WATER-SURFACE PROFILES OF RACCOON RIVER AT DES MOINES, IOWA

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Water Resources Division
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INTRODUCTION

This investigation was undertaken as a part of the cooperative program with the Iowa Institute of Hydraulic Research, the City of Des Moines, and the U. S. Geological Survey. The purpose of this report is twofold:

1. To present water-surface profiles and rating curves for existing channel conditions in the 4-mile reach of Raccoon River upstream from the mouth, and
2. To show the effect upon water-surface profiles of raising the Fleur Drive roadway to eliminate road overflow.

The Raccoon River, having a drainage area of 3,630 square miles, borders the south edge of the Des Moines downtown business district before flowing into the Des Moines River at mile 201.6. A large residential area and the city airport are separated from downtown Des Moines by the Raccoon River (fig. 1). Five highway bridges and one railroad bridge span the river between

the mouth and mile 205.75, the limits of this report (fig. 1). The river is confined to a narrow channel from the mouth to the Chicago, Burlington, and Quincy Railroad bridge (mile 202.6); upstream of this bridge the river is not confined and during high water spreads over a wide flood plain. Fleur Drive, a principal traffic artery to the downtown area, is the only roadway of the five that crosses this wide flood plain. It has been flooded 15 times during the period 1903, 1918-1965.

SUMMARY

Water-surface profiles and rating curves are shown on figures 2 and 4 to 9. Except as noted, they have been computed for the present channel conditions and can be used for engineering studies.

The Des Moines River discharge affects the Raccoon River elevations at least to mile 205, upstream of Fleur Drive. The upstream limits of this influence depend upon the stages and discharges in both rivers. The frequency of occurrence of the Des Moines River discharges cannot be determined for future floods because of the imminent construction and operation of the Saylorville Dam. However, the 40,000 cubic feet per second (cfs) discharge for the Des Moines River upstream from the Raccoon River should be a relatively infrequent flood after the dam is operational.

If the Fleur Drive roadway were raised enough to eliminate road overflow, the water-surface elevation at the upper Water Works Dam (mile 205.5) upstream from Fleur Drive would be increased by approximately 2.2 feet for a 50-year flood on the Raccoon River. It should be noted, however, that Fleur Drive could be raised to an elevation of 796.5 feet above mean sea level (22.7 feet, city datum) without causing an appreciable increase in backwater. This is because of the higher ground elevation upstream from Fleur Drive which excludes flow across Fleur Drive until the water upstream exceeds elevation 796.8 feet.

WATER-SURFACE PROFILES

The water-surface profiles were prepared using an electronic computer and standard U. S. Geological Survey step-backwater procedures for several combinations of Raccoon River discharges and starting elevations. A starting elevation for each profile was determined by using the stage-discharge rating at the Scott Street Bridge, 100 feet downstream from the mouth of the Raccoon River, for the combined discharge of the Raccoon River and the Des Moines River. Three families of three profiles each are shown on figure 2. The families represent the 2.3-year (mean annual flood), the 10-year, and the 50-year recurrence interval floods for the Raccoon River (fig. 3). Figure 3 supersedes the stage-

frequency curve shown for Raccoon River at Southwest 18th Street bridge (fig. 1). The three members of each family represent the Raccoon River profiles for Des Moines River discharges of 20,000, 30,000, and 40,000 cfs upstream from the mouth of the Raccoon River. The converging profiles of each family show that backwater effect from the Des Moines River becomes progressively smaller in the upstream direction.

New profiles were computed after the Fleur Drive roadway was hypothetically raised enough to eliminate road overflow. These profiles show the additional backwater that would be caused by forcing all flow under the existing bridge.

The April 2, 1960, flood profile, as determined from high-water marks, is also shown on the profile sheet. The discharges for this flood were estimated as 34,000 cfs in the Raccoon River and 35,000 cfs in the Des Moines River.

RATING CURVES

Elevation-discharge rating curves have been drawn from the computed profile data for the downstream side of all Raccoon River bridges that are within the area of this report. Each bridge rating (figs. 4-9) contains three curves, one for each of the Des Moines River discharges on the profile sheet. The bridge ratings are self-explanatory except for Fleur Drive which is discussed below.

These curves can be used to find the Raccoon River elevation (or discharge) provided the Raccoon River discharge (or elevation) and the Des Moines River discharge are known. Curves are shown for discharges ranging between the 2.3-year and the 50-year recurrence interval floods on the Raccoon River. The discharges for the 10-year and the 50-year floods are indicated on each rating curve sheet.

The Fleur Drive rating curves (fig. 9) are complicated by the submergence of the roadway. However, the curves shown can be used to determine the actual road overflow, the actual discharge under the bridge, and the total Raccoon River discharge at any selected elevation for the three Des Moines River discharges.

ACKNOWLEDGMENTS

Peak stages and dates of previous floods at Fleur Drive and some high-water mark data were furnished by the Des Moines Water Works.

Raccoon River flood-frequency data were computed using "Magnitude and Frequency of Iowa Floods", Iowa Highway Research Board, Bulletin 28.

Large scale topographic maps were furnished by the City of Des Moines and were used to determine the horizontal distances used in plotting figure 2.

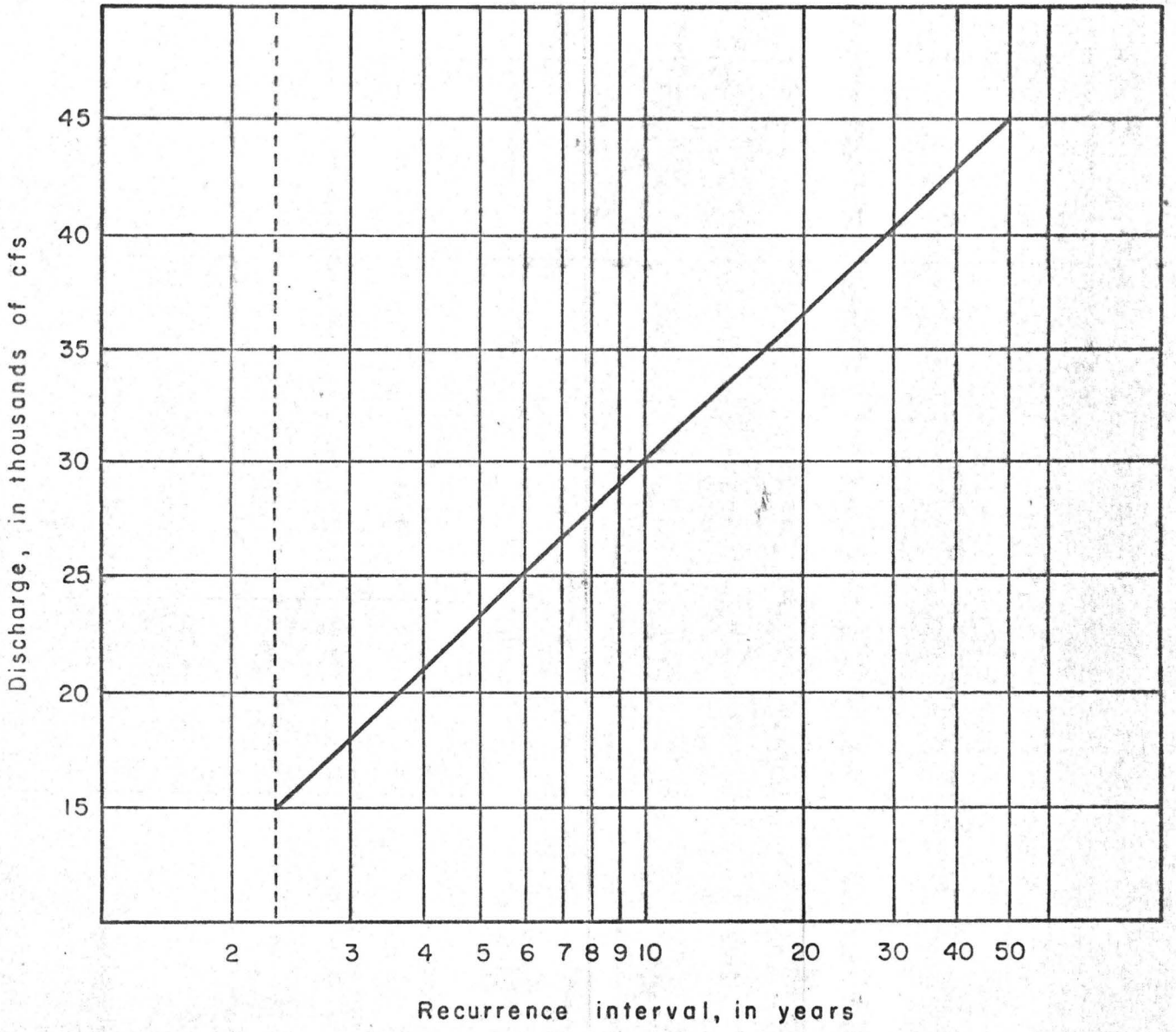

Figure 3. Frequency of floods on Raccoon River at Des Moines, Iowa.

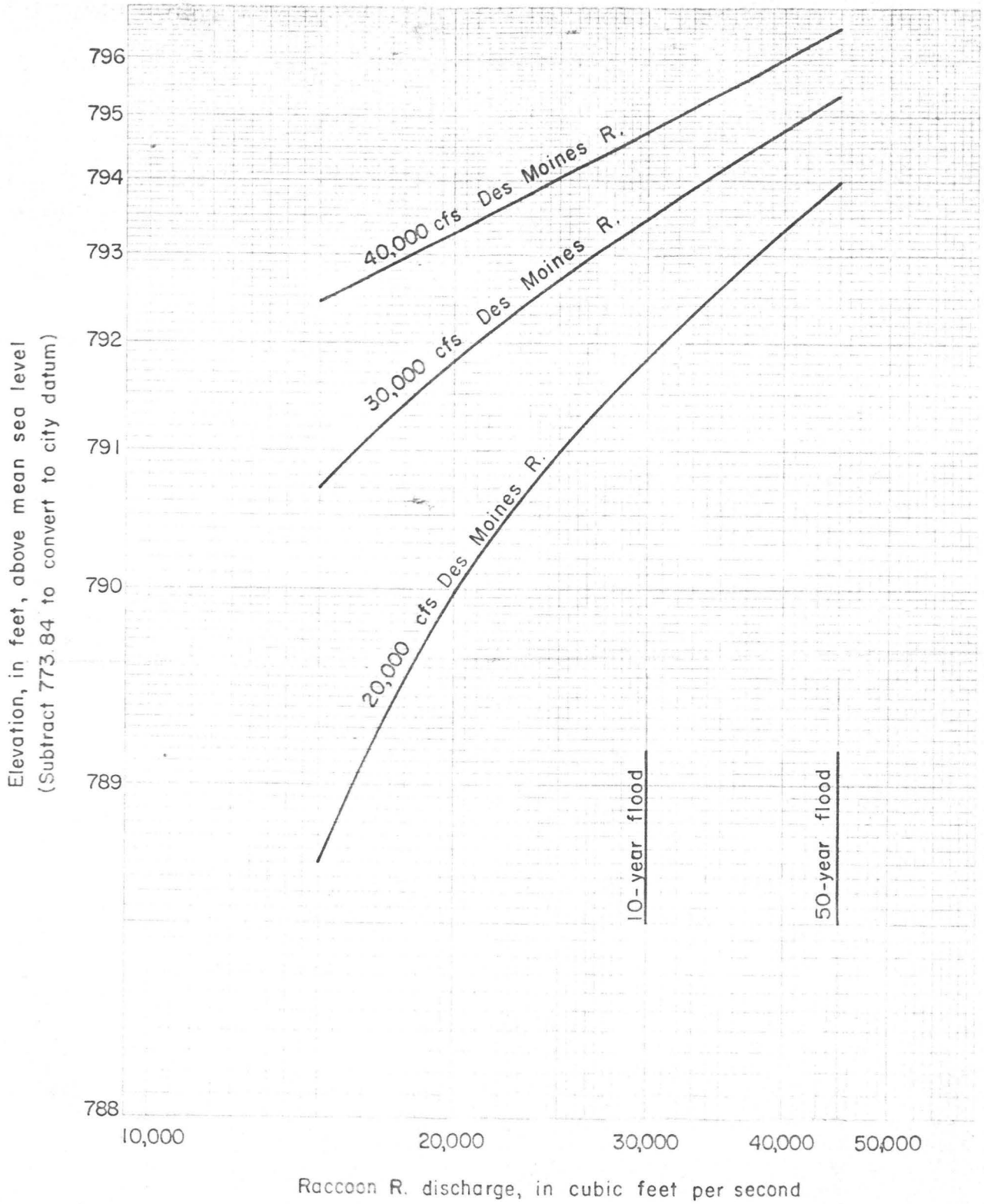

Figure 4. Elevation-discharge rating curve for Riverside Drive bridge.

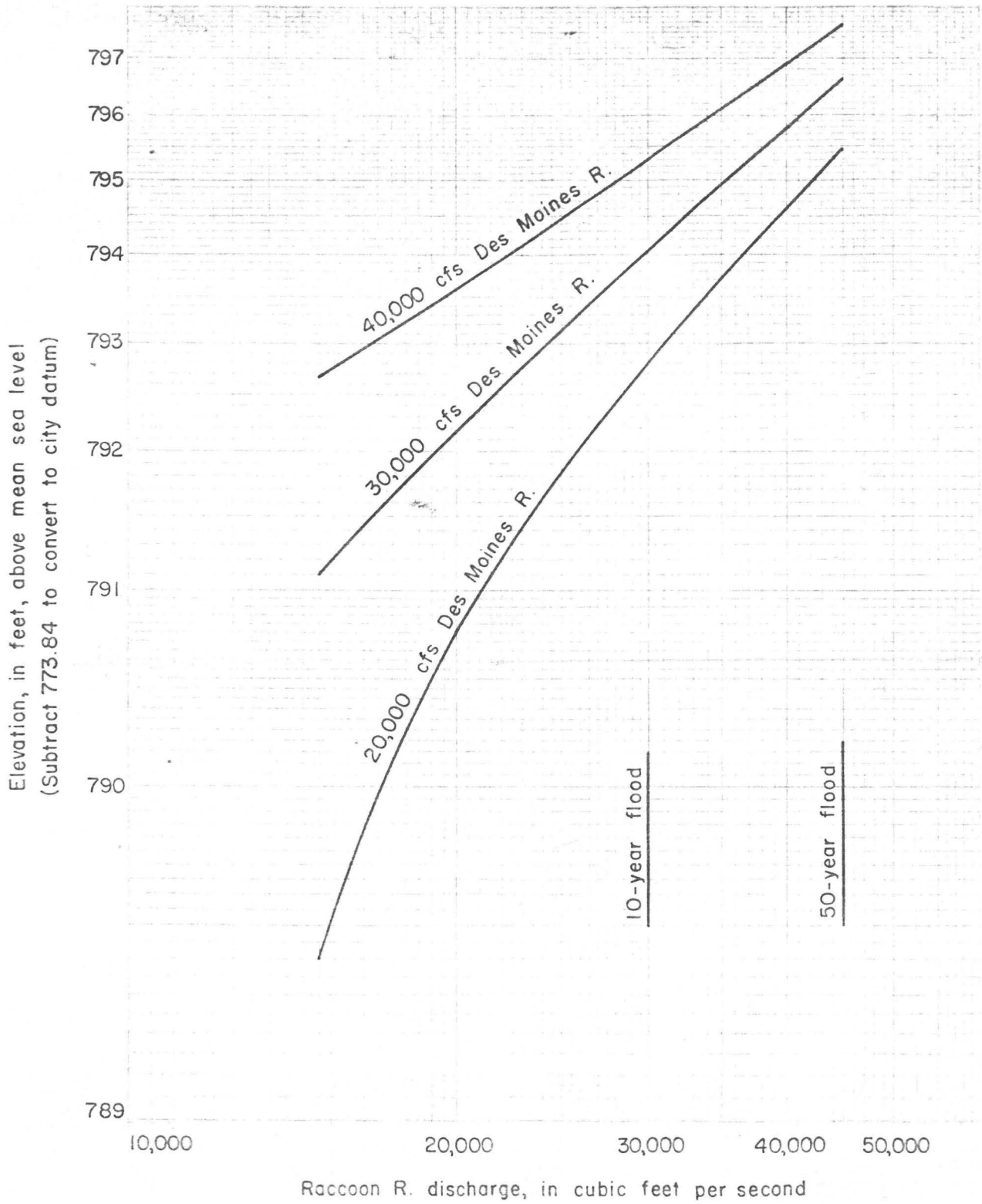

Figure 5. Elevation-discharge rating curve for SW 5th Street bridge.

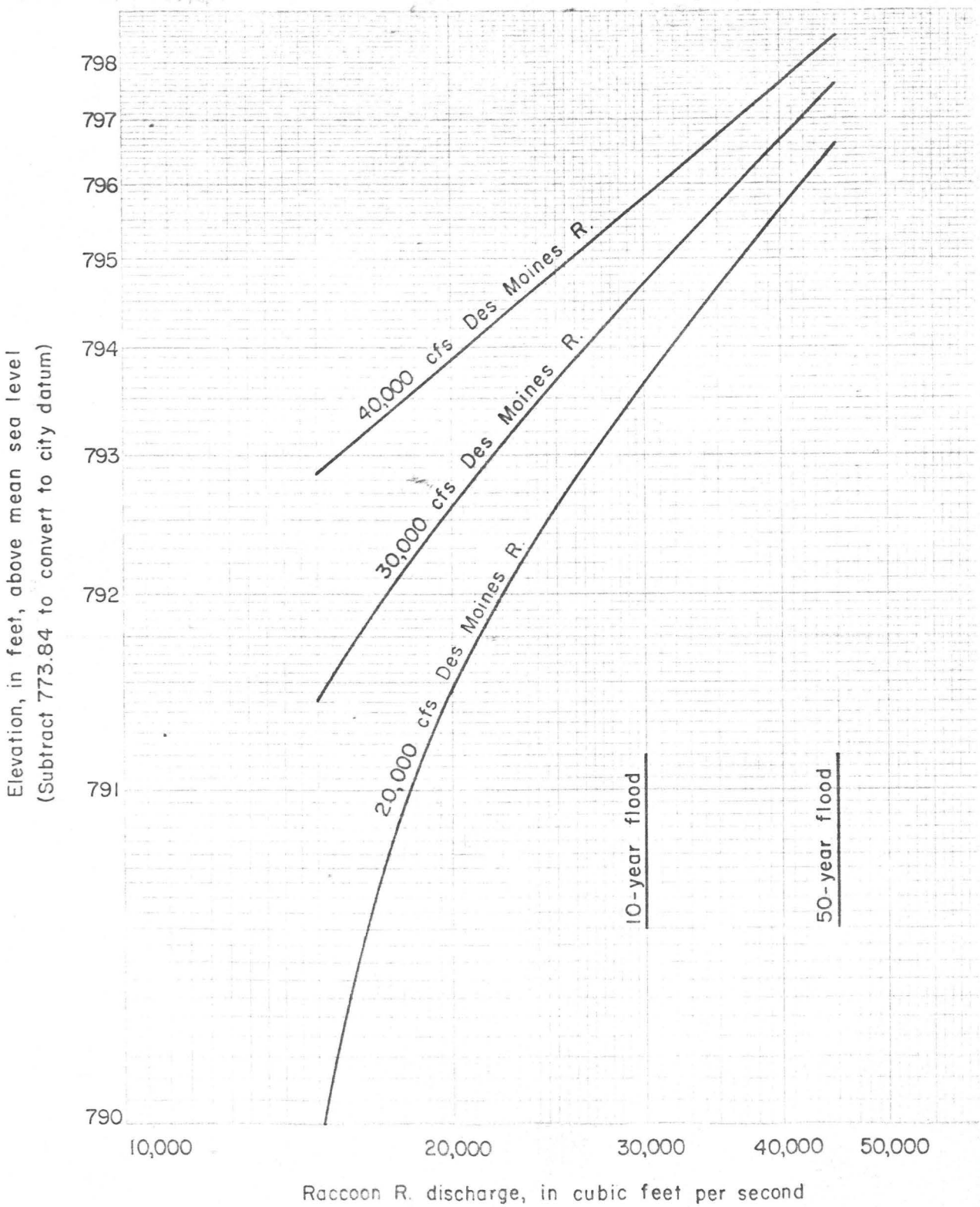

Figure 6. Elevation-discharge rating curve for SW 7th Street bridge.

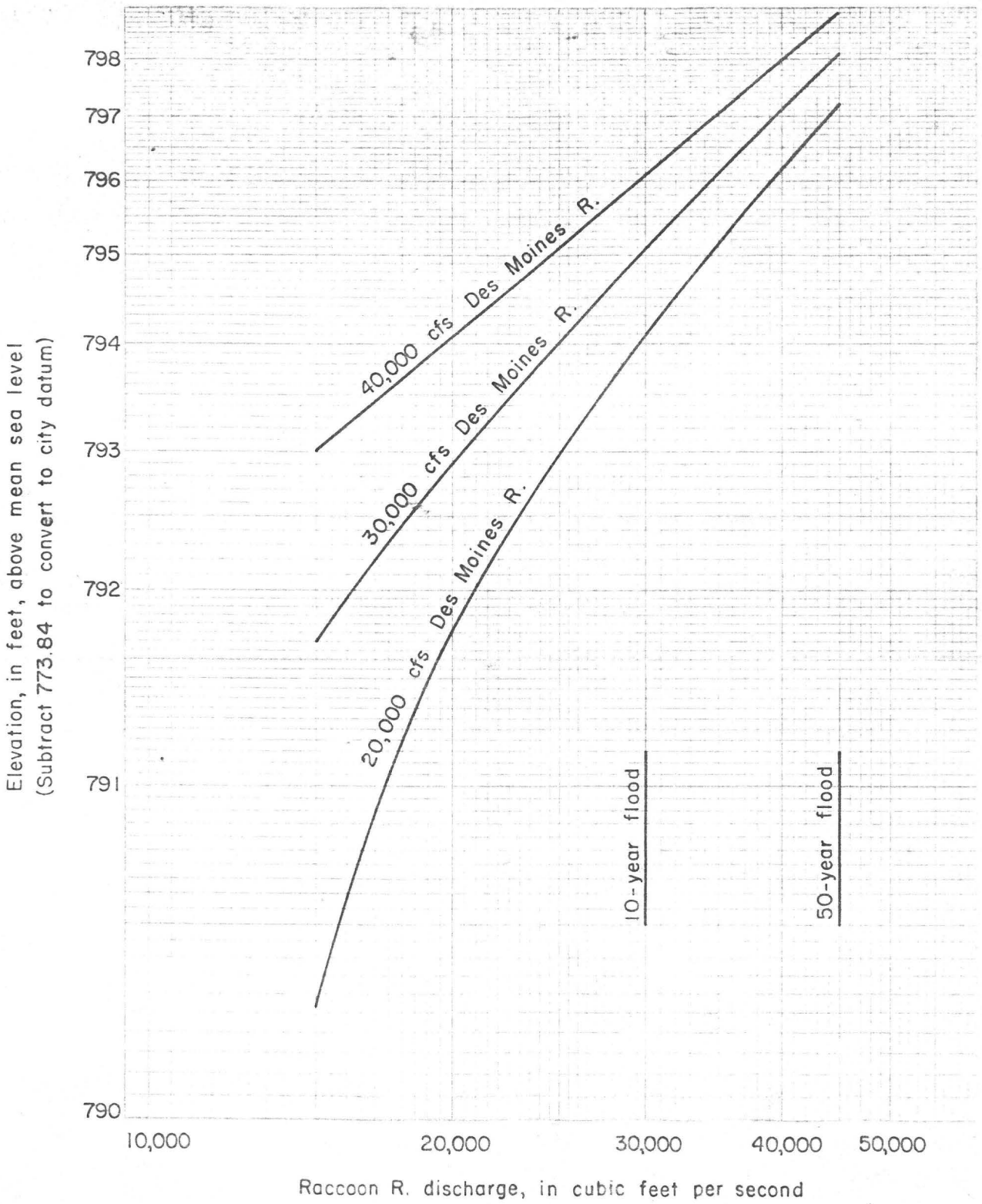

Figure 7 Elevation-discharge rating curve for SW 9th Street bridge.

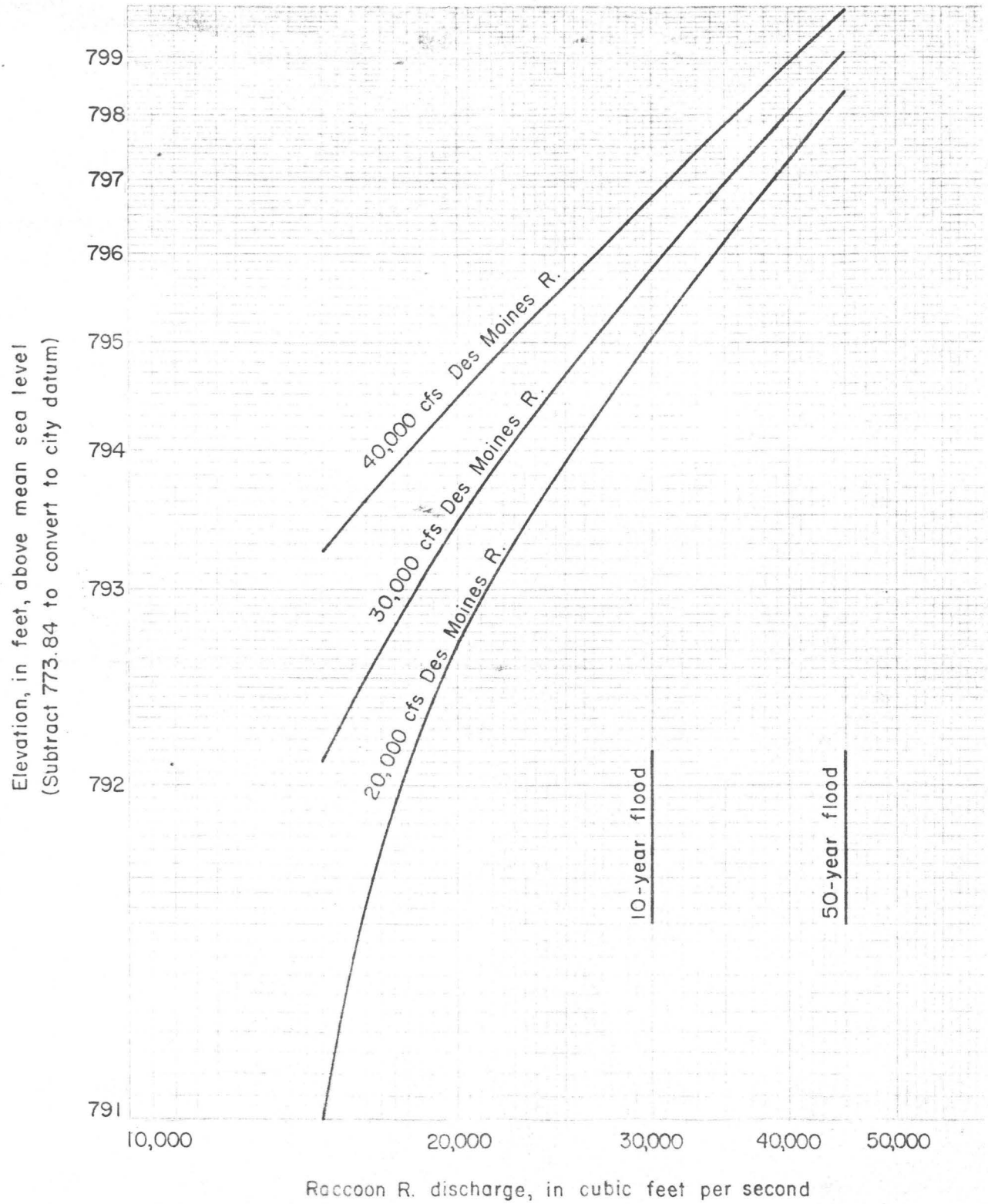

Figure 8. Elevation-discharge rating curve for C. B. & Q. R. R. bridge.

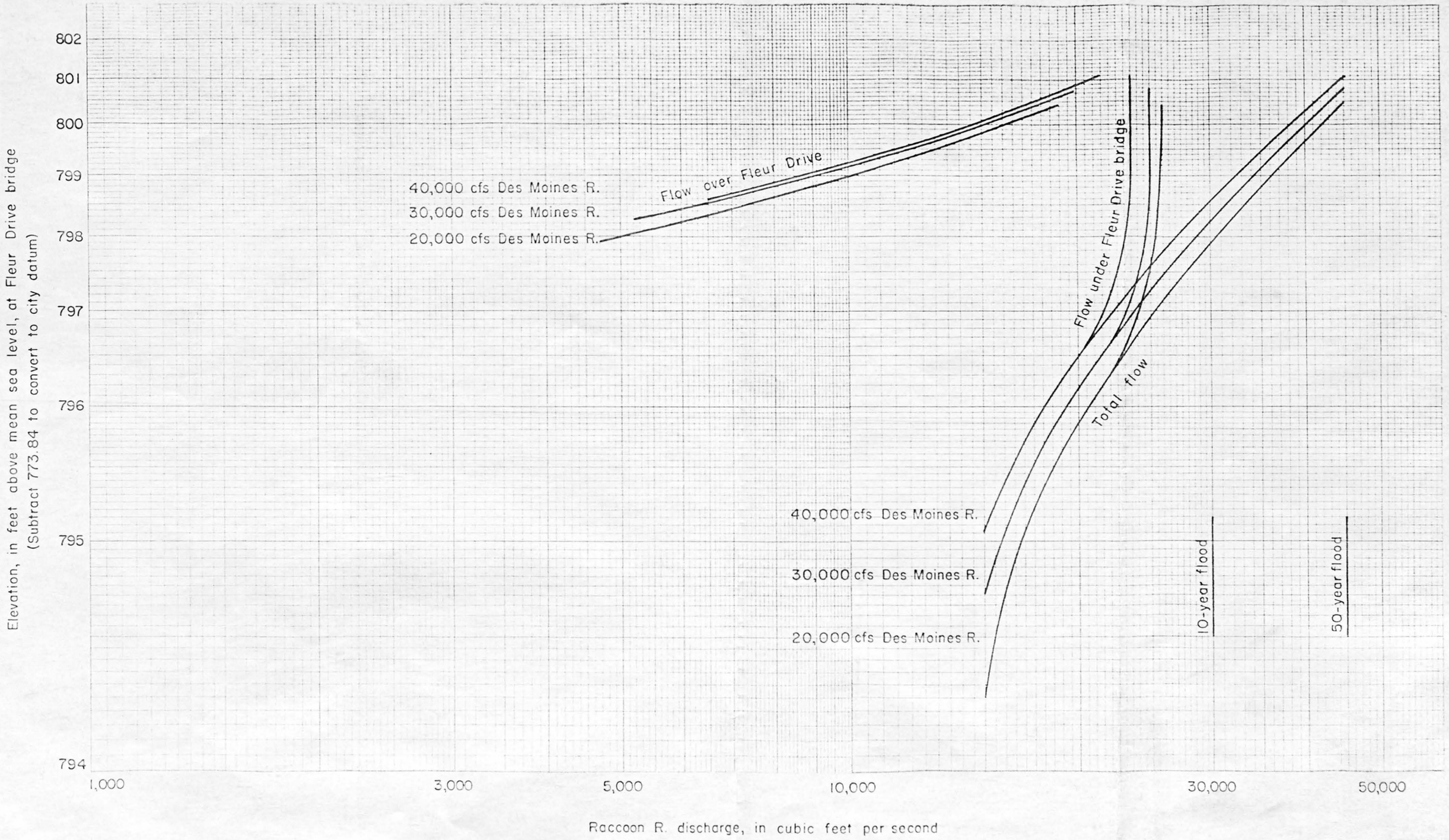

Figure 9. Elevation-discharge rating curve for Fleur Drive bridge.