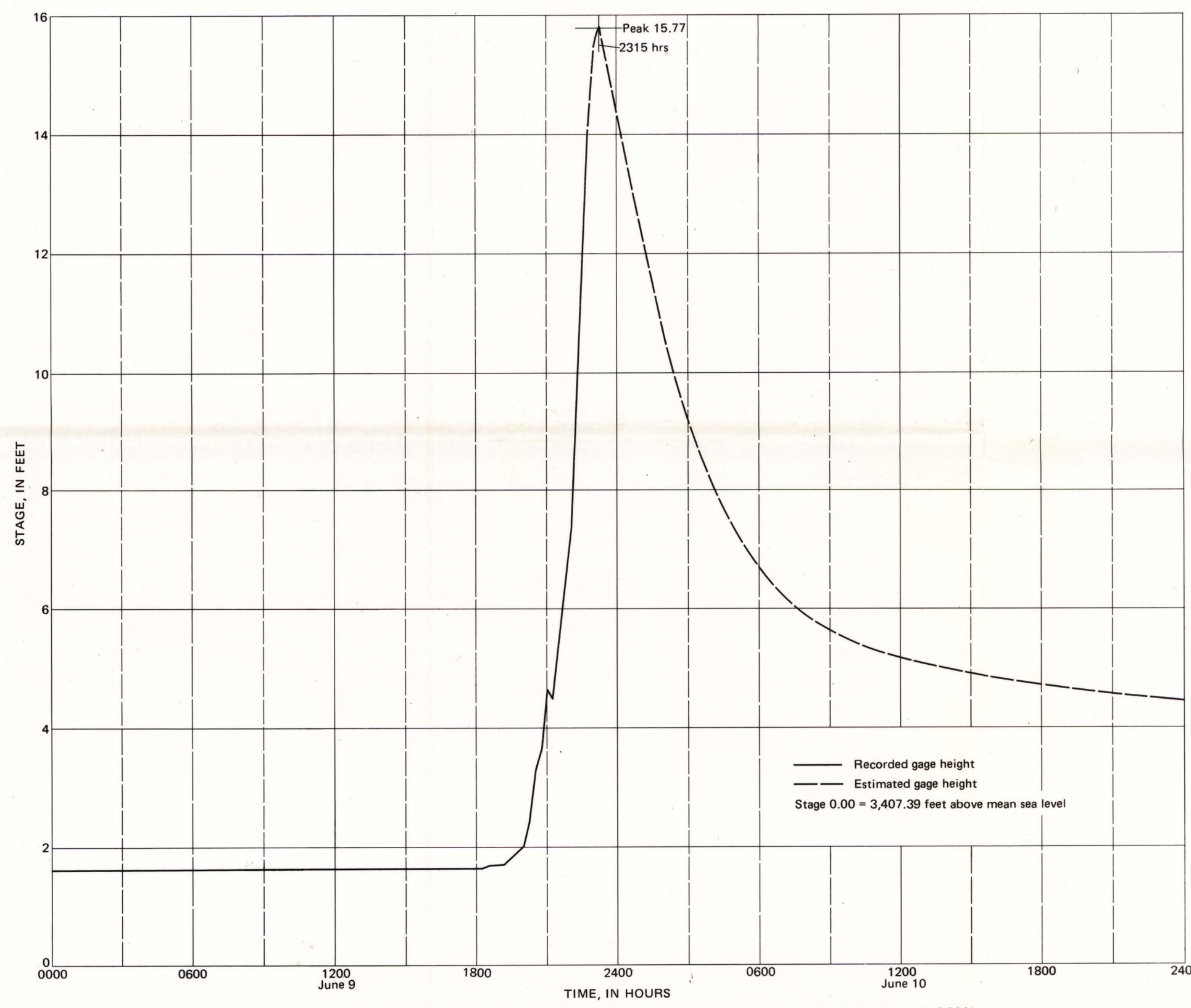


FIGURE 5. — Stage graph for gaging station "Rapid Creek above Canyon Lake near Rapid City" (06412500) for June 9-10, 1972.

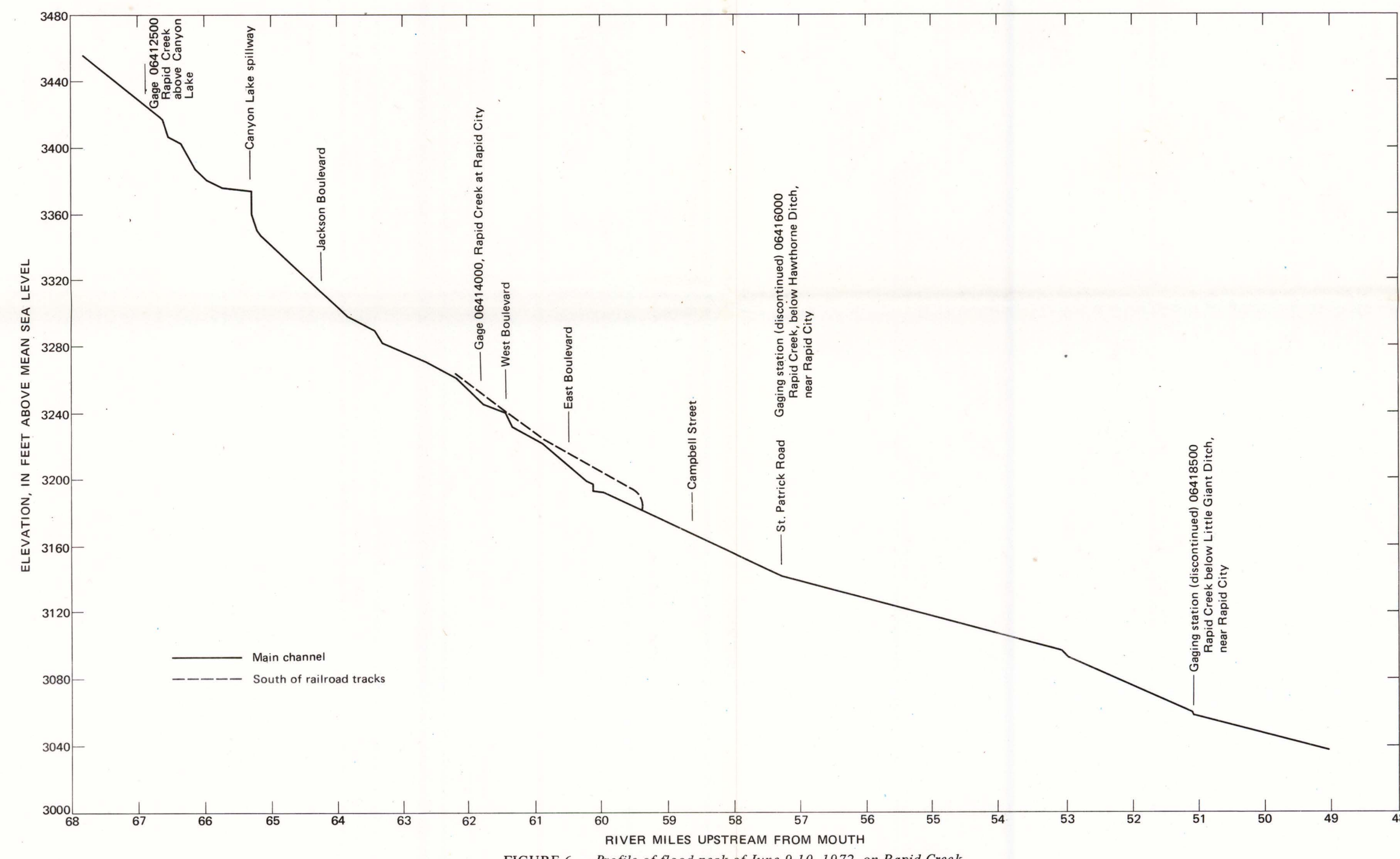


FIGURE 6. — Profile of flood peak of June 9-10, 1972, on Rapid Creek.

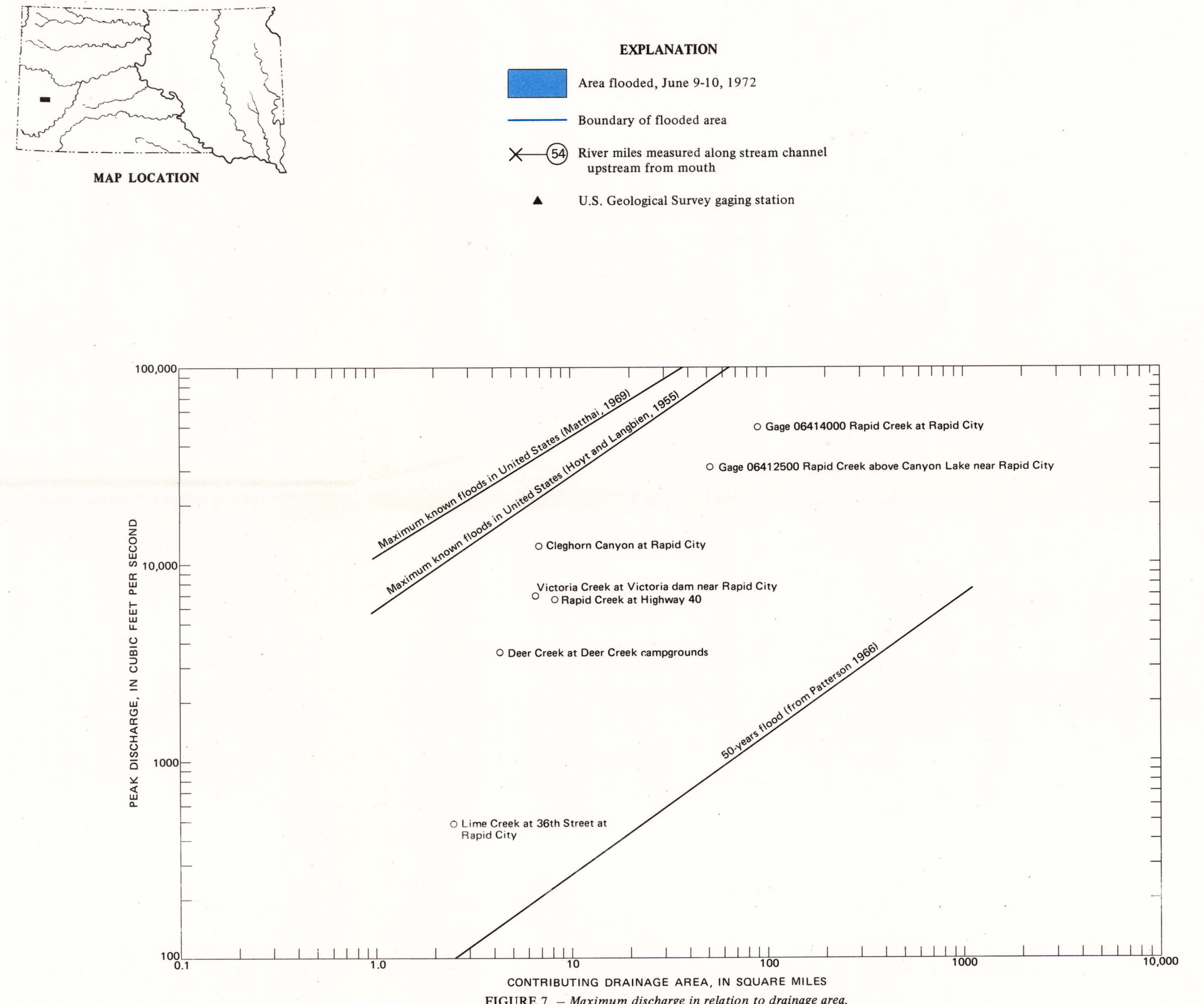


FIGURE 7. — Maximum discharge in relation to drainage area.

FLOOD OF JUNE 9-10, 1972, AT RAPID CITY, SOUTH DAKOTA

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