SOCIOECONOMIC SETTING

The demand for water in the Maumee River basin is directly linked to the area's population, economy, and land use. Public water supply creates the greatest total demand for water in the basin. Water demand is also high for industrial purposes. In rural areas, water is needed primarily for domestic and agricultural uses.

POPULATION

In 1992, the *estimated* population of the Maumee River basin (349,523) made up over 6 percent of Indiana's total population (5,658,323). Of the portions of six counties that comprise the basin, 97 percent of the people lived within Adams, Allen, and DeKalb Counties. Allen County constituted nearly 80 percent of the population (figure 5).

About 61 percent of the basin's total population in 1992 lived in urban areas of at least 2,500 persons. The dominant urban center, Ft. Wayne, had 173,717 residents. Although a small portion of the city's western boundary lies outside the study area, the entire population is counted for purposes of this report. Other urban centers, including Auburn, New Haven, Decatur, and Garrett, all had between 5,000 and 10,000 residents; Berne and Butler had between 2,500 and 5,000 residents (U.S. Bureau of Census, 1993). Berne also has a small area of approximately three square blocks that lies outside the basin; but all of the populous are counted. In 1992, the remainder of the basin's citizenry lived in rural areas, which the U.S. Bureau of the Census defines as non-urban farm and non-farm areas of less than 2,500 persons.

Appendix 1 presents the historic and *projected* population totals for in-basin portions of the six counties incorporating the Maumee River basin. This appendix also lists entire county population data from the U.S. Bureau of Census. The Division of Water derived in-basin population values using these U.S. Bureau of Census figures. Since 1940, the total population of the Maumee River basin has nearly doubled. The most rapid increases in population occurred during the 1950s and 1960s. Though the basin's population growth rate has tapered off during the past few decades, it continues to rise and is projected to reach nearly 400,000 by the year 2030.

Adams, Allen, and DeKalb Counties comprise 87 percent of the Maumee River basin's total area. Allen County, which constitutes only 39 percent of the total basin area, has a population that effectively quadruples that of Adams and DeKalb Counties combined (figure 6). The remaining three counties, Noble, Steuben and Wells, have less than one quarter of their territories lying within the basin and no urban areas within basin boundaries.

Figure 7 displays the vast population differences between Ft. Wayne and the remaining urban areas as reported in the past and projected into the future. Ft. Wayne continues to be the largest urban center in the region and the second largest in the state. Since 1940,

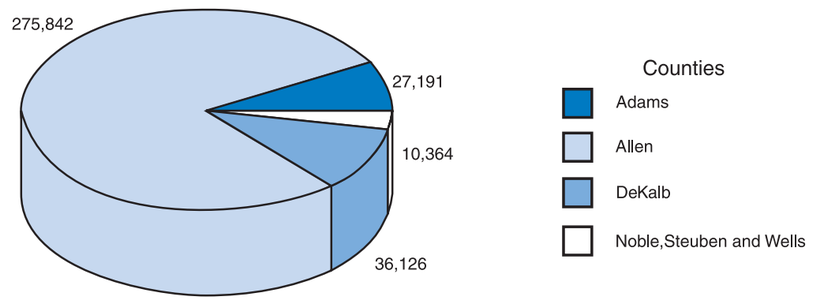

Figure 5. In-basin population estimate for 1992

Ft. Wayne has increased in population by 46 percent. If trends continue as forecasted, it should have over 308,000 persons by the year 2030. As a consequence of Ft. Wayne's rapid industrialization, the neighboring city of New Haven experienced a notable transformation; the population nearly quadrupled from 1940 to 1990 (appendix 2). In the past five decades two other rapidly-growing cities in the region have been Auburn (73 percent increase) and Berne (72 percent increase). All the urban areas are expected to continue growing well into the next millennium.

ECONOMY

Economic activity within the Maumee River basin is an important factor determining water use; different types of enterprise have different water resource requirements. In turn, the availability of water resources dictates which industries locate in an area. The number of residents employed and the proportion of county earnings produced by an industry measure a region's economic dependence on said industry.

Economic data for the major counties of the basin were obtained, unless otherwise noted, from a computerized database (STATIS) maintained by the Indiana Business Research Center. The following basin discussion refers to the three major counties, Adams, Allen and DeKalb, in their entirety, and thus includes areas lying outside the basin boundary.

The labor force consisted of 194,680 persons in 1990, over 80 percent of which resided in Allen County. Of the individuals over the age of twenty-five, 80.3 percent had completed high school, and 17.5 percent had earned a bachelors degree. Both of these figures are above the state averages of 75.6 percent high school completion and 15.6 percent bachelors recipients (table 2).

The basin's unemployment rate rose from the 10-year low of 4.9 percent (1988), to average 6.8 percent by 1992. This rate was only slightly higher than Indiana's 6.5 percent and below the national average of 7.4 percent. An 11.4 percent unemployment rate for DeKalb County in 1983 was the decade high for the basin (figure 8). DeKalb continued to have the most volatile unemployment percentages, spiking to 7.5 percent in 1987 and remaining above both the state and national averages for much of the 1980s. By the end of the decade, Adams County assumed the dubious distinction of having the highest unemployment rate, leaping from 5.1(1989) to 7.5 percent (1990), then continuing to rise well above the state and national percentages. Allen County however, had the largest number of unemployed persons of the three major

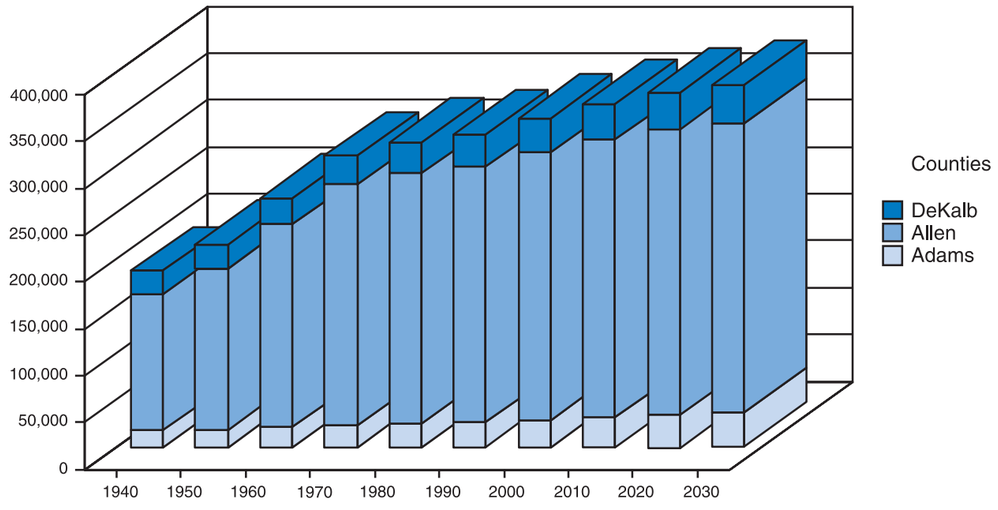

Figure 6. Historic and projected in-basin population of the three most populous counties

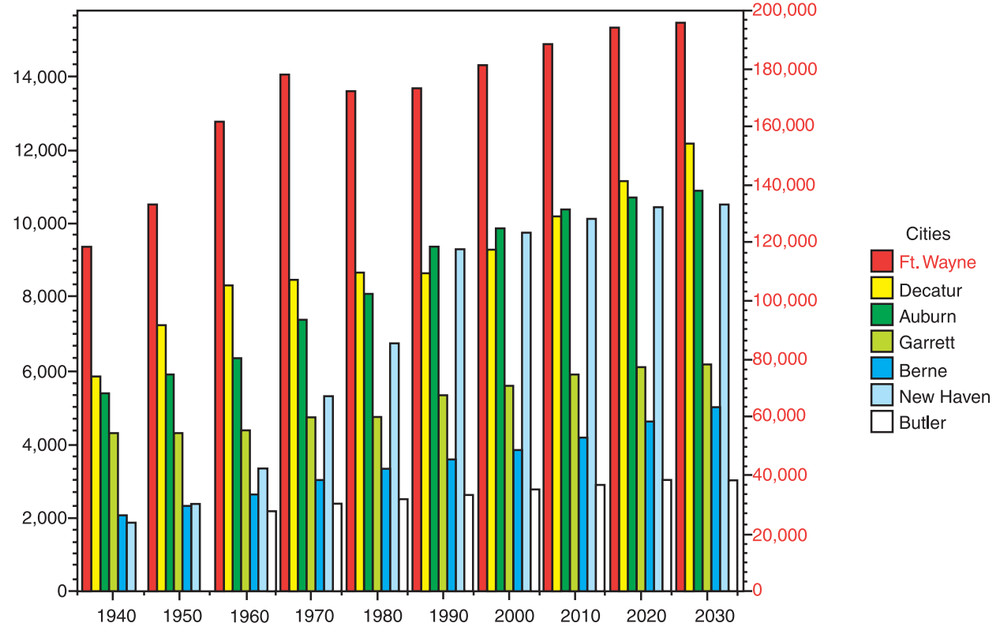

Figure 7. Recent and projected population for selected cities and towns

counties, with an average of over 10,000 in 1992 (table 3).

In 1992, the estimated per capita income within the basin averaged 97.2 percent of Indiana's; but, Allen County's per capita income of $20,754 exceeded the state average of $18,384. Allen County led the basin and Indiana in average per capita income from 1985 to 1992. Figure 9 shows the upward trend of per capita income for the three major counties in the basin and Indiana. The number of persons living in poverty grew from 28,675 in 1980 to 29,206 in 1990, but the percentage of those living below the poverty line remained nearly constant at slightly more than 8 percent.

Between the second quarter of 1979 and the third quarter of 1990 employment in Indiana rose 14.1 percent, while the *real payroll* increased by only 3.8 percent. Statistics for the counties within the basin were highly variable. DeKalb excelled with an employment increase of 43.6 percent and real payroll increase of 32.5 percent, while Allen and Adams had employment increases of 15.2 and 9.5 percent, respectively. Allen County had a real payroll increase of 5.5 percent, but Adams County had a real payroll decrease of 0.4 percent. The basin fared above the state average with an employment increase of 22.8 percent to Indiana's 14.1 percent, and a payroll increase of 12.5 percent to Indiana's 3.8 percent (Guthrie and Ludwin, 1992). The basin's upward employment trend continued as 30,000 non-farm jobs were added to the Fort Wayne area between the first quarter of 1991 and the first quarter of 1994 (Guthrie, 1994b).

The percentage of county workforce employed by, and the individual earnings from each economic sector in 1992 are shown in table 4. The service industry employed the largest number of individuals (61,879) and had the second highest earnings, $1.281 billion. Wholesale and retail trade ranked second employing 56,291 and having the third highest earnings of $940 million. Manufacturing and government rounded out the top four employers with 52,556 and 21,469 workers and posted earnings of $2.003 billion and $527.7 million, respectively. Together, these four industries accounted for 75.7 percent of the total employment

History of the economy

Because of its water resources, the Maumee River basin has been an important economic center in northeastern Indiana for thousands of years. Even before the advent of European immigration, Native Americans had been in the region for nearly 10,000 years, migrating into the area after the retreat of the last glaciers. Prehistoric trade routes passed through the area, bringing such valuable commodities as copper from the Upper Peninsula of Michigan, obsidian from Wyoming, and mica from the Carolinas. Cultures flourished in the Maumee River basin while much of Europe was in the darkness of the Middle Ages.

The portage between the St. Marys and the Wabash Rivers was widely known and used by the indigenous peoples of North America. It was first mapped by the French explorer Samuel de Champlain, who included it on his 1632 map of the Great Lakes. The French explorer LaSalle is credited with discovering that the Maumee-Wabash route from Lake Erie to the Mississippi River was the shortest route with the shortest portage between the Great Lakes and the Gulf of Mexico. The portage was eight miles long.

In the 1670s French fur traders established a settlement near present day Fort Wayne. This was a financial gain, but a cultural loss for the tribes living in the area. The French aided the Miami and Ottawa Indians in reestablishing their claim on the Maumee River headwaters. Together they pushed back the Iroquois who had themselves been displaced by settlers further to the east. The French formed profitable trade alliances with the Native Americans, shipping their wares to Quebec, New Orleans, and beyond. But the interest in the portage and the financial benefits of possessing it led to increased skirmishes between various tribes and their European allies.

Possession of the area changed many times, until the fledgling American government sent in General "Mad" Anthony Wayne to evict the Natives and their allies. In 1794, at the Battle of Fallen Timbers, General Wayne's victory brought the area under American control for the first time. Fighting for command of this course from the Great Lakes to the Ohio River continued until the Treaty of St. Marys in 1818. Following the signing of the Treaty, the military fort closed and a cavalcade of settlers came into the region.

The city of Fort Wayne was established with the sale of the first plat of land in 1823. The Indiana General Assembly created Allen County the following year. Clearing the forests and draining the land enabled farming to become the principle enterprise. Fur trapping and trading quickly diminished because the animals' habitat was diminished. Around Fort Wayne, saw mills were built to process the lumber and grist mills for the grain; both depended upon power from the waterways. In 1843 the Wabash and Erie Canal was completed, which allowed boats to travel from Lake Erie via Fort Wayne to the Ohio River at Evansville. The canal afforded more timely shipping of products from the region to Eastern markets. Between 1850 and 1860 Fort Wayne's population doubled and capital investment nearly quadrupled. Heavy industry, foundries, and the railroad quickly replaced pioneer enterprises.

Transportation was the key to development of the Maumee River basin, and no other mode of transport influenced the development of the area so powerfully as the railroads. Rapidly replacing the canal, the trains increased the convenience and economy of moving goods and services. The city of Garrett in DeKalb County was named after its founder and railroad company president, John W. Garrett. The railroad was the catalyst of rapid expansion of the Fort Wayne area into a commercial, industrial, and cultural community. Local ingenuity has kept the basin economically aggressive and at the forefront of progress.

The Maumee River basin has been the sight of many inventions and innovations during the nineteenth and twentieth centuries. The arc light, the first contained washing machine, baking powder, the gas pump, and the first gas pump that could accurately measure the amount of gas dispensed and give the price in dollars and cents—all these were invented in the basin.

Perfecting the wire-making process brought in several wire companies, and within twenty years the area was the world center for the production of magnetic wire (Maumee River Basin Commission, 1993). Companies like General Electric and Magnavox led the industry in production of electric motors, transformers and various other electronic gear. The Auburn Automobile Company produced more than twenty different makes of automobiles in DeKalb County until the Great Depression effectively halted production.

Devastating most of the country, the Great Depression left the Maumee River basin relatively unscathed. Other than the closing of the Auburn automobile facilities, most of the area's factories, industries and other businesses saw less decline than the rest of the country. In fact, during this period companies like Zollner Piston and Central Soya moved into the basin. Community arts and entertainment flourished with the rise of theaters like the Paramount, Palace, Jefferson, and Embassy.

World War II demanded the conversion of many consumer industries into war-time industries. General Electric made superchargers for bombers; Magnavox created many of the Allied automatic weapons and submarine detection equipment; and Tokheim & Wayne Pump built bombs. Following the War, the Maumee River basin had a substantial industrial base to carry it into the modern era. During the 1950s and 1960s the infrastructure of super highways and the prevalence of personal transportation dispersed the population from the cities to the suburbs, modifying the countryside.

earnings of the three major counties in the basin.

From 1979 to 1989, Indiana experienced a nearly 80 percent increase in agricultural services' employment. During that same decade, the service industry rose 50 percent; and the wholesale and retail trade sector grew 30 percent. Manufacturing however, decreased employment statewide by over 10 percent, even though the actual number of businesses rose over 20 percent (Marcus, 1992).

Figure 10 represents employment totals and earnings for the major sectors within the basin from 1985 to 1992. During this period agricultural services had a 65 percent employment increase, and earnings doubled; but this earnings figure represents only 0.5 percent of the basin's total earnings for 1992 (table 4). Other significant earnings increases occurred in the finance sector which doubled, and in service which rose nearly 90 percent. The only industry showing an earnings loss was mining which fell less than 4 percent. The only employment losses occurred in farming and mining; both were down nearly 25 percent. Unlike state trends, manufacturing employment rose in the basin by over 6 percent and earnings rose nearly 45 percent. Manufacturing is the largest financial

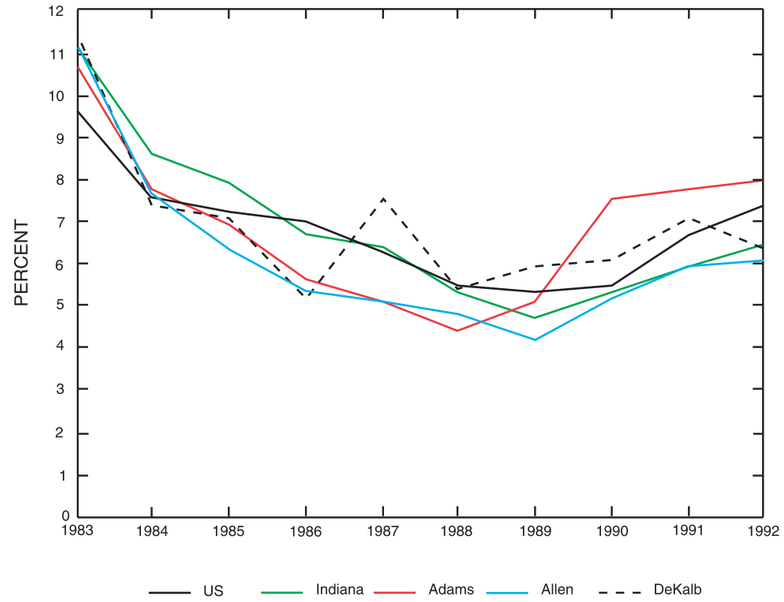

Figure 8. Average unemployment rate

concern in the basin.

The predominant manufacturing groups were machinery, fabricated metal products, food and kindred products, and printing and publishing (Maumee River Basin Commission, 1993). It may appear that the basin is not reliant upon the vitality of the auto industry based upon the low number of auto industry jobs (7,800 in 1980). On the contrary, much of the output from other manufacturing industries is auto related, and many auto component operations located outside the basin fall within its economic sphere. Manufacturers in Fort Wayne produce axles, tires and pistons; in Huntington, wheels; and in Auburn, windshields. The auto/light truck manufacturing sector remains one strength of the Maumee River basin.

In reports for the Indiana Business Review, Thomas Guthrie traced the Fort Wayne economic sphere's development. He noted the difficulties created by the transplanting of Japanese auto/truck assembly operations to plants in North America (Guthrie, 1989). The

Table 2. Educational enrollment and attainment

{Values, for entire counties, are for 1990.}

	Enrollment		Attainment		
	School (age 3+)	College	Persons aged 25+	High school diploma (%)	Bachelors (%)
Indiana	1,436,188	364,219	3,489,470	75.6	15.6
Adams	7979	1156	18,119	74.4	10.7
Allen	80,225	18,827	187,856	81.2	19.0
DeKalb	8630	1257	21,801	77.5	9.9

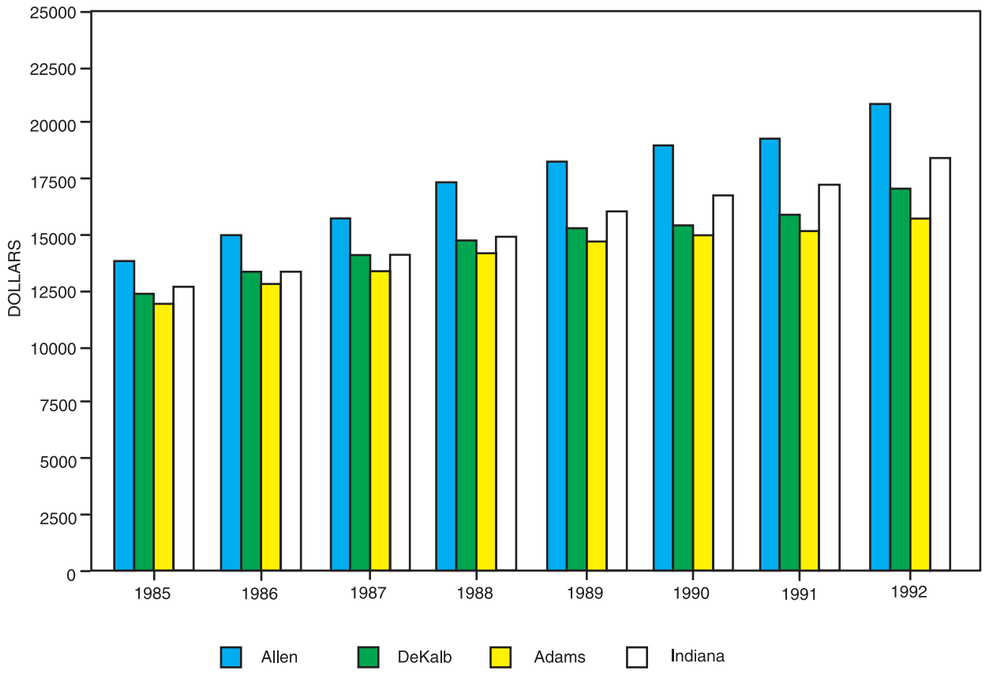

Figure 9. Per capita income

parts required for assembly were imported from Japan, and the final products were in direct competition with American automobiles. By 1993, this situation had changed. The Economic Strategy Institute estimated that when running at full capacity, the Big Three auto makers produced a small car at a lower cost than the Japanese. It also became less expensive to buy parts from original equipment manufacturers (OEM) than to ship them all the way from Japan. This encouraged the Japanese transplants to buy American products. With northeastern Indiana leading the state in OEMs, this produced an economic surge in the basin's manufacturing economy that surpassed the state economy (Guthrie, 1992). With the dollar's weak standing compared to the yen, the market for goods from OEMs should continue to give the basin manufacturing sector a marked boost.

Agriculture has historically played an important role in Indiana's economy. Even with the decline of acreage used in farms, Indiana income derived from farm marketing for 1993 totaled $5.1 billion in cash receipts, an increase of 14 percent from 1992. Nationally, Indiana ranked nineteenth in number of milk cows, sixteenth for wheat production, and seventeenth for oats production. Corn was Indiana's largest cash crop in 1993.

Maumee River basin corn production (17,904,000 bushels) ranked in the lower third or 2.5 percent of the state's total. Wheat, oats, dairy cows and dairy products were the region's major contribution to Indiana's agricultural economy. On the whole, milk products were the state's fifth leading contributor to farm income with $285 million in cash receipts. In the basin, dairy cows numbered 13,100 head producing 218,151 pounds of milk and milk products. Wheat and oats production was at 3,015,000 and 321,800 bushels, respectively (U.S. Bureau of Census, 1994). In 1992, within the three major counties of the basin, over 600,000 acres were in farms (table 5) producing nearly $27 million dollars in earnings.

The future of the Maumee River basin economy rests heavily upon the shoulders of continued innovation and invention. As during the mid to late nineteenth century (see sidebar entitled **History and the economy**), it will take ingenuity to overcome the economic obstacles ahead.

One problem identified for Indiana by the Indiana Department of Commerce, 1986, is the internationalization of standardized manufacturing processes. With the basin's historic and current dependence upon manufacturing, internationalization threatens to alter the current economic stability of the region. Increased worldwide competition in manufacturing leads to the movement of mature, standardized products and jobs

Table 3. Average number of unemployed and unemployment rate

{Values, for entire counties, are for 1992.}

County	Number		Rate	
	Average	Range	Average	Range
Adams	1155.0	960-1440	8.0	6.9-9.9
Allen	10,035.8	8580-12,560	6.1	5.3-7.7
DeKalb	1258.3	1090-1520	6.4	5.6-7.7

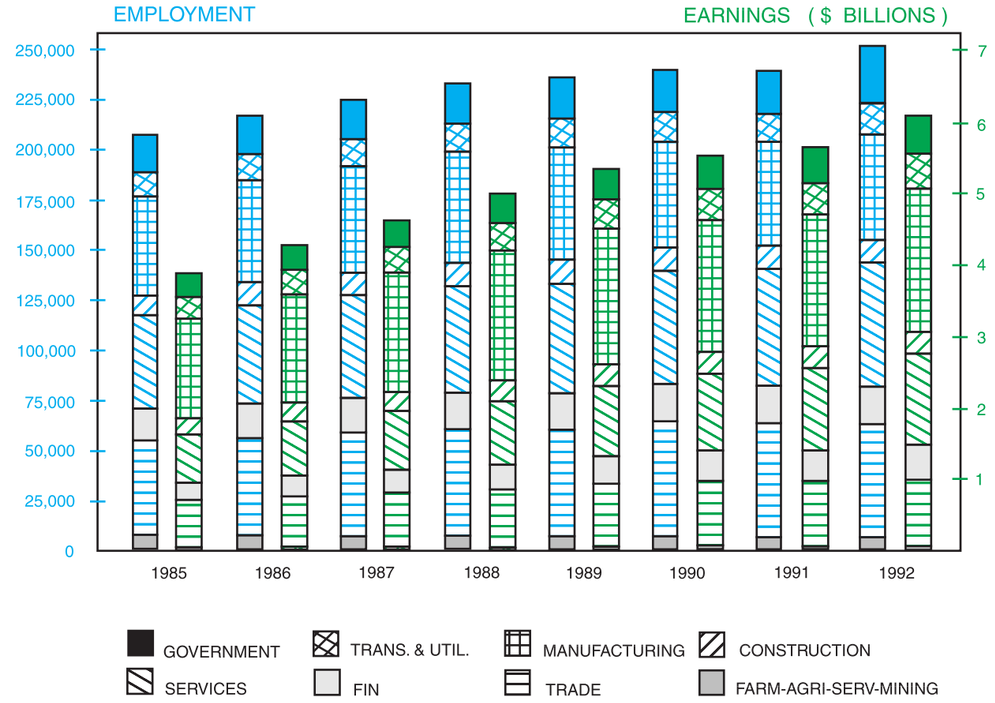

Figure 10. Employment and Earnings

Table 4. Employment and earnings by industry

{Values, for entire counties, are for 1992.}

Column headings are abbreviated as follows: Agri-Serv, agricultural services, forestry, fisheries and others; Trade, wholesale and retail trade; Fin, financial, insurance and real estate; Serv, services; Const, construction; Manuf, manufacturing (durable and non-durable); Trans-Util, transportation and public utilities; Gov, federal civilian, federal military, state and local government.

County totals may not equal 100 percent because of differences in rounding and/or because data were not available (NA).

County	Farm	Agri-Serv	Trade	Fin	Serv	Mining	Const	Manuf	Trans-Util	Gov
Employment (as a percent total)										
Adams	7.8	1.3	17.3	3.5	14.3	0.2	NA	33.4	2.2	10.6
Allen	0.9	0.7	24.1	8.2	26.9	0.1	5.1	18.3	7.0	8.6
DeKalb	4.5	0.8	15.9	3.4	17.5	0.2	3.5	43.1	2.4	8.7
Earnings ($000)										
Adams	7366	3352	32,454	6931	32,738	1089	NA	161,950	8764	35,319
Allen	3939	21,454	866,094	471,475	1,194,633	4987	294,383	1,541,589	467,917	453,103
DeKalb	3177	2169	41,525	7183	54,127	1518	13,354	299,181	13,408	39,287

to countries where production costs are lower.

One exception to this trend is the return to dominance of the American car/light truck industry. For the last few years, sales have increased and projections look bright for the near future (Guthrie, 1994b). Today, the Big Three auto makers can produce a small car, and many of its component parts, for less money than their foreign competition. This combined with a more open trade policy, falling interest rates, and a stable-to-falling exchange rate appears critical for a favorable basin economy.

The ability of companies to research and develop new products will largely decide the basin's economic future. As jobs are lost in manufacturing, displaced workers will be competing for non-manufacturing positions. Because many of the manufacturing jobs are high- paying and require little advanced education, displaced workers who move into other sectors may find it difficult to maintain their income levels (Indiana Department of Commerce, 1986).

Though the Fort Wayne area is ranked fourth in percentage of population with higher education, it has a small university/faculty population. The area ranks at the top of every educational factor, except the student to teacher ratio; the region might enhance its position by expanding the educational opportunities afforded by large four-year institutions. For the economic prosperity of the basin, expansion of the educational base may be necessary. The ties of education to economic development include productivity, quality of life, and the development of new knowledge with applications to business and industry. These are important not only to companies considering relocation, but also to current enterprises facing stiffer competition at home and abroad. Secondary education prepares workers for the current job; post-secondary, for the challenges of future technologies.

The Maumee River basin stands poised, ready to address economic expansion. Geographically, the region sits in an optimum zone for the movement of goods and services between the Midwestern and Eastern markets. The Fort Wayne area is highly accessible with two thousand persons per mile of multi-lane, divided highway (1987 number, Maumee River Basin Commission, 1993). The placement of some interstate highways at the border of this region (away from regional population centers) makes them transregional carriers. Ample rail traffic exists with companies like Amtrak, Conrail, CSX, Indiana Hi-Rail, and Norfolk Southern providing the major cities of the basin with passenger and cargo service. Fort Wayne had the second highest number of *enplanements* in the state in 1988 (Indiana Department of Commerce, 1988). In 1991 alone, Fort Wayne International Airport serviced 300,000 customers (Maumee River Basin Commission, 1993).

A report by the Indiana Department of Commerce (1988) identifies the economic strengths and weaknesses and growth potential of 14 regions in Indiana. Although the findings of the study are regional, they provide an overview of the economic status of the basin and surrounding areas. The study concluded that Region 3 (Adams, Allen, DeKalb, Huntington, LaGrange, Noble, Steuben, Wells, Whitley Counties) is in an excellent position to experience economic growth.

This region exhibited higher than average results for nearly every economic development factor in the state. Its workforce was ranked fourth in the state in percentage of population with higher education, although it was the only region without a major university. Transportation remains near state averages. The region has the second highest per capita bank deposits, and ranks third in both the percentage of commercial/industrial bank loans and the percentage of commercial/ industrial loans to capital. Local government has the second lowest level of debt/lease obligation; per capita assessed property values and income levels are both above the state average. These two factors give government the opportunity to expand infrastructure funding. Environmentally Region 3 continues to meet all six EPA air quality standards for all types of pollution (Ken Ritter, Indiana Department of Environmental Management, oral commun., 1995). The region also has ample wastewater and solid waste disposal space for immediate new growth, though some smaller wastewater treatment facilities approach their capacity limit.

LAND USE

The landscape of the Maumee River basin today bears little resemblance to the natural landscape of pre-settlement times. Until the early 1800s, the basin was characterized by a vast sprawling forest of giant hardwoods and a wetland glacial-lake plain. Much of the eastern half of Noble County and most of DeKalb, Adams, and Wells Counties were occupied by beech-maple hardwood forest. Oak-hickory hardwood forest covered the western half of Allen County and most of Steuben County. The Three Rivers occupied a vast wetland lake plain. Two striking changes have occurred to the landscape since 1885, the replacement of extensive forests by cultivation and the elimination of natural ponding through organized drainage projects since 1885 (Lindsey, 1966).

The U.S. Geological Survey has produced a series of land-use and land-cover maps by using aerial photographs and other remotely-sensed data (Anderson and others, 1976). Land use refers to man's activities which are directly related to the land. Land cover describes the vegetation, water, natural surface, and artificial constructions at the land surface (U.S. Geological Survey, 1982a). It should be noted that only urban areas, bodies of water, gravel pits and certain agricultural areas of at least 10 acres are mapped. For other land use categories, the minimum mapping unit is 40 acres.

Figure 11 was produced from digital files of the U.S. Geological Survey land-use and land-cover maps using ARC/INFO geographic information system (GIS). The date of the aerial photography for the Maumee River basin is 1981; and although land uses have changed somewhat since the date of the photography, figure 11 provides a general picture of land use for the basin. Land uses in the basin were grouped into five general categories for illustrative purposes. Tabular data of acreage for each general category and numerous subcategories were also generated from the digital files (appendix 3). Higher resolution data on different types of land use may be obtained from other federal, state and local agencies.

In the Maumee River basin, agricultural land constituted approximately 88 percent of the land at the time of the aerial photography. Urban or built-up land accounted for about 7.5 percent of the basin's land area; forest land for nearly 4 percent; and water, wetlands and barren land for the remaining 0.5 percent. Since the aerial photographs were taken, the agricultural land acreage has decreased and the urban area has increased in the basin.

Agricultural land

The U.S. Bureau of the Census compiles and publishes land use data for agricultural land, which is designated as "land in farms". A farm is defined as any place from which the sale of agricultural products normally amounts to at least $1,000 during the census year.

Of the five agricultural land use categories defined by the bureau, the following four are mutually exclusive: cropland, woodland, other land, and land set aside in federal farm programs. The fifth category,

Table 5. Selected land use data for farmland

{Values are for entire counties.}

Total area: Acreages are from county land areas listed in U.S. Bureau of Census, 1994.

Land in farms, total cropland, total woodland, other land: upper numbers are for 1992; lower numbers are for 1987 (U.S. Bureau of the Census, 1994).

County	Total area (acres)	Land in farms		Total cropland		Total woodland		Other land	
		Acres	Percent of total area	Acres	Percent of farmland	Acres	Percent of farmland	Acres	Percent of farmland
Adams	217,198	197,724	91	181,238	92	8,499	4	7,987	4
		205,872		186,594		9,680		9,598	
Allen	420,662	285,730	68	257,177	90	16,117	6	12,436	4
		291,154		256,694		19,147		15,313	
DeKalb	232,259	153,213	66	131,593	86	12,527	8	9,093	6
		175,153		152,340		12,598		10,215	
Noble	263,125	184,118	70	154,213	84	15,356	8	14,549	8
		197,875		164,363		17,662		15,850	
Steuben	197,591	121,710	62	99,044	81	12,245	10	10,421	9
		132,099		106,514		13,610		11,975	
Wells	236,791	198,680	84	184,093	93	7,444	4	7,143	3
		209,261		189,705		9,495		10,061	

total pastureland, is the sum of cropland, woodland, and other land used for pasture or grazing.

Agricultural statistics published by the U.S. Bureau of the Census are available on a county basis, and thus include areas lying outside the Maumee River basin boundary. However, the data available for the six counties lying partially within the Maumee River basin provide a general overview of agricultural land use.

Table 5 presents county data for the three major land uses on farmland. Cropland accounts for an average of about 88 percent of total farmland in the six-county area. Most of the cropland is classified as harvested cropland, which includes not only land for field crops but also for orchards, vineyards, nurseries and greenhouses. Some small tracts of cropland are used for pasture, grazing, cultivated summer fallow, idle cropland or soil improvement crops. During the 5-year period between 1987 and 1992, cropland acreage showed a net decrease of approximately 4.5 percent.

Woodland accounts for an average of about 6.5 percent of all farmland in the six counties (table 5). Most woodland is used for woodlots, timber production and Christmas tree production.

Farmland designated as "other land" (table 5) constitutes about 5.5 percent of all farmland, and includes primarily land in house and barn lots, ponds, roads, ditches, and wastelands. It includes those acres in the farm operation not classified as cropland, pastureland, or woodland. It should be noted that some of the barren land and land in lots or roads which the U.S. Bureau of the Census considers as agricultural land may be classified and mapped as barren, non-agricultural land by the U.S. Geological Survey.

Data on timberland are available on a county basis from the U.S. Forest Service (Smith and Golitz, 1988). Timberland is defined as forest land producing or capable of producing crops of industrial wood and not withdrawn from timber utilization. Table 6 presents timberland data for the six counties in the basin. Because the tabulated values include not only forest land held for non-agricultural uses but also woodland in farms, there is some overlap between timberland values in table 6 and total woodland values in table 5.

The area of timberland reported in the U.S. Forest Service's 1986 inventory is greater than the area reported in a 1967 inventory (Smith and Golitz, 1988). An additional 18,000 acres of timberland are reported for the six basin counties. All of the counties except Allen and Wells show an increase in timberland acreage. The authors of the statewide survey attributed the higher timberland acreage primarily to reversion

STATE OF INDIANA
DEPARTMENT OF NATURAL RESOURCES
DIVISION OF WATER

MAUMEE RIVER BASIN

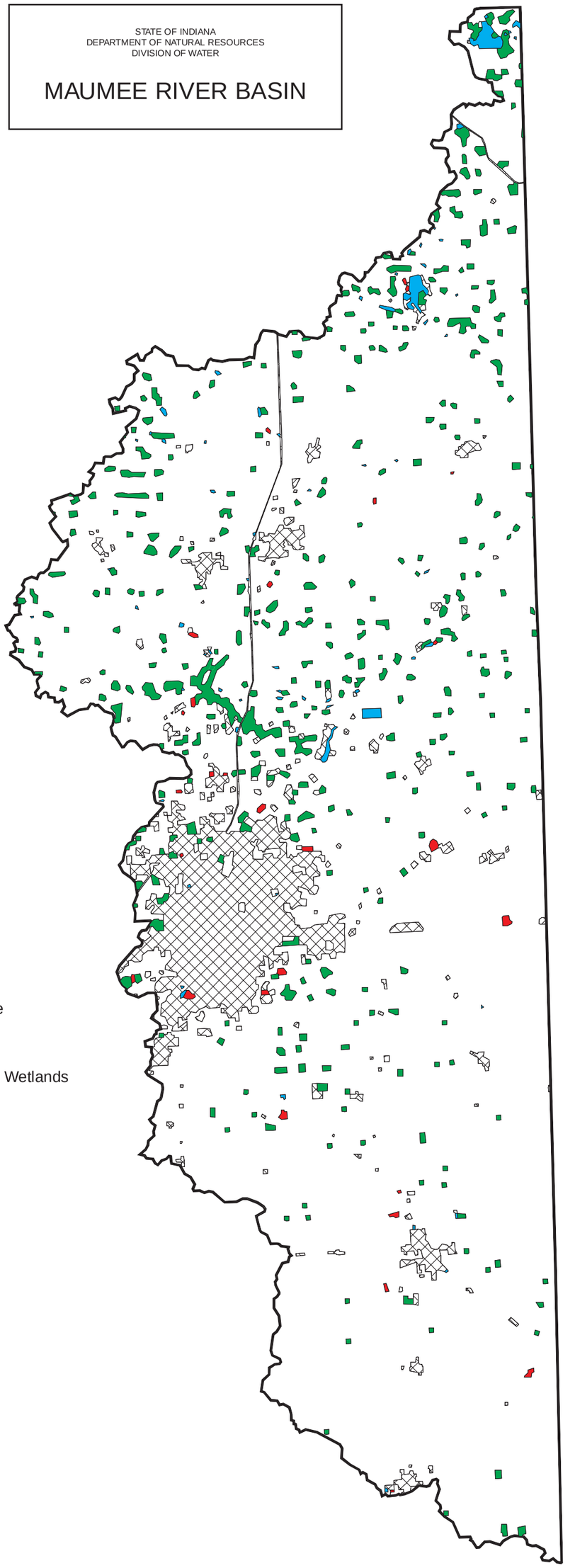

Figure 11. Land use and land cover
(adapted from U.S. Geological Survey, 1980-81)

of wooded pasture and marginal farmland.

Some areas mapped as cropland in figure 11 may be classified by the U.S. Fish and Wildlife Service as wetlands. Other areas mapped as forested wetlands may be classified by the U.S. Forest Service as riparian forest, or by the U.S. Bureau of the Census as wooded farmland. A discussion of wetlands and wetland classification used by the U.S. Fish and Wildlife Service is found in the **Surface Water Hydrology** chapter of this report under the subheading **Wetlands**.

Table 6. Area of timberland

{Values, for entire counties, are from a 1986 inventory report by Smith and Golitz, 1988.}

County	Acres	Percent of county area
Adams	14,200	6.5
Allen	30,500	7.1
DeKalb	27,400	11.7
Noble	33,600	12.2
Steuben	32,500	16.0
Wells	17,300	6.8

WATER USE OVERVIEW

The demand for water in the basin is influenced by a variety of factors including the level of urban and industrial development, the physical environment, and the hydrologic systems. A brief overview of current water use in the basin is presented below as a prelude to discussions of climate, geology, soils and hydrology. Details of current and projected water use are presented in the **Water Resource Development** chapter of this report.

Withdrawal uses

Withdrawals involve the physical removal of water from its surface-water or ground-water source, and conveyance to its place of use. The water withdrawn can be used in either a consumptive or non-consumptive manner.

Water applied for irrigation, incorporated into a manufactured product, lost to evaporation, or otherwise removed from the immediate water supply is considered to be consumed if it is unavailable for reuse in a short period of time. Other applications, such as public water supply, energy production and many industrial uses, typically return most of the withdrawn water to the surface-water or ground-water systems.

Water-use data in Indiana historically have been obtained by combining limited data for public water supplies with various estimation techniques and voluntary responses to mailed questionnaires.

Since 1985, annual water-use data for large withdrawal facilities in Indiana have been compiled as mandated in the 1983 Water Resource Management Act (I.C. 14-25-7.15, previously 13-2-6.1). This legislation requires owners of significant water withdrawal facilities to register these facilities and report annual water use to the Natural Resources Commission through the Indiana Department of Natural Resources, Division of Water. Significant water withdrawal facilities are defined as facilities capable of withdrawing at least 100,000 gallons per day of surface water, ground water, or surface and ground water combined.

Reported water use for registered facilities typically is determined by metering devices, the multiplication of pump capacity and total time of pumpage, or by other methods approved by the Division of Water. Total non-registered water withdrawals generally are estimated by the Division of Water using approximated values for population and per capita water use.

Although water withdrawals from a single well or surface-water intake may serve several purposes, each registered water withdrawal facility is grouped by the Division of Water into one of the following six categories: industrial, energy production, public supply, rural, agricultural, and miscellaneous. These categories differ slightly from those used in the 1980 report by the Governor's Water Resources Study Commission (Indiana Department of Natural Resources).

Registered withdrawals in the Maumee River basin totaled about 18.7 billion gallons (BG) during 1993. About 96 percent of the withdrawals by the 111 facilities in the basin were used for public supplies and industrial purposes (figure 12).

Public supply accounted for approximately 77 percent (14.3 BG) of the total registered water use in the basin during 1993. The 34 significant water withdrawal facilities used for public water supplies repre-

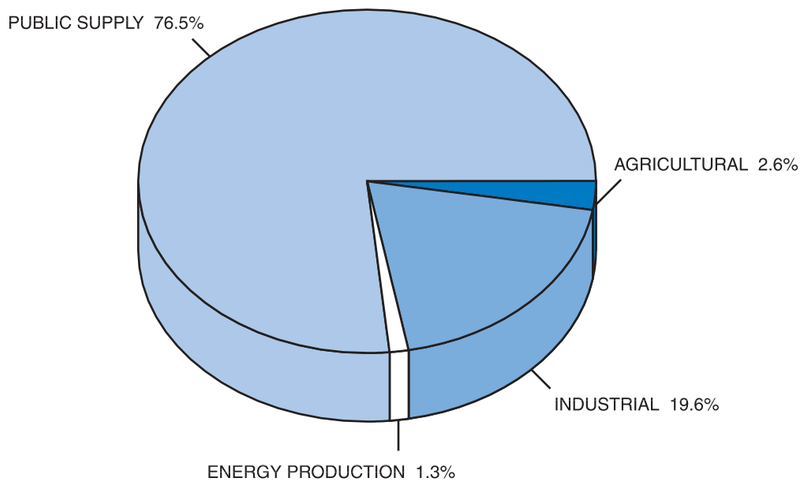

Figure 12. Percentage of registered water use by category

sent about 31 percent of all registered facilities in the basin.

Industrial self-supplied is the second highest water-use category in the Maumee River basin. The 36 facilities grouped into this category withdrew about 3.7 BG of water or about 20 percent of the total water withdrawals in the entire basin during 1993.

Agricultural water use represents about 3 percent of the total water withdrawals in the basin. The number of facilities grouped in the agricultural water-use category are 32 percent of all registered facilities in the basin.

Energy production, the smallest water-use category in the basin, uses about 1 percent of the total water-use in the basin. There were no registered rural or miscellaneous withdrawal facilities in the basin in 1993.

In 1993, about 79 percent of Maumee River basin high-capacity water withdrawal was from surface water sources and about 21 percent was from ground water sources.

Facilities capable of withdrawing less than 100,000 gallons of water per day are not required to be registered with the Division of Water or monitored for annual pumpage. However, some types of non-registered facilities can create a large aggregate demand for water. It is estimated, by the Division of Water, that approximately 38 percent of the basin's residents obtain their water from non-registered, privately owned domestic wells, and that non-registered facilities in the basin withdraw approximately 3.7 billion gallons of water annually.

Instream uses

Instream uses are defined as non-withdrawal uses taking place within a stream, lake or reservoir. Instream uses in Maumee River basin streams include recreation activities, fish and wetland flora and fauna habitat, and waste assimilation.

Water-based **recreation** activities, which include fishing, swimming, boating (including motorboating and sailing), and water skiing also occur. Hunting, camping, nature study, birdwatching, photography, walking, jogging, running, and bicycling are among the activities that are strongly associated with or enhanced by the presence of water.

Water-dependent **wildlife habitat** in the Maumee River basin is composed primarily of wetlands and associated lakes, reservoirs, and streams. These open waters and adjoining wetlands are excellent habitat for furbearers, waterfowl, reptiles, amphibians, and various other game and non-game species. In addition, countless varieties of flora thrive in these environments. Several species registered on federal and state endangered and threatened species lists rely on these habitats. To date, four of Indiana's dedicated nature preserves within the Maumee basin contain these water-associated habitats.

Fisheries are present in the streams and lakes of the Maumee River basin. Because the type of fish population found largely depends on ambient water quality, fisheries are summarized in the **Surface-Water Hydrology** chapter of this report in the section entitled **Surface-Water Quality**.

The treated effluents of **wastewater treatment** plants in the Maumee River basin are discharged directly into the St. Marys and Maumee Rivers, Cedar and Little Cedar Creeks, and numerous smaller streams and ditches. Wastewater discharges are discussed in the **Surface-Water Quality** section of this report.