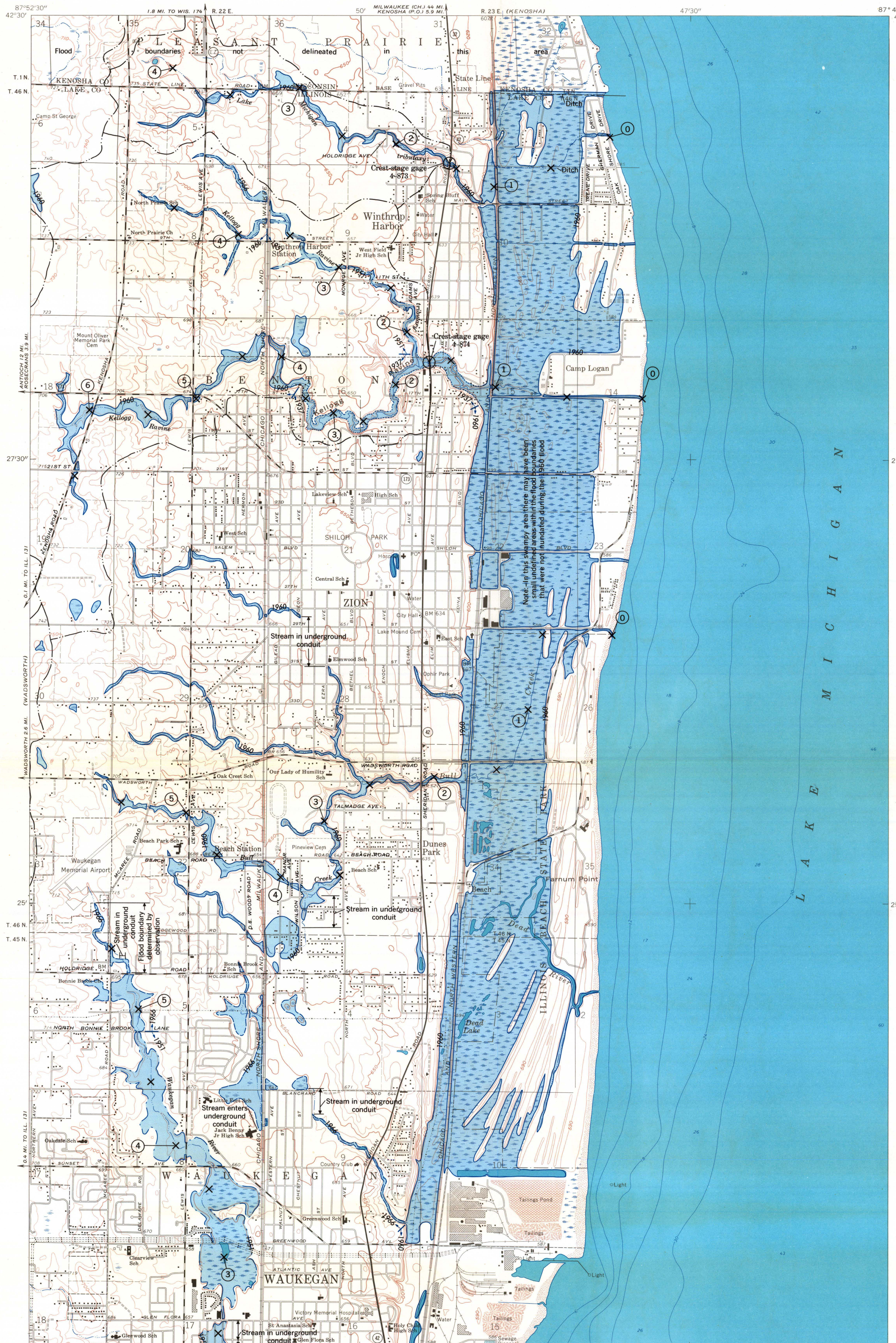
PREPARED IN COOPERATION WITH
THE NORTHEASTERN ILLINOIS METROPOLITAN
AREA PLANNING COMMISSION



Base from U.S. Geological Survey topographic quadrangle, 1960

SCALE 1:24 000

CONTOUR INTERVAL 10 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS LOW WATER 576.8 FEET

QUADRANGLE LOCATION

EXPLANATION

- Area flooded
- Boundary of 1937 flood
- Boundary of 1951 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 ZION QUADRANGLE NORTHEASTERN ILLINOIS

This report presents hydrologic data concerning the extent, depth, and frequency of flooding that are useful for an appraisal of the hazards involved in occupancy and development of flood plains in the Zion quadrangle, northeastern Illinois. It is intended to aid individuals, governmental agencies, and others responsibile for solving existing flood problems and for formulating effective flood-plain regulations that would minimize the creation of new flood problems. The report will be useful for preparing building and zoning regulations, locating waste disposal facilities, purchasing unoccupied land, developing recreational areas, and managing surface water in relation to the ground-water resources.

The areas inundated by specific floods along streams in the Zion quadrangle are delineated on a topographic map. The quadrangle location is shown in figure 1. Inundated areas are shown for the floods listed below:

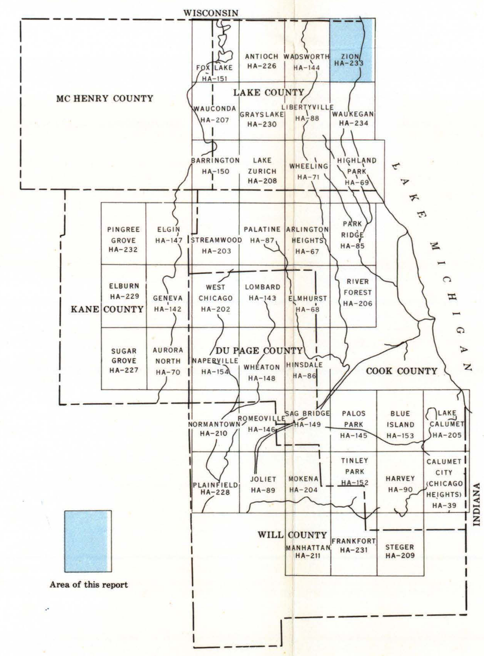


FIGURE 1.—*Index map of northeastern Illinois showing location of quadrangles in the flood-hazard mapping program.*

Date of flood	Area flooded
June 1937	Kellogg Ravine upstream from mile 1.03 to mile 3.56.
November 1951	Waukegan River upstream to mile 4.87; Kellogg Ravine tributary (at mile 1.75 on Kellogg Ravine) upstream to mile 3.70.
April 1960	Bull Creek and tributaries; Kellogg Ravine upstream from mile 3.56; Lake Michigan. tributary; large swampy area parallel to and near the shore of lake Michigan.
April 1966	Waukegan River upstream from mile 4.87; Kellogg Ravine tributary upstream from mile 3.70.

The flood of November 1951 on Waukegan River was reported by local residents to be the highest in the past 65 years. The flood of July 1938 on Lake Michigan tributary was reported to be the highest since at least 1900 at Sheridan Road (State Highway 42).

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.

In general, the procedure used in defining flood boundaries was to construct flood profiles from elevations of floodmarks identified in the field and from data in the U.S. Geological Survey files or from other agencies. The flood profiles were used to delineate the extent of flooding on the topographic base map by interpolation between contours (lines of equal ground elevations). Overflow boundaries identified during field investigations and surveys were used to supplement data from the profiles and map. 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 Zion quadrangle where surface water accumulates because of inadequate surface drainage to streams. Depth of flooding in these areas is 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 detected in this investigation.

Cooperation and acknowledgment.— The preparation of this report is a 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. Under the agreement, flood maps will be prepared for the 7½-minute quadrangles shown in figure 1. The program includes parts of Cook, Kane, McHenry, 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 Lake County.

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 Davis W. Ellis, engineer-in-charge of the project.

Acknowledgment is made to the Lake County Highway Department 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 on the map are in feet above mean sea level. Gage heights at the crest-stage gages in the Zion 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. The size of drainage basin for each station is also shown in the table. Subbasin divides from which the areas were determined are shown on the flood map.

Crest-stage gage	Station number	Datum of gage above mean sea level (feet)	Drainage area (square miles)
Lake Michigan tributary at Winthrop Harbor[1]	4-873	596.57	1.51
Kellogg Ravine at Zion	4-874	603.52	5.00

[1] Water-stage recorder installed October 1965 to obtain continuous record for several flood events.

The maximum and minimum monthly mean water level of Lake Michigan at Calumet Harbor, Ill., for each calendar year during the period 1904-65 is shown in figure 2. This graph illustrates the range in annual extreme monthly mean elevations of Lake Michigan.

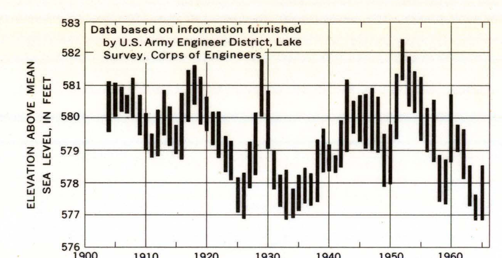


FIGURE 2.—*Maximum and minimum monthly mean water levels of Lake Michigan at Calumet Harbor, for each calendar year, 1904-65.*

Gage height and year of occurrence of each annual flood (highest peak stage in each calendar year) above 658-foot elevation at the gaging station, Des Plaines River near Gurnee, Ill., during the period 1946-65 are shown in figure 3. The gaging station near Gurnee is on Belvidere Road (State Highway 120) 4 miles southwest of the Zion quadrangle. This histogram shows the history of floods recorded at the Gurnee gage and also portrays the irregular occurrence of floods.

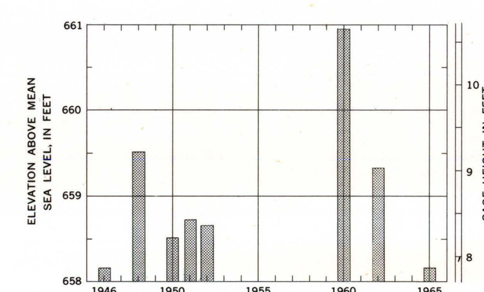


FIGURE 3.—*Annual floods above 658-foot elevation 1946-65, Des Plaines River near Gurnee (Belvidere Road).*

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, 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.— Frequencies of floods at the Geological Survey gaging stations, Des Plaines River at Wadsworth and Skokie River at Lake Forest, 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 gaging station at Wadsworth is 2 3/4 miles west of the Zion quadrangle, and the Lake Forest station is 9 3/4 miles south of the Zion quadrangle. The 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 channels and constrictions. The stage-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.

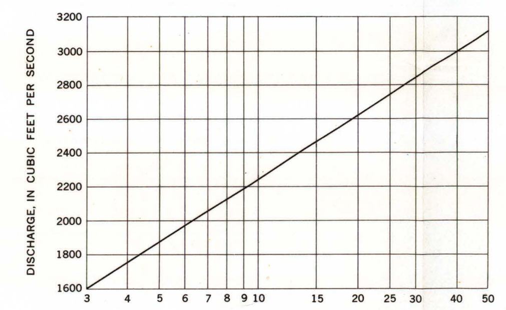


FIGURE 4.—*Frequency of flood discharges on Des Plaines River at Wadsworth (Wadsworth Road).*

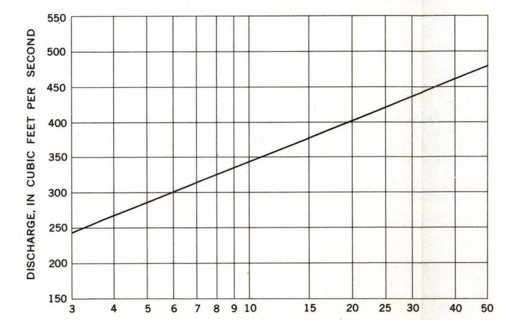


FIGURE 5.—*Frequency of flood discharges on Skokie River at Lake Forest (State Highway 19A—Westleigh Road).*

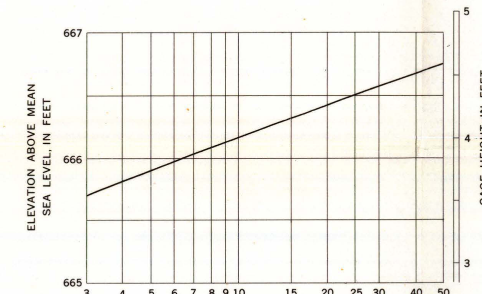


FIGURE 6.—*Frequency of flood stages on Des Plaines River at Wadsworth (Wadsworth Road).*

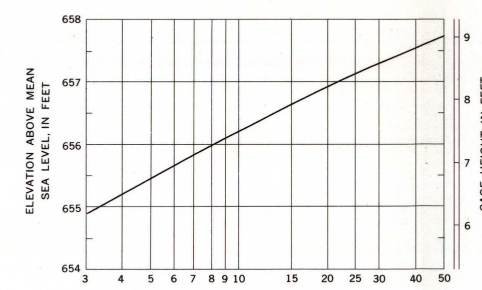


FIGURE 7.—*Frequency of flood stages on Skokie River at Lake Forest (State Highway 19A—Westleigh Road).*

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. The general relation between recurrence interval and flood height at gaging stations on Des Plaines River at Wadsworth (fig. 6) and Skokie River at Lake Forest (fig. 7) is tabulated below:

Recurrence interval (years)	Elevation above mean sea level (feet)	
	Skokie River at Lake Forest	Des Plaines River at Wadsworth
50	657.7	666.8
25	657.1	666.5
10	656.2	666.2
5	655.5	665.9
3	654.9	665.7

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 June 1937, November 1951, April 1960, February 1966, and April 1966 are shown in figures 8-11. These profiles are based on elevations of marks left by the floods, or, where floodmarks could not be obtained, the profiles were constructed by using flood crests determined from photographs and from reports of local residents. Elevations of streambeds and lower flood stages were also used to help define the profiles of higher floods. 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 8-11. The approximate ground elevation can be determined from contours on the map; however, more accurate elevations can be obtained by leveling from nearby bench marks.

Additional data.— Other information pertaining to floods in the Zion 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.

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

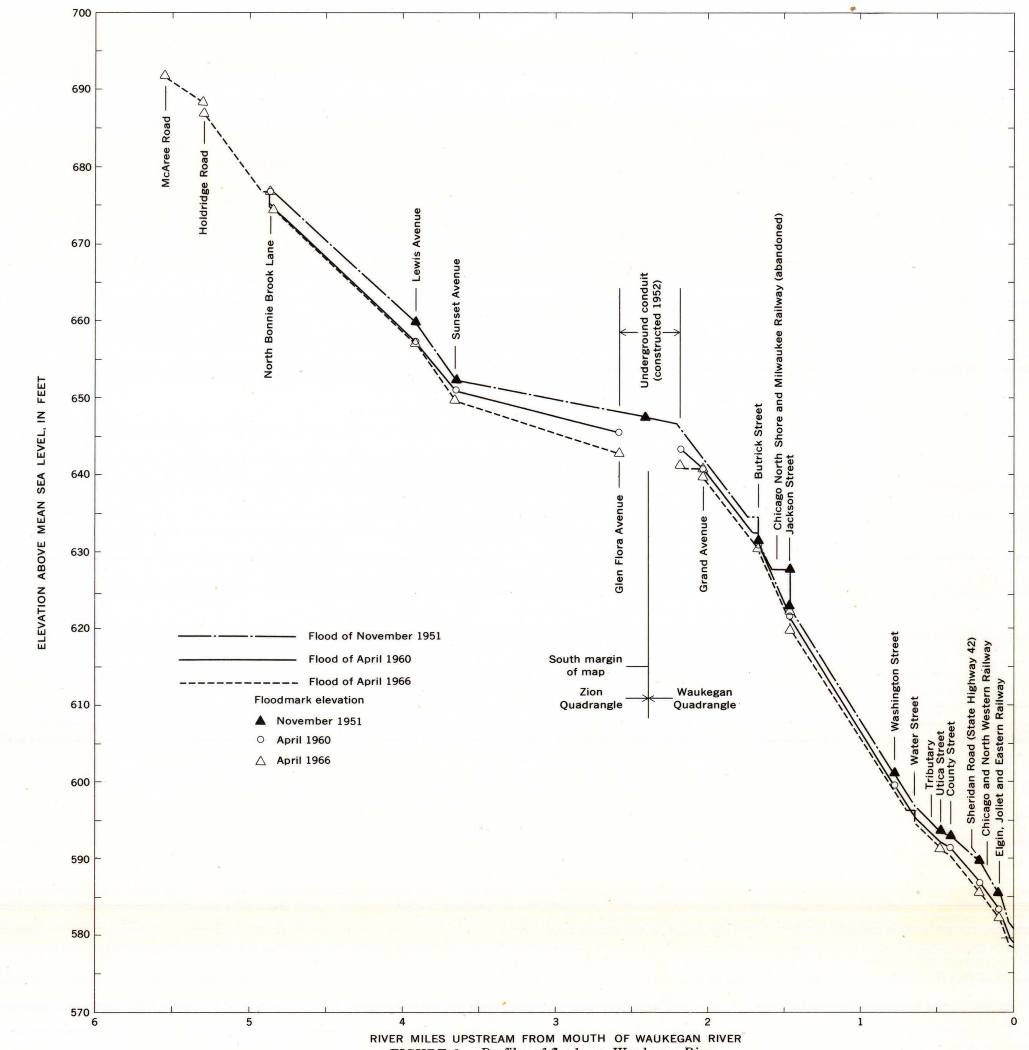


FIGURE 8.—*Profiles of floods on Waukegan River.*

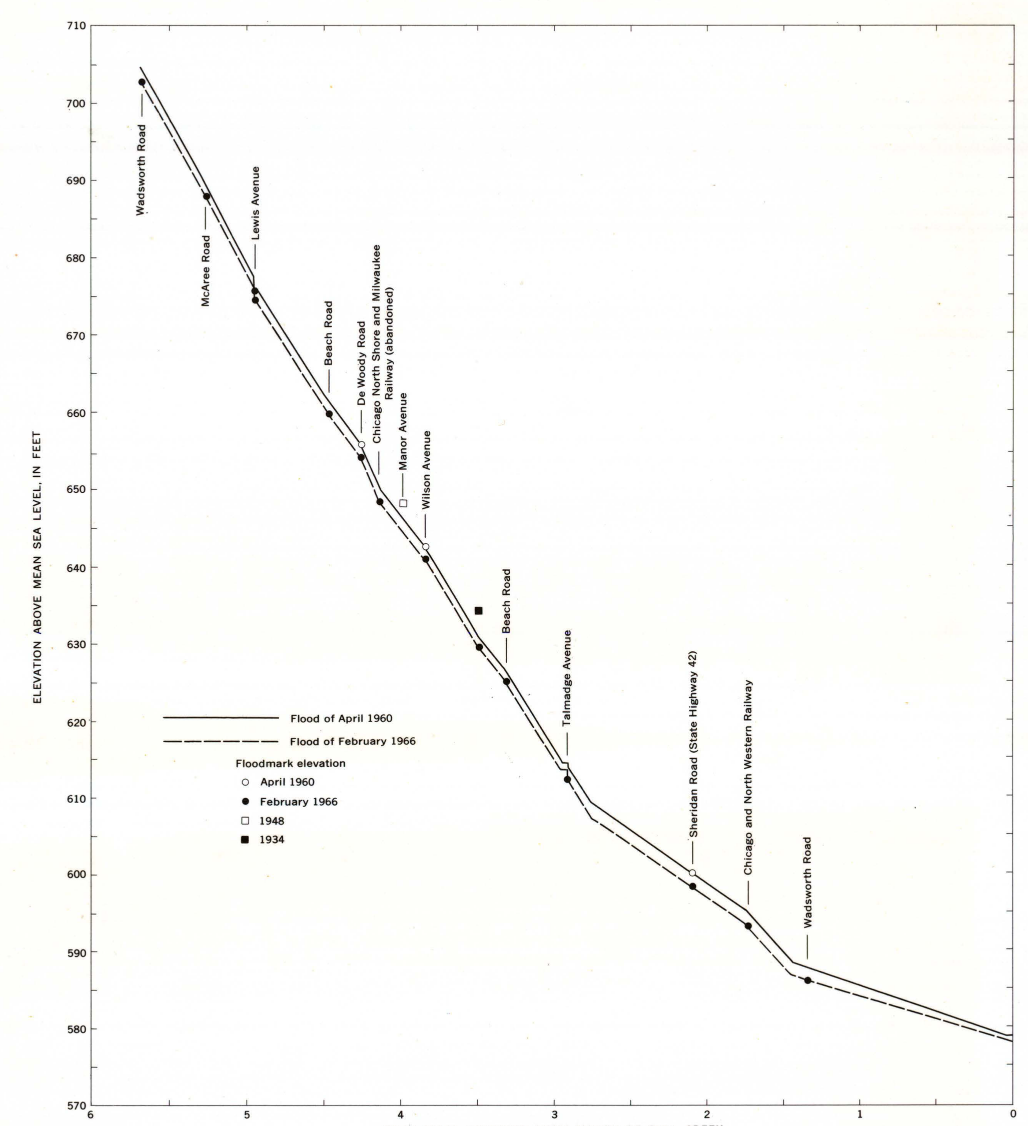


FIGURE 9.*Profiles of floods on Bull Creek.*

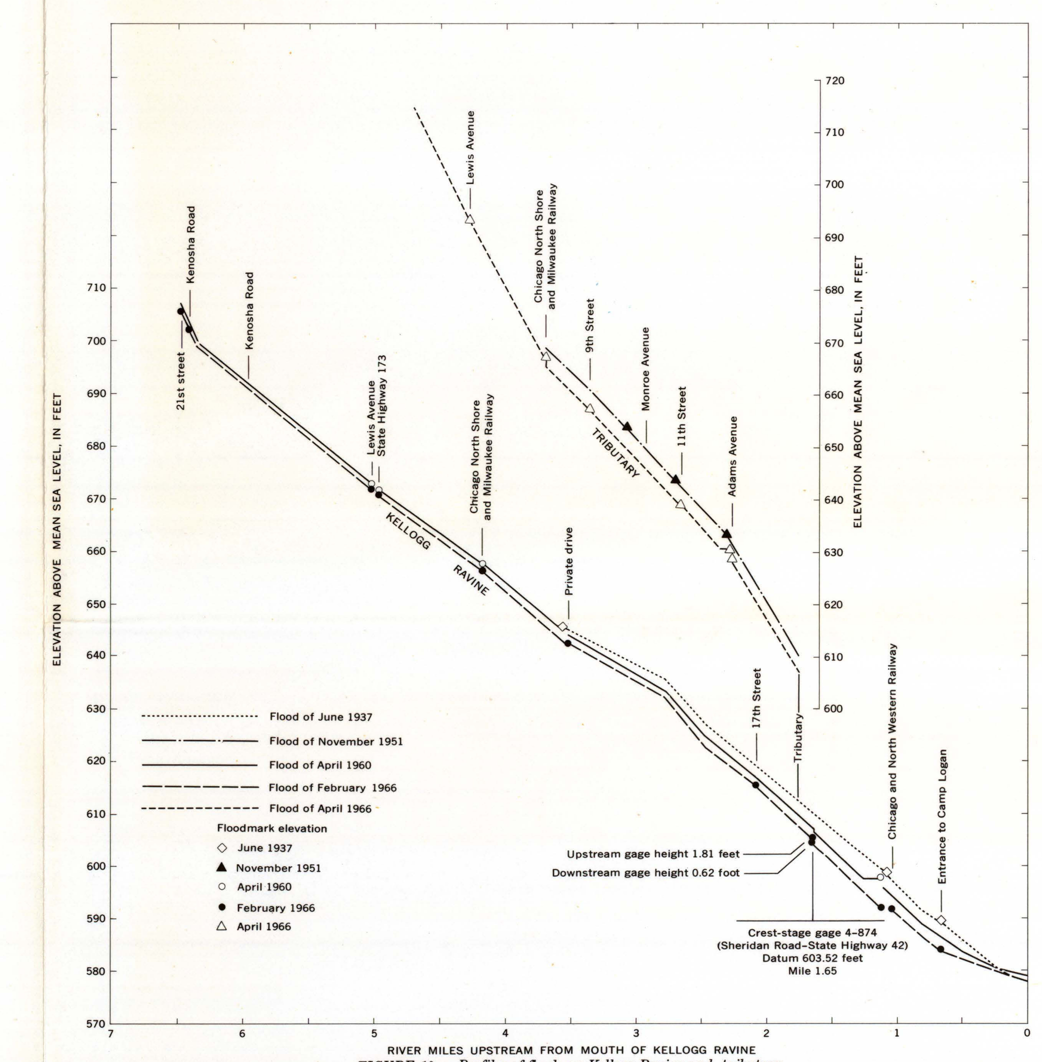


FIGURE 10.—*Profiles of floods on Kellogg Ravine and tributary.*

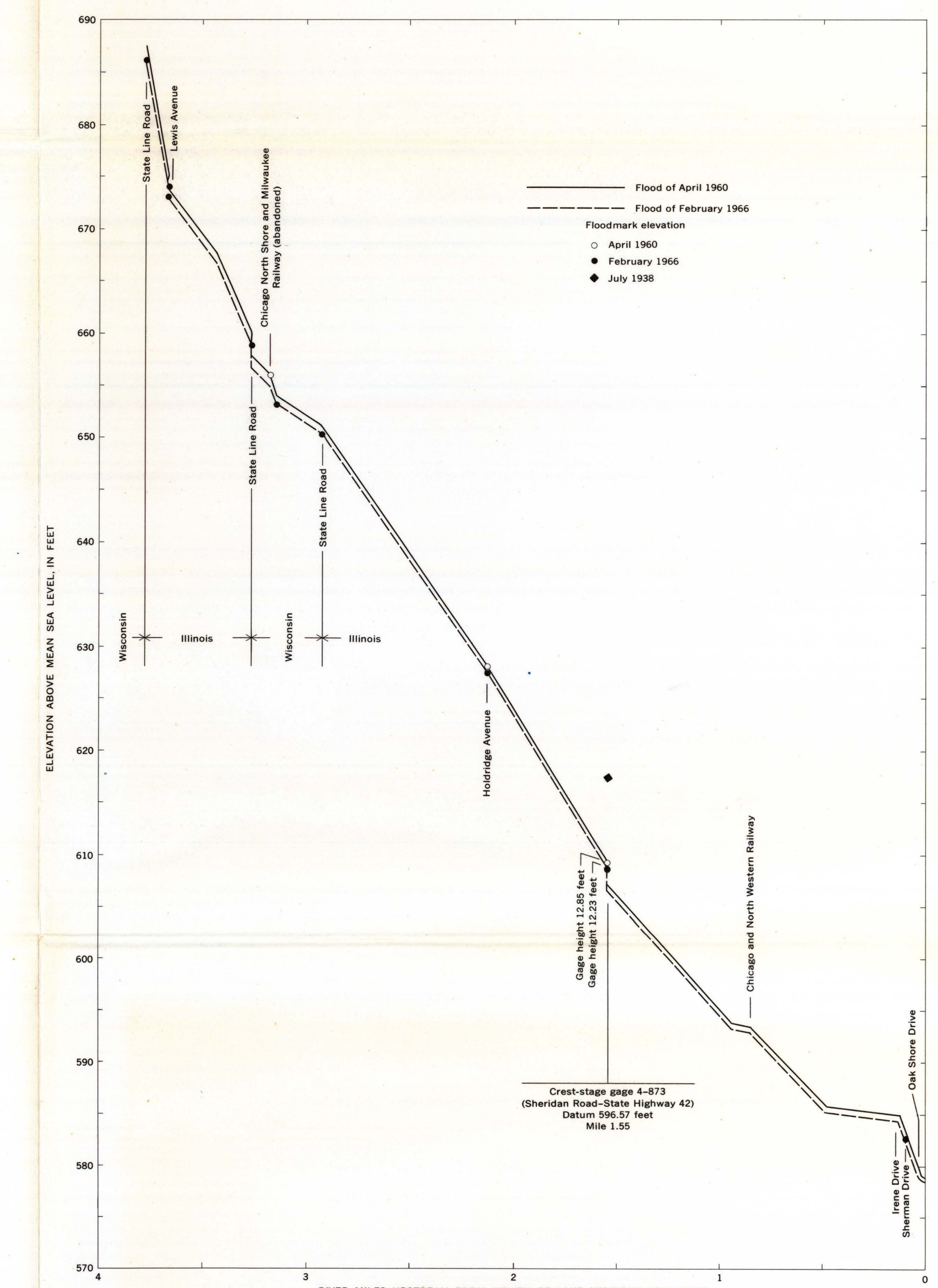


FIGURE 11.—*Profiles of floods on Lake Michigan tributary.*

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1967

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By
V. Jeff May and Roman T. Mycyk

1967

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