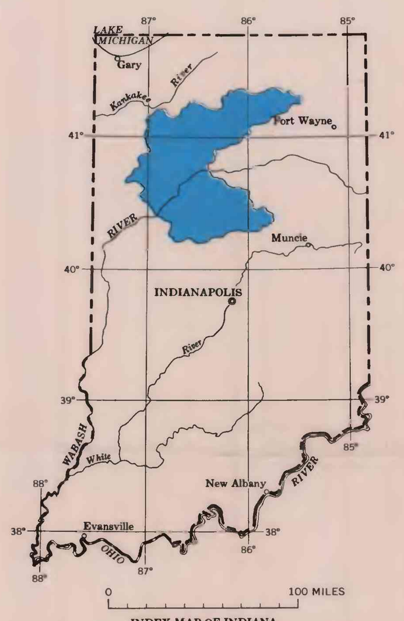
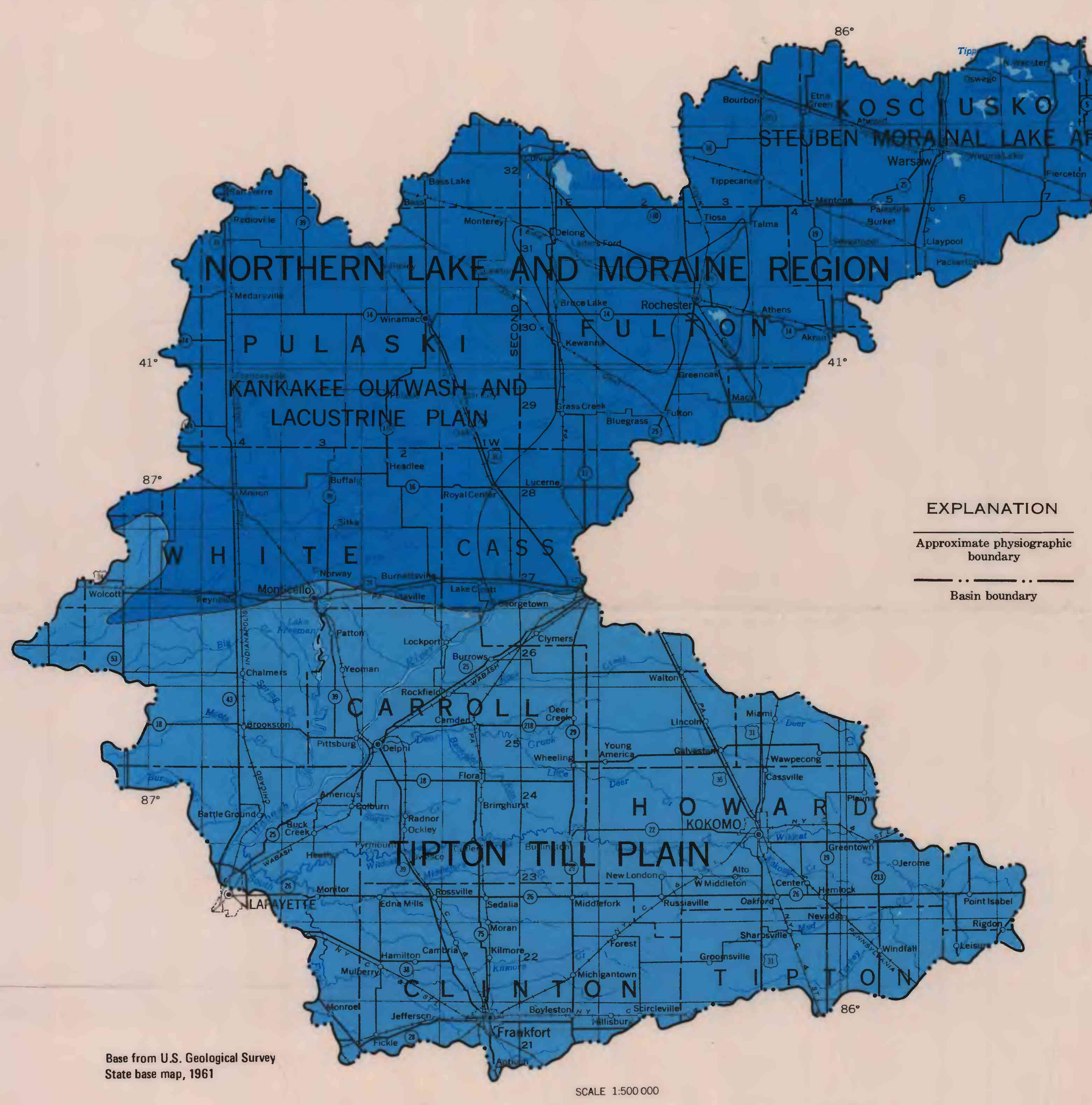
INTRODUCTION AND PHYSICAL SETTING



THE MIDDLE WABASH RIVER BASIN IS LOCATED IN NORTH-CENTRAL INDIANA



THE BASIN LIES IN TWO MAJOR PHYSIOGRAPHIC UNITS IN INDIANA: THE TIPTON TILL PLAIN AND THE NORTHERN LAKE AND MORAINE REGION

PURPOSE AND SCOPE

This report describes the availability, distribution, general use, and quality of water in the middle Wabash River basin, and defines the physical characteristics of the surface-water and ground-water systems in the basin. Emphasis has been placed on regional analysis of data in order to provide the water planner with a background of hydrologic information and relationships that he may apply in the solution of specific water-related problems. The data used in this report were provided by Federal and State agencies; in addition, some new data were collected during the course of the investigation. The reader is referred to the selected references for sources of additional information.

LOCATION AND EXTENT

The middle Wabash River basin consists of the area drained by the Wabash River and its tributaries from Logansport to Lafayette, an area of about 3,488 square miles in north-central Indiana. This area of the State is primarily an agricultural region, and is suitable for a variety of agricultural production including grain, livestock, dairy, and truck farming. The population in the basin is approximately 315,000 (1970 census); Kokomo and Lafayette are the principal manufacturing centers.

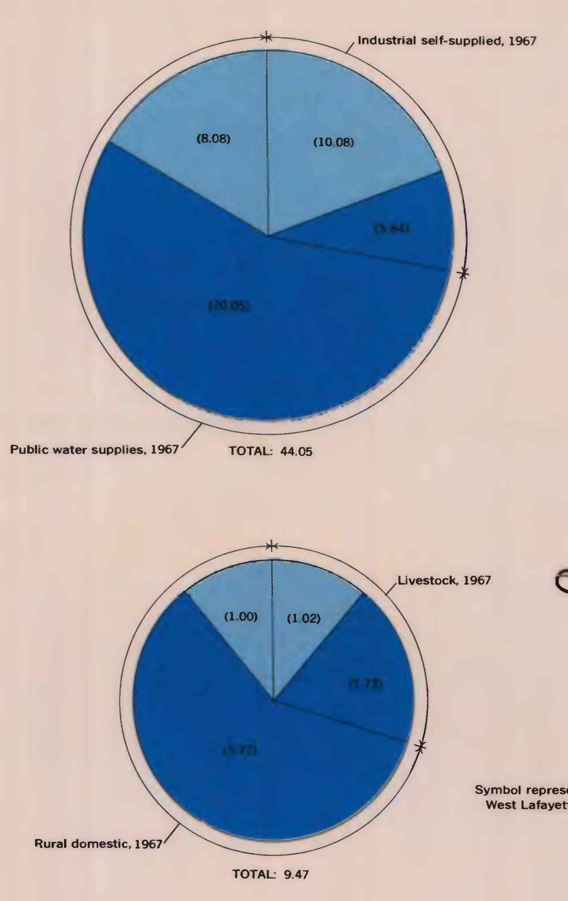
PHYSIOGRAPHY AND DRAINAGE

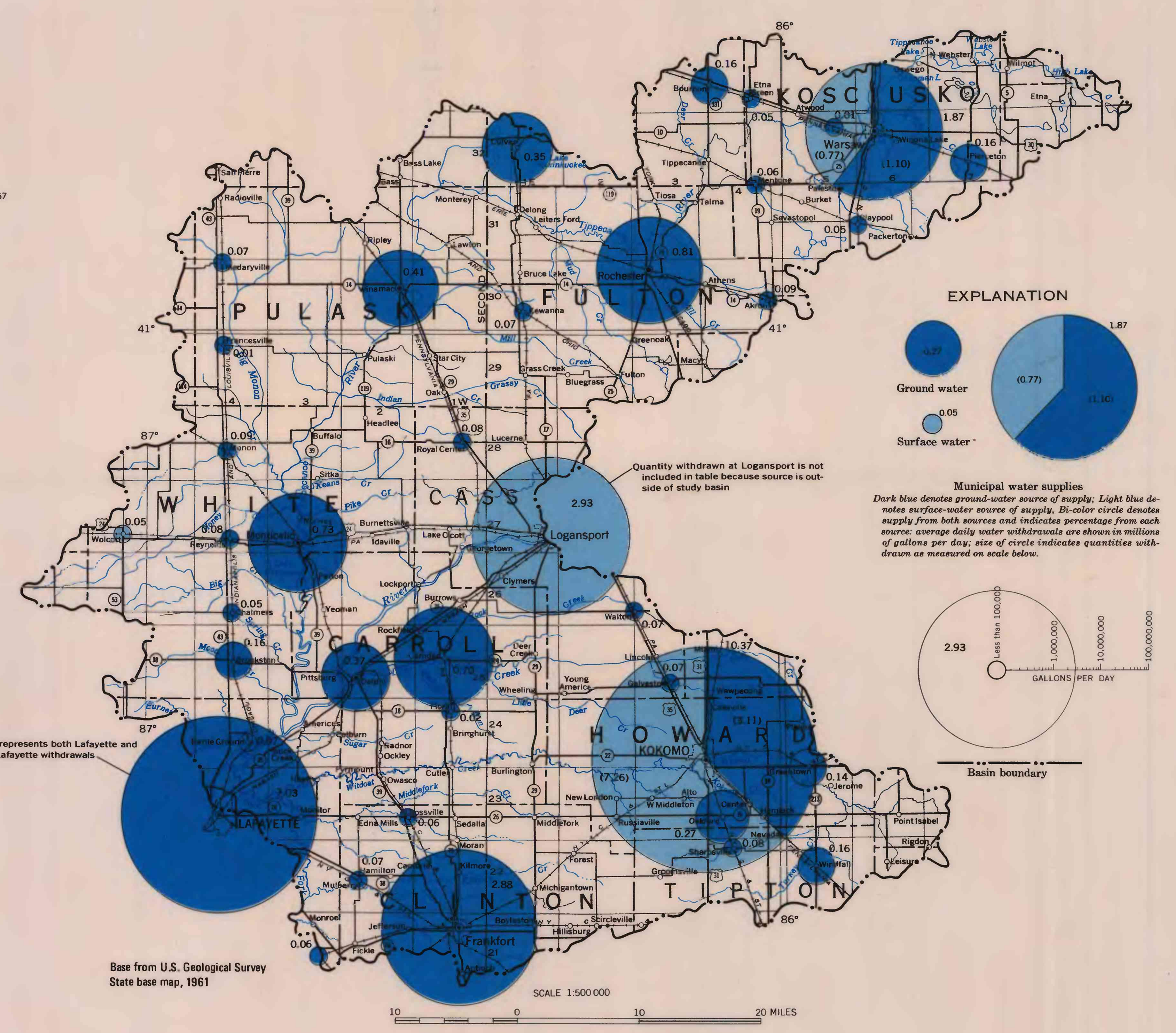
The middle Wabash River basin is part of the Central Lowlands Province (Fenneman, 1938). The topography within the basin is made up of a variety of landforms resulting from continental glaciation and postglacial erosion. The area lying generally south of the Wabash River is part of a broad nearly flat plain called the Tipton Till Plain (Malott, 1922). Relief is low and the plain has been only slightly modified by streams. The fine-grained clay-rich surficial materials overlying this area have allowed development of a fairly dense drainage pattern. Drainage divides are broad; some improvement in the natural drainage system has been necessary during agricultural development of the land.

The area north of the Wabash River is also of very low relief. This area lies within two parts of the subdivided Northern Lake and Moraine Region (Malott, 1922). The Kankakee outwash and lacustrine plain is composed of a variety of glacial and postglacial features: sandy lacustrine plains, valley trains, outwash plains, and dunes. The Steuben morainal lake area has some local unevenness of topography because of kettles and kame fields. Glacial lakes are abundant in the moraines and outwash plains. Coarse-grained and sandy materials overlie the Northern Lake and Moraine Region, where drainage is widely spaced and poorly developed. Many depressions in dune and moraine areas, formerly swamps and bogs, have been drained for agricultural production. The area's overall poor drainage features have necessitated extensive modification and improvment of the natural drainage system.

WATER WITHDRAWALS

AVERAGE DAILY WITHDRAWALS, IN MILLION GALLONS
Dark blue denotes ground-water supply.
Light blue denotes surface-water supply.





MORE THAN 53 MILLION GALLONS OF WATER IS USED ON AN AVERAGE DAY IN THE MIDDLE WABASH RIVER BASIN

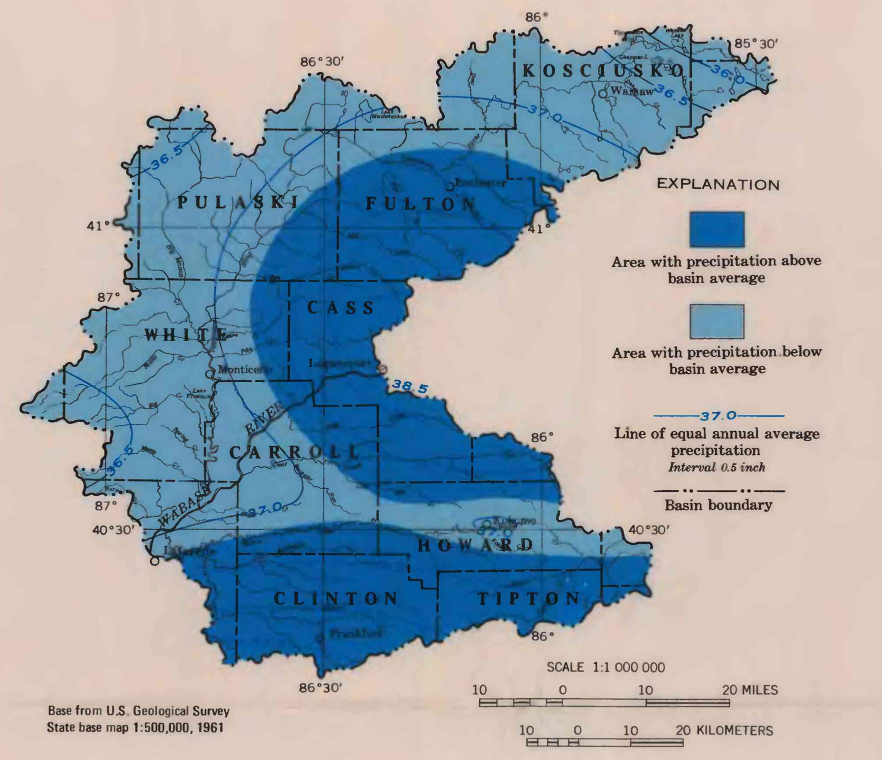
TOTAL AVERAGE WITHDRAWALS, IN MILLION GALLONS PER DAY (1967 DATA)
[Data compiled from U.S. Geological Survey, Indiana Dept. of Natural Resources, and Indiana State Board of Health records.]

SOURCE	PUBLIC WATER SUPPLIES*	INDUSTRIAL	RURAL	STOCK	TOTAL	PERCENT
Ground water	20.05	5.84	5.72	1.73	33.34	62.3
Surface water	8.08	10.08	1.00	1.02	20.18	37.7
Total	28.13	15.92	6.72	2.75	53.52	100.0

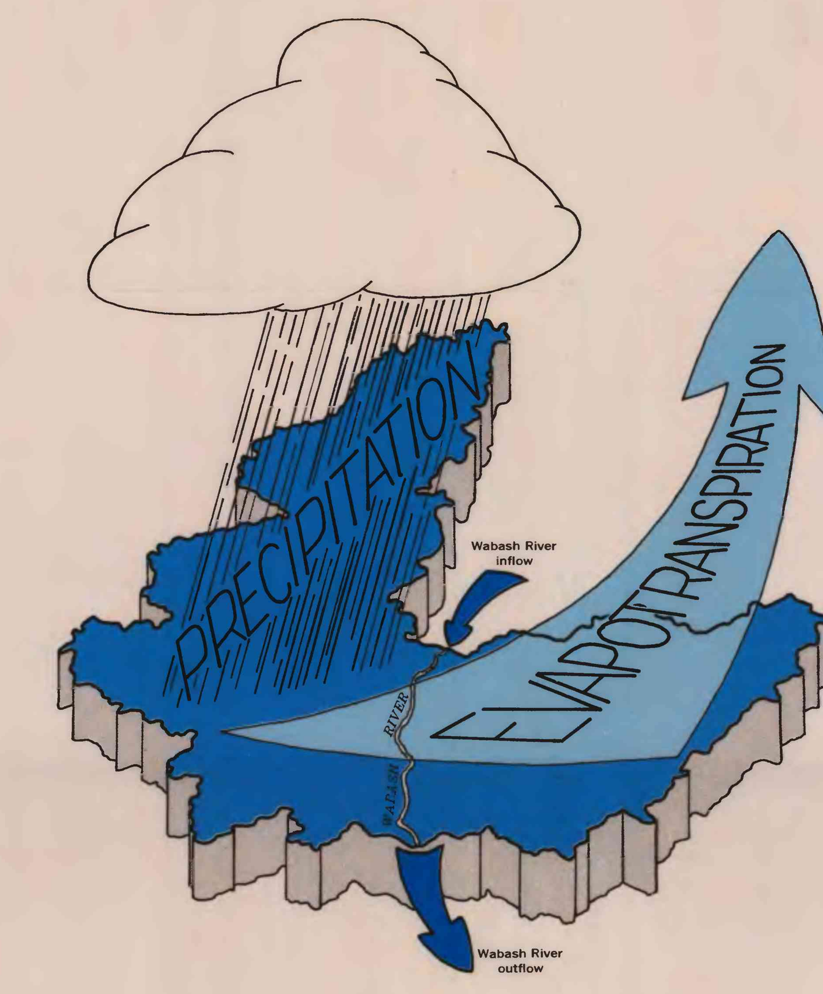
*Number of public water supplies: 38
Population served: 181,700
Average daily per capita use (public water supplies for basin): 155 gallons
Average daily per capita use (public water supplies for Indiana): 139 gallons

AVERAGE ANNUAL WATER BUDGET

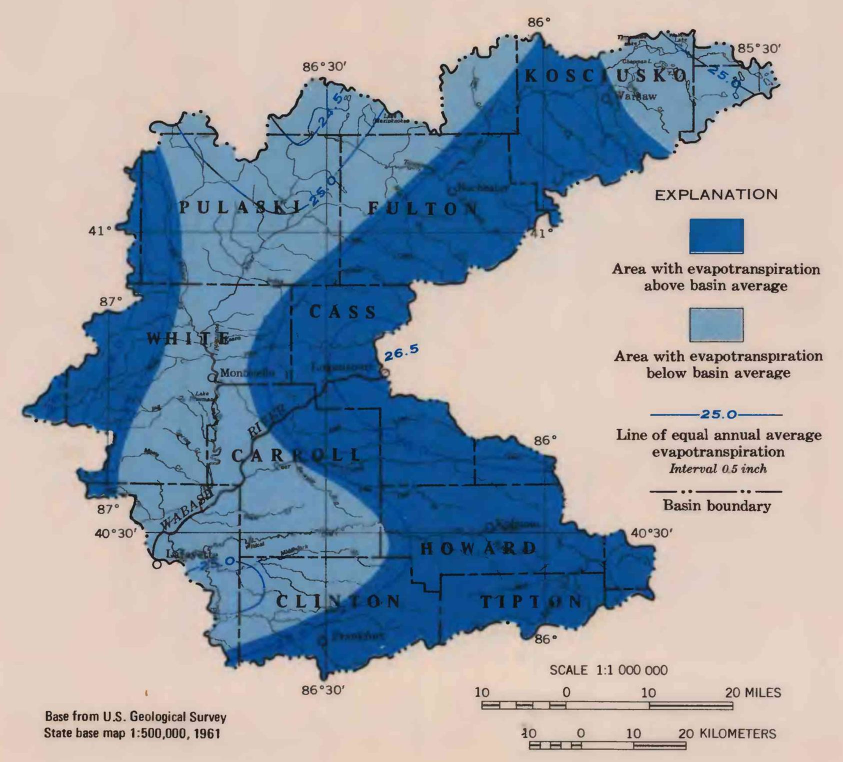
Based on index period 1945–69.



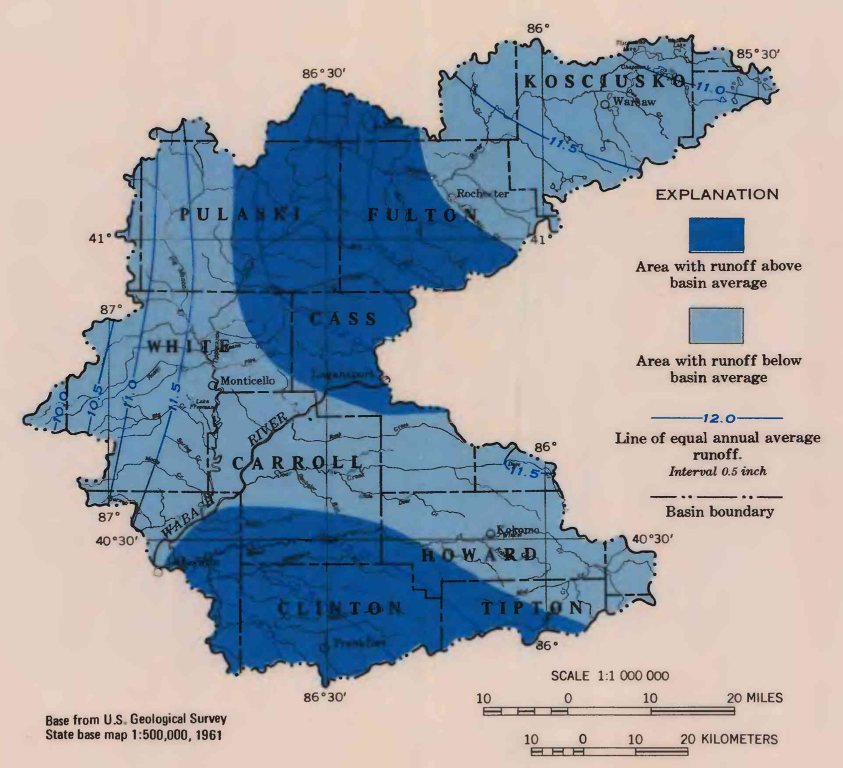
THE AVERAGE ANNUAL PRECIPITATION FALLING ON THE BASIN IS 37.24 INCHES, OR ABOUT 6,180 MILLION GALLONS PER DAY



MORE THAN 8 BILLION GALLONS OF WATER ENTERS AND LEAVES THE MIDDLE WABASH RIVER BASIN, ON THE AVERAGE, EACH DAY



THE AVERAGE ANNUAL EVAPOTRANSPIRATION LEAVING THE BASIN IS 25.44 INCHES, OR ABOUT 4,200 MILLION GALLONS EVERY DAY



THE AVERAGE ANNUAL RUNOFF FROM WITHIN THE BASIN IS 11.80 INCHES, OR ABOUT 1,980 MILLION GALLONS EVERY DAY

SIGNIFICANT WATER FACTS FOR THE MIDDLE WABASH RIVER BASIN

1. On the average, more than 8 billion gallons of water enters and leaves the middle Wabash River basin each day.
2. Under natural conditions, precipitation is the ultimate source of virtually all water in the basin. The average annual precipitation is about 37.24 inches, or about 6,180 mgd (million gallons per day).
3. Average annual streamflow originating within the basin is about 1,980 mgd. Of this amount about 1,150 million gallons (58 percent) is ground-water seepage into the streams.
4. Evapotranspiration, average 25.44 inches per year, is the largest single water withdrawal from the basin.
5. Total water withdrawl in the basin increased from about 25 mgd in 1940 to about 54 mgd in 1967. It is estimated that by the year 2020 about 215 mgd will be needed to meet the demand.
6. More than 62 percent of the water withdrawn in 1967 was ground water. About 52 percent of the total withdrawals was for public supplies, with the city of Kokomo the largest single user.
7. Productive aquifers underlie most of the basin. The valley train and outwash sand and gravel aquifers provide consistently high well yields, generally about 1,000 gpm. Indications are that two to three times this yield can be expected from properly developed wells in the sand and gravel aquifers in many areas of the basin. Bedrock aquifers underlying the southeastern part of the basin can be expected to supply 400 to 500 gpm from properly constructed wells.
8. About 6,000,000 million gallons of fresh water is in storage within the aquifers underlying the basin.
9. Natural ground-water movement within the basin is from the divide toward the Wabash River.
10. The average potentiometric surface is, in general, a subdued replica of the land surface. The altitude of the potentiometric surface is highest near the northeastern and southern basin divides and progressively decreases toward the Wabash River. The average annual fluctuations of the water levels range from less than 2 feet in the till areas in the north-central part of the basin to more than 20 feet in the alluvial aquifer along the Tippecanoe and Wabash Rivers.
11. Fluctuations of ground-water levels correlate closely with the cumulative departure from normal precipitation values.
12. All samples of fresh ground water analyzed from aquifers underlying the basin were of the calcium magnesium bicarbonate type, were very hard, and had a high iron content. Except for the iron content, which commonly exceeds the recommended limit, and the hardness, ground water is of excellent chemical quality for most uses.
13. Ground water is available from sources within the basin to meet all foreseeable future demands. However, farsighted planning, wise management, and efficient design of well fields are the keys to solving the problems that will arise as more and more water is withdrawn in the future to meet the demand when and where it is made.
14. The maximum observed discharge (131,000 cfs) in the basin occurred on the Wabash River at Lafayette on May 19, 1943.
15. The relative magnitude of floods on streams in the Tippecanoe River basin is less than that on the other tributaries in the basin.
16. On the average, a discharge of about 190 cfs can be expected to be equaled or exceeded about 90 percent of the time on the Tippecanoe River near Ora. A discharge of 89 cfs can be expected to be equaled or exceeded 90 percent of the time on Wildcat Creek near Lafayette.
17. Results of time-of-travel surveys show that at most flow rates the average velocity in the stream tends to increase as it moves downstream.
18. Travel times for peak concentrations of solutes are generally about 25 percent longer than travel times for the leading edges in the middle Wabash River basin.

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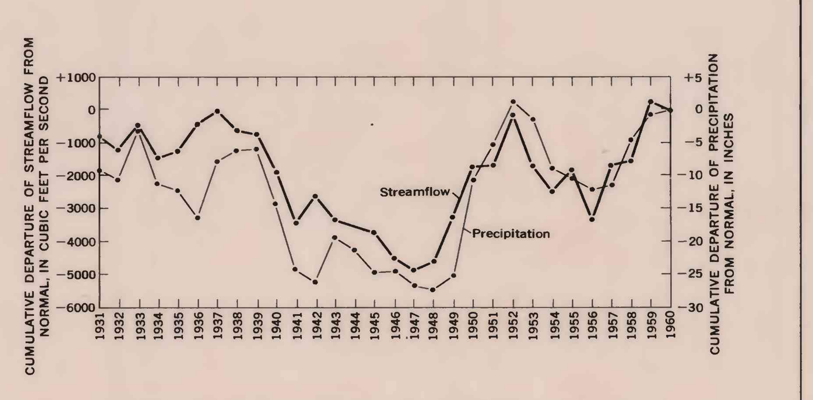
	Million gallons per day	
Water entering		
1. Precipitation	------	6,180
2. Wabash River at Logansport	------	2,080
Total	------	8,260
Water leaving		
3. Streamflow		4,060
A. Overland runoff contribution to streamflow	830	
B. Ground water contribution to streamflow	1,150	
C. Water flowing through the basin by way of Wabash River	2,080	
Subtotal	4,060	
4. Ground-water underflow	------	Negligible
5. Evapotranspiration	------	4,200
Total	------	8,260
Change in water in storage		Negligible

AS DETERMINED FROM THE AVERAGE ANNUAL WATER BUDGET FOR THE PERIOD 1945 TO 1969, ABOUT 8,260 MILLION GALLONS OF WATER PASS THROUGH THE BASIN EACH DAY



CUMULATIVE DEPARTURES FROM NORMAL OF BOTH STREAMFLOW AND PRECIPITATION ILLUSTRATE THE HIGH DEGREE OF DEPENDENCE OF BASIN OUTFLOW ON THE AMOUNT OF PRECIPITATION

INTERIOR—GEOLOGICAL SURVEY, WASHINGTON, D.C.—1974—W73064

WATER RESOURCES OF THE MIDDLE WABASH RIVER BASIN, INDIANA

By
James R. Marie and L. G. Davis

1974

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