HYDROLOGY

Precipitation

Precipitation averages 35.3 inches annually at Wayland, Missouri (Gann et.al. 1971). The greatest amount of precipitation occurs during the months of June, July, and August, which produce 34% of the total annual precipitation (MDNR 1986). Snowfall averages 22 inches per year and average annual evaporation is approximately 4.8 inches at Wayland.

Average annual run-off at Wayland is 7.3 inches (Figure 6). Based on average annual precipitation and average annual run-off data, approximately 21% of the average annual precipitation appears as streamflow and the remaining 79% is lost primarily to evapo-transpiration.

U.S.G.S. Gaging Station

One gaging station occurs in the Fox River basin (05495000). It is located at 40 23' latitude and 91 35' longitude in the NE 1/4 of the NW 1/4 of S31, R6W, T65N approximately ½ mile west of Wayland, Missouri (Figure gs). Two "type A" wire-weight gates are located on the downstream side of the U.S. Highway 136 bridge, one on the east side and one on the west side of the bridge handrail. The period of record is from 1921 to present.

Permanent/Intermittent Streams

The basin has numerous intermittent streams and ephemeral ditches (Figure 3, Table 1). A total of 39 streams were identified in the basin, seven of which support permanent pools: Fox River, Little Fox River, Honey Creek from approximately RM-20 to its confluence with Fox River, Sugar Creek from approximately RM-10 to its confluence with Honey Creek, Linn Creek from the junction of North and South Linn creeks to its confluence with the Little Fox River, and the entire length of Brush Creek, its flow being augmented by treated wastewater release from the City of Kahoka.

There are no sizeable springs in the basin. Because the surface stream network accounts for most of the water movement in the drainage, base flow is low. All streams in the basin are subject to no-flow periods.

Streamflow Characteristics

Average annual discharge in Fox River for a 66-year period ending in 1988 was 258 cubic feet per second (USGS 1988). The cumulative mean annual discharge is plotted in Figure 7. High flows in the 1920s were followed by a relatively long period of lower but stable flows until the late 1970s and early 1980s when higher flows returned. The Q2 seven-day low flow is 1.3 cfs; Q10 and Q20 seven-day low flows are 0 cfs. The slope index, therefore, cannot be computed.

The 63-year flow duration curve for Fox River shows that high flows often result in flash floods while groundwater contribution to discharge is low, resulting in zero flow during dry periods (Figure 8a).

From the duration table of daily flows, data were compared to determine if Fox River has become more or less susceptible to flooding and/or drying in recent years. Figure 8b depicts duration flows from 1922 through 1952 and 1953 through 1980. During each time period, an equal number of high and low flow periods occurred and the median flow of each period was within 6 cfs. The computer-generated plotting points were too few to make meaningful comparisons of high-flow intensity, but low-flow duration could be compared. The graph suggests that extremely low base flows were more frequent during 1953-1980 than during the early time period. However, visual differences were not examined statistically. Note that data for each time period were similar in the graph's middle section.

Over a period of time, high- and low-flow effects tend to cancel one another, making it necessary to have many years of data to detect rends in flow duration. To negate this, flows during two four-year time periods were selected within each of the original two periods. Criteria for selection were: 1) high run-off periods to establish duration curves emphasizing changes in the middle section of the curve; and 2) similar flows over an equal time period, in this case four years. The periods analyzed were 1926-1929, 1945-1948, 1958-1961 and 1977-1980. For clarity, only two of the four curves are shown in Figure 8c, although the omitted curves fit within the curves shown. Note the disparity between the two curves, suggesting greater maintenance of base flow during 1926-1929. This is consistent with casual observations that streams in northeastern Missouri flood and dry up with greater frequency today than in years past.

The 90:10 ratio, determined by computer-generated flow data ending in 1985, is 2.2 cfs:539 cfs or 1:245. This is a relatively low ratio, indicating great variance in flow. Flood frequency data show the 2, 5, 10, 25, 50 and 100 year floods to be 6,000, 9,950, 12,600, 15,800, 18,200 and 20,400 cubic feet per second, respectively (Hauth 1974).

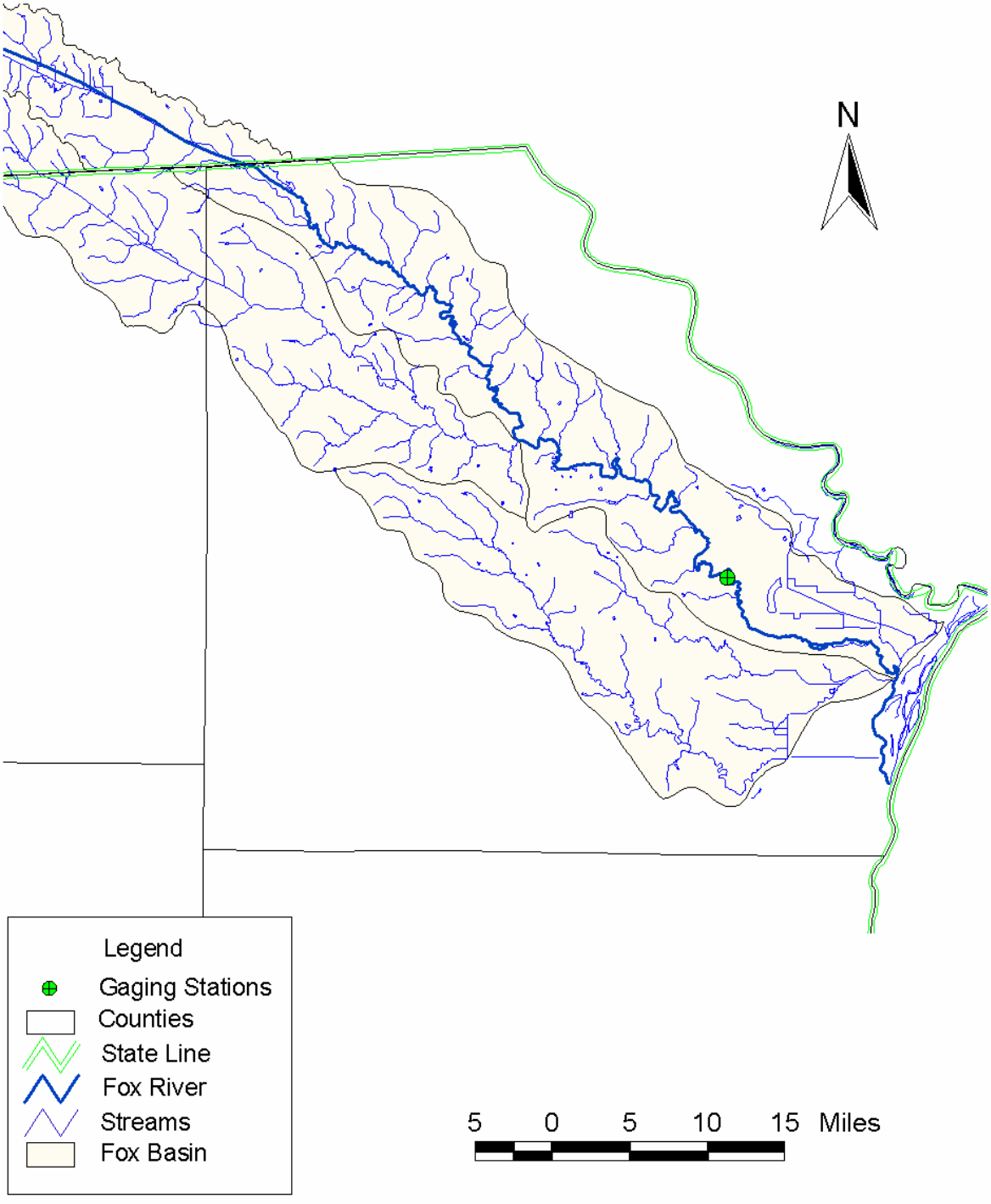


Figure gs. Gaging stations in the Fox River Basin, in Missouri.

Figure 6. Relationship of precipitation to streamflow in the Fox River (from Gann, et. al. 1971). Precipitation during the summer months, when evapotranspiration and soil-moisture requirements are greatest, is seen to have less effect on streamflow and the water table than does precipitation during the spring.

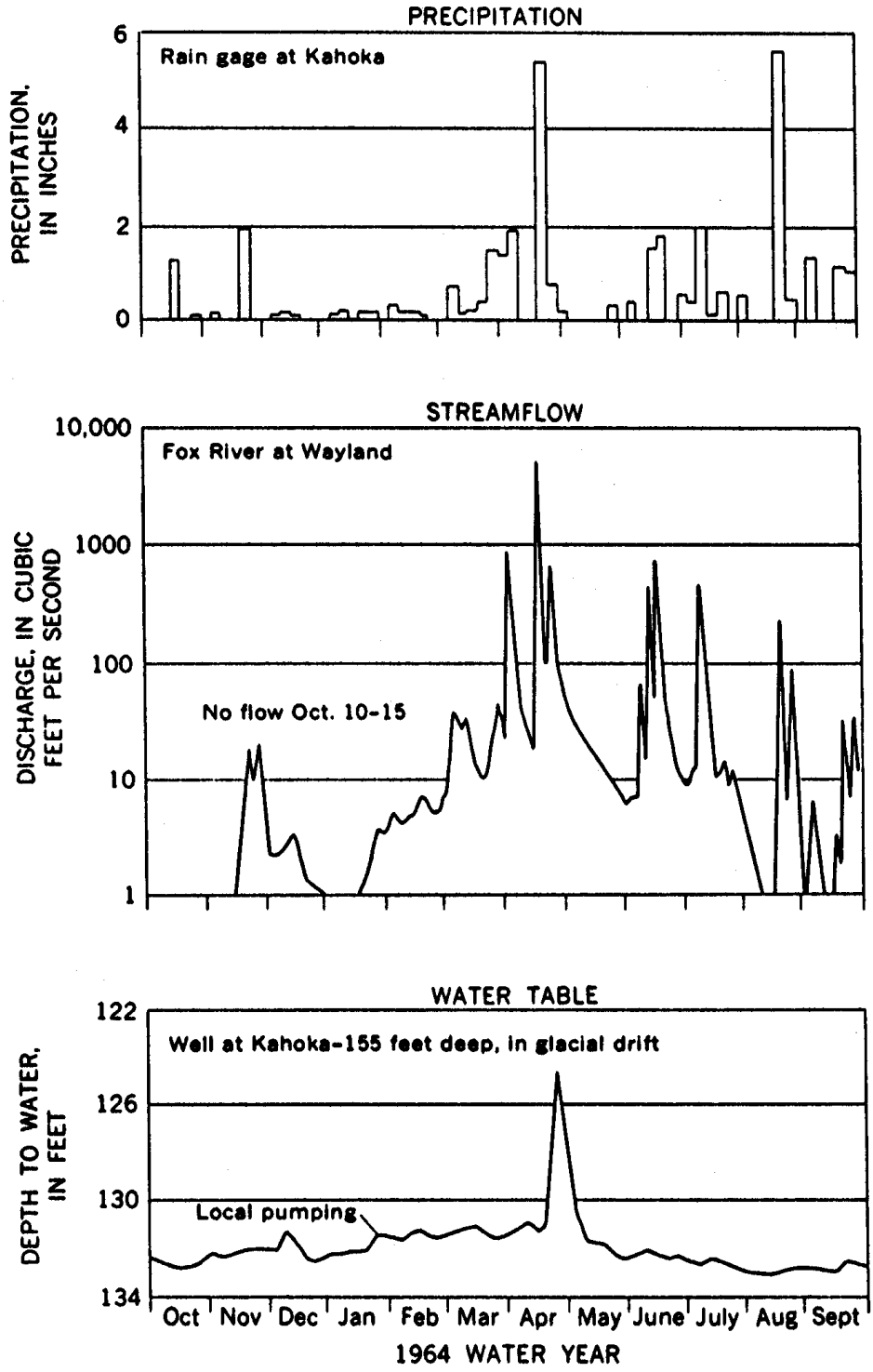


Figure 7. Cumulative average flow of the Fox River, 1922-1988.

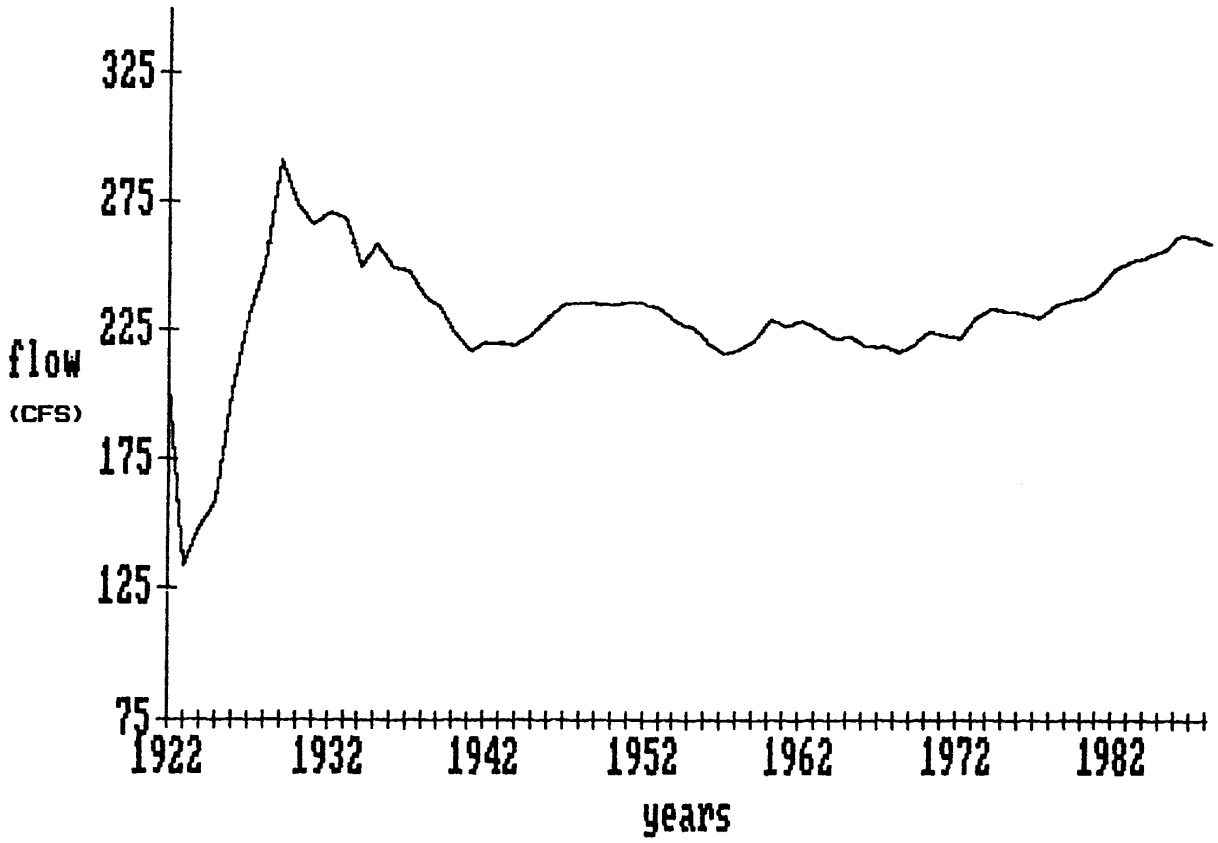


Figure 8a. Fox River duration curve

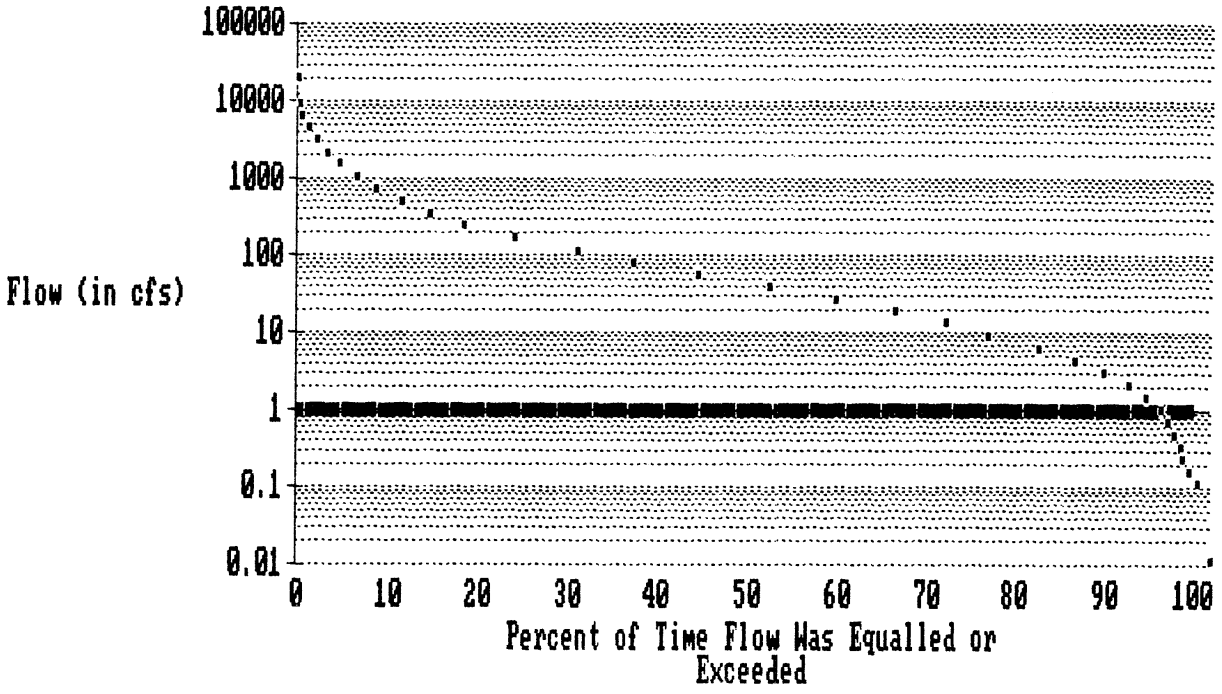
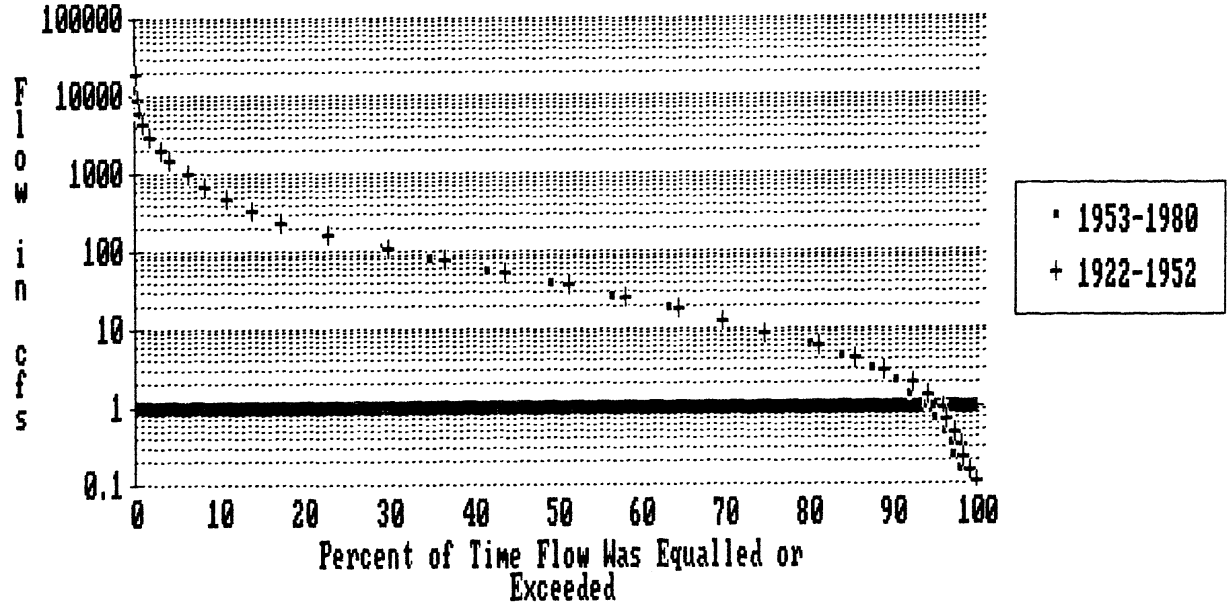


Figure 8b. Comparison of duration curves from two time periods in the Fox River basin.



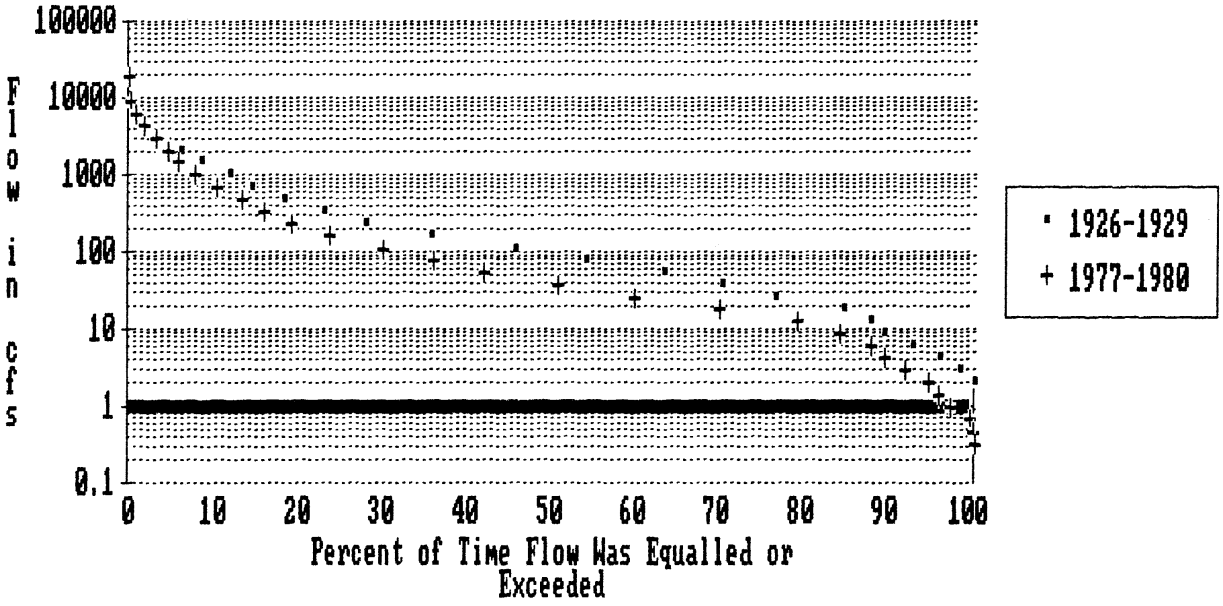


Figure 8c. Comparison of duration curves from two, four year high flow periods in the Fox River basin.