

REGIONAL FLOOD LIMITS OF UPPER YAHARA RIVER IN DANE COUNTY, WISCONSIN

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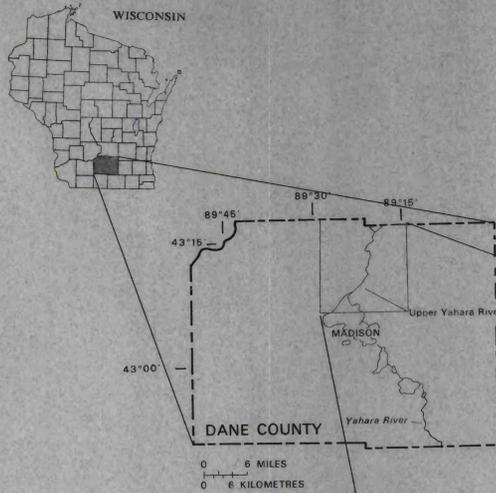


Table 2.--Discharge-frequency figures for selected sites in upper Yahara River.

Location	Drainage area (mi ²)	Frequency (years)	Discharge (ft ³ /s)
U.S. Highway 51	6.4	10	250
		50	630
		100	820
		500	1,400
South Road	4.3	10	740
		50	1,470
		100	1,900
		500	3,100
State Highway 19	76	10	1,000
		50	2,060
		100	2,600
		500	4,200

Purpose and Scope

The purpose of this report is to provide information on the extent, depth, and frequency of flooding that will affect the lands adjacent to the upper Yahara River in Dane County, Wis.

The report contains discharge-frequency data for flood peaks, flood-frequency profiles, and the regional flood- (100-year flood) inundation limits for the upper Yahara River. The studied reach is in northern Dane County upstream from Lake Mendota and is 11 river miles (18 km) in length. It extends from a point 1,400 ft (395 m) downstream from State Highway 19 upstream to U.S. Highway 51 near the northern Dane County line.

The Wisconsin Legislature has enacted flood-plain-zoning legislation (1965) to encourage economic use of flood plains and to minimize flood losses. This act gave counties, cities, and villages the responsibility of enacting, administering, and enforcing reasonable and effective flood-plain regulations.

This report is a sequel to an earlier report by Shearman and Lawrence (1971). The earlier report provided much of the same information, but the scale of the map defining limits of flooding was much smaller. This report, using orthophotographs at a scale of 1 in = 400 ft, provides greater detail.

A report by Krug (1976) gives the same types of flood information for major parts of five other streams in Dane County. The five streams (not shown on maps in this report) are Badger Mill Creek, Koshong Creek, the Waubesa River, the Sugar River, and the Wisconsin River.

The report is based on conditions existing in 1971. All elevations are to mean sea level, datum of 1929.

Figure 1 shows the location and extent of the Yahara River and Dane County. It also shows the orientation of the four orthophotographs within the Yahara River basin.

Table 1 gives factors for converting English units, as used in the report, to International System (SI) units.

A report providing flood data for the Yahara River at Lake Waubesa and downstream in Dane County, and in an identical format to this, is now in preparation.

Table 1.--Factors for converting English units to International System (SI) units

Multiply English units	By	To obtain SI units
feet (ft)	0.3048	metres (m)
miles (mi)	1.609	kilometres (km)
square miles (mi ²)	2.590	square kilometres (km ²)
cubic feet per second (ft ³ /s)	.02832	cubic metres per second (m ³ /s)

Cooperation and Acknowledgments

This report was prepared by the U.S. Geological Survey in cooperation with the Dane County Regional Planning Commission. The 10-, 50-, and 500-year flood profiles were developed for a flood-insurance study that was prepared for the Federal Insurance Administration, U.S. Department of Housing and Urban Development. Some information contained in this report came from the following other sources: the Wisconsin Department of Natural Resources, the Wisconsin Department of Transportation, and local residents. Their helpfulness is appreciated. The orthophotographs were prepared by Hansa Engineering Corporation, San Francisco, Calif., under a contract executed by the U.S. Geological Survey.

Peak Flood Discharges

The flood-frequency profiles in this report represent the water-surface elevation expected to be caused by flood discharges that will be exceeded once in 10-, 50-, 100-, and 500 years. A 100-year flood discharge will be exceeded on the average, once every 100 years, and there is one chance in 100 that a flood discharge greater than the 100-year flood discharge will occur in any year.

Flood-frequency estimates can be determined from statistical analysis of streamflow records or from regional relations based on physical characteristics of the basin. On the upper Yahara River where adequate streamflow records were not available for analysis, discharge figures were determined using equations derived by Conger (1971). The 2-, 5-, 10-, 25-, and 50-year flood discharges defined by this method were plotted on log-normal probability paper and the curve defined by these points extended to give the 100- and 500-year flood discharges. The computed flood discharges were acceptable to the Wisconsin Department of Natural Resources, Bureau of Water and Channel Management. The flood discharges used in this study are tabulated in table 2.

Flood-Frequency Profiles

The 10-, 50-, 100-, and 500-year flood-frequency profiles (fig. 3) were computed by the standard step method (Chow, 1959, p. 263) using a digital-computer model. The computer model used a mathematical representation of the geometry of the valley and of the surface roughness to determine water-surface profiles. The normal low-water profile, as shown in figure 3, was observed during field surveys in June 1970. Any variation from this except during periods of direct surface runoff would be insignificant.

Geometry of the valleys is represented by cross sections in figure 4. The full extent of the surveyed cross sections shown was not necessarily used in the model and in a few cases additional points not shown were estimated from the available maps and used in the model. Interpretations were made to consider probable flow patterns or conveyance at each cross section. Roughness characteristics were expressed in terms of Manning's "n" values (Chow, 1959, p. 99), determined by field inspection.

Backwater at bridges and culverts was calculated using different computer models. The computer model used for open-channel computations also calculated the effect of backwater from bridges and flow over roads, using the geometry of the road, the bridge opening, and the valley just upstream. A separate computer model was used to calculate backwater caused by culverts, using procedures outlined by Bodhaine (1968).

Flood-Inundation Limits

The flood-plain limits for the regional (100-year) flood are shown in figure 2, which consists of orthophotographs at a scale of 1 in = 400 ft (1:4800). 300-foot (0.6-m) contours are shown in a range that overlaps the regional flood. Also shown on the orthophotographs are regional flood elevations along the main channel, shown in increments ranging from 1 to 5 ft (0.3 to 1.5 m) depending on steepness of the channel; points of known elevations; river-mile markers; and locations of cross sections.

In all cases the flood inundation shown is due to flooding of the stream studied. Tributary streams may produce higher flooding in their own valleys. No attempt was made to account for this in drawing the inundation limits.

The flood-plain limits and flood profiles in this report do not represent the most severe flooding that could occur in the study reach; both the regional flood discharge and the 500-year flood discharge could be exceeded. Also, bridges or culverts plugged with ice or debris can cause abnormally high stages for a given discharge. These stages may exceed stages caused by a greater but unobstructed discharge.

Vertical Control

Bench marks, points of known elevation used in this study, are tabulated in table 3. These points are indicated on the orthophotographs.

References Cited

Bodhaine, C. L., 1968, Measurement of peak discharge at culverts by indirect methods: U.S. Geol. Survey Techniques Water-Resources Inv., book 3, chap. A3, 60 p.

Chow, Ven Te, 1959, Open channel hydraulics: New York, McGraw-Hill, 621 p.

Conger, D. H., 1971, Estimating magnitude and frequency of floods in Wisconsin: U.S. Geol. Survey open-file rept., 200 p.

Krug, W. R., 1976, Flood-plain delineation for regional flood in Dane County, Wisconsin: U.S. Geol. Survey open-file rept. 76-164, 168 p.

Shearman, J. O., and Lawrence, C. L., 1971, Floods on Yahara River upstream from Lake Mendota, Dane County, Wisconsin: U.S. Geol. Survey open-file rept., 1 p.

Wisconsin Legislature, 1965, Senate Bill 650 in Water Resources Act, Chapter 514, Laws of 1965: Madison, Wis., Dept. of Resource Development, 26 p.



Base from Wisconsin Geological and Natural History Survey Dane County Map, 1973

FIGURE 1. LOCATION AND EXTENT OF STUDY