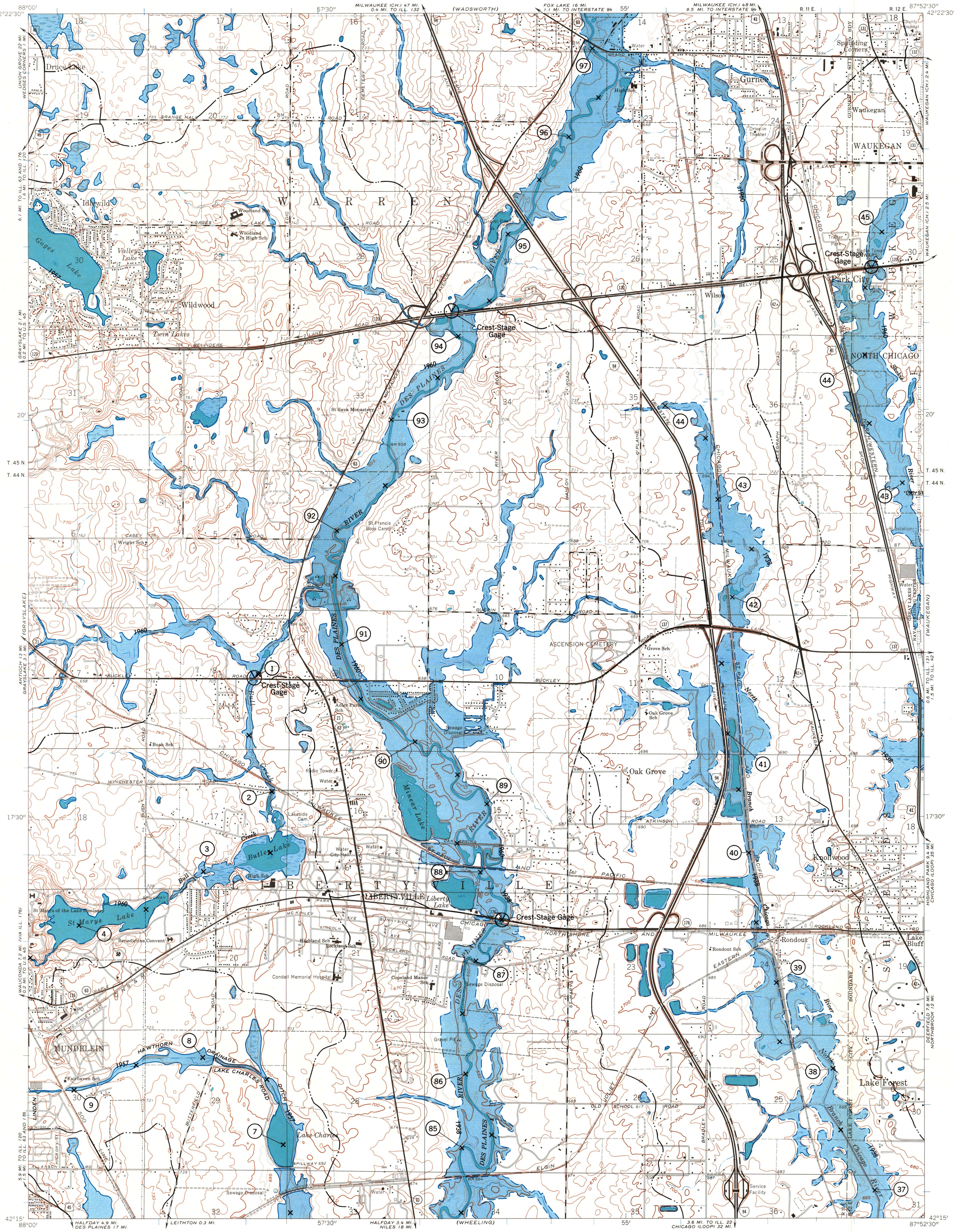
PREPARED IN COOPERATION WITH
THE NORTHEASTERN ILLINOIS METROPOLITAN
AREA PLANNING COMMISSION



Base map by Topographic Division
U.S. Geological Survey, 1960

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL

QUADRANGLE LOCATION

EXPLANATION

Area flooded 1938, 1957, and 1960

Flood limit 1938

Flood limit 1957

Flood limit 1960

Drainage divide

River mile measured along stream channel

Inundated areas defined for different floods, upstream and downstream

FLOODS IN LIBERTYVILLE QUADRANGLE ILLINOIS

Hydrologic data for evaluating the depth and frequency of flooding that affect the economic development of flood plains are presented in this report. The report is a planning tool and the data provide a technical basis for making sound decisions concerning the use of flood-plain lands. No recommendations or suggestions for land-use regulations are made and no solutions of existing flood problems are proposed.

The approximate areas inundated by floods along streams in the Libertyville 7 1/2-minute quadrangle are delineated on the map. The quadrangle location is shown in figure 1. Inundated areas are shown along Des Plaines River for the flood of July 1938 downstream from the Chicago, Milwaukee, St. Paul, and Pacific Railway and for the flood of April 1960 upstream from the Railway; along North Branch Chicago River for the flood of July 1938; along Hawthorn Drainage ditch for the flood of July 1957; and along Skokie River and Bull Creek for the flood of March 1960. Along the reach of the Des Plaines River from Gurnee to Libertyville, the flood of July 1938 was reported to be from 1 foot lower to 1 foot higher than the 1960 flood. In the Libertyville quadrangle the Skokie River is characterized by low swampy terrain with no defined channel. Parts of the Skokie River valley are drained by field tiles which are broken in several places, thereby causing frequent ponding.

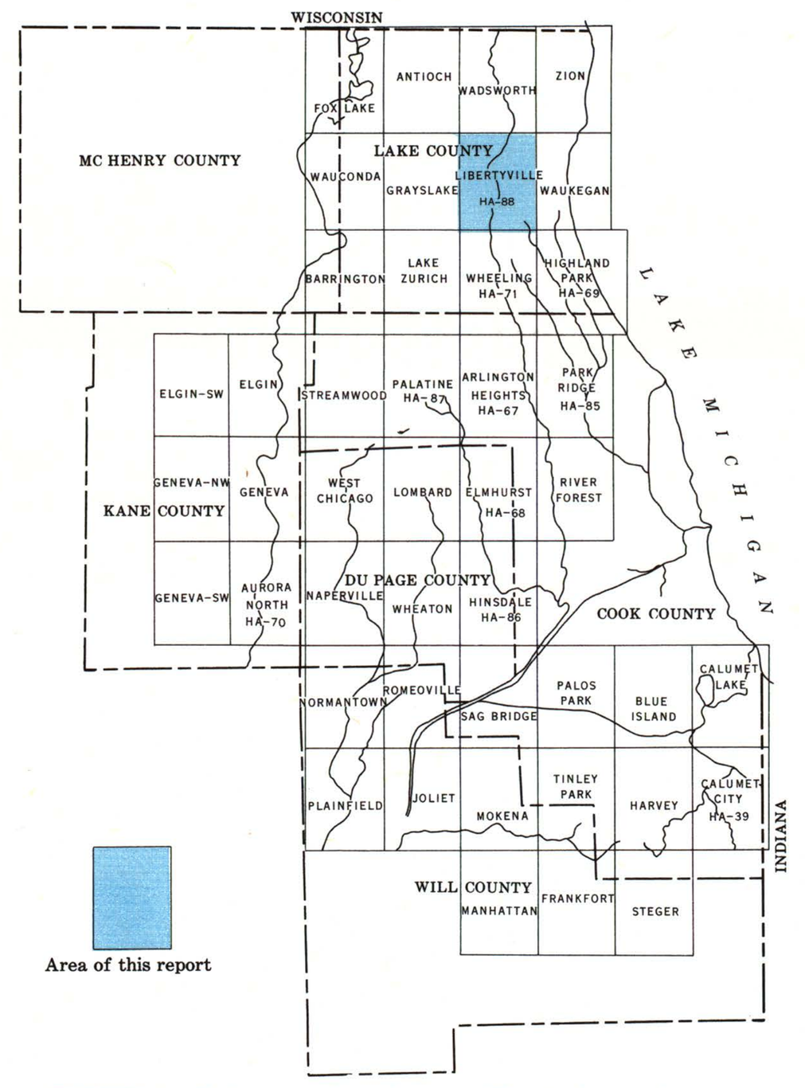


FIGURE 1.—*Index map of northeastern Illinois showing location of quadrangles included in flood-hazard mapping program*

The general procedure followed in defining flood limits was, first, to develop flood profiles from elevations of floodmarks identified in the field. The horizontal extent of flooding delineated on the topographic map was derived from the profile by interpolation between contours (lines of equal elevation) and by plotting overflow limits identified during field investigations and surveys. The locations of flood limits shown on the map are only approximate because the map scale is small (1 inch equals 2,000 feet) and the contour interval is relatively large (5 feet and 10 feet).

The flood limits shown on the map are not necessarily those for the highest floods expected. Greater floods are possible but definition of their probable overflow limits is not within the scope of this report. The flood limits provide a record of historic facts that reflect channel conditions existing when the floods occurred. No attempt was made to appraise the effect of changes in channel conditions, waterway openings at highways and railroads, or changes in runoff characteristics of the stream caused by increased urbanization that may have taken place after the floods occurred. Protective works built after the floods of 1938, 1957, and 1960 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.

There are numerous depressions or lowland areas in the Libertyville quadrangle. Flood limits are shown for many such areas where accumulations of surface water were observed. Other lowland areas for which flood limits are not shown may be subject to temporary inundation after a rainstorm.

Flood limits are not defined for areas inundated as a result of backup in storm drains.

Cooperation and acknowledgement —The preparation of this report is part of an extensive flood-mapping program financed through a cooperative agreement between The Northeastern Illinois Metropolitan Area Planning Commission and the U.S. Geological Survey whereby flood maps will be prepared for the 7 1/2-minute quadrangles shown in figure 1. Areal limits of the program include parts of Cook, Kane, McHenry, and Will Counties, and all of Du Page and Lake Counties. The six counties cooperate financially in the program through separate agreements with the Planning Commission. Financial support for the preparation of this report was provided by Lake County, in which the Libertyville quadrangle is located.

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

The flood maps are prepared by the Geological Survey under the administrative direction of William D. Mitchell, district engineer, and under the immediate supervision of Davis W. Ellis, engineer-in-charge of the project. The Libertyville flood map was prepared by Allen W. Noehre and Dean E. Long with assistance from other staff members of the Oak Park subdistrict office.

Acknowledgment is made to the following agencies that supplied some of the flood data on which this report is based: the State of Illinois, Department of Public Works and Buildings, Division of Waterways; Lake County Highway Department; Lake County Regional Planning Commission; and the Corps of Engineers, U.S. Army. The Division of Waterways also furnished 2-foot-interval contour maps along Des Plaines River.

Additional data were obtained from officials of municipalities in the area, particularly Libertyville and Mundelein; from the chief engineer of Chicago, Milwaukee, St. Paul, and Pacific Railroad Company; 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 on the map are in feet above mean sea level. Gage heights for crest-stage gages located in the Libertyville 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 drainage area at each station also is shown in the table. Drainage divides are shown on the map.

Crest-stage gage	Datum of gage above mean sea level (feet)	Drainage area (square miles)
Des Plaines River:		
near Gurnee (Belvidere Road) [1]	650.3	230
at Libertyville (Park Avenue)	647.84	259
Bull Creek near Libertyville (Buckley Road)	676.86	6.75
Skokie River at Park City (Belvidere Road)	693.34	1.32

[1] Water-stage recorder, 1946-58

Gage height and year of occurrence of each annual flood (highest peak discharge in each calendar year) above 658-foot elevation at the crest-stage gage on Des Plaines River near Gurnee during the period 1946-62 are shown in figure 2. The irregular occurrence of floods is evident.

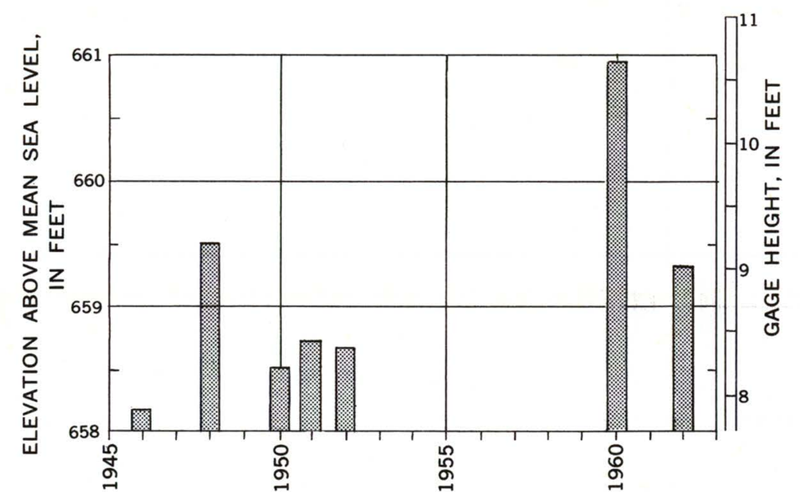


FIGURE 2.—*Annual floods above 658-foot elevation 1946-62, Des Plaines River near Gurnee (Belvidere Road)*

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 is the maximum value of the discharge attained by a flood. The peak discharge during a flood generally occurs at the time of the maximum height of the flood, but if a stream is affected by variable backwater, the peak discharge may not coincide with the maximum stage.

Flood frequency —Frequency of floods at the Geological Survey crest-stage gage on Des Plaines River near Gurnee was derived from streamflow records from this station combined with records from nearby stations and with the regional flood-frequency relation for streams in northern Illinois (Mitchell, 1954). The general relation between frequency and discharge is shown in figure 3, and the general relation between frequency and stage is shown in figure 4.

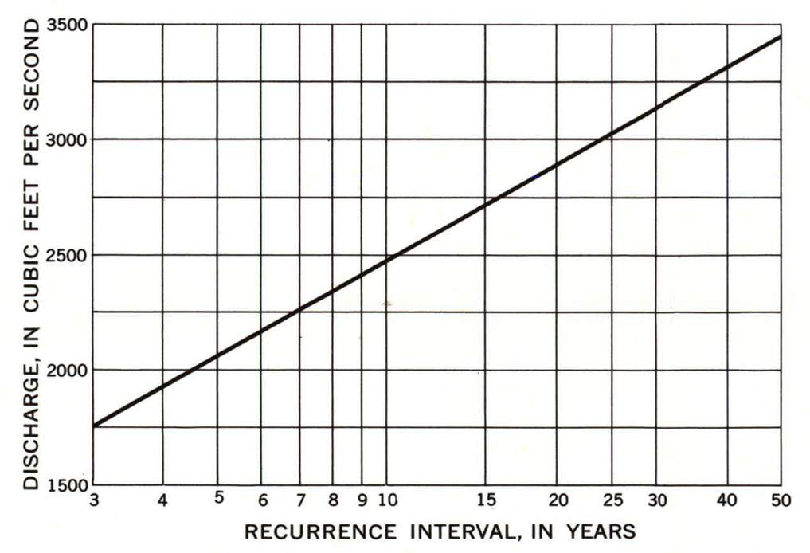


FIGURE 3.—*Frequency of flood discharges on Des Plaines River near Gurnee (Belvidere Road)*

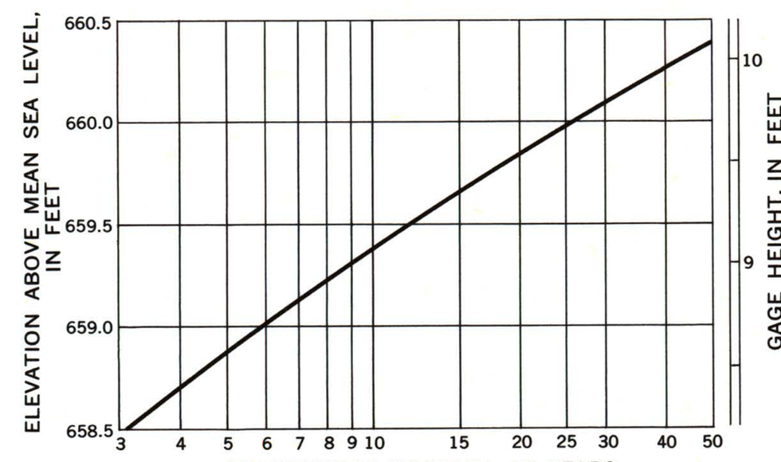


FIGURE 4.—*Frequency of flood stages on Des Plaines River near Gurnee (Belvidere Road)*

The relation between stage and frequency is dependent on the relation of stage to discharge which is affected by changes in physical conditions of channels and constrictions. The frequency curve shown in figure 4 is based on channel conditions existing in 1962. 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 because of the possibility of large errors.

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 may be stated in terms of their probabilities of occurrence (reciprocals of their recurrence intervals). 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 crest-stage gage on Des Plaines River near Gurnee (fig. 4) is tabulated below:

Recurrence interval (years)	Elevation above mean sea level (feet)
50	660.4
40	660.3
30	660.1
20	659.8
10	659.4
5	658.9
3	658.5

It is emphasized that recurrence intervals are average figures--the average number of years that will elapse 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 in the next week.

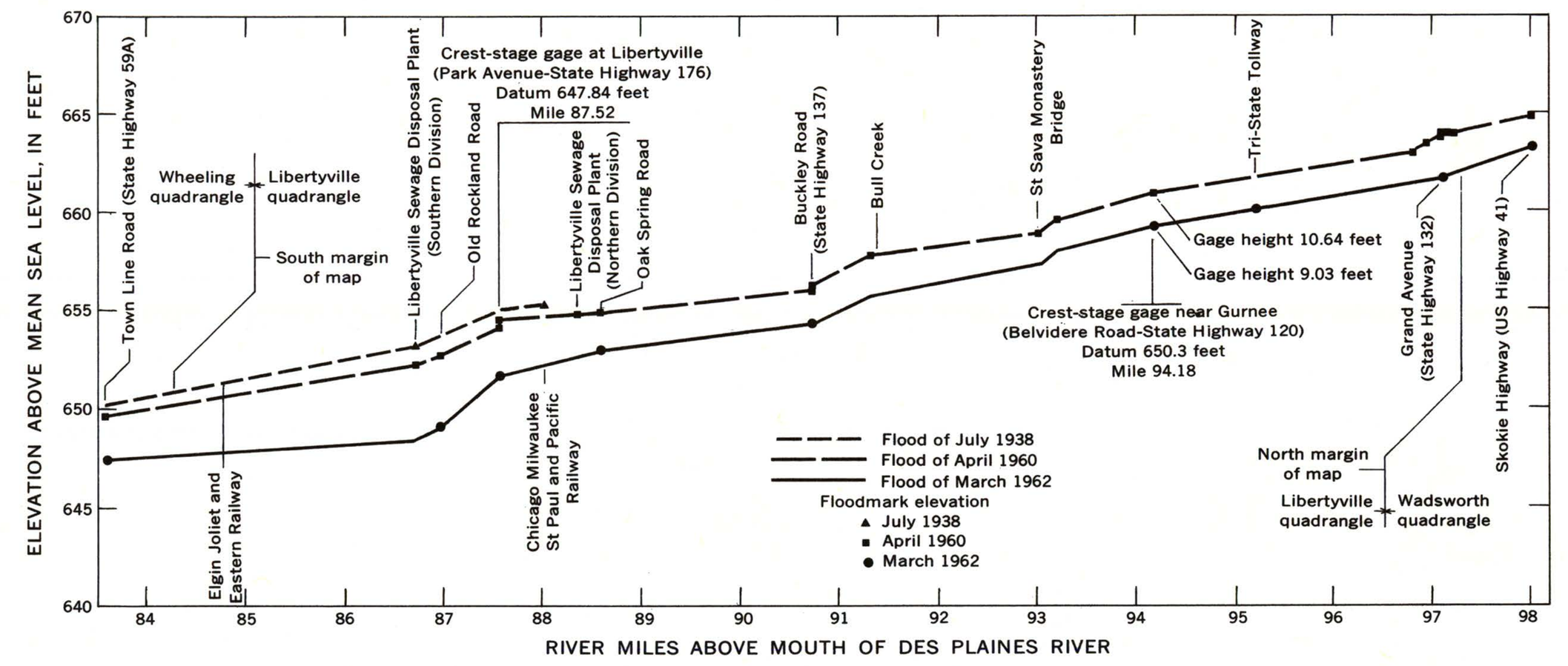


FIGURE 5.—*Profiles of floods on Des Plaines River*

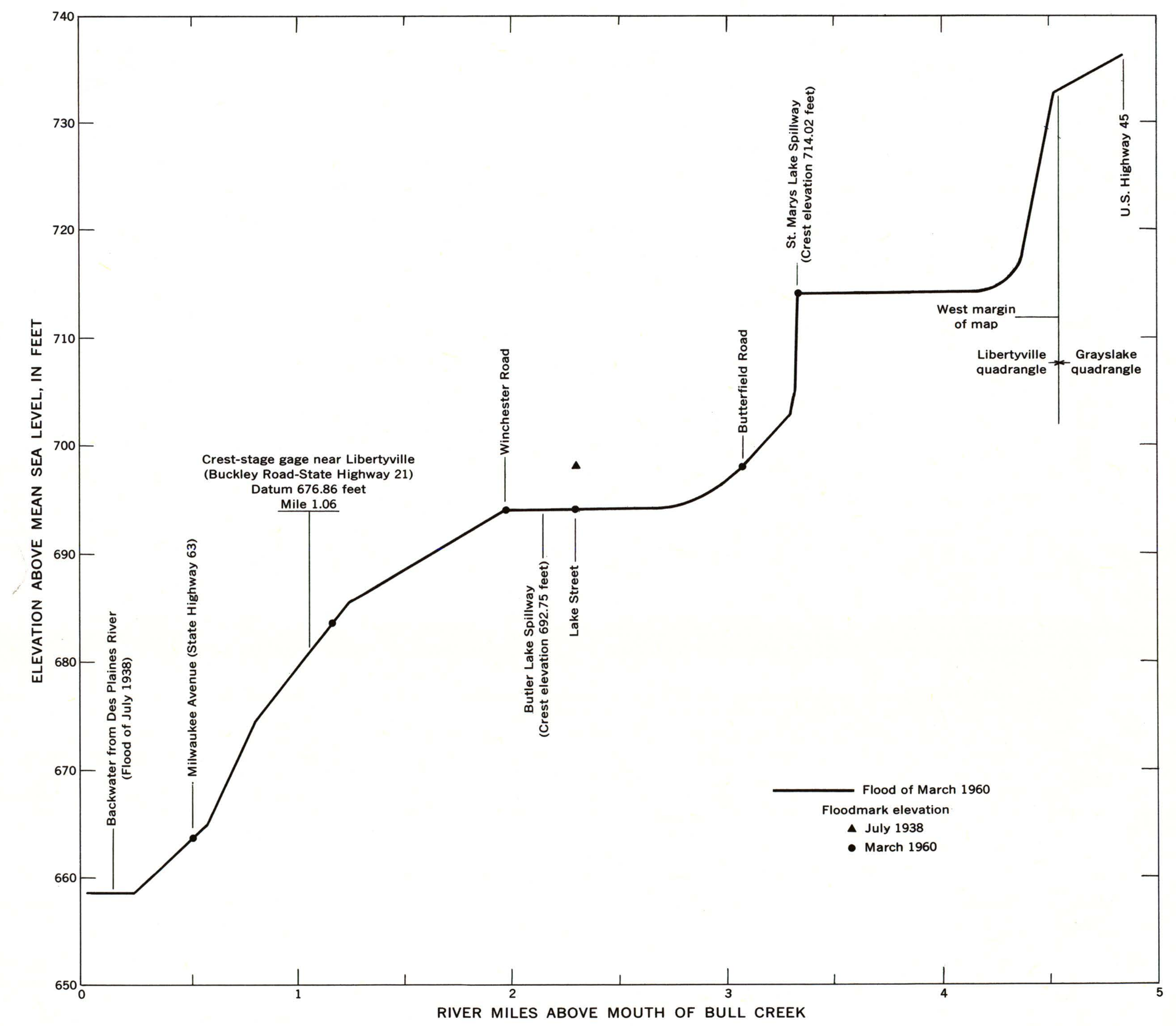


FIGURE 6.—*Profile of flood on Bull Creek*

Flood profiles —Profiles of the water surface, based primarily on elevations of marks left by floods of July 1938, July 1957, and March and April 1960, are shown in figures 5-9. Where floodmarks could not be identified, the profiles were constructed on the basis of elevations of lower floods and streambeds, and the extent of overflows was determined from photographs and reports in local newspapers. River miles used for the profiles correspond to those marked along the streams shown 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 produced by 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 indicated by the profiles in figures 5-9. The approximate ground elevation can be determined from information indicated by contours on the map, although more accurate elevations may be obtained by leveling to nearby bench marks.

Additional data —Other information pertaining to floods in the Libertyville quadrangle may 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, 1961, Report on plan for flood control and drainage development, Des Plaines River, 143 p.

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

Ramey, H. P., 1959, Storm Water drainage in the Chicago area: Am. Soc. Civil Engineers Proc., v. 85, no. HY 4, p. 11-37.

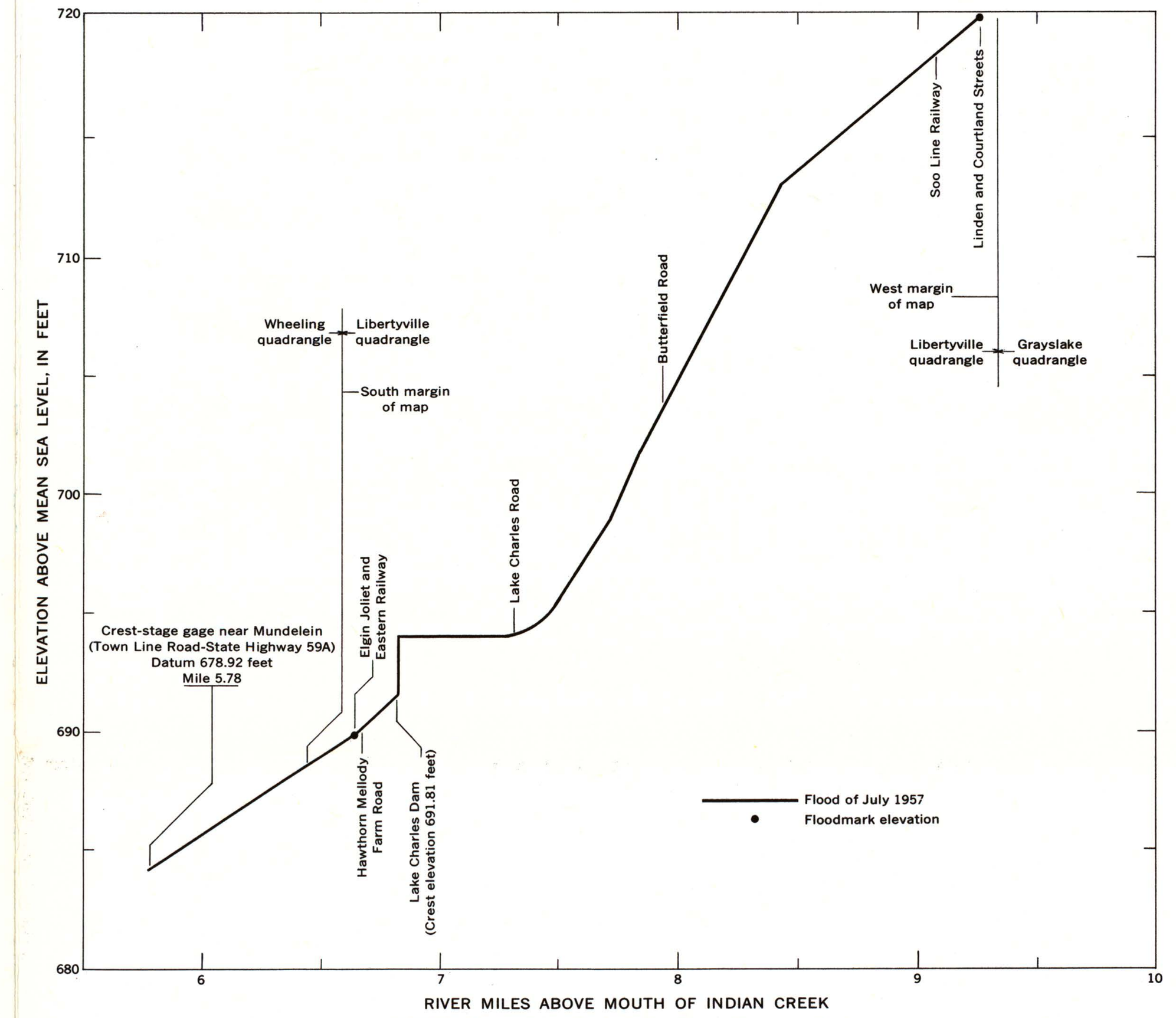


FIGURE 7.—*Profile of flood on Hawthorn Drainage Ditch*

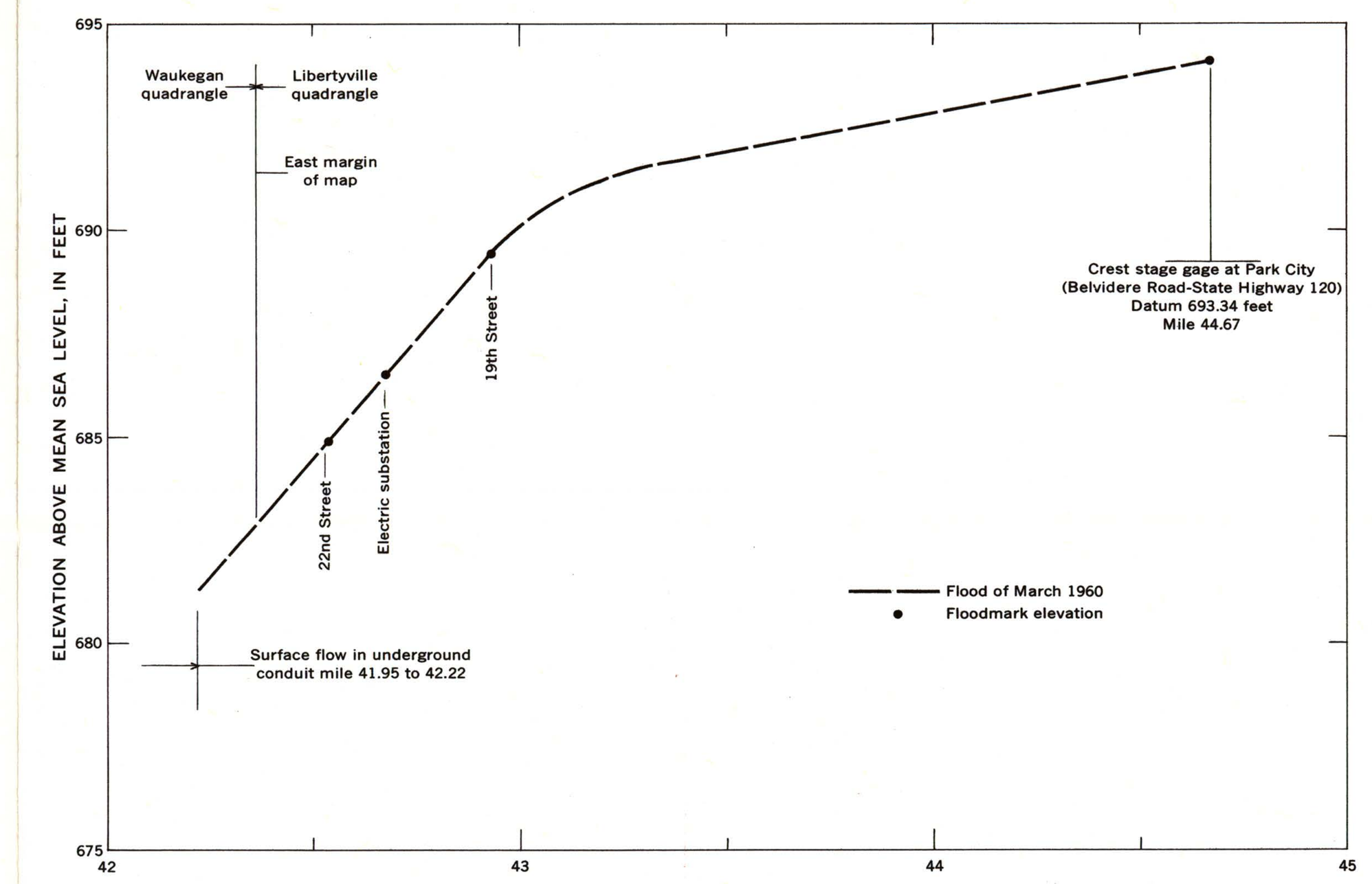


FIGURE 8.—*Profile of flood on Skokie River*

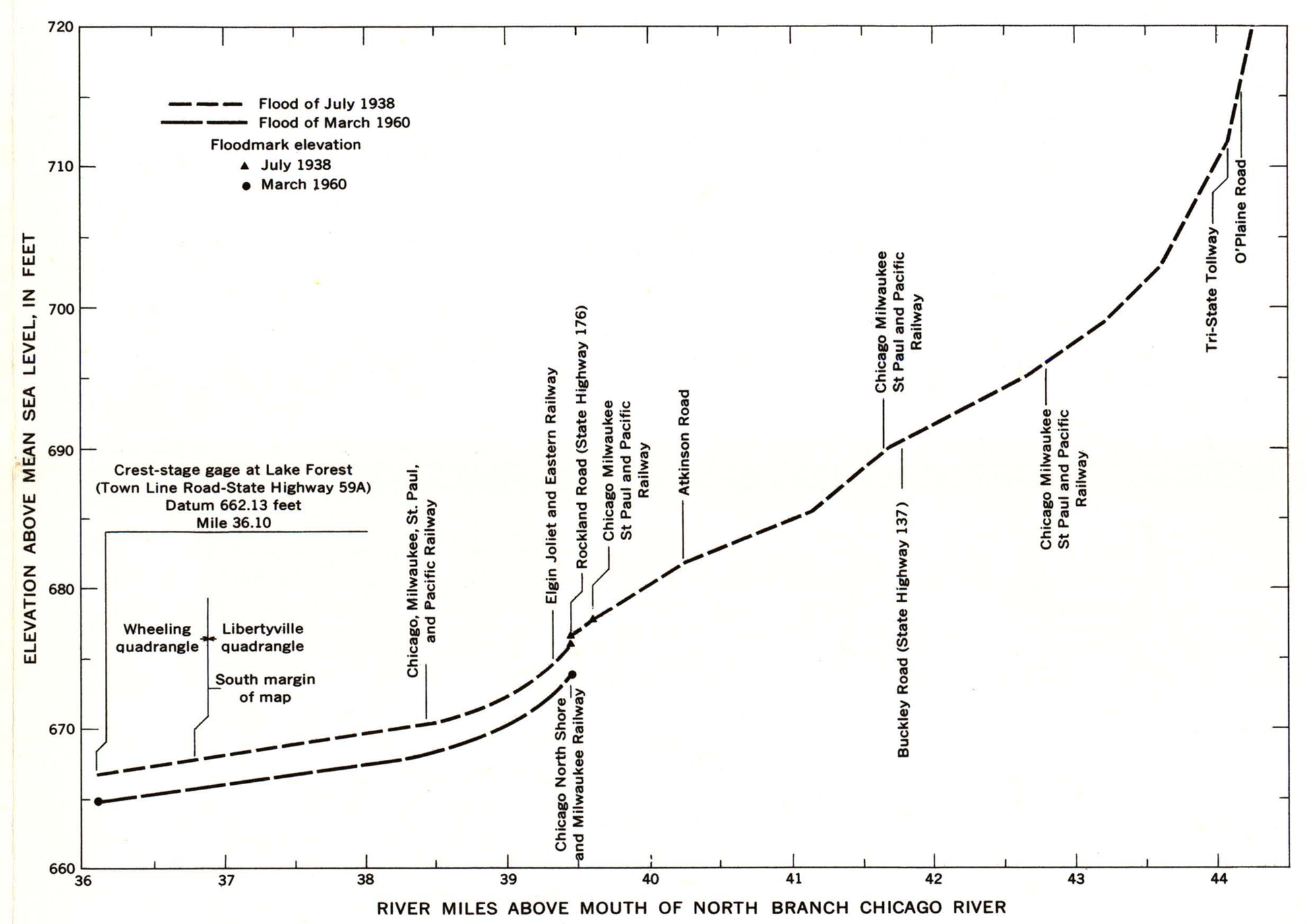


FIGURE 9.—*Profiles of floods on North Branch Chicago River*

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By

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1964

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