DEPARTMENT OF THE INTERIOR
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH
THE NORTHEASTERN ILLINOIS METROPOLITAN
AREA PLANNING COMMISSION

HYDROLOGIC INVESTIGATIONS
ATLAS HA-69

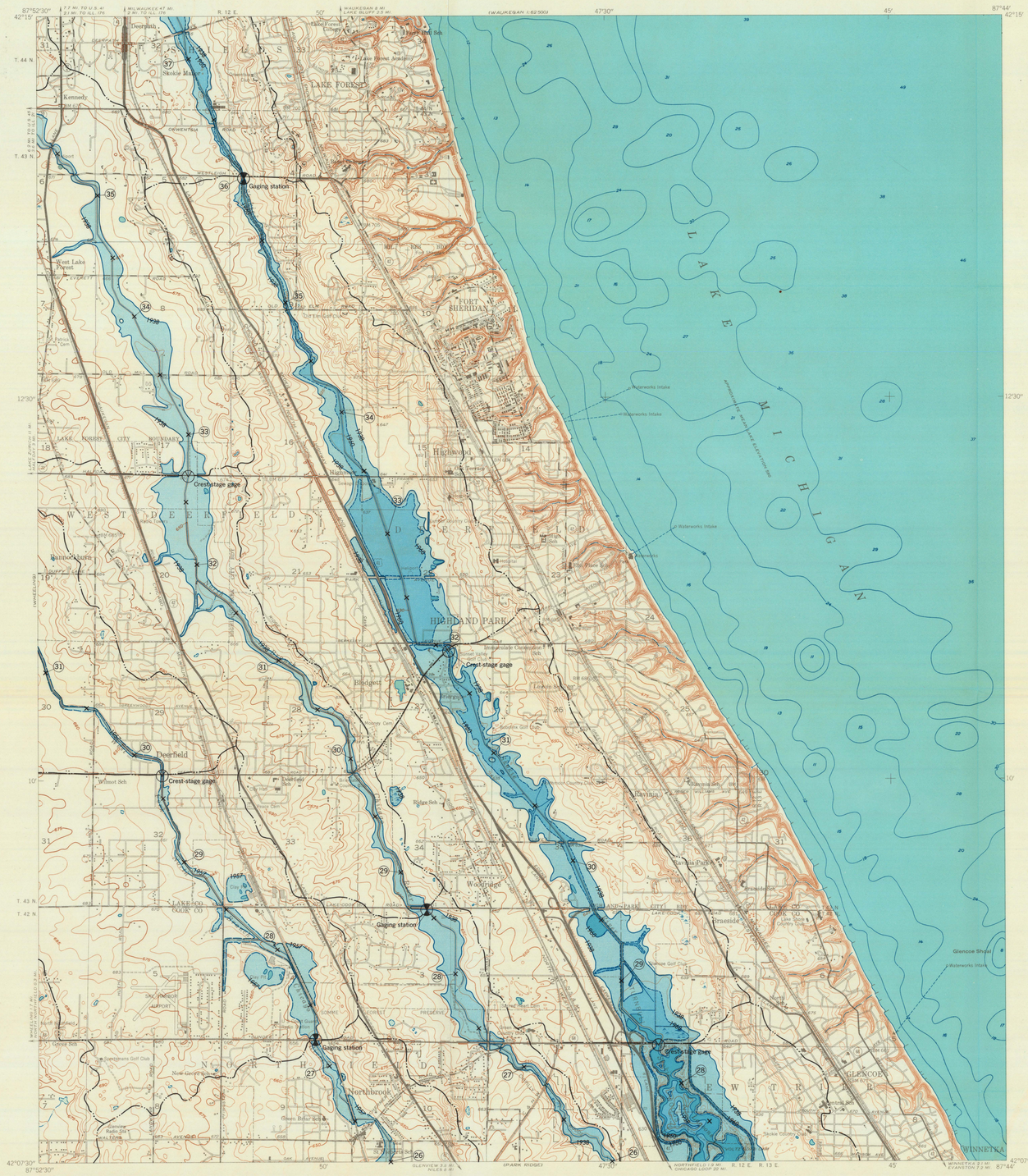

FIGURE 6.— *Profiles of floods on North Branch Chicago River.*

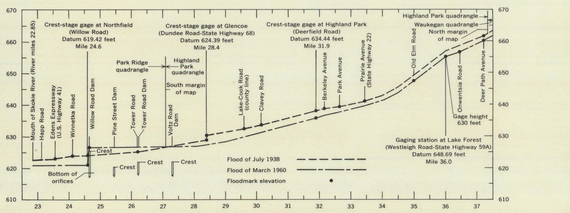

FIGURE 7.— *Profiles of floods on Skokie River.*

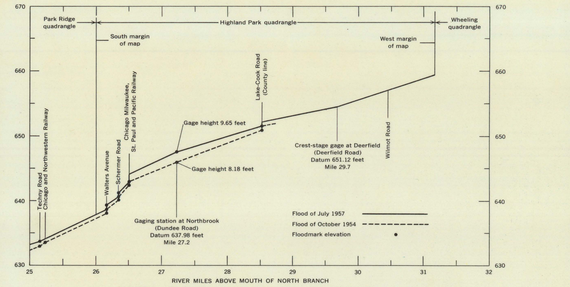

FIGURE 8.— *Profiles of floods on West Fork of North Branch Chicago River.*

Base from U.S. Geological Survey topographic map

SCALE 1:24 000

1 ½ 0 1 MILE

1 .5 0 1 KILOMETER

CONTOUR INTERVAL 5 FEET
DATUM IS MEAN SEA LEVEL
DEPTH CURVES AND SOUNDINGS IN FEET—DATUM IS 5.78 FEET

APPROXIMATE MEAN DECLINATION, 1963

QUADRANGLE LOCATION

EXPLANATION

- Area flooded 1938, 1957
- Area flooded 1960
- Boundary of 1938 flood (1938)
- Boundary of 1957 flood (1957)
- Boundary of 1960 flood (1960)
- Drainage divide
- River miles measured along stream channel (37)

FLOODS IN HIGHLAND PARK QUADRANGLE, ILLINOIS

This report presents hydrologic data that will be useful in the evaluation of flood conditions, to minimize the flood hazard in the economic development of flood plains. 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. This is the fourth of many such reports planned for northeastern Illinois.

The approximate areas inundated by floods are delineated along streams in the Highland Park 7½-minute quadrangle. Location of the Highland Park quadrangle is shown in figure 1. Inundated areas are shown along the North Branch Chicago River for the flood of July 1938; along West Fork of North Branch Chicago River for the flood of July 1957; and along Skokie River for the floods of July 1938 and March 1960.

Below mile 29 on the Skokie River the inundation pattern of the 1938 flood was affected by temporary dikes and diversion channels associated with the development of the Skokie Lagoons by the Forest Preserve District of Cook County. The lagoons were formed by excavating low swampy areas of the flood plain, constructing dikes along the edges of the flood plain, and by constructing a series of four dams. The lagoons provide about 1,500 acre-feet of storage that is available for flood control. All floods that occurred after the project was completed in 1940 were contained within the dikes. Diversion ditches on the outside of the dikes accommodate local runoff.

The flood limits shown on the map are not necessarily those for the highest floods expected along the streams. Greater floods are possible, but definition of their probable overflow limits is not within the scope of this report. The flood limits reflect channel conditions that existed when the floods occurred and no attempt is made to appraise the effect of channel changes that may have been made later. Protective works built after the floods of 1938, 1957, and 1960 may reduce the frequency of flooding in the area but will not 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.

Flood limits are not defined for the incised streams flowing into Lake Michigan nor for the areas flooded as a result of backup in storm drains.

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 whereby flood maps will be prepared for the 7½-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. The Highland Park quadrangle is in Lake and Cook Counties. Financial support for the preparation of this report was provided by Lake and Cook Counties, the Metropolitan Sanitary District of Greater Chicago, and the Forest Preserve District of Cook County.

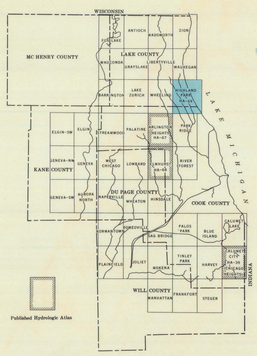

FIGURE 1.— *Index map of northeastern Illinois showing location of Highland Park quadrangle*

The cooperative program is administered on behalf of the Planning Commission by Paul Opermann, 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 Highland Park flood map was prepared by Howard E. Allen and Allen W. Noehre.

The following agencies supplied some of the flood data on which this report is based: Department of Public Works and Buildings, Division of Waterways, of the State of Illinois; Department of Highways of Cook County; the Forest Preserve District of Cook County; and the Metropolitan Sanitary District of Greater Chicago.

Additional data were obtained from officials of municipalities located in the area, particularly Highland Park, Winnetka, Lake Forest, Deerfield, and Northbrook; from Greeley and Hansen, Hydraulic and Sanitary Engineers, Chicago, Ill.; and from personal interviews with private citizens.

Flood heights --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 gaging stations in the Highland Park quadrangle can be converted to elevations above mean sea level by adding the gage height to the appropriate datum of gage listed in the table below. Size of drainage area and type of gage at each station also are shown in the table. Drainage divides are shown on the map.

Gaging Station	Type of gage[1]	Datum of gage above mean sea level (feet)	Drainage area (square miles)
North Branch Chicago River:			
At Bannockburn (Halfday Road)	C	652.65	16.8
At Deerfield (Lake-Cook Road)	R	638.88	20.7
Skokie River:			
At Lake Forest (Westleigh Road)	R	648.69	12.8
At Highland Park Deerfield Road	C	634.44	18.6
At Glencoe (Dundee Road)	C	624.39	23.6
West Fork of North Branch Chicago River:			
At Deerfield (Deerfield Road)	C	651.12	6.51
At Northbrook (Dundee Road)	R	637.98	11.5

[1] R, Water-stage recorder; C, Crest-stage gage.

Gage height and year of occurrence of each annual flood (highest peak discharge in each calendar year) above 610-foot elevation at the gaging station on North Branch Chicago River at Niles during the period 1948-61 are shown in figure 2. The Niles gaging station is located at Touhy Avenue, about 8 miles south of the Highland Park quadrangle, and at mile 15.6. The irregular occurrence of floods is evident from figure 2 which shows that the 610-foot elevation was exceeded on the average of once every three years, but there was a 5-year period when that elevation was not reached and 2 years in succession when it was exceeded.

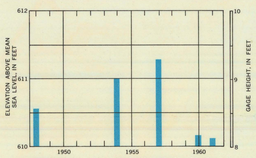

FIGURE 2— *Annual floods above 610-foot elevation, 1948-61, North Branch Chicago River at Niles, Illinois.*

Flood frequency --Frequency of floods at the Geological Survey gaging stations on North Branch Chicago River at Deerfield, Skokie River at Lake Forest, and West Fork of North Branch Chicago River at Northbrook, was derived from streamflow records at the stations, combined with the regional flood-frequency relation for streams in northern Illinois (Mitchell, 1954). The general relation between frequency, flood height, and discharge is shown in figures 3-5. The relation between flood height and frequency is dependent on the relation of flood height to discharge which is affected by changes in physical conditions of channels and constrictions.

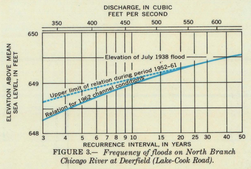

FIGURE 3— *Frequency of floods on North Branch Chicago River at Deerfield (Lake-Cook Road).*

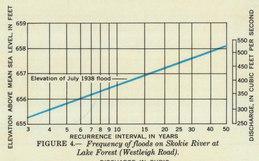

FIGURE 4— *Frequency of floods on Skokie River at Lake Forest (Westleigh Road).*

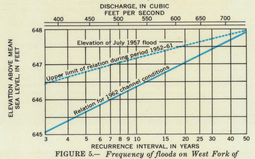

FIGURE 5— *Frequency of floods on West Fork of North Branch Chicago River at Northbrook (Dundee Road).*

Figures 3 and 5 illustrate graphically the effect of such changes on the stage-frequency relations at the Deerfield and Northbrook gaging stations, respectively. A local resident reported that in March 1962 a series of log jams was cleared from a limited reach of North Branch Chicago River in the vicinity of the Deerfield station. In 1958 the village of Northbrook improved the West Fork of North Branch Chicago River from the gaging station downstream through the village. The dashline curves (figs. 3 and 5) represent the upper limits of the stage-frequency relations defined during the period 1952-61 and the lower curves represent the relations for present channel conditions. The curves indicate that the two stream channels now have greater capacity than at any other time since 1952. The following interpretation may be made from figure 5 for the Northbrook station: A flood having a discharge of 530 cubic feet per second, which is expected to be exceeded on the average of once in 10 years, would occur at an elevation of 646.4 feet for present channel conditions; but if the channel were allowed to deteriorate, the same discharge might occur at an elevation of 647.2 feet or possibly higher. Another type of interpretation can be made. A flood having an elevation of 647 feet is expected to be exceeded on the average of once in about 20 years for present channel conditions, but for poor channel conditions, that elevation might be exceeded on the average as often as once in 7 years. Similar interpretations may be made for the Deerfield station. Longer records and future changes in channel conditions may define somewhat different flood-frequency relations. 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 height 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.

The general relation between recurrence interval and flood height at gaging stations on North Branch Chicago River at Deerfield, Skokie River at Lake Forest, and on West Fork of North Branch Chicago River at Northbrook is tabulated below:

Recurrence interval (years)	Elevation above mean sea level (feet)		
	North Branch Chicago River at Deerfield	Skokie River at Lake Forest	West Fork of North Branch Chicago River at Northbrook
50	649.5	658.1	647.9
40	649.5	657.9	647.7
30	649.4	657.6	647.4
20	649.3	657.2	647.0
10	649.0	656.6	646.4
5	648.6	655.8	645.7
3	648.2	655.3	645.1

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 was experienced in one year, such as the flood of July 1938 on North Branch Chicago River, does not reduce the probability of that flood being exceeded in the next year or in the next week.

Flood profiles --Profiles of the water surface, based primarily on gaging station records and elevations of marks left by floods, are shown in figures 6-8. Where definite floodmarks could not be identified, the profiles were constructed on basis of elevations of lower floods and streambeds, and the extent of overflows determined from newspaper articles and reports of local residents. 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. These differences reflect the relative capacities of waterway areas of bridge openings and those of channels and flood plains. The drop in water-surface elevation through bridge openings during future floods may be different from those 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 6-8. The approximate ground elevation can be determined from information indicated by contours on the map, although more accurate elevations can be obtained by leveling to nearby bench marks.

Additional data --Other information pertaining to floods in the Highland Park 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. Geological Survey Water-Supply Paper 1370-B.

Mitchell, W. D., 1954, Floods in Illinois, magnitude and frequency: Illinois Div. Waterways, Dept. Public Works and Buildings.

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

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