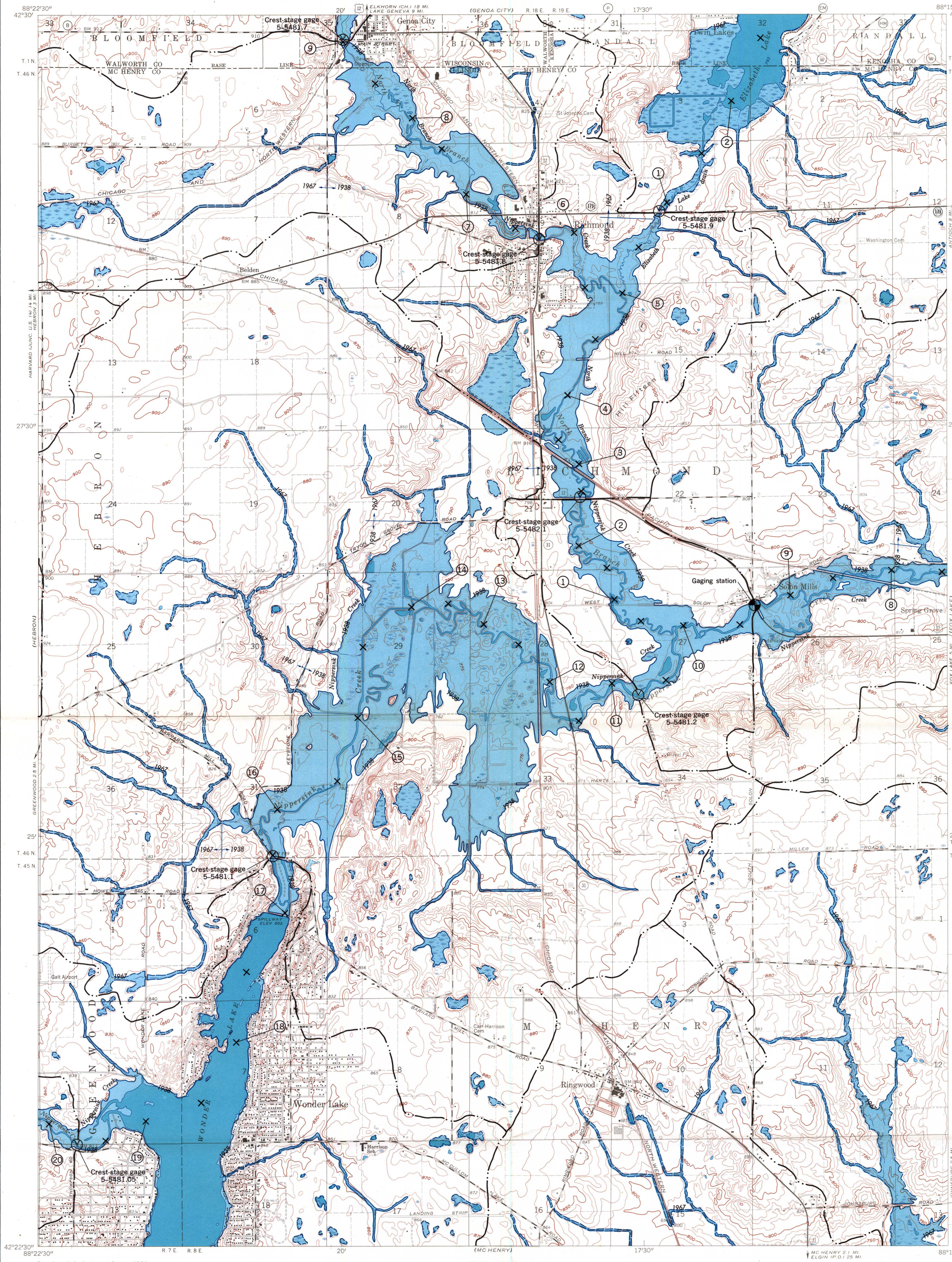
PREPARED IN COOPERATION WITH
THE NORTHEASTERN ILLINOIS
PLANNING COMMISSION



Base from U.S. Geological Survey, 1964

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DOTTED LINES REPRESENT 5-FOOT CONTOURS
DATUM IS MEAN SEA LEVEL

APPROXIMATE MEAN DECLINATION, 1969

QUADRANGLE LOCATION

EXPLANATION

Area flooded

Boundary of 1938 flood

Boundary of 1967 flood

Drainage divide

River mile measured along stream channel

Inundated areas defined from different floods, upstream and downstream

FLOODS IN RICHMOND QUADRANGLE NORTHEASTERN ILLINOIS

This report presents hydrologic data that can be used to evaluate the extent, depth, and frequency of flooding that affect the economic development of flood plains in the Richmond quadrangle, northeastern Illinois. It will aid individuals, government agencies, and others responsible for solving existing flood problems and for formulating effective flood-plain regulations that will minimize the creation of new flood problems. The report will also be useful for preparing building and zoning regulations, locating waste disposal facilities, developing recreational areas, and managing surface water in relation to ground-water resources.

The approximate areas inundated by floods along streams in the Richmond quadrangle are delineated on a topographic map. The quadrangle location is shown in figure 1.

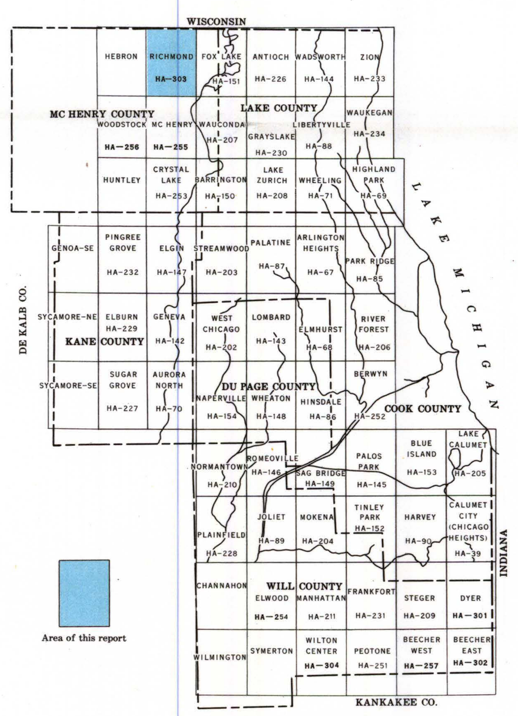


FIGURE 1.—*Index map of northeastern Illinois showing location of quadrangles included in flood-hazard mapping program.*

Inundated areas are shown for the floods in the following list:

Date of flood	Area flooded
July 1938	Nippersink Creek; North Branch Nippersink Creek; Elizabeth Lake drain downstream from mile 0.80; and several unnamed tributaries to these streams
June 1967	Elizabeth Lake drain upstream from mile 0.80 and tributaries; several unnamed tributaries to Nippersink Creek, North Branch Nippersink, and Dutch Creek; and most of the depressions on the map

The flood of July 1938 on Nippersink Creek and North Branch Nippersink Creek was reported by local residents to be the highest in the past 70 years. The flood stage of June 1967 on Elizabeth Lake drain was the highest since the 1957 flood (which was about a foot higher).

Greater floods than those whose boundaries are shown on the map are possible. The flood boundaries shown provide a record of historic fact that reflects channel conditions existing when the floods occurred. Changes in channel conditions, waterway openings at highways and railroads, or changes in runoff characteristics of the streams caused by increased urbanization that may have taken place subsequent to the floods shown on the map could affect the flood height of future floods of comparable discharge. Protective works built after the floods shown may reduce the frequency of flooding in the area but will not necessarily eliminate all future flooding. The inundation pattern of future floods may be affected by new highways and bridges, relocation and improvement of stream channels, and other cultural changes.

The general procedure used in defining flood boundaries was to construct flood profiles from elevations of floodmarks identified in the field and from data available from other agencies. The extent of flooding delineated on the topographic map was derived from the profiles by interpolation between contours (lines of equal ground elevations) and by plotting overflow limits identified during field investigations and surveys. The portrayal of flood boundaries is consistent with the scale of the map (1 inch = 2,000 feet; contour intervals, 5 feet and 10 feet).

There are depressions and lowland areas in the Richmond quadrangle where surface water accumulates because of inadequate drainage into the streams. Frequency and depth of flooding in these areas are unrelated to the water-surface elevation along the streams. Some areas are flooded only briefly after periods of heavy rainfall or snowmelt, whereas others remain inundated continuously, depending largely upon the rate of evaporation and seepage into the ground. Flood boundaries are shown for all such areas that were detected in this investigation.

Cooperation and acknowledgment.— The preparation of this report is a part of an extensive flood-mapping program financed through cooperative agreements between the Northeastern Illinois Planning Commission and the U.S. Geological Survey. Under previous agreements, flood maps were prepared for forty-three 7½-minute quadrangles. Under present agreements with the Planning Commission and the Illinois Department of Public Works and Buildings, Division of Waterways the flood-mapping program was expanded to include all the 7½-minute quadrangles shown in figure 1. The counties of Cook, Du Page, Kane, Lake, and McHenry cooperate in the program financially through separate agreements with the Planning Commission. The Illinois Department of Public Works and Buildings, Division of Waterways cooperates in financing the flood-mapping of the following 7½-minute quadrangles: Beecher East, Wilton Center, Channahon, Wilmington and Symerton. The total program includes parts of Cook, and McHenry Counties, nearly all of Kane and Will Counties, and all of Du Page and Lake Counties. Financial support for the preparation of this report was provided by McHenry County through the Northeastern Illinois Planning Commission.

The cooperative program is administered on behalf of the Planning Commission by Matthew L. Rockwell, Executive Director.

This report was prepared by the U.S. Geological Survey under the administrative direction of William D. Mitchell, district chief, and under the immediate supervision of Allen W. Noehre, engineer-in-charge of the project.

Acknowledgment is made to the McHenry County Highway Department and the State of Illinois, Department of Public Works and Buildings, Division of Waterways for furnishing some of the data on which this report is based.

Additional data were obtained from public officials in the area and from field investigations.

Flood height.— The height of a flood at a gaging station usually is stated in terms of gage height, or stage, which is the elevation of the water surface above a selected datum plane. Elevations shown in this report are in feet above mean sea level. Gage heights for crest-stage gages in the Richmond quadrangle can be converted to elevations above mean sea level by adding the gage height to the appropriate datum of gage listed in the following table.

Gaging station	Station number	Type of gage[1]	Datum of gage above mean sea level (feet)	Drainage area (square miles)
Nippersink Creek:				
Above Wonder Lake (Thompson Road)	5-5481.05	C	806.31	86.2
Below Wonder Lake (Barnard Mill Road)	5-5481.1	C	780.29	98.3
Near Solon Mills (Pioneer Road)	5-5481.2	C	764.96	118
At Solon Mills (U.S. Highway 12)[2]	----------	R	754.98	188
North Branch Nippersink Creek:				
At Genoa City, Wis. (County Road B-Main Street)	5-5481.7	C	812.86	43.7
At Richmond (U.S. Highway 12)	5-5481.8	C	792.49	50.8
Near Solon Mills (U.S. Highway 12)	5-5482.1	C	771.55	67.4
Elizabeth Lake drain at Richmond (State Highway 173)	5-5481.9	C	790.96	13.0

[1] C, Crest-stage gage; R, Water-stage recorder.
[2] Division of Waterways gage discontinued October 1966.

Size of the drainage basin for each station also is given in the table. The subbasin divides from which the areas were determined are shown on the flood map. The divides were described in the traditional manner of following the ridge line or highest ground elevation between adjacent streams. Relief in parts of the quadrangle is slight and at times some of the divides may become submerged during floods. When this occurs water may flow in either direction across the divide depending upon the relative elevation of the streams and conveyance of their channels.

Gage height and year of occurrence of each annual flood (highest peak stage in each calendar year) above 742.5-foot elevation at the gaging station Fox River at Wilmot, Wis., during the period 1940-66 are shown in figure 2. This gaging station is 300 feet upstream from Wilmot Dam in Wilmot, Wis., and 3.7 miles northeast of the Richmond quadrangle.

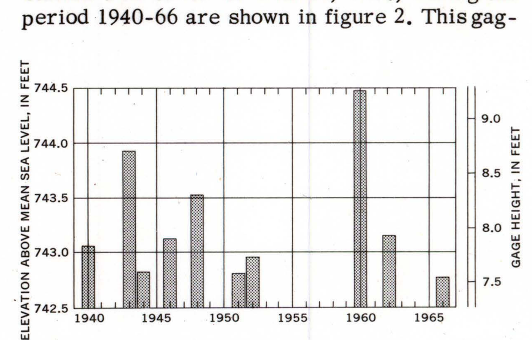


FIGURE 2.—*Annual floods above 742.5-foot elevation, 1940–66, Fox River at Wilmot, Wis.*

Flood discharge.—The rate of discharge of a stream is the volume of flow that passes a particular location in a given period of time. Discharge rates usually are expressed in units of cubic feet per second (cfs). Peak discharge, the maximum discharge attained by a flood, generally occurs at the time of the maximum height (stage) of the flood, but if a stream is affected by variable backwater, the time of the peak discharge may not coincide with that of the maximum stage. For example, backwater from debris or an ice jam may cause a high stage during a period of relatively low discharge.

Flood frequency.— Frequency of floods at the Geological Survey gaging station Fox River at Wilmot, Wis., was derived from streamflow records for this station combined with records for nearby stations and with the regional flood-frequency relation for streams in southern Wisconsin (Ericson, 1961). The general relation between frequency and discharge at the gaging station is shown in figure 3, and the relation between frequency and stage is shown in figure 4. The relation between stage and frequency is dependent on the relation of stage to discharge

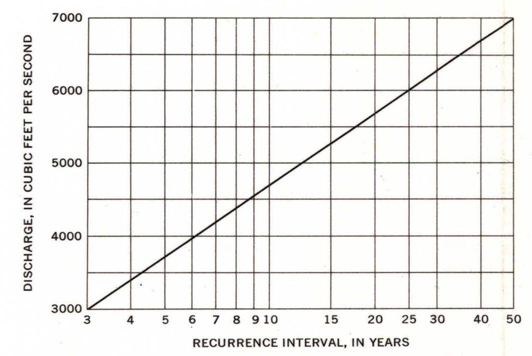


FIGURE 3.—*Frequency of flood discharges on Fox River at Wilmot, Wis.*

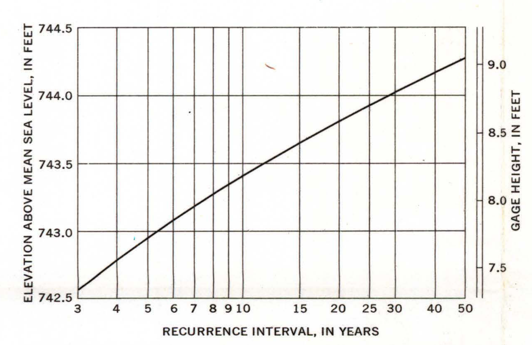


FIGURE 4.—*Frequency of flood stages on Fox River at Wilmot, Wis.*

which is affected by changes in physical conditions of stream channels and constrictions. The frequency curve shown in figure 4 is based on channel conditions existing in 1967. Longer records and future changes in channel conditions may define somewhat different flood-frequency curves. Extrapolation of the curves beyond the limits shown is not recommended.

Recurrence intervals.—As applied to flood events, recurrence interval is the average interval of time within which a given flood will be equaled or exceeded once. Frequencies of floods can be stated in terms of their probabilities of occurrence (virtually reciprocals of their recurrence intervals for floods with recurrence intervals greater than 10 years). For example, a flood with a 25-year recurrence interval would have a 4-percent chance of being equaled or exceeded in any given year, or a flood with a 50-year recurrence interval would have a 2-percent chance of being equaled or exceeded in any given year. The general relation between recurrence interval and flood height at the gaging station on Fox River at Wilmot, Wis. (fig. 4) is tabulated below:

Recurrence interval (years)	Elevation above mean sea level (feet)
50	744.3
30	744.0
20	743.8
10	743.4
5	743.0
3	742.6

It is emphasized that recurrence intervals are average figures—the average number of years between occurrences of floods that equal or exceed a given magnitude. The fact that a major flood is experienced in one year does not reduce the probability of that flood being exceeded during the next year or even during the next week.

Flood profiles.— Profiles of the water surface for the floods of July 1938, and June 1967 are shown in figures 5-7.

Where floodmarks could not be identified, the profiles were constructed on the basis of flood crests determined from photographs and from reports by local residents, and on elevations of streambeds and lower flood stages. River miles used for the profiles correspond to those marked along the streams on the flood map.

The abrupt changes in the profiles, shown at some road crossings, indicate the difference in water-surface elevations at the upstream and downstream sides of bridges that produce channel constrictions. The drop in water surface through bridge openings during future floods may be different from that shown on the profiles. An increase in channel capacity through a bridge opening would reduce the flood height on the upstream side. An accumulation of debris at a bridge would reduce the channel capacity and tend to increase the upstream flood height. Channel changes through bridge openings may also change the overflow pattern of future floods.

Flood depths.— Depth of flooding at any point can be estimated by subtracting the ground elevation from the water-surface elevation at the same point, indicated by the profiles in figures 5-7. The approximate ground elevation can be determined from contours on the map, although more accurate elevations can be obtained by leveling from nearby bench marks.

Additional data.— Other information pertaining to floods in the Richmond quadrangle can be obtained at the office of the U.S. Geological Survey, Oak Park, Ill., and from the following reports:

Daniels, W. S., and Hale, M. D., 1958, Floods of October 1954 in the Chicago area, Illinois and Indiana: U.S. Geol. Survey Water-Supply Paper 1370-B, p. 107-200.

Ericson, D. W., 1961, Floods in Wisconsin, magnitude and frequency: U.S. Geol. Survey open-file report, 109 p.

Illinois Department of Public Works and Buildings, Division of Waterways, 1962, Survey Report for development of Fox River for recreational navigation, 204 p.

Mitchell, W. D., 1954, Floods in Illinois, magnitude and frequency: Illinois Dept. Public Works and Bldgs., Div. of Waterways, 386 p.

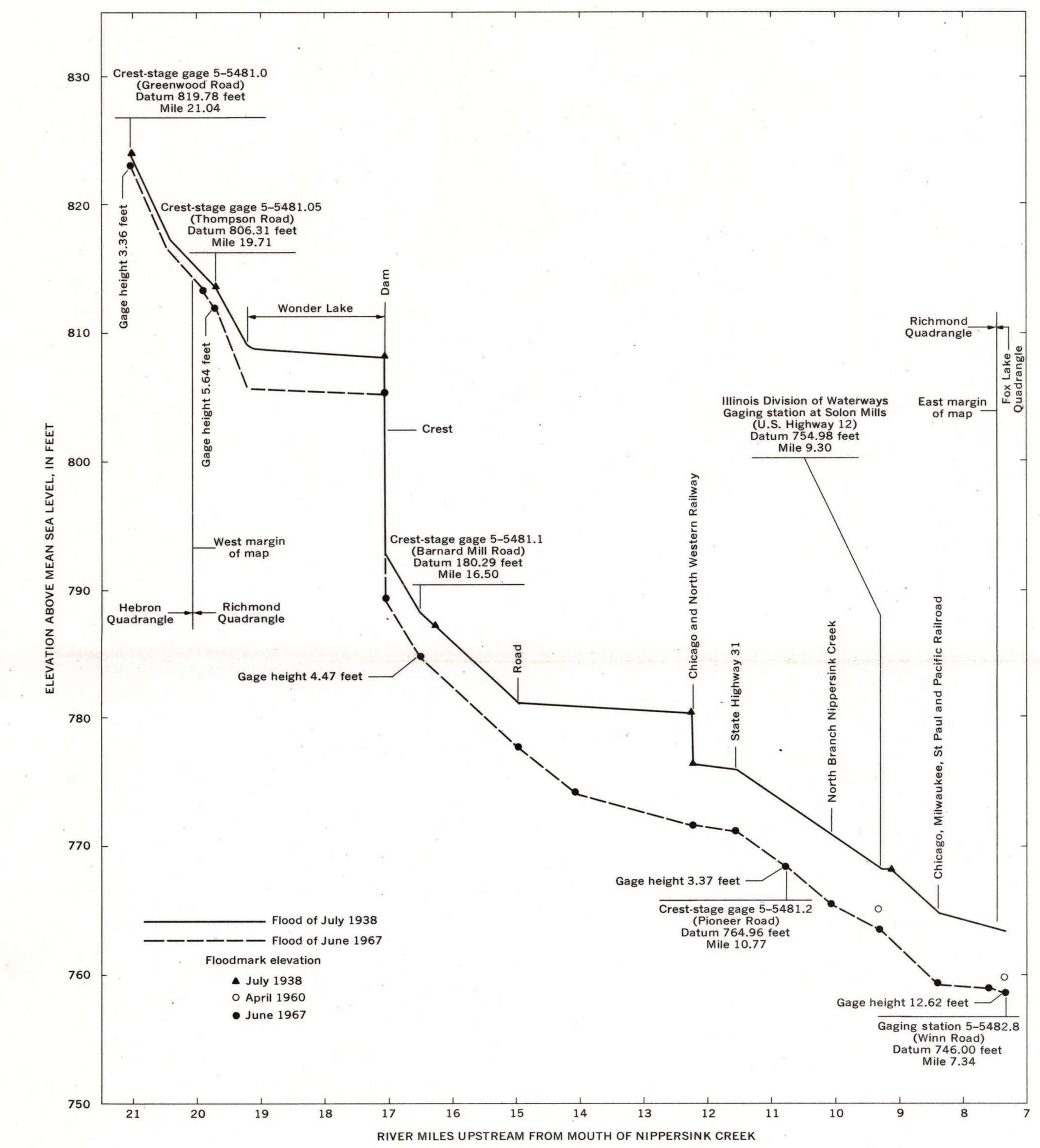


FIGURE 5.—*Profiles of floods on Nippersink Creek.*

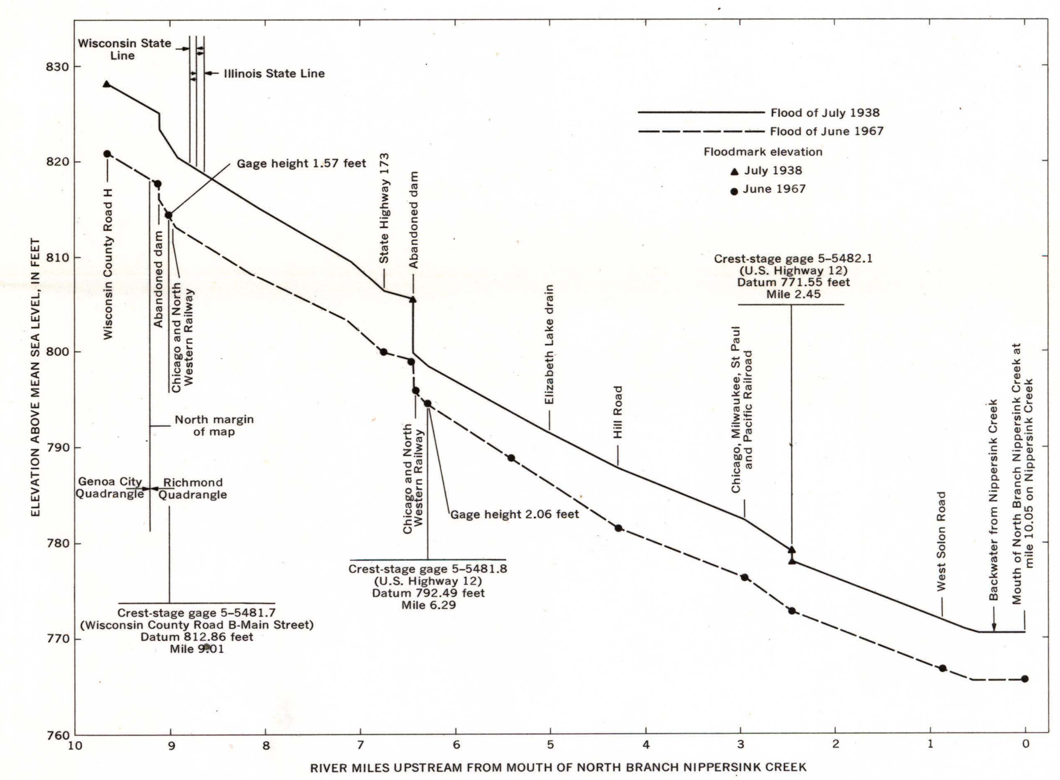


FIGURE 6.—*Profiles of floods on North Branch Nippersink Creek.*

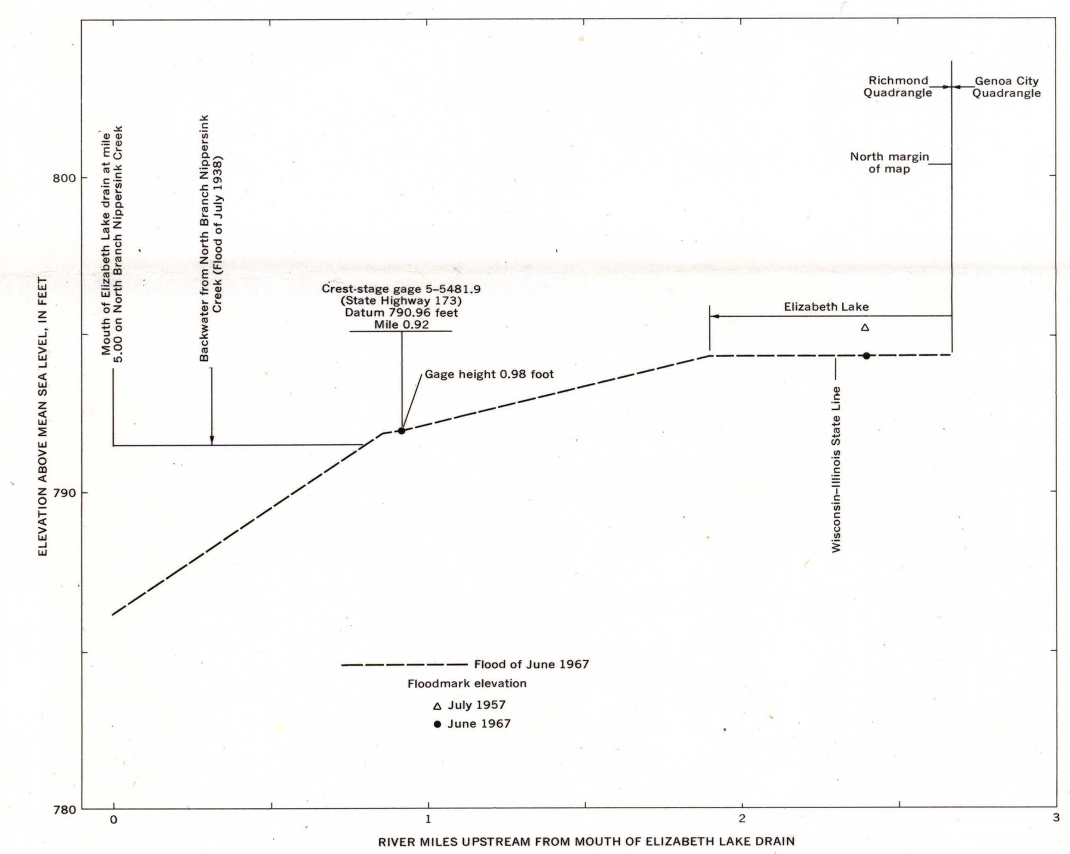


FIGURE 7.—*Profile of flood on Elizabeth Lake drain.*

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1969

For sale by U.S. Geological Survey, price 75 cents