UNITED STATES
DEPARTMENT OF THE INTERIOR
GEOLOGICAL SURVEY

FLOODFLOW CHARACTERISTICS AT BRIDGE SITE ON INTERSTATE HIGHWAY 80, THE GREEN RIVER NEAR GREEN RIVER, WYOMING

Open-File Report 76-237

Prepared in cooperation with the

Wyoming Highway Department

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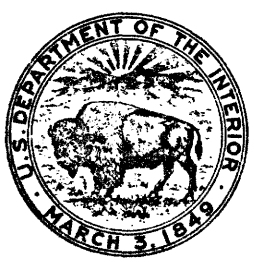

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ABSTRACT

This report was prepared in 1964, before construction of the Interstate Highway 80 bridge and the Fontenelle Reservoir. The 50-year flood at the bridge centerline was estimated to be 20,100 cubic feet per second (570 cubic metres per second). Elevation of this flood at the approach section 465 feet (142 metres) upstream from the bridge site is 6,099.3 feet (1,859.1 metres). Annual peaks are most likely to occur in May or June. Fontenelle Reservoir, under construction in 1964, can pass flows much greater than the 50-year flood. Mean velocity in the approach section for the 50-year flood is about 4.2 feet per second (1.3 metres per second) overall and 5.8 feet per second (1.8 metres per second) in the main channel. Such velocities could cause scour, especially just upstream from the right abutment of the I-80 bridge.

INTRODUCTION

The purpose of this report is to analyze the floodflow characteristics of the Green River at the crossing of Interstate Highway 80. The bridge site is approximately 250 ft (76 m) upstream from the bridge on U.S. Highway 30 and about 4 mi (6.4 km) west of the town of Green River (fig. 1). The report was prepared in February 1964 as part of a cooperative program between the Wyoming Highway Department and the U.S. Geological Survey. Owing to renewed interest in the floodflow characteristics of the river, it was decided in February 1976 to release the report to the open file. During the intervening years, the I-80 bridge was built and the Fontennelle Reservoir was constructed. The remainder of this report refers to these as future events. Except for the addition of metric units, the original text has not changed.

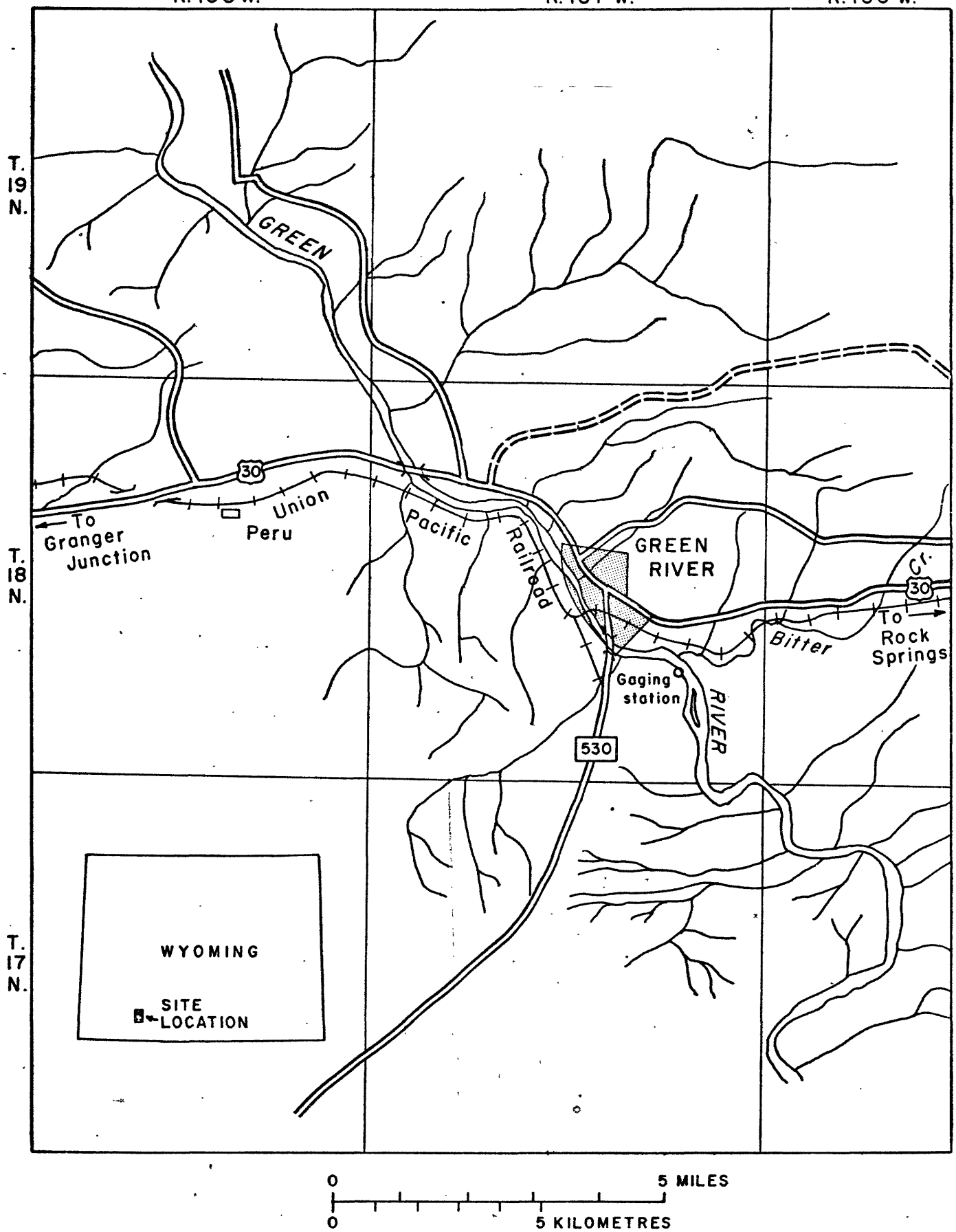

Figure 1.—Location map, the Green River near Green River, Wyoming.

For those readers interested in using the metric system, metric equivalents of English units of measurement are given in parentheses. The following table may be used to convert the English units of measurement used in this report to metric units:

acre-feet	X	1,233	= cubic metres (m^3)
cubic feet per second (ft^3/s)	X	.02832	= cubic metres per second (m^3/s)
feet (ft)	X	.3048	= metres (m)
feet per second (ft/s)	X	.3048	= metres per second (m/s)
miles (mi)	X	1.6093	= kilometres (km)
square miles (mi^2)	X	2.59	= square kilometres (km^2)

The factors considered in this report are: Magnitude and frequency of floods; history of floods; relation of stage to discharge; and, for a selected flood, mean velocities and the distribution of flow at an approach section 465 ft (142 m) upstream from the proposed centerline.

SITE DESCRIPTION

The drainage area of Green River at the bridge site is about 7,600 mi^2 (19,700 km^2)

The channel is straight for a considerable distance upstream from the proposed crossing with low to medium stages contained by a high shale bluff along the left bank, and a low bank on the right. High flows will cover the right bank flood plain which extends back about 1,000 ft (305 m) at the centerline. At this point the river channel is about 500 ft (152 m) wide. Fairly dense willows and brush grow along the right bank at the centerline, and sagebrush, trees, and bushes are scattered over the flood plain. Some details can be seen in the photographs shown in figures 2 and 3.

Interstate 80 will parallel U.S. Highway 30 which crosses the Green River on a 30-degree skew. The present bridge will be left in place. See detailed location map, plate 1.

DATA AVAILABLE

The Wyoming Highway Department furnished plan and profile sheets of the centerline.

Figure 2. View downstream past centerline of Interstate 80 toward bridge on U.S. Highway 30 showing shale bluff, in left foreground, along left side of river.

Figure 3. View upstream from bridge on U.S. Highway 30 showing low right bank. Centerline for Interstate 80 crosses river just above riffle in foreground.

The Geological Survey has operated a gaging station on the Green River (drainage area, 9,700 mi^2 (25,000 km^2)) near Green River, about 6 mi (9.7 km) downstream from the bridge site and a quarter of a mile (0.4 km) below Bitter Creek, since 1951. Prior records were obtained at a point about 4 mi (6.4 km) downstream from the bridge site (drainage area, 7,670 mi^2 (19,870 km^2)) and 1½ mi (2.4 km) upstream from Bitter Creek, during the periods 1891, 1894-99, 1900-06, and 1914-45. The flood-frequency report by Carter and Green (1963) provided regional flood characteristics which are applicable to the Green River at the site.

Geological Survey engineers inspected the proposed bridge site on July 9 and August 27, 1963, surveyed the approach sections, selected appropriate channel coefficients, determined the elevation of the 1962 peak discharge from highwater marks, and water surface elevations for discharges of 880 and 4,010 ft^3/s (24.9 and 114 m^3/s).

All elevations given in this report are referred to the Highway Department sea-level datum at the site.

HISTORICAL DATA

A listing of the maximum flood peaks on the Green River at Green River, Wyoming, for the periods of record, 1891, 1894-99, 1900-06, 1914-45, 1951-62, follows:

Year	Month	Drainage area (mi^2)	Discharge (ft^3/s)
1899	June	7,670	21,300
1918	June	7,670	22,200
1921	June	7,670	21,200

MAGNITUDE AND FREQUENCY OF FLOODS

The discharge-frequency relation (fig. 4) was derived from the section on the Green River and the Upper Colorado River drainage basins in the regional flood-frequency report (Carter and Green, 1963). The magnitude of the 50-year flood is 20,100 ft^3/s (569 m^3/s); that of the 25-year flood, 18,900 ft^3/s (535 m^3/s); and that of the mean annual flood (recurrence interval 2.33 years), 12,200 ft^3/s (346 m^3/s).

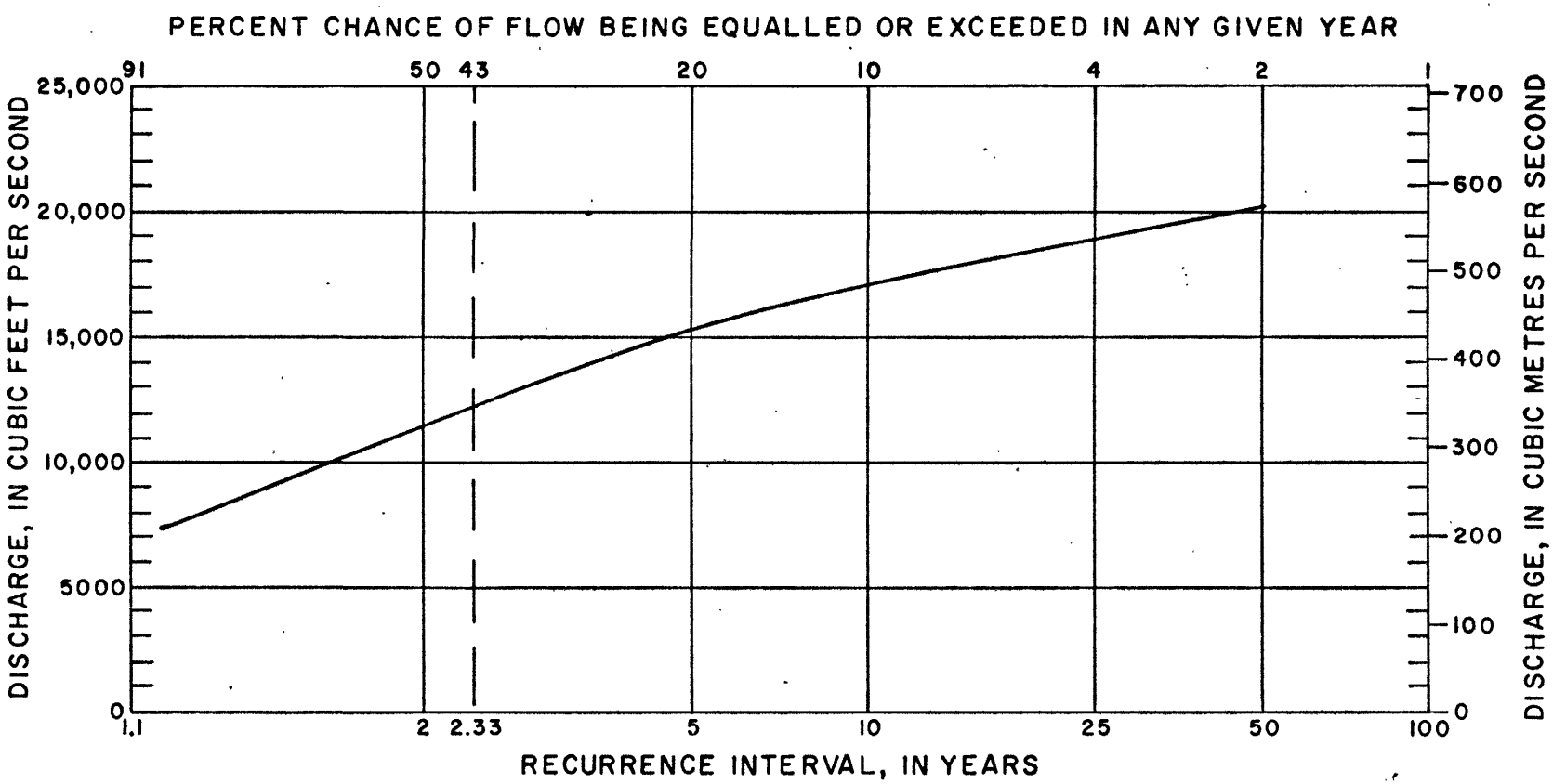

Figure 4.—Flood-frequency curve, the Green River near Green River, Wyoming.

RELATION OF STAGE TO DISCHARGE

The stage-discharge relation at the approach section 465 ft (142 m) upstream from the proposed centerline is shown in figure 5.

The relation was developed from the following:

1. Elevations at the proposed centerline for discharges of 880 ft^3/s (24.9 m^3/s) and 4,010 ft^3/s (114 m^3/s).

2. The elevation of the 1962 peak discharge of 8,680 ft^3/s (246 m^3/s) at the downstream side of U.S. Highway 30 bridge.

3. A study of the slope and conveyance of the river channel.

4. Backwater caused by U.S. Highway 30 bridge downstream.

From figure 5, a discharge of 20,100 ft^3/s (569 m^3/s) will reach an elevation of 6,099.3 ft (1.859.1 m), including 0.4 ft (0.1 m) of backwater from the existing bridge.

ICE EFFECT

Winter discharge measurements on the Green River near Green River indicate backwater from ice is usually less than 1 ft (0.3 m). Complete ice cover occurs during the winter months when discharges are relatively small. Very little information is available on ice thickness or ice jams. Mid-winter thaws and ice jams do occur, but there are no records of high stages from them.

The ice is gone from the river by the time the mountain snowmelt runoff, which causes the peak flows, reaches the vicinity of the bridge site. Records collected since 1895 indicate that annual peak discharges occur after late March and mostly in May and June.

FLOOD CONTROL

There is no definite flood plan for the Green River above the site according to the Bureau of Reclamation. A new dam being built at Fontenelle, Wyo., about 60 mi (97 km) upstream from the bridge site, will be in operation by the summer of 1964. The active storage capacity will be 155,000 acre-feet (191×10^6 m^3) with a total capacity of 340,000 acre-feet (419×10^6 m^3). It will be primarily an irrigation reservoir and produce some power. Although it will suppress some flood peaks, the dam will be capable of passing 20,000 ft^3/s (570 m^3/s) through the spillway and 18,000 ft^3/s (510 m^3/s) through the river outlet, a total of 38,000 ft^3/s (1,080 m^3/s), which exceeds the 50-year flood of 20,100 ft^3/s (570 m^3/s).

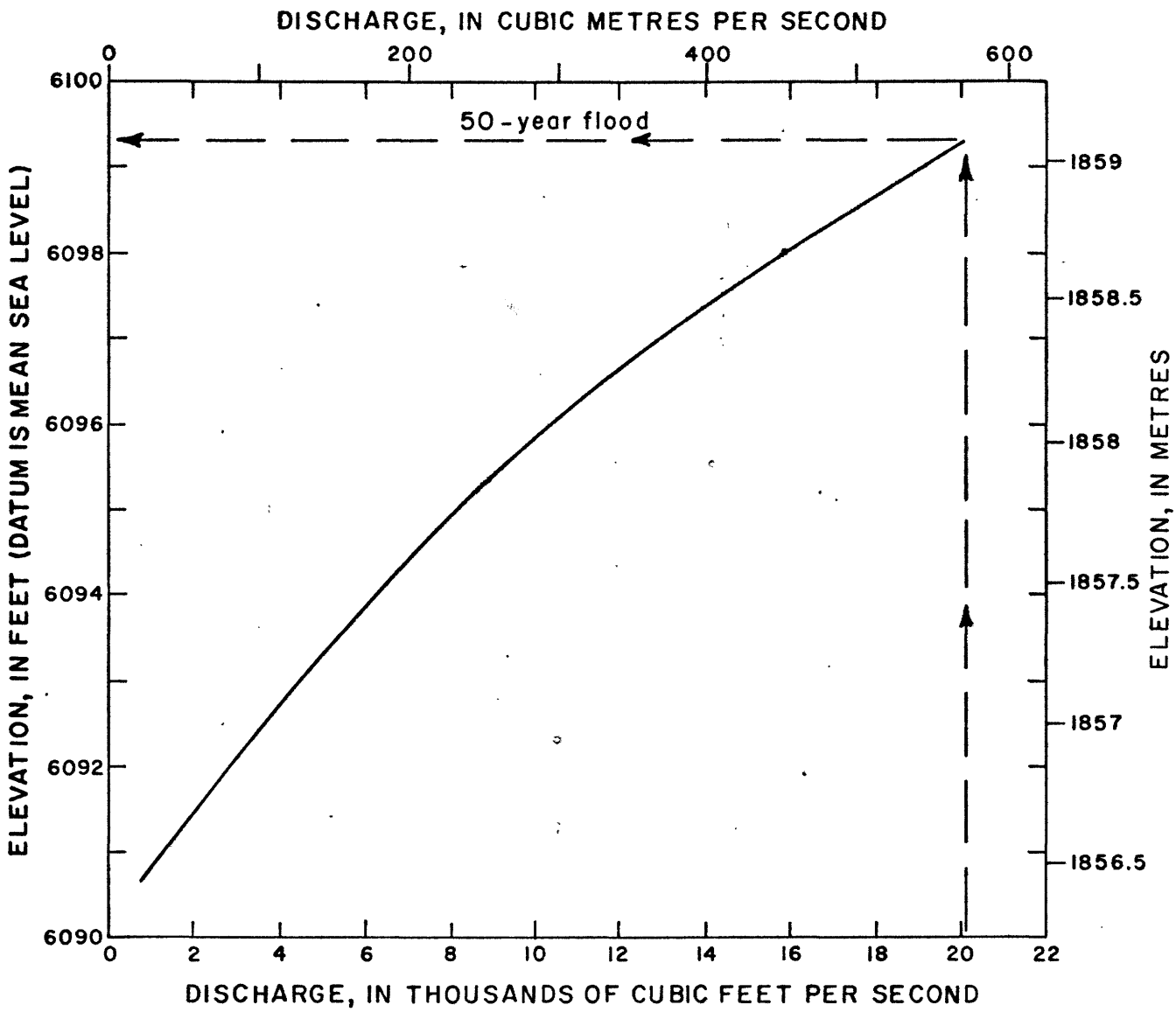

Figure 5.—Relation of stage to discharge at approach to centerline.

DISTRIBUTION OF FLOW

The distribution of flow for the 50-year flood at the approach section, 20,100 ft^3/s (570 m^3/s), is shown in figure 6 as 19 increments of 1,000 ft^3/s (28 m^3/s) and one increment of 1,100 ft^3/s (31 m^3/s). The main channel will carry about 18,500 ft^3/s (52 m^3/s), with the remaining 1,600 ft^3/s (50 m^3/s) distributed over the flood plain.

The overall mean velocity in the approach section is about 4.2 ft/s (1.3 m/s) and that in the main channel is about 5.8 ft/s (1.8 m/s).

The distribution of flow in the approach section is influenced by the existing highway embankment. The embankment causes the water on the flood plain to be funneled toward the main channel at the bridge. Velocities along the embankment could cause some scouring. These velocities usually increase as the flow approaches the bridge. The critical point for scour may be the embankment just upstream from the right abutment.

SUMMARY

1. The 50-year flood on the Green River near Green River, Wyoming, at the proposed centerline is 20,100 ft^3/s (570 m^3/s).

2. A discharge of 20,100 ft^3/s (570 m^3/s) at the approach section to the centerline will reach an elevation of 6,099.3 ft (1,859.1 m), including 0.4 ft (0.1 m) of backwater from the existing bridge.

3. Records collected since 1895 indicate that annual peak discharges occur after late March and mostly in May and June when the river is free of ice.

4. There is no flood control plan for the Green River above the site, and the new reservoir under construction near Fontenelle, Wyoming, will be capable of passing peak flows much greater than the 50-year flood.

5. A distribution of flow in the approach section for a discharge of 20,100 ft^3/s (570 m^3/s), in 19 increments of 1,000 ft^3/s (28 m^3/s) and one increment of 1,100 ft^3/s (31 m^3/s), is shown in figure 6.

6. The overall mean velocity in the approach section is about 4.2 ft/s (1.3 m/s) and that in the main channel is about 5.8 ft/s (1.8 m/s).

7. Velocities along the highway embankment could cause some scouring, especially just upstream from the right abutment.

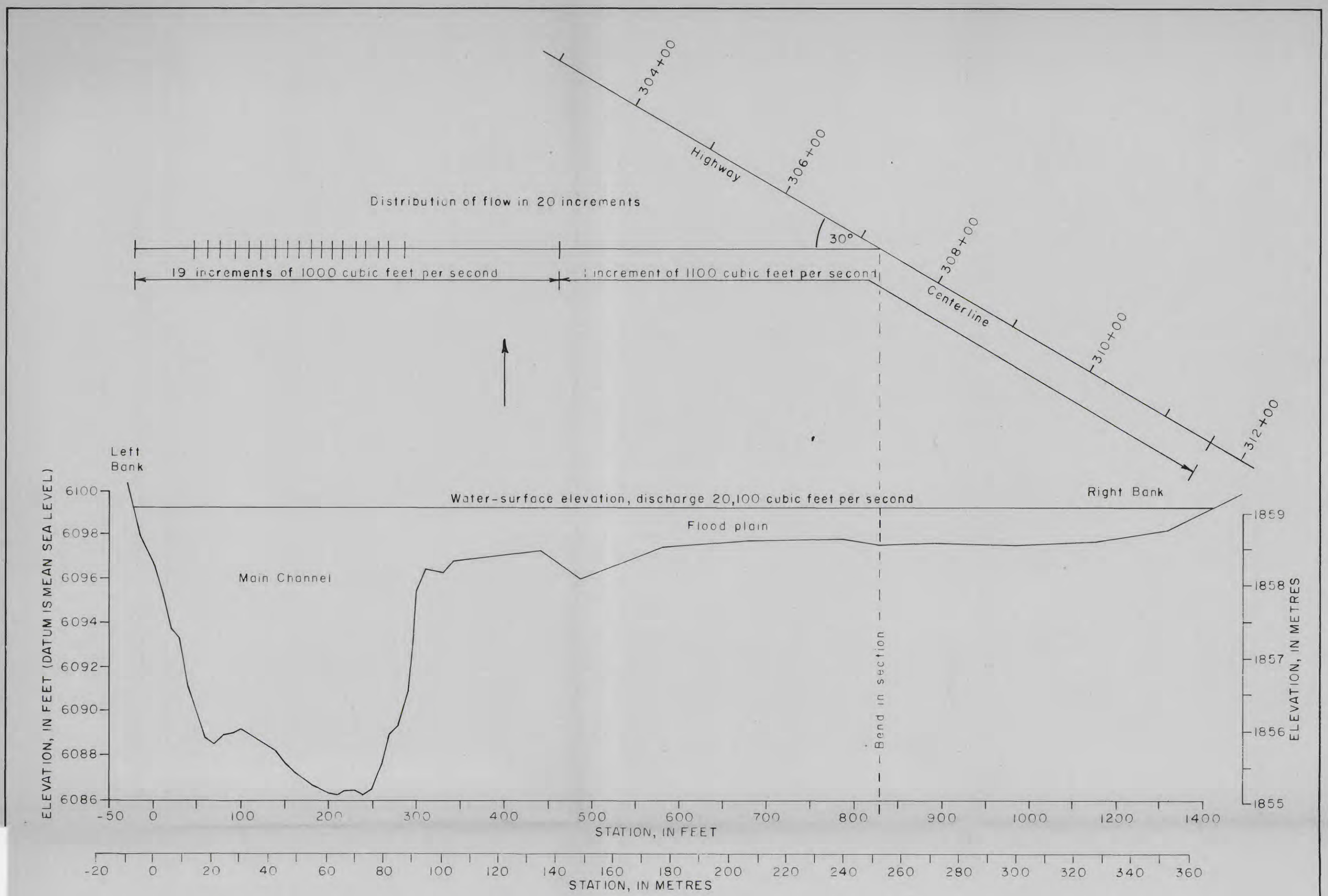

Figure 6.—Valley cross section at approach to centerline, the Green River near Green River, Wyoming.

REFERENCE

Carter, J. R., and Green, A. R., 1963, Floods in Wyoming, magnitude and frequency: U.S. Geol. Survey Circ. 478, 27 p., 2 pl.