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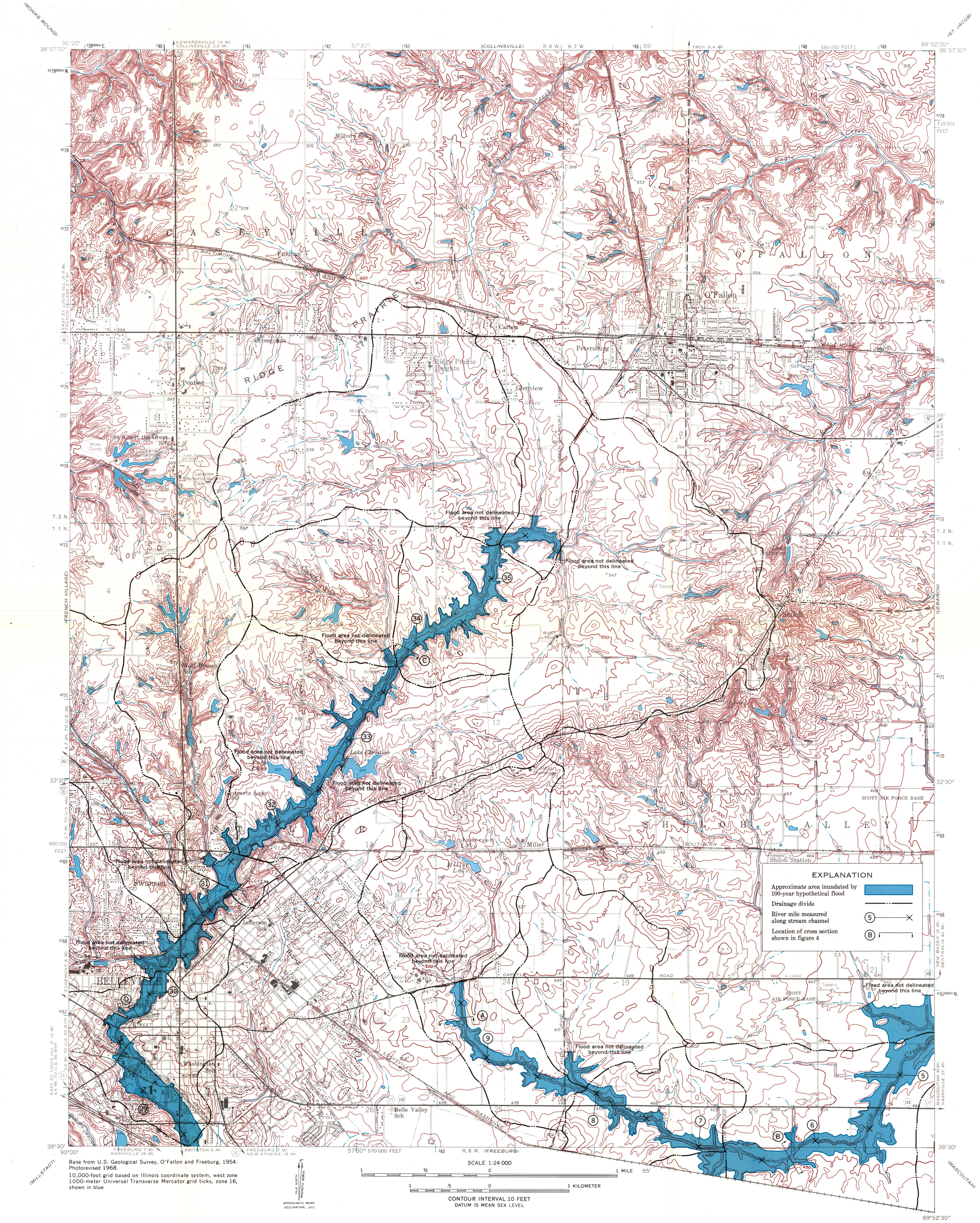
UNITED STATES GEOLOGICAL SURVEY

PREPARED IN COOPERATION WITH THE
STATE OF ILLINOIS
DEPARTMENT OF PUBLIC WORKS AND BUILDINGS
DIVISION OF WATERWAYS

HYDROLOGIC INVESTIGATIONS
ATLAS HA-449



FLOODS ON LOOP CREEK AND RICHLAND CREEK NEAR BELLEVILLE, ILLINOIS

Introduction.—This report presents information pertaining to the depth, velocity, and frequency of flooding that can be expected along Loop Creek and Richland Creek in the vicinity of Belleville, Illinois. The data presented provide a technical basis for solving existing flood problems and formulating effective flood-plain regulations that will minimize the creation of new flood problems. The report will also be useful in preparing building and zoning regulations, locating waste disposal and water treatment facilities, developing recreational areas, and managing surface waters in relation to ground-water resources.

The approximate area that would be inundated by a flood having a recurrence interval of 100 years on Loop Creek and Richland Creek near Belleville is shown on a map. Figure 1 shows the general location of this map. Flood profiles are given also for floods having recurrence intervals of 25 and 50 years and for the 1957 flood, which is the maximum known in the vicinity of Belleville. The boundaries for these floods are not delineated on the map as the differences between their elevations and the elevations of the 100-year flood are so small in relation to the scale and contour interval of the map that the boundaries would be indistinguishable in most places.

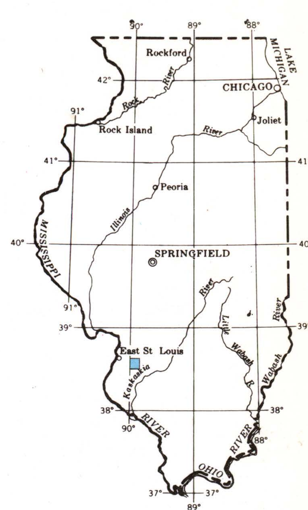


FIGURE 1.—*Map of Illinois showing location of map area.*

Information obtained from local residents and newspapers indicate a history of damaging floods along Richland Creek. The first noted flood was in May 1908, followed by severe floods in 1912, 1915, 1916, 1919, 1927, 1942, 1946, and 1957. The flood of June 15, 1957, is remembered as the most severe and damaging of these floods and was the highest since at least 1874, based on information furnished by employees of the J.F. Imbs Milling Company (later renamed International Milling Company) who stated that water reached the first floor of the mill for the first time in history. The mill was established in 1874. According to local residents, the flood of August 16, 1946, was about 2 feet lower than the 1957 flood on Richland Creek and was the second largest since 1939 at the gaging station on Canteen Creek at Caseyville, Ill. The 1957 flood did an estimated $2.7 million of damages in the Belleville area. As a direct result of the flood, four persons lost their lives in Belleville.

The 1957 flood resulted from one of the most severe rainstorms of short duration recorded in the midwest. The storm was centered at Millstadt, Ill., about 7 miles southwest of Belleville where 16.54 inches of rain fell in less than 12 hours.

There is not much information available concerning floods on Loop Creek, probably because the Loop Creek basin is not heavily populated and the major losses were agricultural. There is little doubt that Loop Creek experienced the same floods as observed on Richland Creek because of their proximity. If urban encroachment continues on the Loop Creek flood plain, future floods will be more detrimental in this basin.

The general procedure used in defining the flood boundary shown on the topographic map was to construct the profile for the 100-year flood by using step-backwater procedures. The extent of flooding delineated on the map was derived from the 100-year profile on the basis of field surveys and by interpolation between contours (lines of equal ground elevations). The portrayal of the flood boundary is consistent with the scale of the map (1 inch = 2,000 feet; contour interval, 10 feet).

Floods greater than the 100-year flood, which is delineated on the map, have occurred and undoubtedly will occur again in the future. The flood boundaries shown reflect channel and flood plain conditions existing in July 1969. Subsequent changes in channel conditions, highways and bridges, urban development, and other cultural changes may affect the inundation pattern of future floods. Future protective works may reduce the extent and frequency of flooding, but may not eliminate all future flooding.

Cooperation and acknowledgment.—The preparation of this report is a part of an investigative program financed through a cooperative agreement between the Illinois Department of Public Works and Buildings, Division of Waterways, and the U.S. Geological Survey. The cooperative program is administered on behalf of the Division of Waterways, by J.C. Guillou, Chief Waterway Engineer.

This report was prepared by the U.S. Geological Survey under the administrative direction of William D. Mitchell, district chief.

Acknowledgment is made to the Corps of Engineers, U.S. Army; Soil Conservation Service, U.S. Department of Agriculture; St. Clair County Highway Department; and other city and county officials for furnishing some of the data on which this report is based.

Flood discharge.—Discharge is the rate at which water flows, expressed as volume per unit time, usually 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 ice may cause a high stage during a period of relatively low discharge.

The discharge and year of occurrence of each annual flood (greatest peak discharge in each calendar year) that exceeded 2,000 cfs at the gaging station Canteen Creek at Caseyville during the period 1939–69 are shown in figure 2. The gaging station is located approximately 9 miles northwest of Belleville and its record is indicative of the distribution of floods anticipated on other streams in the Belleville area. The two greatest floods of record occurred in 1957 and 1946, with respective discharges of 10,200 and 10,000 cfs. Figure 2 illustrates the irregular distribution of floods.

Flood frequency.—Frequency of floods at the U.S. Geological Survey gaging station Canteen Creek at Caseyville was derived from streamflow records for this station adjusted to give weight to regional values. The general relation between frequency and discharge at the gaging station is also depicted in figure 2.

The magnitudes of the 25-, 50-, and 100-year flood discharges along Loop Creek and Richland Creek were determined from the appropriate flood-frequency relation (Ellis, 1968) and adjusted for the effects of existing urbanization (Leopold, 1968). The resulting discharges, used for computing corresponding flood profiles, are given in a following section of this report.

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. Frequency of floods may also 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 1 chance in 25 or a 4-percent chance of being equaled or exceeded in any given year, or one with a 50-year recurrence interval would have 1 chance in 50 or a 2-percent chance of being equaled or exceeded in any given year.

It is emphasized that recurrence intervals are average figures—the average number of years that will elapse between the occurrence of floods that equal or exceed a given magnitude. The fact that a major flood occurs in one year does not reduce the probability of a flood as great or greater occurring during the next year or even during the next week. This is illustrated in figure 2. Two floods in a 31-year period exceeded the 100-year flood.

Flood profiles.—Profiles for the 25-, 50-, 100-year, and 1957 floods for Loop Creek and Richland Creek are shown in figures 3 and 4 respectively.

The roughness coefficients selected for step-backwater computations represent conditions that would give the highest flood elevations (during the summer when the vegetation is the heaviest). Should floods of the same magnitude occur during the winter months, the profiles could be somewhat lower.

The following table shows the distribution of the discharge that was used along the streams to compute the flood profiles. Size of the drainage area is also shown for selected points along Loop Creek and Richland Creek. The drainage divides shown on the flood map were defined by following the ridge line or highest ground elevation between adjacent streams. River miles shown in the table and on the profiles correspond with those marked along the streams on the flood map.

The profiles for the 1957 flood were constructed on the basis of high-water information obtained from local residents and city and county officials. Consideration was given to the streambed profile and the computed profiles for the lower floods when drawing the 1957 flood profile. The profile is not shown for the entire reach of channel studied on Richland Creek because of insufficient data upstream from the Old Collinsville Road.

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 constrict channels. The drop in water surface through bridge openings during future floods may be quite 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 tend to increase the upstream flood height. Channel changes through bridges may also change the overflow pattern of future floods. It is again emphasized that the flood profiles and the inundation pattern shown in this report are for conditions that existed in the summer of 1969 when the field data were gathered. Any subsequent physical changes to the channel, flood plain, or bridges may alter the pattern of flooding shown in this report. An increase in urbanization may change the runoff characteristics of the streams and therefore affect the height reached by future floods of comparable discharges.

Flood depths.—Depth of flooding at any point can be estimated for the three hypothetical floods (25-, 50-, and 100-year floods) and for the 1957 flood by subtracting the ground elevation from the water-surface elevation at that point as indicated by the profiles in figures 3 and 4. The approximate ground elevation can be determined by contours on the map; more accurate elevations can be obtained by leveling from nearby bench marks. For the convenience of those wishing to run levels in this area, a list of bench marks and reference marks is shown below. Elevations of the reference marks were established by surveying from the listed bench marks.

BENCH MARKS

Belleville, Ill., 7 feet north and 20 feet east from northeast corner of St. Clair County courthouse, 150 feet south and 40 feet west from center of city square; top of bronze cap on iron post set flush with sidewalk and stamped "Prim Trav Sta No 15 1905 Adj."

Elevation, 529.08 feet.

Belleville, Ill., 4½ miles northeast of, near northwest corner sec. 1, T. 1 N., R. 8 W., 20 feet south and 20 feet east from junction of T-road south, 20 feet south and 155 feet east from junction of T-road north, in concrete post; standard tablet stamped "TT Sta No 20 F 1928."

Elevation, 556.54 feet.

Belleville, Ill., 5½ miles east of, 1.0 mile south of Shiloh Station, near center of sec. 21, T. 1 N., R. 7 W., on south side of State Highway 161 (Carlyle Road); 62 feet south of T-road north, in concrete post; standard tablet stamped "TT Sta No 13 F 1928 RESET 1960."

Elevation, 441.38 feet.

REFERENCE MARKS

Loop Creek, chiseled square on top of north curb of bridge on State Highways 158 and 177 in sec. 28, T. 1 N., R. 7 W. Mark is 6.5 feet west of east end of bridge.

Elevation, 440.06 feet.

Loop Creek, chiseled square on top of south curb of bridge on State Highways 158 and 177 in sec. 30, T. 1 N., R. 7 W. Mark is 6 feet west of east end of bridge.

Elevation, 462.70 feet.

Loop Creek, chiseled square on top of east curb of bridge on Green Mount Road in sec. 30, T. 1 N., R. 7 W.

Elevation, 467.65 feet.

Loop Creek, chiseled square on top and near center of north headwall of culvert on State Highway 161 in sec. 24, T. 1 N., R. 8 W.

Elevation, 487.67 feet.

Richland Creek, chiseled square on northeast abutment of bridge on South Illinois Street (State Highway 159).

Elevation, 478.84 feet.

Richland Creek, chiseled square on center of east handrail of bridge on South 3rd Street.

Elevation, 482.76 feet.

Richland Creek, chiseled square on center of south curb of bridge on West Monroe Street.

Elevation, 481.34 feet.

Richland Creek, chiseled square on northeast end of south (downstream) headwall of bridge on West Centerville Avenue.

Elevation, 481.70 feet.

Richland Creek, chiseled square on top of the north (upstream) end of culvert on West Main Street. Mark is on west side of culvert.

Elevation, 486.39 feet.

Richland Creek, chiseled square on top of the northwest corner of headwall of bridge on West C Street.

Elevation, 488.39 feet.

Richland Creek, chiseled square on top of the southwest corner of headwall of culvert at North 2nd Street.

Elevation, 490.10 feet.

Richland Creek, chiseled square on top of 5th post south of north end of east handrail of bridge at North Illinois Avenue (State Highway 159).

Elevation, 504.90 feet.

Richland Creek, chiseled square on top of southwest corner of box culvert at North Douglas Avenue.

Elevation, 489.67 feet.

Richland Creek, chiseled square on top of the southwest wingwall of bridge at State Highway 161.

Elevation, 504.36 feet.

Richland Creek, chiseled square on top of bridge curb at northeast corner of bridge at Old Collinsville Road.

Elevation, 507.52 feet.

Richland Creek, chiseled square on top of west bridge curb near center of bridge at Hartman Lane.

Elevation, 518.28 feet.

Richland Creek, chiseled square near center of west handrail of bridge at Green Mount Road.

Elevation, 527.39 feet.

Flood velocities.—The cross sections in figure 5 show the depth of the 100-year flood at selected cross sections on Loop Creek and Richland Creek. The horizontal distribution of velocity for each cross section is also shown. The distribution was determined on the basis of the relative roughness of the stream channels and flood plains. Velocities are greatest in the main channel and least in the flood plains. Velocities shown are the average for each subsection and point velocities may deviate substantially from the average. It is not possible to predict accurately what the velocity will be for a given flood at a given point. However, the values shown are representative for the 100-year flood and can be used for flood-plain planning and development.

Additional data.—Other information pertaining to floods on Loop Creek and Richland Creek near Belleville can be obtained at the office of the U.S. Geological Survey, Champaign, Ill., and from the following reports:

Ellis, D.W., 1968, Floodflows from small drainage areas in Illinois: preliminary flood-frequency relations: U.S. Geol. Survey open-file report, 10 p.
Leopold, L.B., 1968, Hydrology for urban land planning—a guidebook on the hydrologic effects of urban land use: U.S. Geol. Survey Circular 554, 18 p.
Mitchell, W.D., 1954, Floods in Illinois, magnitude and frequency: Illinois Dept. Public Works and Bldgs., Div. of Waterways, 386 p.
U.S. Army, Corps of Engineers, 1962, Richland Creek, Illinois: U.S. 87th Congress, 2d sess., Doc. 571.
U.S. Department of Agriculture, 1966, Richland Creek Watershed, St. Clair County, Illinois: Soil Conservation Service watershed work plan, 35 p.

LOOP CREEK

Location	River miles upstream from mouth	Drainage area in square miles	Discharge in cubic feet per second: 25-year flood	50-year flood	100-year flood
Carlyle Road (State Highway 161)	9.66	1.82	1,410	1,790	2,320
Just upstream from tributary from north sec. 30, T. 1 N., R. 7 W.	8.08	2.70	1,410	1,790	2,320
Just downstream from tributary from north sec. 30, T. 1 N., R. 7 W.	8.07	4.23	2,070	2,620	3,400
Just upstream from tributary from south sec. 29, T. 1 N., R. 7 W. (Plum Hill Road)	6.81	5.20	2,070	2,620	3,400
Just downstream from tributary from south sec. 29, T. 1 N., R. 7 W. (Plum Hill Road)	6.80	7.07	2,880	3,650	4,750
East edge of map	4.55	9.94	2,880	3,650	4,750

RICHLAND CREEK

Location	River miles upstream from mouth	Drainage area in square miles	Discharge in cubic feet per second: 25-year flood	50-year flood	100-year flood
Green Mount Road	35.90	3.46	2,550	3,250	4,220
Just upstream from tributary entering from north in sec. 1, T. 1 N., R. 8 W.	35.27	4.33	2,590	3,300	4,280
Just downstream from tributary entering from north in sec. 1, T. 1 N., R. 8 W.	35.25	7.23	3,670	4,680	6,080
Just upstream from Country Club Branch	33.77	8.31	3,670	4,680	6,080
Just downstream from Country Club Branch	33.75	9.51	3,670	4,680	6,080
State Highway 161	31.60	12.33	3,670	4,680	6,080
Just downstream from Wolf Branch	31.36	14.24	4,330	5,040	6,240
Just downstream from Swansea Branch	30.88	16.03	4,980	5,800	7,180
Just downstream from Catawba Creek (F Street)	30.25	18.37	5,560	6,470	8,000
South edge of map	28.41	19.48	5,560	6,470	8,000

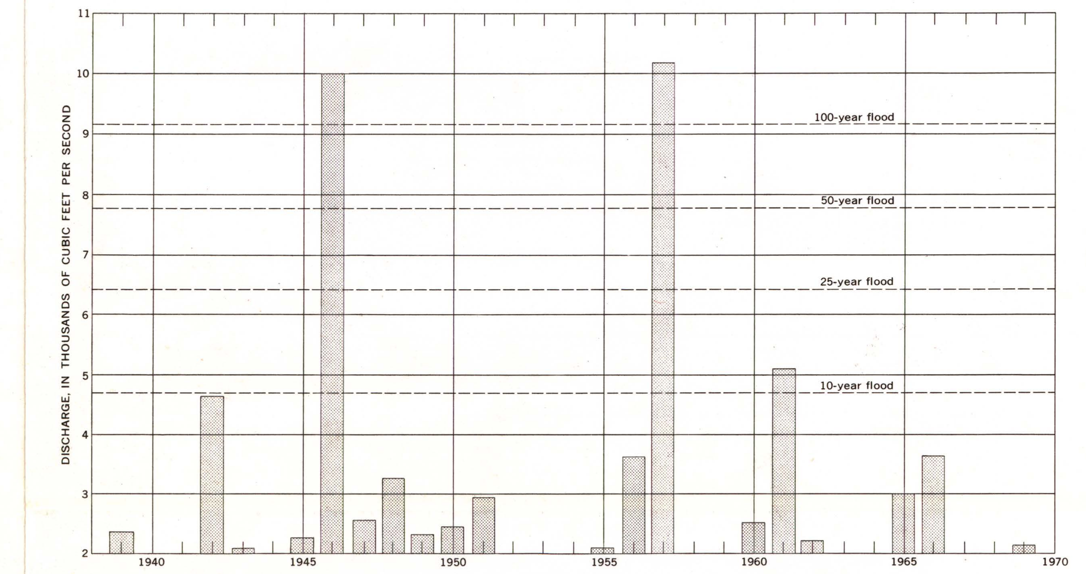


FIGURE 2.—*Annual floods above 2,000 cubic feet per second, 1939–69, Canteen Creek at Caseyville.*

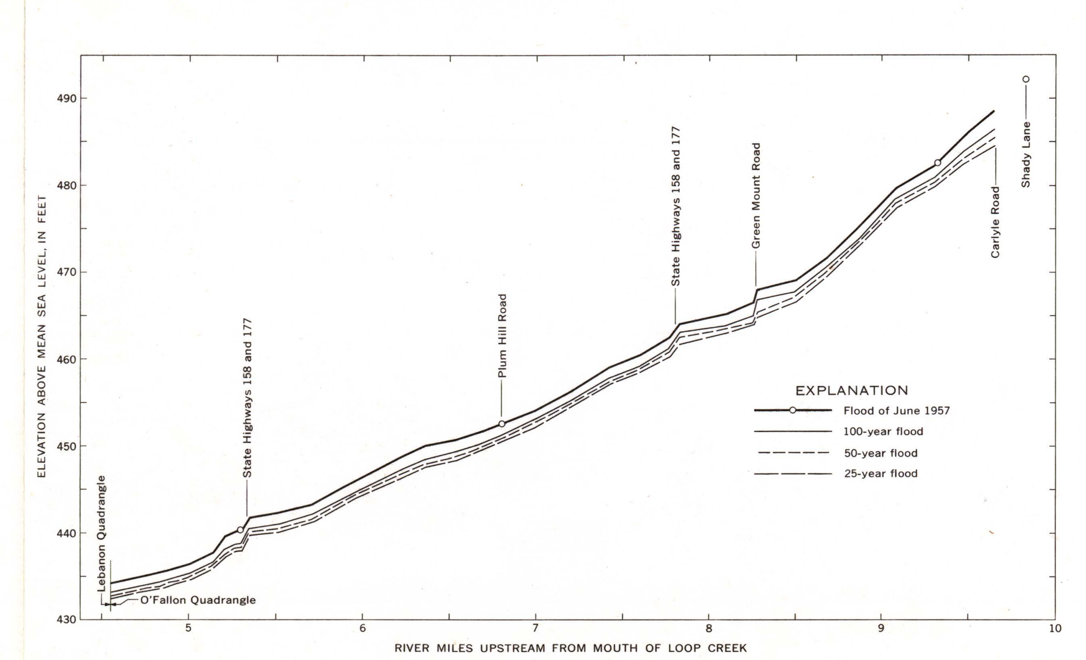


FIGURE 3.—*Profiles of floods on Loop Creek.*

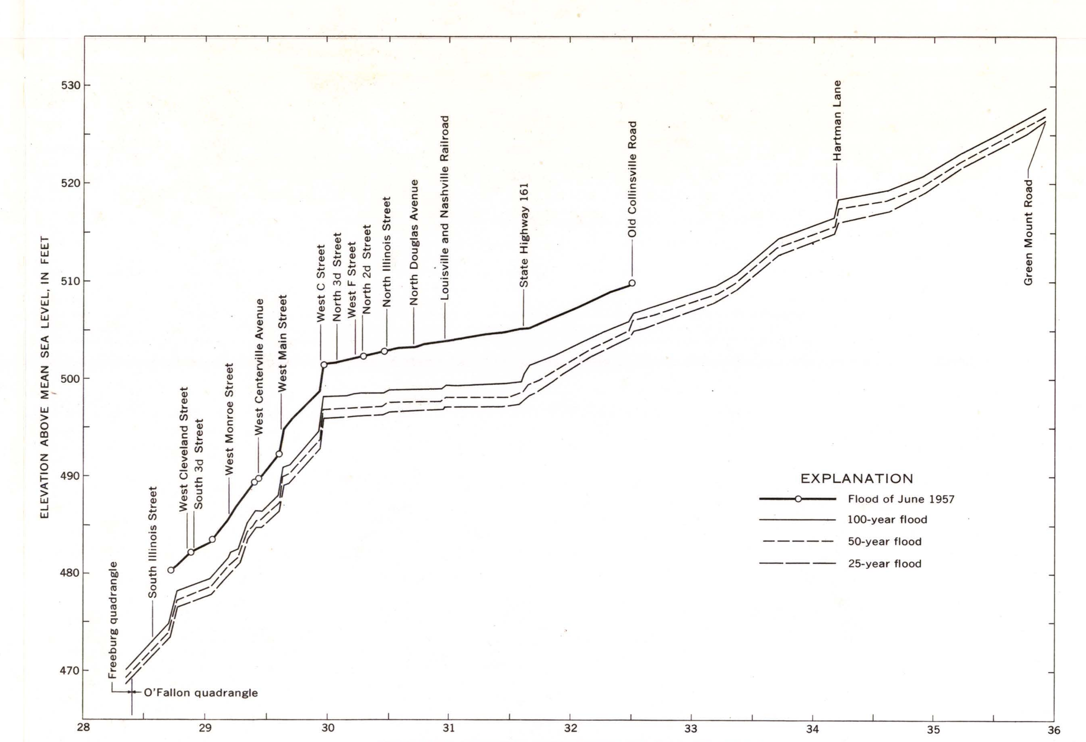
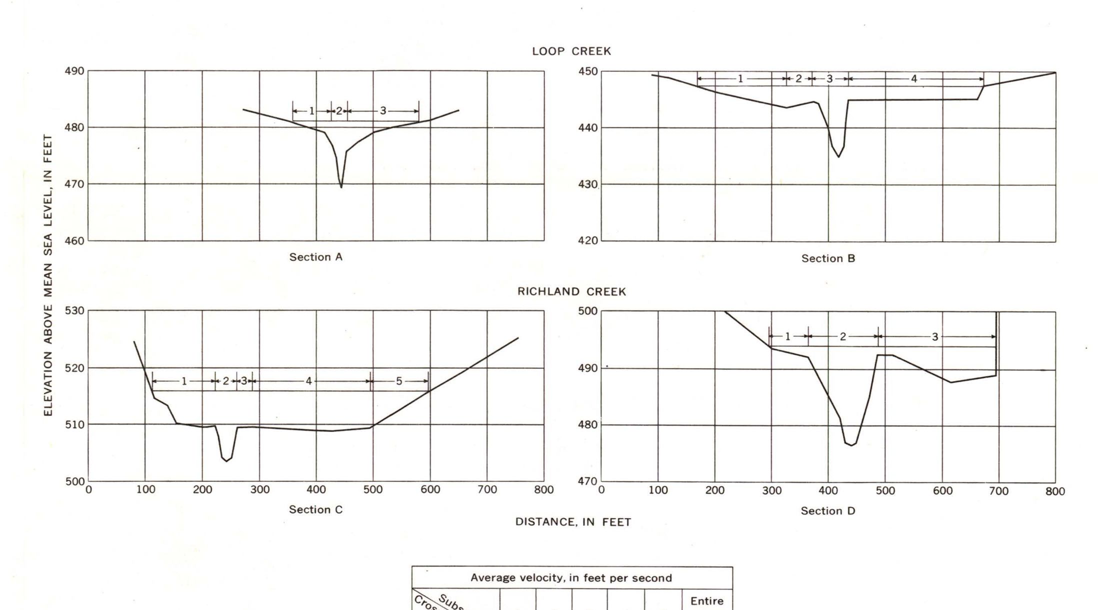


FIGURE 4.—*Profiles of floods on Richland Creek.*



Cross section \ Subsection	1	2	3	4	5	Entire cross section
A	2.87	7.37	1.97			4.32
B	1.62	3.13	5.32	2.19		2.99
C	1.83	3.02	1.37	2.37	1.46	2.19
D	.71	5.02	1.70			3.53

Average velocity, in feet per second

FIGURE 5.—*Selected cross sections of Loop Creek and Richland Creek showing depth and velocity distributions for the 100-year flood.*

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By
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1972

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