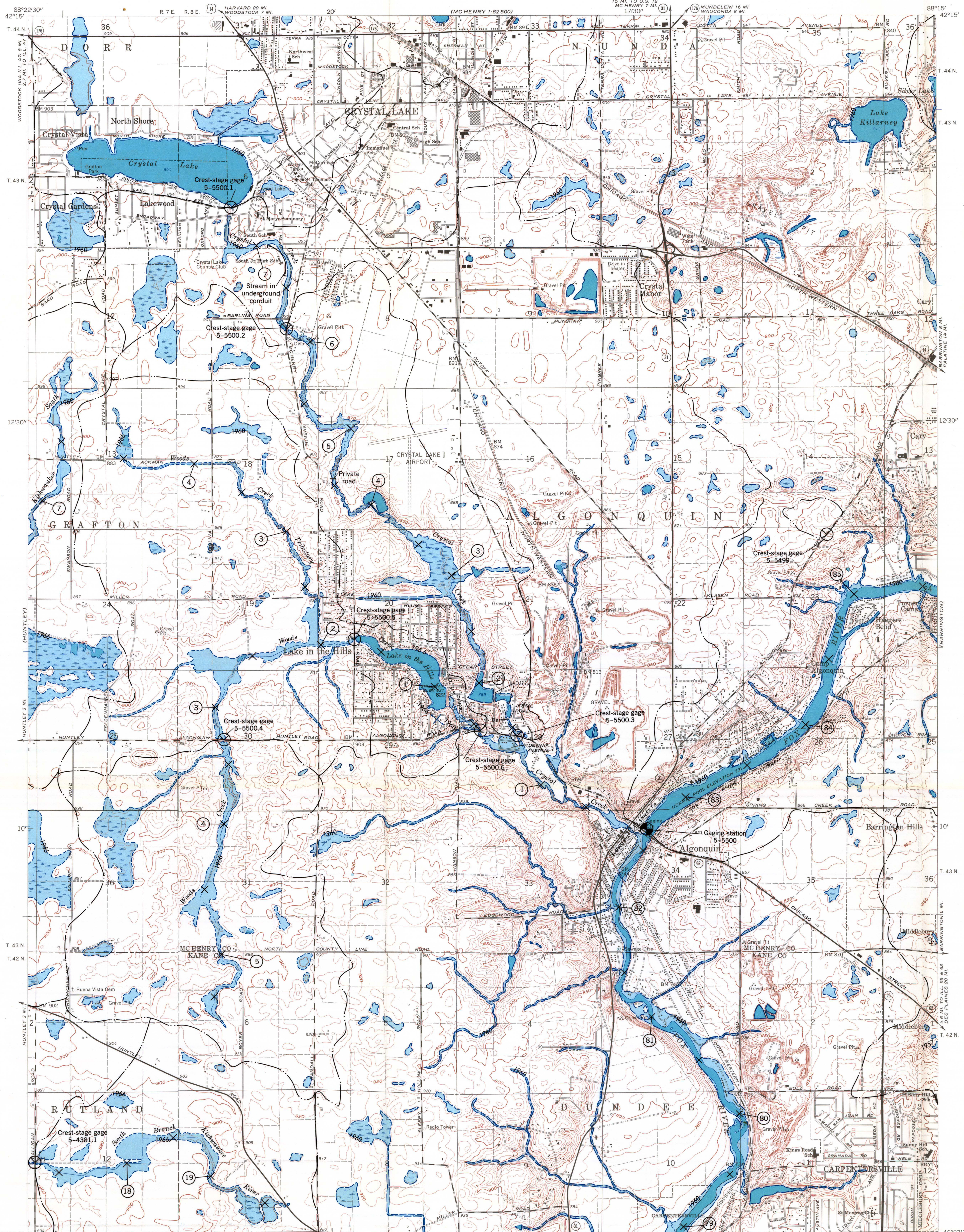
PREPARED IN COOPERATION WITH
THE NORTHEASTERN ILLINOIS METROPOLITAN
AREA PLANNING COMMISSION



Base from U.S. Geological Survey, 1962

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

EXPLANATION

- Area flooded
- Boundary of 1957 flood
- Boundary of 1960 flood
- Boundary of 1966 flood
- Drainage divide
- River mile measured along stream channel
- Inundated areas defined for different floods upstream and downstream — 1966 / 1960

FLOODS IN CRYSTAL LAKE 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 Crystal Lake 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 the ground-water resources.

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

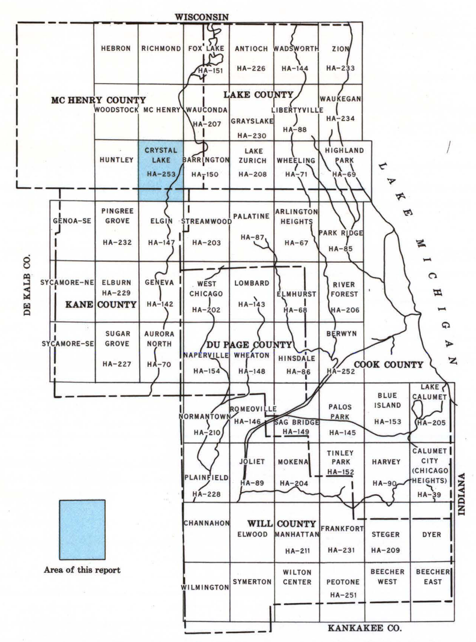


FIGURE 1.—*Index map of northeastern Illinois showing location of quadrangles included in flood-hazard mapping program.*

Dates and areas where flooding has occurred are shown in the following list:

Date of flood	Area flooded
July 1957 ------------------	Small depressions in the southeast area of the map.
April 1960------------------	Fox River, Crystal Creek, Woods Creek downstream from mile 0.82, Kishwaukee Creek South, and several unnamed tributaries to these streams.
February 1966--------------	Woods Creek upstream from mile 0.82, Woods Creek tributaries, and South Branch Kishwaukee River.

The flood of April 1960 on Crystal Creek was reported by local residents to be the highest since 1938. The July 1938 flood was reported to have been about 1 foot higher in the vicinity of Algonquin.

Greater floods than those 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 interval, 10 feet).

There are depressions and lowland areas in the Crystal Lake 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 rates 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 Metropolitan Area Planning Commission and the U.S. Geological Survey. Under previous agreements, flood maps were prepared for forty-three 7½-minute quadrangles. Under the present agreement, the flood-mapping program was expanded to include all the 7½-minute quadrangles shown in figure 1. The program includes parts of Cook and McHenry Counties, nearly all of Kane and Will Counties, and all of Du Page and Lake Counties. The six counties cooperate in the program financially through separate agreements with the Planning Commission. Financial support for the preparation of this report was provided by McHenry County through the Northeastern Illinois Metropolitan Area Planning Commission.

The cooperative program is administered on behalf of the Planning Commission by Matthew L. Rockwell, Executive Director, and is directly coordinated by John R. Sheaffer, Chief Planner.

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 State of Illinois, Department of Public Works and Buildings, Division of Waterways, for supplying 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 gaging stations in the Crystal Lake 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. Size of the drainage basin for each station also is shown in the table. The subbasin divides from which the areas were determined are shown on the flood map.

Gaging station	Station number	Type of gage[1]	Datum of gage above mean sea level (feet)	Drainage area (square miles)
Fox River tributary near Cary (Cary-Algonquin Road) ----------	5-5499	C[2]	858.14	0.07
Fox River at Algonquin (Chicago Street-State Highway 62) --	5-5500	R	729.48	1,364
Crystal Creek: At Crystal Lake (Lake Avenue) --	5-5500.1	C	889.82	5.87
Near Crystal Lake (McHenry Avenue) --------	5-5500.2	C	878.38	8.49
At Lake in the Hills (Huntley-Algonquin Road)	5-5500.3	C	764.65	12.1
Woods Creek: Near Lake in the Hills (Huntley-Algonquin Road)	5-5500.4	C	844.45	3.65
At Lake in the Hills (Crystal Lake Road) -----	5-5500.5	C	822.32	8.08
Near Algonquin (Huntley-Algonquin Road)	5-5500.6	C	777.84	8.72
South Branch Kishwaukee River near Gilberts (Galligan Road) -	5-4381.1	C	882.07	2.74

[1]C Crest-stage gage; R Water-stage recorder.
[2]Water-stage recorder installed August 1964 to obtain continuous record for several flood events.

Gage height and year of occurrence of each annual flood (highest peak stage in a calendar year) above 733-foot elevation at the gaging station, Fox River at Algonquin, during the period 1916-65 are shown in figure 2. Removal of an old dam and construction of a new one at approximately the same location in 1946 changed the stage-discharge relation for this site. Stages for flows of specific discharges were lower after the new dam was constructed.

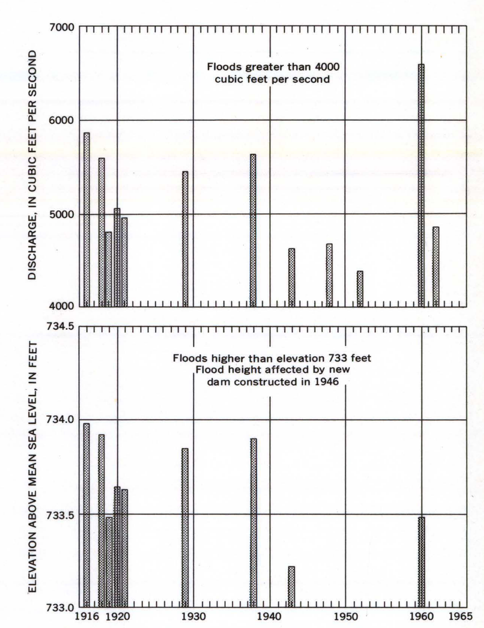


FIGURE 2.—*Annual floods 1916-65, Fox River at Algonquin (Chicago Street-State Highway 62).*

Gage height and year of occurrence of each annual flood above 773-foot elevation at the gaging station, Boone Creek near McHenry during the period 1949-65 are shown in figure 3. This gaging station is located about 5 miles north of the Crystal Lake quadrangle.

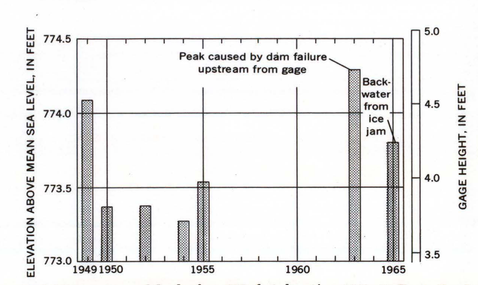


FIGURE 3.—*Annual floods above 773-foot elevation, 1949-65, Boone Creek near McHenry (Bull Valley Road).*

These histograms illustrate the irregular occurrence of floods at two gaging stations with drainage areas differing in size by a factor of almost 100 (drainage area for Boone Creek near McHenry, 15.3 square miles; for Fox River at Algonquin, 1,364 square miles) and typifies the probable relative magnitude of floods on streams in the Crystal Lake quadrangle.

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.

Figure 2 includes a graph of the annual maximum discharges in excess of 4,000 cfs for the period of record at the Algonquin gaging station. This graph portrays the relative magnitudes of the flood discharges which are independent of changes resulting from the dam constructed in 1946.

Flood frequency.—Frequencies of floods at the Geological Survey gaging stations, Fox River at Algonquin and Boone Creek near McHenry, were derived from streamflow records at these stations combined with records of nearby stations and with the regional flood-frequency relation for streams in northern Illinois (Mitchell, 1954). The general relations between frequency and discharge at the two gaging stations are shown in figures 4 and 5, and the relations between frequency and stage are shown in figures 6 and 7. The relation between stage and frequency is dependent on the relation of stage to discharge which is affected by changes in physical conditions of stream channels and constrictions.

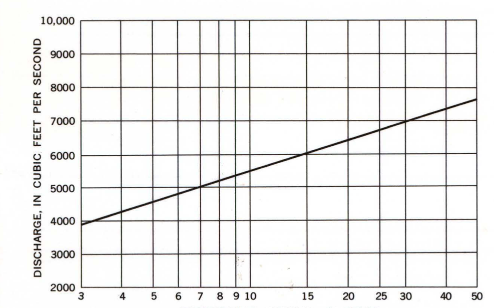


FIGURE 4.—*Frequency of flood discharges on Fox River at Algonquin (Chicago Street-State Highway 62).*

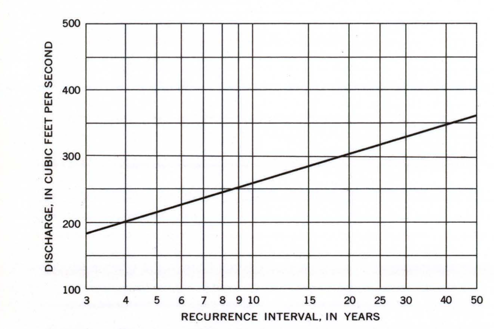


FIGURE 5.—*Frequency of flood discharges on Boone Creek near McHenry (Bull Valley Road).*

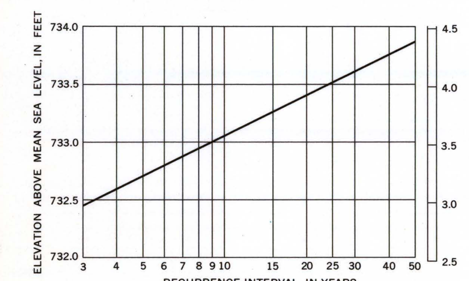


FIGURE 6.—*Frequency of flood stages on Fox River at Algonquin (Chicago Street-State Highway 62).*

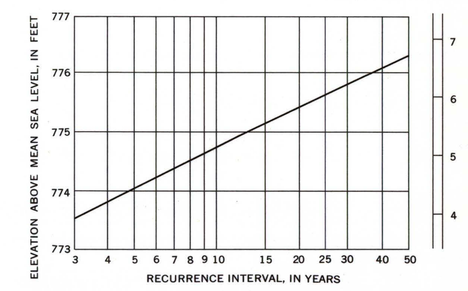


FIGURE 7.—*Frequency of flood stages on Boone Creek near McHenry (Bull Valley Road).*

The frequency curves shown in figures 6 and 7 are based on channel conditions existing in 1966. 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 gaging stations on Fox River at Algonquin (fig. 6) and Boone Creek near McHenry (fig. 7) is tabulated below:

Recurrence interval (years)	Elevation above mean sea level (feet)	
	Fox River at Algonquin	Boone Creek near McHenry
50---------	733.9	776.3
30---------	733.6	775.8
20---------	733.4	775.4
10---------	733.1	774.7
5---------	732.7	774.0
3---------	732.5	773.5

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 in the next year or even in the next week.

Flood profiles.—Profiles of the water surface of the floods of April 1960, March 1962, and February 1966 are shown in figures 8-12. 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 8-12. 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 Crystal Lake quadrangle can be obtained at the office of the U.S. Geological Survey, Oak Park, Ill., and from the following published 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.

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.

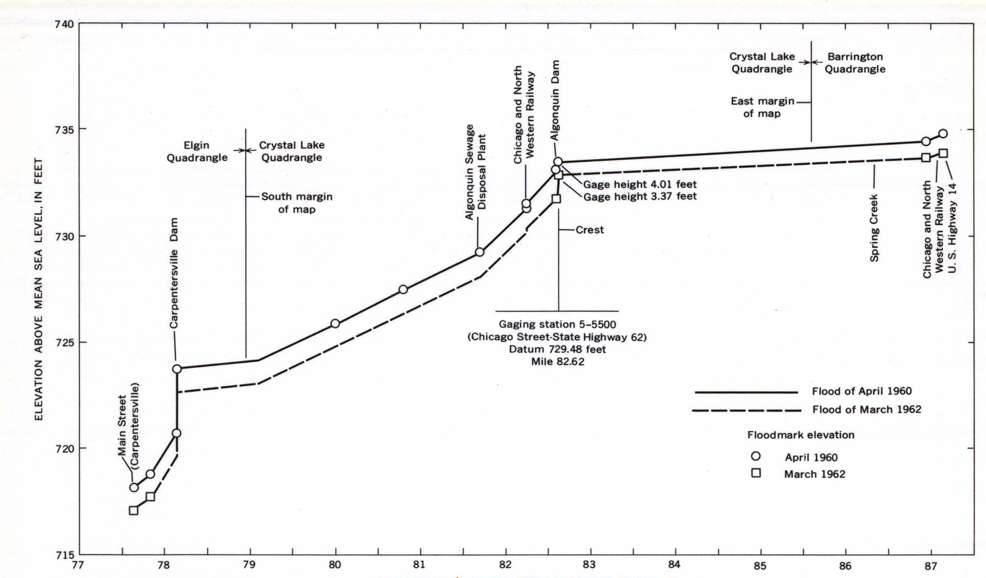


FIGURE 8.—*Profiles of floods on Fox River.*

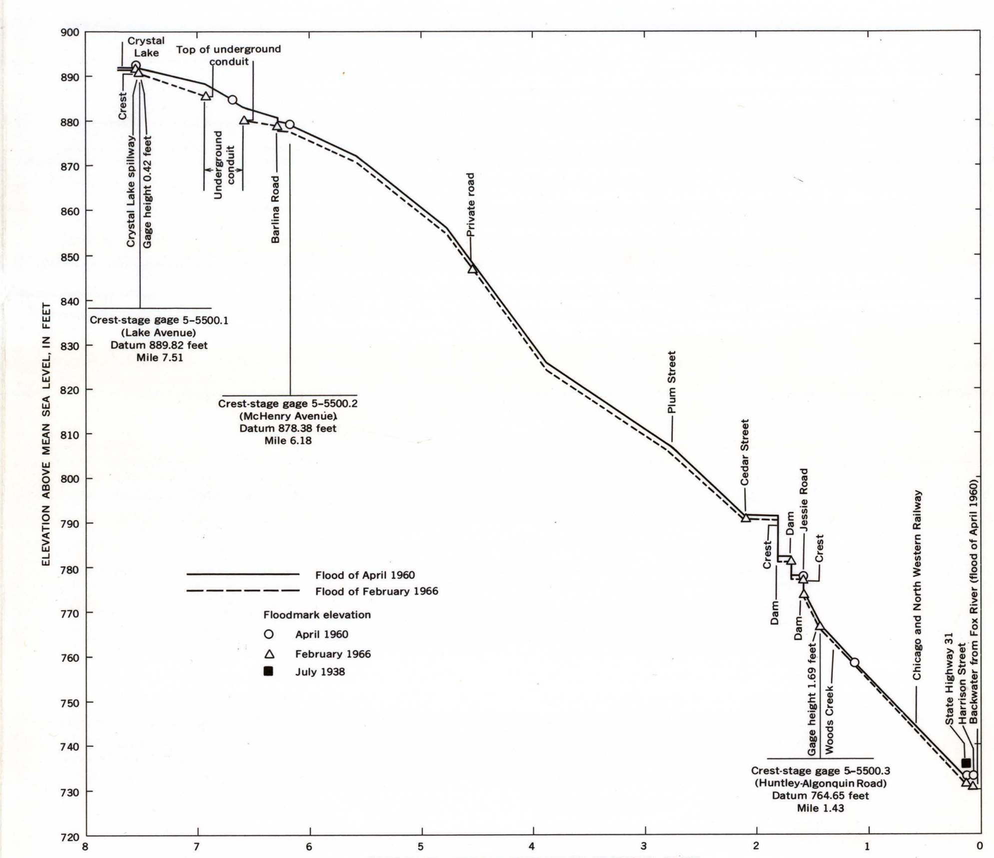


FIGURE 9.—*Profiles of floods on Crystal Creek.*

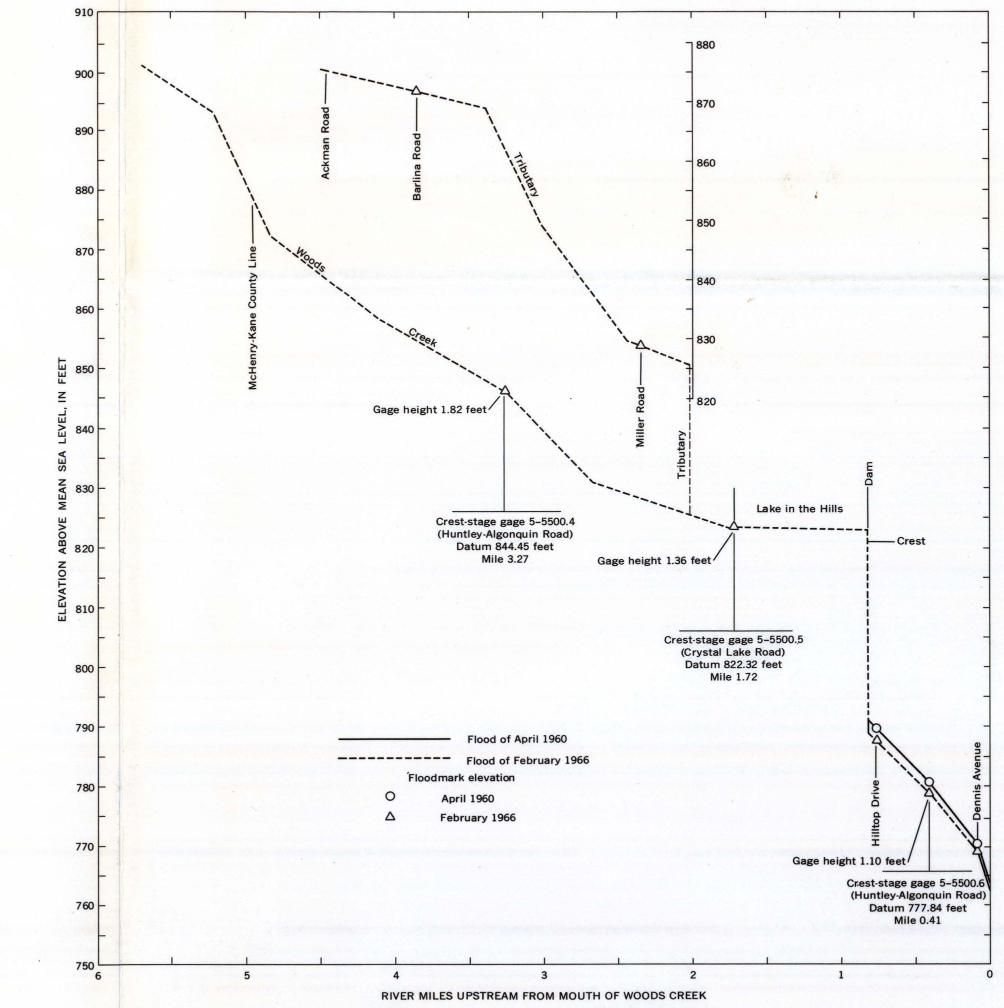


FIGURE 10.—*Profiles of floods on Woods Creek and tributary.*

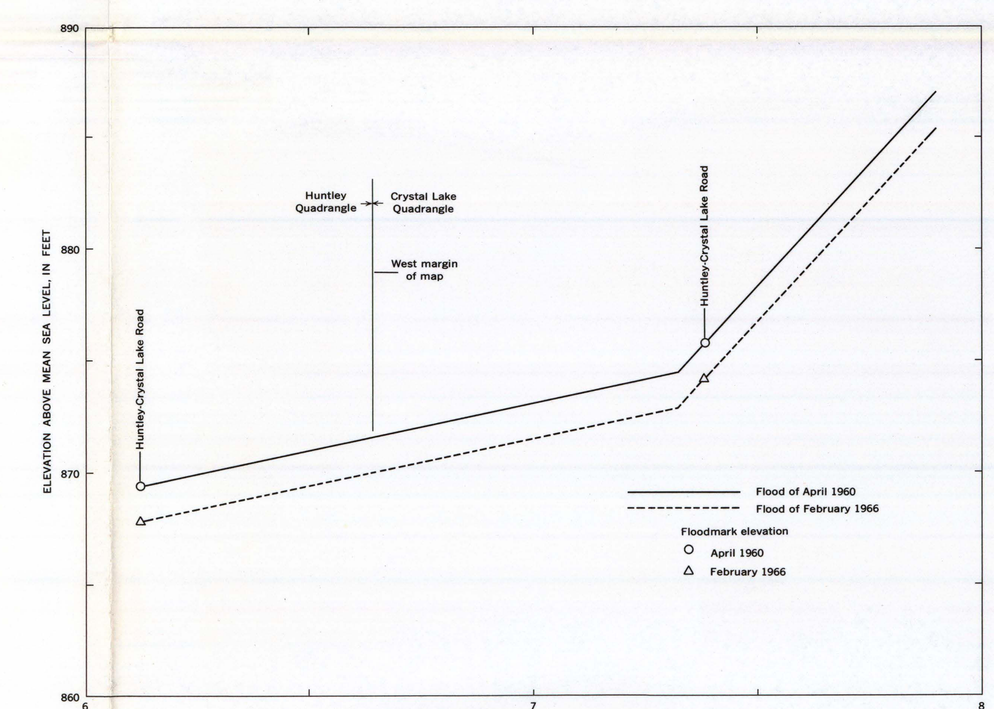


FIGURE 11.—*Profiles of floods on Kishwaukee Creek South.*

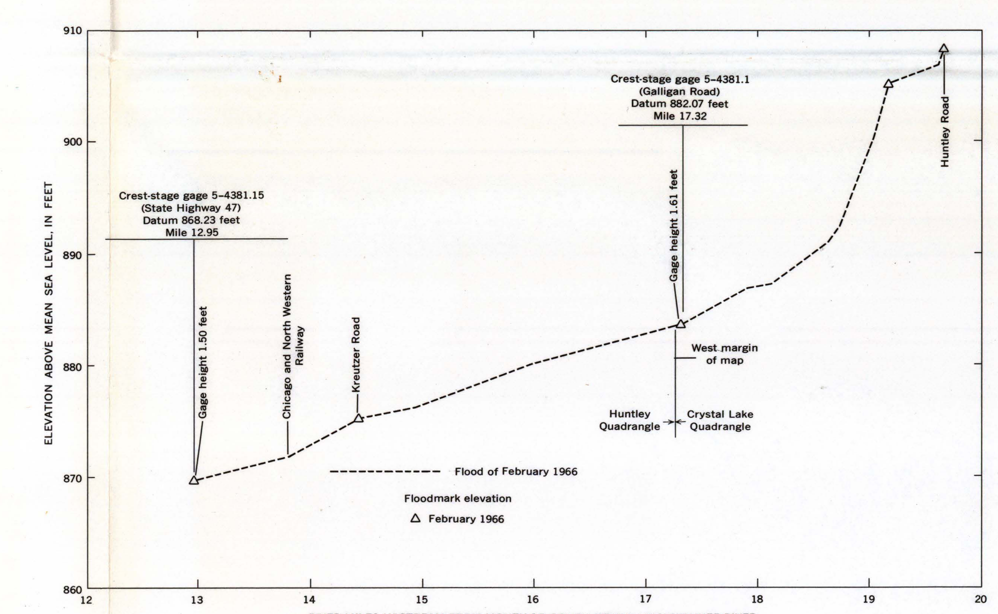


FIGURE 12.—*Profile of flood on South Branch Kishwaukee River.*

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FLOODS IN CRYSTAL LAKE QUADRANGLE, NORTHEASTERN ILLINOIS

By
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