Region Six

Blackford, Delaware, Grant, Henry, Jay, Madison, and Randolph Counties, located in west-central Indiana, form Region Six. The region contains approximately 2,680 square miles and is bounded by Ohio to the east; Wayne, Rush and Hancock Counties to the south; Hamilton, Tipton, Grant, and Miami Counties to the west; and Wabash, Huntington, Wells, and Adams Counties to the north, as shown in Figure 134.

The 1975 population was 474,600. The official Indiana Population Projections indicate that by the year 2000, the region's population may increase to 527,000. The 1975 population and the projections for each county are tabulated below.

Table 103
The 1975 and projected populations for Region Six.

County	*1975*	*1980*	*1990*	*2000*
Blackford	15,859	16,500	17,300	18,100
Delaware	128,989	135,200	141,600	144,100
Grant	83,896	86,500	90,500	92,000
Henry	53,720	54,300	56,500	58,400
Jay	24,183	24,900	26,500	27,900
Madison	138,548	141,900	148,100	152,100
Randolph	29,294	30,500	32,300	34,400
Total	474,589	489,800	512,800	527,000

The major population centers are Anderson in Madison County and Muncie in Delaware County. These urban centers accounted for fifty-six percent of the region's 1975 population.

Agriculture is the dominant land use with more than eighty-three percent of the area devoted to that purpose. Approximately seven percent of the land is

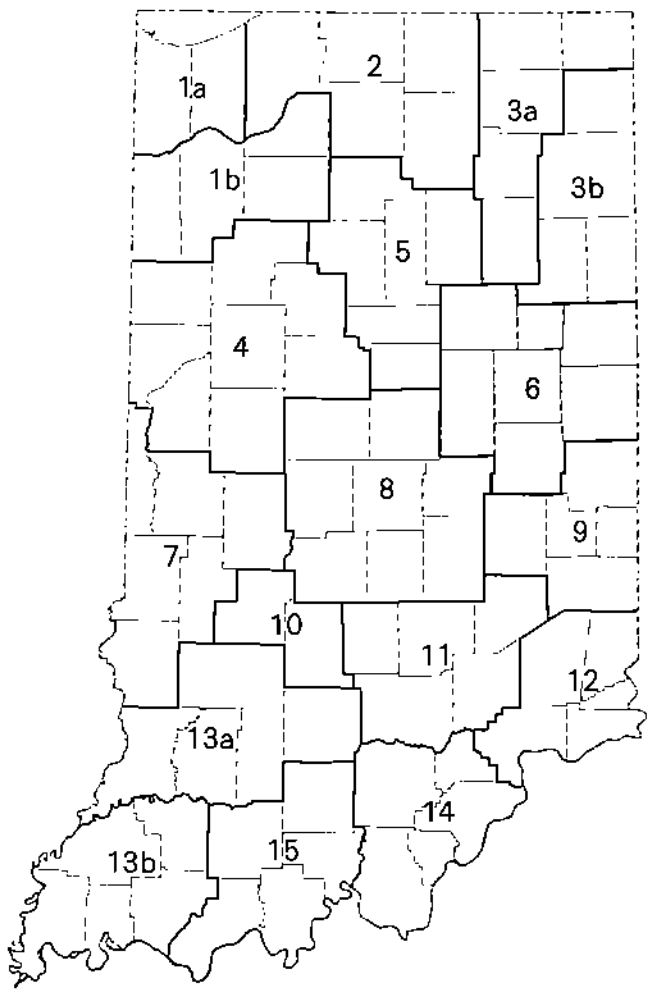

Figure 134
Map of Indiana showing the location of Region Six.

forested while the remaining ten percent is utilized for urban and miscellaneous purposes.

Thirty-five percent of the region's population, plus an additional 5,880 persons, were employed within the region. The electrical machinery, transportation equipment, and fabricated metal industries employ thirty percent of the work force.

The region has gently rolling highlands divided by stream valleys with moderate to wide flood plains. The curving, northwestern to southeastern trending moraines shape the drainage pattern of the Wabash, Salamonie, and Mississinewa Rivers which flow toward the northwest parallel to the moraines.

The region receives approximately 38.5 inches of precipitation annually. This varies from a high of 4.5 inches in June and a low of 2.2 inches in February. Of the 38.5 inches of precipitation, approximately 11.5 inches appear as streamflow while 27.0 inches are consumed through evapotranspiration. The average temperatures range from 27°F. in January to 73.5°F. in July. The average annual temperature is 51.5°F. Data from surrounding areas indicate the prevailing wind is from the southwest at 8.9 miles per hour.

THE WATER RESOURCE

Ground Water

The entire region was glaciated during the last Wisconsinan glacial advance. The materials deposited include ice-contact sand and gravel, glacial till, lake sediments, and valley train and outwash sand and gravel. The glacial drift is over 300 feet thick where the buried Teays drainage system has been filled with glacial deposits. The drift is absent in a few areas where erosion has exposed the underlying bedrock. Concentric bands of glacial deposits or end moraines are found throughout this region, marking the extent of various glacial advances. Till is the predominant glacial deposit in most of this area. Within the till exist scattered sand and gravel units which often supply moderate amounts of ground water. For the most part, till and the outwash sand and gravel deposits are the primary glacial aquifers.

Bedrock deposits, ranging in age from Ordovician to Silurian, occur beneath the cover of glacial materials. The Ordovician rocks occur in areas where erosion of the Teays Valley has cut through the younger Silurian formations. Shales with interbedded limestone lenses are common among these Ordovician rocks. Silurian limestones and dolomites occur beneath the glacial drift in most of the region and are usually good producers of ground water. The degree of fracturing and the nature of overlying material will strongly affect the capability of the bedrock to yield water to wells.

Of particular interest is the area in northwestern Jay and northcentral Grant Counties where the buried pre-glacial Teays Valley contains varying thicknesses of water-bearing sand and gravel. It is estimated that 600 or more gallons-per-minute (gpm) may be the potential yield from wells tapping this aquifer, as shown in Figure 135. In addition, bedrock aquifers, particularly the Silurian limestones and dolomites, offer a moderate yield of 200 to 400 gpm to properly constructed, large-diameter wells.

In Grant County, potential well production is estimated to range between 200 and 400 gpm. Small areas associated with the buried Teays Valley may yield 600 gpm. Yields of 600 gpm are expected from sand and gravel within Jay and Blackford Counties adjacent to the Teays Valley. Ground-water availability in Delaware and Madison Counties is generally good and wells may produce 200 to 400 gpm. A small area in central Madison County may be capable of producing up to 600 gpm. The northwestern two-thirds of Henry County can be characterized as having ground-water resources capable of producing 400 to 600 gpm, while in the southeastern portion of the county, well yields of 100 to 200 gpm are normally expected. In Randolph County, well yields of 100 gpm are expected in the extreme southeastern portion, while 200 to 400 gpm may be developed elsewhere. Small areas of thicker sand and gravel deposits in central and southern Randolph County may yield up to 600 gpm.

The ground-water quality is strongly affected by the glacial drift and the underlying bedrock formations. Notable consituents are sulfates and fluorides which occur in higher than normal concentrations. Hardness levels range from 300 to 500 parts-per-million (ppm). The iron content for ground water ranges from 0.3 to 3.0 (ppm).

Surface Water

Streamflow The major streams include the Mississinewa River, Salamonie River, and the West Fork of the White River. These streams generally flow in a westerly direction and are within the Wabash River drainage basin. The Salamonie River and the West Fork of the White River originate within the region.

The seven day, once in ten year (Q7-10); one day, once in thirty year (Q1-30); and the average annual flow for major streams with gaging stations within Region Six are presented in Table 104.

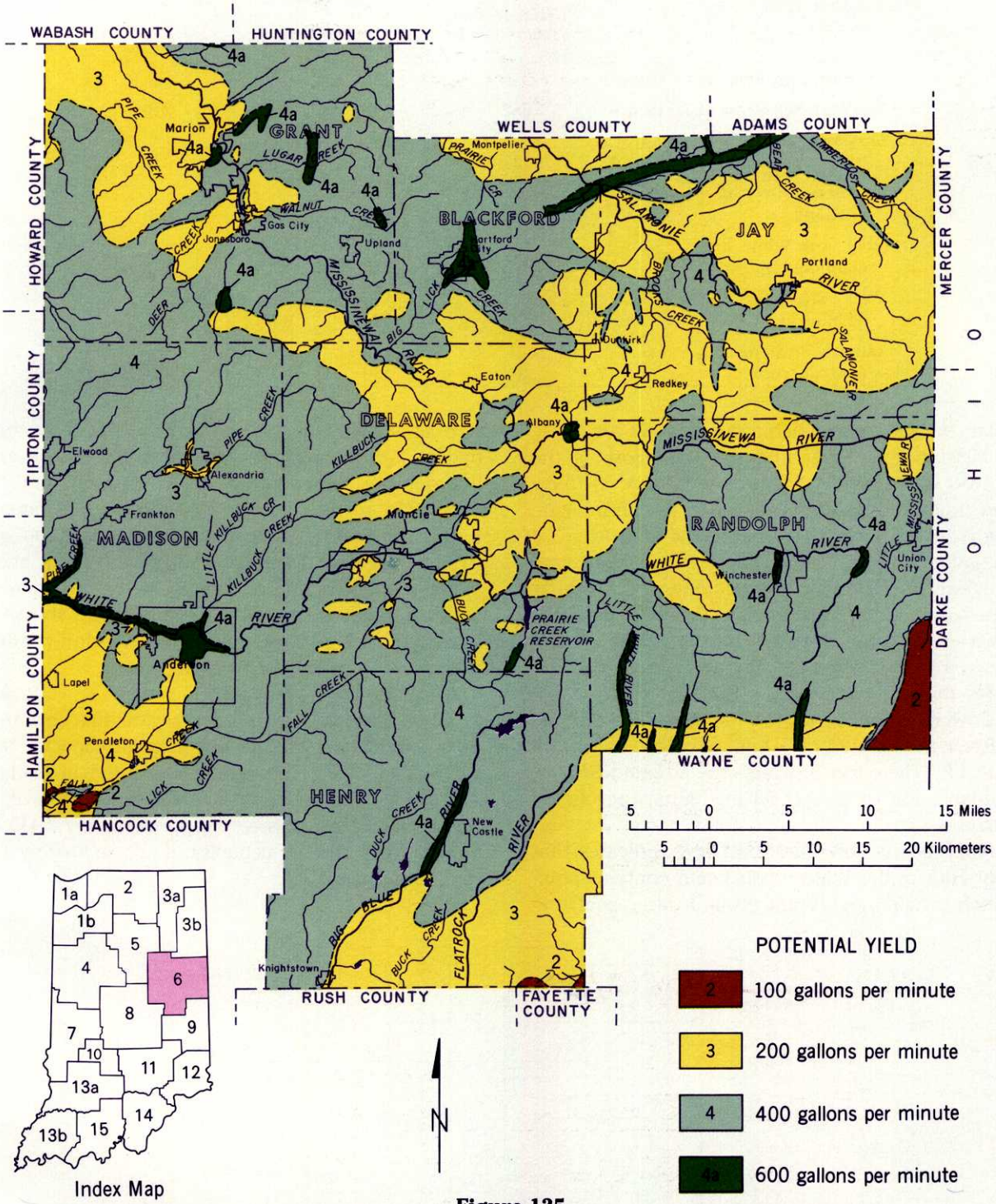

Figure 135

Map of Region Six showing the location and potential yield of ground water from properly constructed large diameter wells.

Table 104
Flow characteristics of streams.

Stream	Drainage Area (square miles)	Million-Gallons-Per-Day		
		Average Annual	Q7-10	Q1-30
Mississinewa River near Eaton	310	170	1.9	1.2
Mississinewa River at Marion	682	420	12.0	2.3
Mississinewa River near Ridgeville	133	80	0.6	0.3
Salamonie River at Portland	86	46	0.6	0.3
West Fork White River at Anderson	406	240	26.0	19.0
West Fork White River at Muncie	241	130	1.4	0.6
Wabash River near New Corydon	262	130	1.3	0.9

The largest and most reliable streamflows are those in the Mississinewa River and the West Fork of the White River at Anderson. The one day, once in thirty year low flows for the Mississinewa at Marion indicate that the river will have a sustained flow of at least 2.3 million-gallons-per-day (mgd), while the average annual flow exceeds 420 mgd. The one day, once in thirty year low flows for the West Fork of the White River at Anderson indicate the river will have a sustained flow of at least 19 mgd, while the average annual flow exceeds 240 mgd.

The flow duration curve for the West Fork of the White River at Muncie has a minimal slope as shown in Figure 136. The curve indicates the stream will have a dependable flow of at least 6.1 mgd ninety percent of the time.

The slope of the flow duration curve indicates that the West Fork of the White River basin contains aquifers which provide significant ground-water contribution to streamflow. To verify this, the technique of hydrograph separation was applied to three annual hydrographs representing "dry," "average," and "wet" years. The results indicate that the ground-water contribution to streamflow amounts to thirty-eight, twenty, and thirteen percent for dry, average, and wet years respectively. Conversely, sixty-two to eighty-seven percent of the flow, depending on the year, is due to direct surface runoff from runoff-producing precipitation events or from snowmelt.

Lakes The lakes within the region that are at least 50.0 acres in size or have a storage capacity of 32.5 million gallons or more are presented in Table 105, and are located on Figure 137. These eleven lakes have a combined surface area of approximately 2,440 acres with a gross storage capacity of approximately 14,140 million gallons.

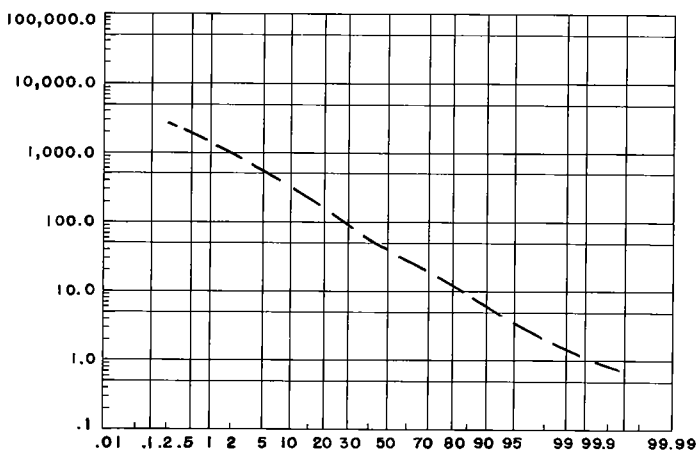

Figure 136
The flow duration curve for the West Fork of the White River at Muncie.

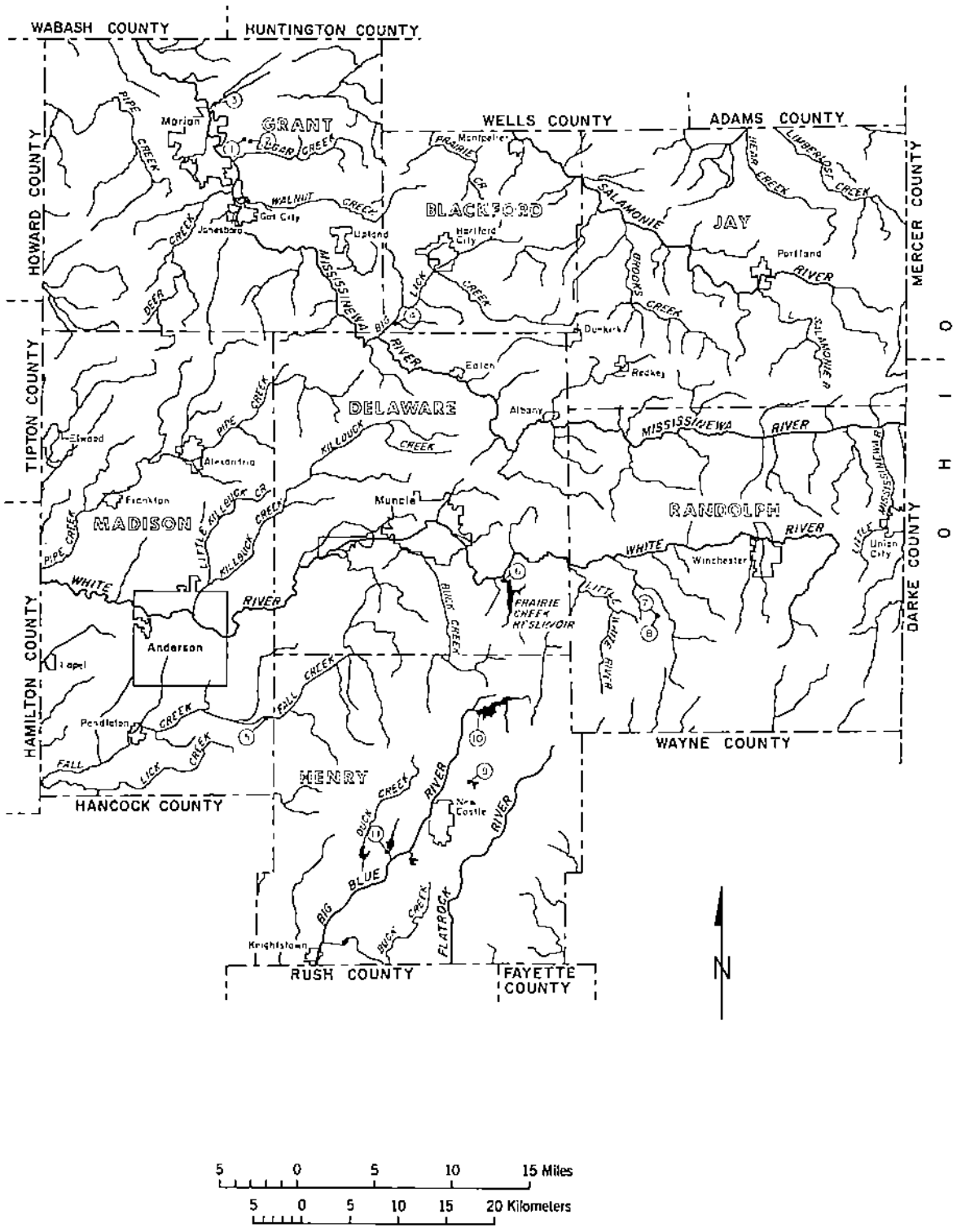

Figure 137
Map of Region Six showing the location of lakes that are at least 50.0 acres in size or that have a storage capacity of 32.5 million gallons or more.

Table 105

Lakes at least 50 acres in size or having a storage capacity of 32.5 million gallons or more.

Lake Number	*Lake Name*	*Drainage Area (square miles)*	*Surface Area (acres)*	*Gross Storage (million gallons)*
1	Loew Lake, North	na	10.4	71
2	Loew Lake, South	na	23.4	114
3	Wagner Lake	na	42.1	65
4	Lake Mohee	na	24.2	104
5	County Line Fishing Lake	na	9.4	42
6	Prairie Creek Reservoir	16.80	1,275.0	7,168
7	Indian Trail Lake No. 1	na	na	97
8	Indian Trail Lake No. 2	na	na	97
9	Big Blue River Structure No. 15	4.86	67.7	248
10	Big Blue River Structure No. 20	8.90	815.0	5,181
11	Westwood Run Structure No. 13	na	173.0	953

na: not available.

UTILIZATION OF THE WATER RESOURCE

Instream Uses

The supply and demand analysis for recreational uses of water by the residents of Region Six is presented in Table 106. The existing supply for recreational activity is expressed as a percentage of the demand. Therefore, when this percentage exceeds one hundred the supply exceeds the demand. Conversely when the supply as a percentage of demand is less than one hundred, the supply is less than the projected demand.

Boating and Waterskiing According to estimates, only five percent of the demand for boating is met by available boating areas. This shortage may continue through the year 2000. None of the demand for waterskiing acreage is satisfied. This shortage is expected to continue through the year 2000.

Canoeing Canoeing opportunities in the region are available primarily on the Mississinewa and Salamonie Rivers, and the West Fork of the White River.

A total of 144 miles of streams in Region Six has been identified as suitable for canoeing. This supply represents a surplus of the current canoeing demand. The surplus is expected to continue through the year 2000.

Swimming and Ice-Skating The current demand for swimming opportunities exceeds the available supply. This shortage is expected to continue through the year 2000. Ice-skating facilities are not sufficient to

Table 106

The outdoor recreation demand and supply analysis.

Activity	*Percent of Population Participating*	*Density Guideline*	*Approximate Supply*	*Existing Supply as a Percentage of Projected Demand*		
				1980	*1990*	*2000*
Boating	28	19.6 boats/acre/year	1,600 acres	5	5	5
Waterskiing	9	34.4 skiers/acre/year	400 acres	0	0	0
Canoeing	7	585 canoes/mile/year	144 miles	100+	100+	100+
Swimming	39	76,600 swimmers/acre/year	28 acres	51	53	52
Ice-Skating	8	6,678 skaters/acre/year	20 acres	67	67	65
Fishing	45	66 persons/acre/year	5,200 acres	10	10	10

This table is based upon the 1979 Indiana State Outdoor Recreation Plan. Only the supply and recreational demands of residents of the region are displayed. The available recreational opportunities outside the region are not considered, nor are the recreational demands of nonresidents considered.

meet the current and projected demand through the year 2000.

Fishing The quality of the fisheries habitat is indicated on Figure 138. The Mississinewa River contains the region's best stream fishery, with the white bass spawning run of special interest to fishermen. Along most of their lengths, the Salamonie River and West Fork of the White River offer good aquatic habitat, although stretches of each stream are limited by poor water quality. Many smaller streams have been adversely affected by adjacent land uses and consequently offer lower quality aquatic habitat attracting less desirable fish.

Prairie Creek Lake has the best lake fishing in the region. This warmwater fishery consists of sunfish, bass, catfish, walleye pike, and yellow perch. Other lakes, with a few exceptions, do not have good fisheries habitat due to heavy siltation.

Public access for fishing is limited mainly to city and county properties or road crossings. Mounds State Park and Wilbur Wright Fish and Wildlife Area offer limited fishing access.

Ten percent of the demand for fishing opportunities generated by residents of Region Six is currently being met by the supply. This shortage is expected to continue through the year 2000.

Riparian Habitat The quality of the habitat associated with streams and lakes is indicated in Figure 139. Riparian habitat is good along the Mississinewa River and stretches of the other major rivers in the region. The banks of these rivers provide habitat for upland game, various birds, and some muskrats. Waterfowl and shorebirds make use of the larger streams also. Many smaller streams, especially in intensively farmed areas, have low wildlife habitat values. Many of the region's lakes are also farmed up to the edge so little riparian habitat is available. The shoreline of Prarie Creek Lake offers some grass and shrub habitat which is valuable to many types of wildlife. A narrow border of deep marsh exists in Lake Placid. Wilbur Wright Fish and Wildlife Area has man-made marshes along the Blue River to attract waterfowl and also offers the only state-owned public hunting area in the region.

Withdrawal Uses

Public Water Supplies Blackford, Delaware, Grant, Henry, Jay, Madison, and Randolph Counties are served by forty public water utilities. Information on public water supply systems in Region Six follows.

Table 107
The public water supply systems as of 1975.

Counties	*Number of Systems*	*Service Population*	*Total Average Daily Use in Million-Gallons-Per-Day*
Blackford	3	10,360	1.8
Delaware	5	85,278	13.3
Grant	8	59,452	8.9
Henry	8	27,845	4.5
Jay	3	11,775	1.3
Madison	10	98,621	18.9
Randolph	5	12,957	2.0
Total	42	306,288	50.8

The Anderson Water Utility, the largest water utility in the region, withdraws an average of 15.7 mgd for nearly 69,500 customers. The Marion, Muncie, and New Castle water systems are also large suppliers to their respective communities. Marion and Anderson withdraw ground water from well fields. Figure 140 shows the water service areas within Region Six.

Public water utilities withdrew an average of 50.8 mgd with maximum daily withdrawals of 70.0 mgd in 1975. Approximately 5.3 mgd of the total withdrawals is consumed. Seventy-four percent of public water withdrawals is from ground-water sources. Only Montpelier, Muncie, and the Indiana Reformatory systems withdraw from surface water.

Muncie utilizes ground water as an auxiliary supply source. Its primary supply is derived from the White River, supplemented by discharge from Prairie Creek Reservoir during periods of low flows. The Salamonie River is used as a water source by Montpelier.

Those community systems utilizing ground water generally withdraw from wells located in or near their service areas. The region does not contain any rural water systems.

Projections of public water supply withdrawals indicate that these withdrawals may increase to 62.9 mgd by the year 2000, as indicated in the following table.

Table 108
The 1977 and projected withdrawal and consumption rates of public water supplies by the year 2000, in million-gallons-per-day.

Public Water	*1977*	*1980*	*1990*	*2000*
Withdrawal	50.8	52.5	58.4	62.9
Consumption	5.3	5.5	6.1	6.6

Industrial Water Industrial establishments had an estimated water intake averaging 54.4 mgd in 1977. Of this amount, 7.5 mgd was consumed. Of the total industrial intake, approximately 33.4 mgd was developed by the industries themselves while 20.1 mgd was purchased from the region's public utilities. Virtually all of

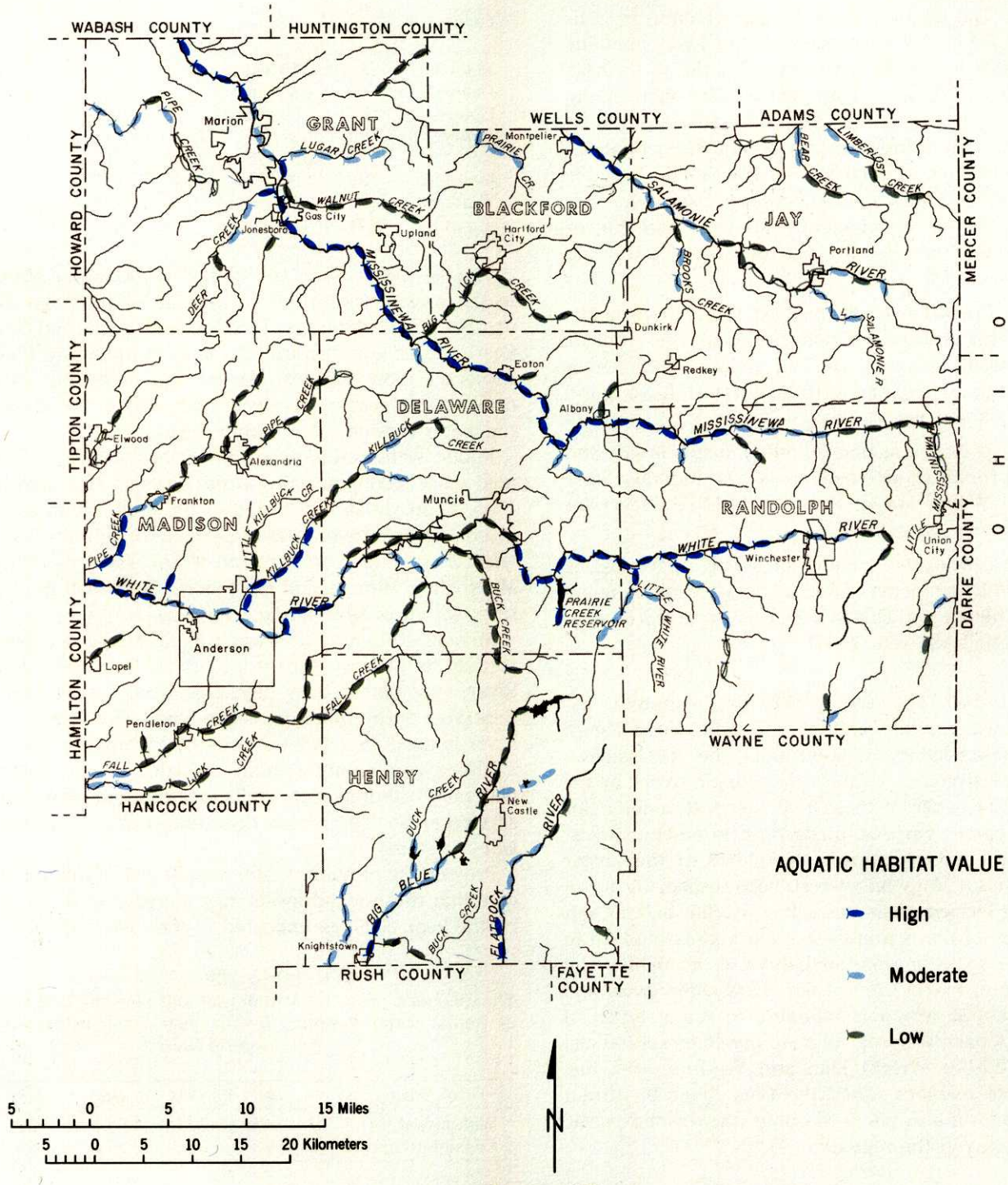

Figure 138
Map of Region Six showing the quality of the fisheries habitat.

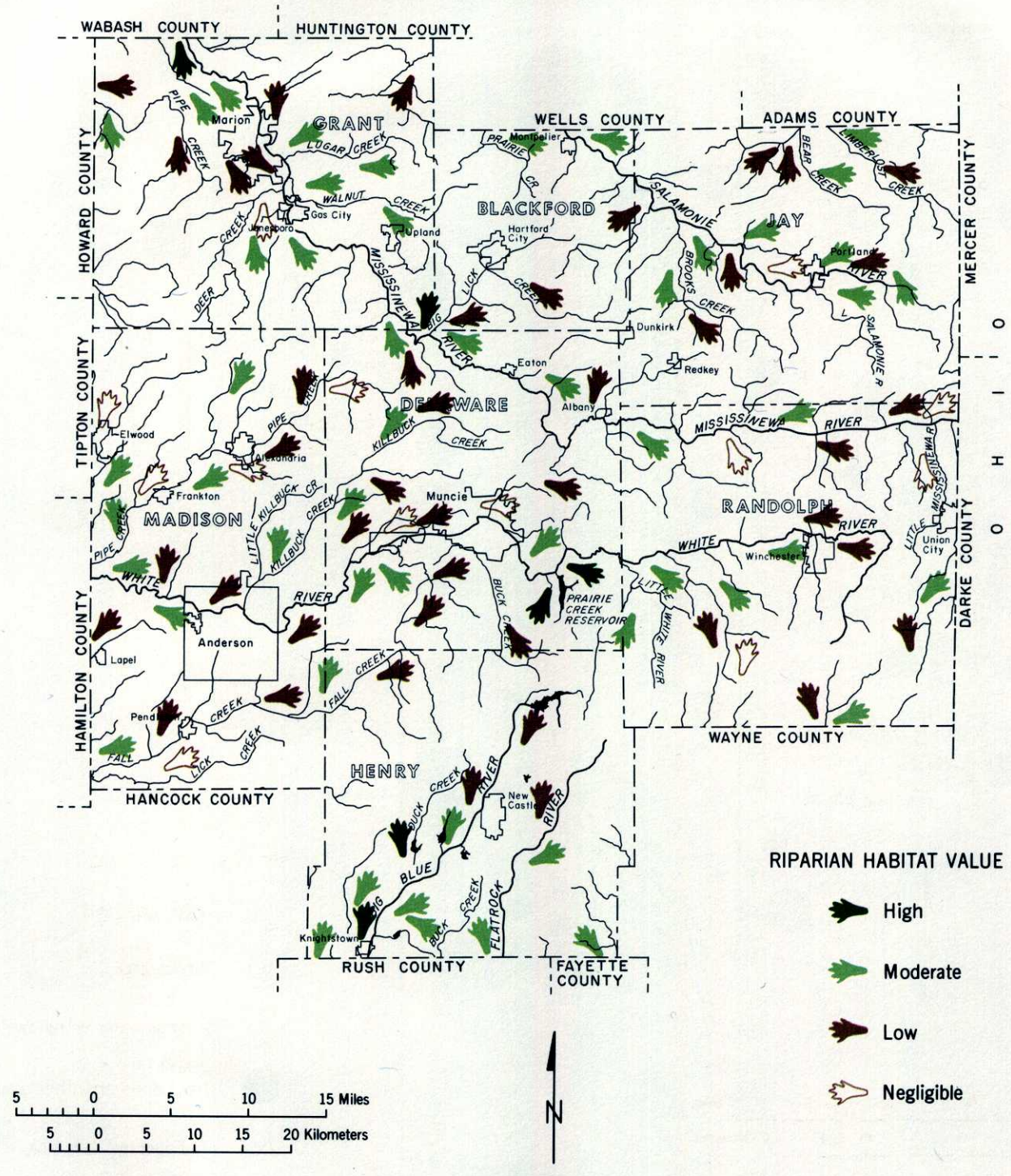

Figure 139
Map of Region Six showing the quality of the riparian habitat.

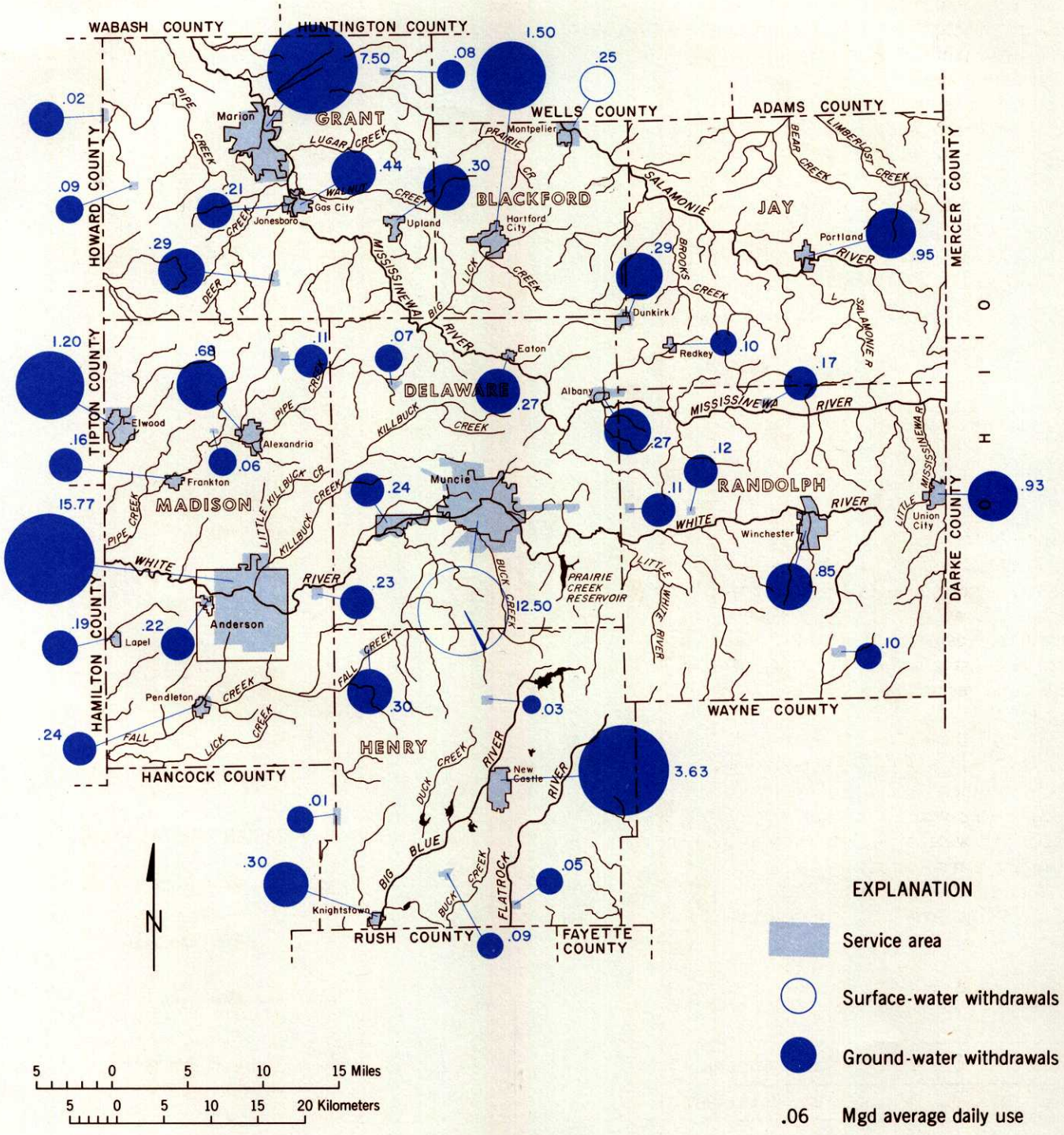

Figure 140

Map of Region Six showing the service areas of the public water utilities and average daily use in million-gallons-per-day.