Region Eleven

Bartholomew, Brown, Decatur, Jackson, and Jennings Counties, located in south-central Indiana, form Region Eleven. The region contains approximately 1,990 square miles and is bounded by Morgan, Johnson, Shelby, and Rush Counties to the north; Franklin and Ripley Counties to the east; Jefferson, Scott, and Washington Counties to the south; and Lawrence and Monroe Counties to the west as shown by Figure 192.

The 1975 population was 148,107 of which forty percent resided in Bartholomew County. The official Indiana Population Projections indicate the population may increase by thirty percent by the year 2000. The 1975 population of each county and the projections for future growth are listed below.

The 1975 and projected populations for Region Eleven.

County	*1975*	*1980*	*1990*	*2000*
Bartholomew	59,664	62,600	69,700	76,200
Brown	9,831	10,600	12,900	15,800
Decatur	23,628	24,100	26,800	30,000
Jackson	34,109	35,800	38,700	41,200
Jennings	20,875	22,200	25,500	29,200
Total	148,107	155,300	173,600	192,400

The major population centers within the region are Columbus in Bartholomew County, Greensburg in Decatur County, Seymour in Jackson County, and North Vernon in Jennings County. These urban centers accounted for thirty-seven percent of the region's 1975 population.

Agriculture is the dominant land use comprising more than fifty-five percent of the area. Approximately

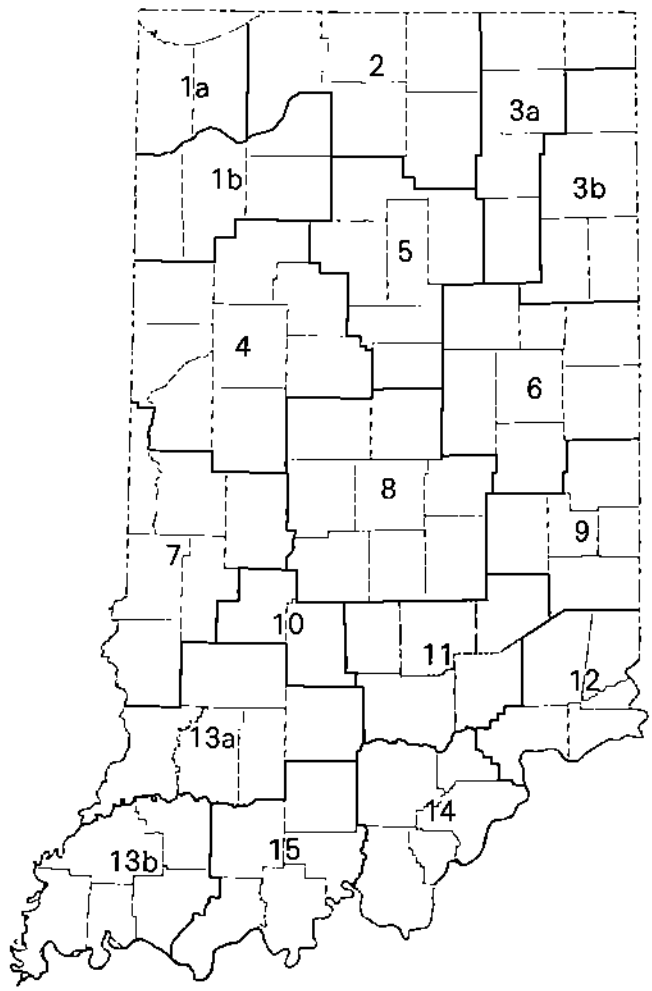

Figure 192
Map of Indiana showing the location of Region Eleven.

twenty-seven percent of the land is forested while the remaining nine percent represents urban and miscellaneous uses.

Topographic and physiographic conditions within the region are quite varied, ranging from poorly drained flat lands and till plain areas in the eastern portions of the region to the rich bottom lands, alluvial deposits, and gravel terraces in the central portion, and finally to the rolling hills and timbered "knobs" of Brown, Jackson, and Bartholomew Counties.

Average annual precipitation is approximately 43.0 inches. This varies from a high of 4.5 inches in May to a low of 2.5 inches in October. Of the 43.0 inches falling annually, approximately 15.0 inches appear as streamflow while 28.0 inches are consumed through evapotranspiration.

The area has a moderate temperature with averages ranging from 30.5°F. in January to 76°F. in July. The average annual temperature is 53.5°F. The annual prevailing winds appear to be from the south-southwest at approximately 8.1 miles per hour.

THE WATER RESOURCE

Ground Water

Much of the region was covered by continental glaciers which occurred in Indiana during the Wisconsinan, Illinoian, and older glacial periods. The materials left by these ice sheets have materially altered the region leaving behind clay-rich glacial tills, fine-grained lake deposits, sizeable amounts of sand and gravel in the major river valleys, and wind-blown sand and silt along the East Fork of the White River valley.

Most of Decatur and Bartholomew Counties were covered by the more recent Wisconsinan deposits, while the remaining portions of these counties, including Jennings and parts of Brown and Jackson Counties, received materials from the Illinoian and older glacial periods. A "driftless" area not covered by glaciers is found in much of Brown County and to a limited degree in Jackson County.

Bedrock formations of various types ranging in age from Mississippian to Ordovician underlie the glacial deposits of this region. In the western part of the area in Brown, Jackson, and western Bartholomew Counties, the rolling timbered hills and "knobs" mark the presence of bedrock composed of shale, siltstone, and fine-grained sandstone. These formations comprise the Borden Group of lower Mississippian age. These deposits are some of the poorest water-bearing formations in the state, exclusive of limited areas where glacial deposits are present, or in the valley of the East Fork of the White River. Eastward in Jennings, Bartholomew, eastern Jackson, and western Decatur Counties, black shale and limestone of Devonian age are present. These formations yield limited quantities of water and, except for an occasional well, are expected to yield less than ten gallons-per-minute (gpm). Similar circumstances apply to the Silurian age limestones and dolomites which occur eastward of the outcrop area of the Devonian age bedrock. Exceptions to this availability pattern exist in the vicinity of Greensburg where an occasional well has been recorded as yielding one hundred gpm or greater. Rocks of Ordovician age are not considered to be potential water-bearing formations.

The availability of ground water is associated with the nature and type of aquifer materials present in a given area. In general, ground-water availability is quite limited in much of the region as shown in Figure 193. Expected well yields are less than ten gpm under most circumstances. In a number of areas, particularly in Brown and Jackson Counties, "dry holes" are common. The major ground-water sources are confined to the sand and gravel deposits of the East Fork of the White River valley. These deposits contain significant amounts of ground water and extend southward from Edinburg through the Columbus, Seymour, Brownstown, and Medora areas. A number of municipal, industrial, irrigation, and rural water system wells tap these deposits. Well yields from this aquifer system commonly exceed 1,000 gpm to properly constructed wells, and yields as great as 4,200 gpm have been obtained in the Columbus area.

Elsewhere, moderate amounts of ground water are available in the Flatrock River valley of northern Bartholomew County, along some of the tributary streams to the East Fork of the White River, in localized areas near Crothersville, and to a limited degree in the Greensburg area. Beyond these areas and beyond the sand and gravel deposits in the White River bottoms water is lacking.

Water hardness levels in the region normally are in the range of 270 to 466 parts-per-million (ppm), and iron is usually present in sufficient amounts as to require some form of iron removal or treatment. Chemical constituents of note include the presence of locally high manganese levels in the sand and gravel deposits of the East Fork White River valley, particularly in the Brownstown, Columbus, and Seymour areas, and the presence of hydrogen sulfide in aquifers below the New Albany shale in portions of Jennings and Bartholomew Counties. Highly mineralized or even "salt water," may be encountered in deep wells in bedrock aquifers of western Bartholomew and Jackson Counties.

Surface Water

Streamflow The East Fork of the White River is the major stream along with its primary tributaries of

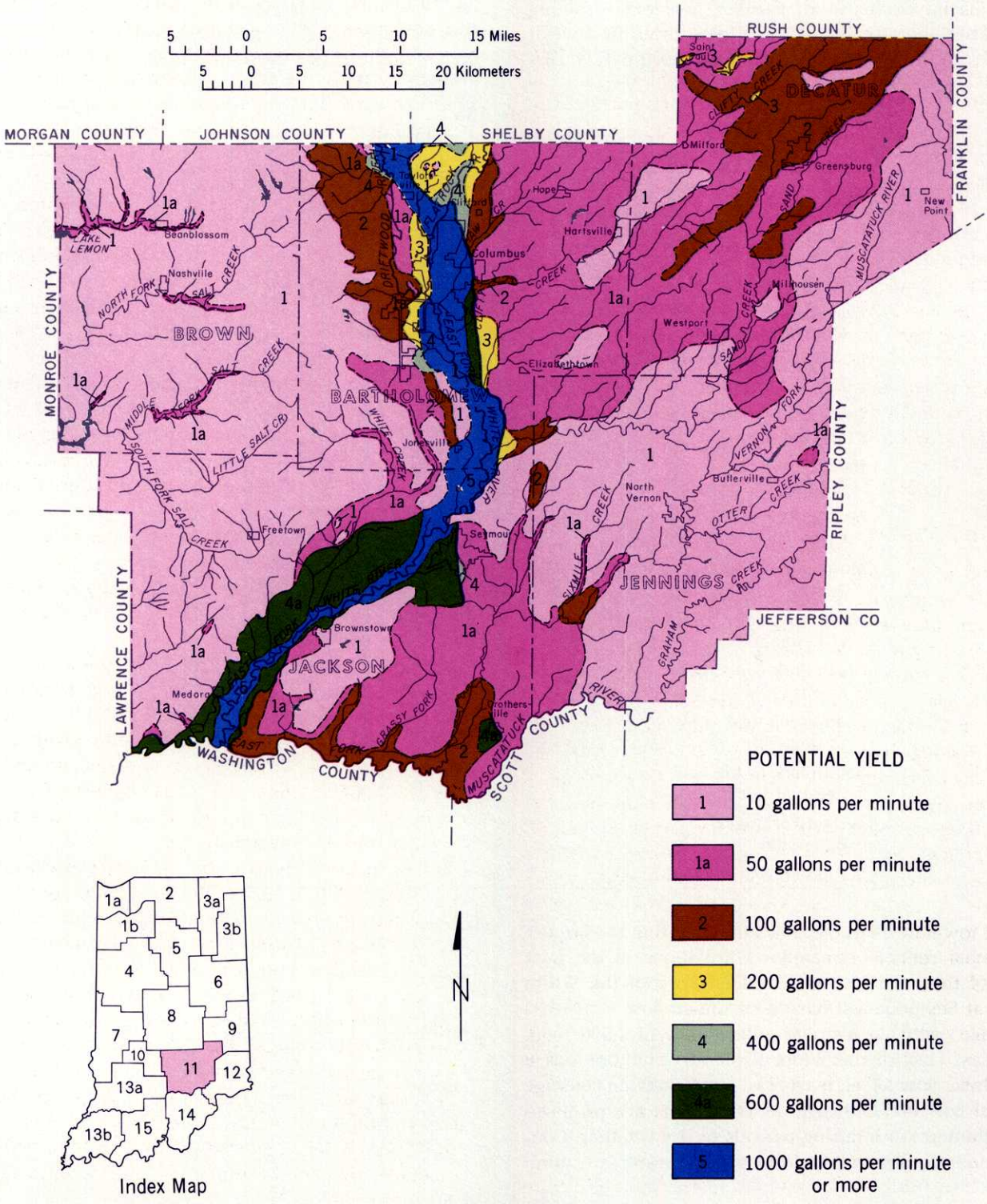

Figure 193
Map of Region Eleven showing the location and potential yield of ground water from properly constructed large diameter wells.

Driftwood, Flatrock, and Muscatatuck Rivers and Clifty, Sand and Salt Creeks. A small portion of the region drains southeasterly into Laughery Creek and the Ohio River basin. Exclusive of the southeasterly draining tributaries the streams of this region drain in a westerly to southwesterly direction and ultimately discharge into the East Fork of the White River, a member of the Wabash River basin.

The seven day, once in ten year (Q7-10), one day, once in thirty year (Q1-30) and the average annual flow in million-gallons-per-day (mgd) for streams with gaging stations are presented in the following table.

Table 155
Flow characteristics of streams.

Stream	*Drainage Area (square miles)*	*Million-Gallons-Per-Day*		
		Average Annual	*Q7-10*	*Q1-30*
Clifty Creek at Hartsville	9	64	0	0
East Fork of the White River at Columbus	1,707	1,200	81.0	63.0
East Fork of the White River at Seymour	2,341	1,500	109.0	83.0
Graham Creek near Vernon	77	60	0	0
Haw Creek near Columbus	51	9	0.06	0
Middle Fork of the Salt Creek near Story	38	5	0	0
Muscatatuck River at Austin	359	250	0.6	0.1
North Fork Salt Creek at Belmont	120	84	0	0
North Fork Salt Creek at Nashville	76	49	0	0
Sand Creek near Brewersville	155	108	0	0
South Fork of the Salt Creek at Kurtz	38	26	0	0
Vernon Fork near Butlerville	86	60	0.01	0
Vernon Fork at Vernon	198	140	0.1	0

The low-flow characteristics indicate that the largest and most reliable streamflows are those in the East Fork of the White River. The East Fork of the White River at Seymour will have a sustained flow of at least 83 (mgd) with an average annual flow of 1,500 mgd. The East Fork of the White River at Columbus has a sustained flow of at least 63.0 mgd with an average annual flow of 1,200 mgd. Most streams are prone to very limited flows during periods of dry weather. Contributions to streamflow from ground water are minimal.

The flow duration curve for the Vernon Fork of the Muscatatuck River at Vernon, as shown by Figure 194, indicates the stream will have a dependable flow of 1.0 mgd ninety percent of the time.

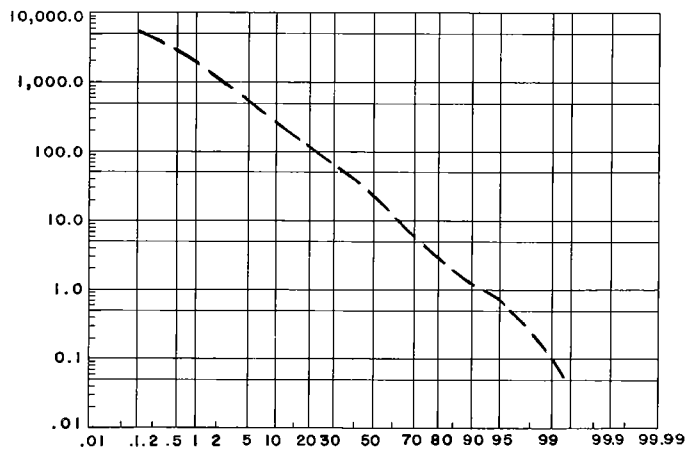

Figure 194
The flow duration curve for the Vernon Fork at Vernon.

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 156, and are located on Figure 195. These fifty-five lakes have a combined surface area of approximately 2,500 acres and a gross storage capacity of approximately 16,460 million gallons.

Table 156

Lakes at least 50.0 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	Bear Lake	na	9.4	57
2	Berry Farm Lake	1.02	13.0	34
3	Cordry Lake	1.07	166.0	2,059
4	Deerskin Lake	0.02	2.6	32
5	Don Fox Lake	0.10	14.4	48
6	Gallahue Lake	0.83	35.0	114
7	Green Lake	1.63	51.0	280
8	Greenbriar Lake	na	10.9	81
9	Happy Hollow Lake	0.80	11.4	38
10	Hidden Valley Lake	na	21.9	247
11	Jeanson Lake	na	15.0	48
12	Lake LaSalle	1.38	37.0	138
13	Lutheran Church Camp Lake	0.14	18.0	45
14	Newport Lake	0.30	3.7	187
15	Ogle Lake	1.03	20.0	81
16	Parkview Lake	na	3.9	45
17	Pfau Lake	na	10.0	40
18	Somerset Lake	0.75	28.4	138
19	Strahl Lake	na	11.7	45
20	Stuart Lake	na	na	153
21	Sweetwater Lake	2.31	275.0	3,095
22	Tousley Lake	3.44	31.0	110
23	Woodland Lake	na	15.1	143
24	Yellowwood Lake	6.88	133.0	615
25	Echo Lake	na	18.0	32
26	F.O.P. Lake	na	23.4	234
27	Forest Lake Estates	0.07	8.2	39
28	Grandview Lake	1.97	211.8	2,215
29	Grouse Ridge Lake	na	20.6	208
30	Harrison North Lake	na	50.5	604
31	Harrison South Lake	na	38.0	371
32	Lake Barbara	na	na	68
33	Lake Schaefer	na	92.6	195
34	Lutheran Lake	na	79.6	338
35	Shure Lake	na	9.4	42
36	Tamerix Lake	na	8.0	39
37	Terrace Lake	na	9.9	48
38	Greensburg Reservoir	0.45	na	84
39	Lake McCoy	4.62	43.7	241
40	Lake Santee	4.63	250.0	883
41	Leming and Robinson Lake	1.83	21.7	68
42	Middle Fork Lake	na	28.6	260
43	Reed's Lake	na	na	55
44	C.J. Rust Lake	0.31	35.1	210
45	Hillview Lake	na	13.1	48
46	Knob Lake	na	9.4	52
47	Lake and Forest Lake	1.45	55.2	651
48	Lake Pyoca	0.59	21.9	117
49	Lake Tarzian	1.83	56.0	263
50	Starve Hollow Lake	6.67	145.0	319
51	Timber Lake	na	5.1	71

Table 156 (continued)

Lake Number	Lake Name	Drainage Area (square miles)	Surface Area (acres)	Gross Storage (million gallons)
52	Broomsage Ranch Lake	0.35	22.0	33
53	Brush Creek Reservoir	14.30	170.0	664
54	Crosley Lake	na	14.0	42
55	Hickory Lake	na	35.9	97

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 Eleven are presented in Table 157. 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 is less than one hundred the supply is less than the projected demand.

Boating and Waterskiing The demand for boating and waterskiing opportunities currently exceeds the supply within the region. This shortage of supply is expected to remain through the year 2000. Sweetwater and Lemon Lakes in Brown County, and Lake Santee in Decatur County provide the only opportunity for waterskiing.

Table 157
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	29	19.6 boats/acre/year	4,300 acres	62	57	55
Waterskiing	8	34.4 skiers/acre/year	1,000 acres	60	56	54
Canoeing	7	585 canoes/mile/year	122 miles	100+	100+	100+
Swimming	38	76,600 swimmers/acre/year	23 acres	100+	100+	100+
Ice-Skating	8	6,678 skaters/acre/year	5 acres	71	63	63
Fishing	46	66 persons/acre/year	10,000 acres	54	49	46

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.

Canoeing At least 122 miles of canoeing streams are available. The East Fork of the White, Flatrock, Driftwood, and Muscatatuck Rivers are all recommended for canoe trips. There is no current or projected shortage of canoeing mileage.

Swimming and Ice-Skating The swimming needs are adequately met by the existing supply of public beaches and pools. No shortages are expected to occur through the year 2000. The demand for ice-skating opportunities exceeds the supply and is projected to exceed the supply through the year 2000.

Fishing The quality of the fisheries habitat is shown on Figure 196. The aquatic habitat with the highest value to the fisheries resource is located in steadily flowing streams with sand, gravel, and rock beds lined with pools and riffles. Streams with poor low-flow characteristics such as the Fall Fork of Clifty Creek, Bear Creek, and Wyaloosing Creek, or streams subject to intensive agricultural practices, have lower aquatic habitat values. Warmwater fish are present in most streams in the region, especially sunfish and catfish. Spring sucker fishing is recommended in Clifty Creek, Sand Creek, and the Driftwood River. Smallmouth bass use Big and Little Graham Creeks and Ninevah Creek for spawning. Jackson Creek above Yellowwood Lake supports a "put-and-take" trout fishery. The larger streams, such as the East Fork of the White River and Muscatatuck River generally have good aquatic habitat.

All public lakes in the region are man-made, with the exception of the old river oxbows. The oxbows are landlocked most of the year but restock their fisheries during periods of high water. Except for Greensburg City Park Lake, all the lakes have good habitat for

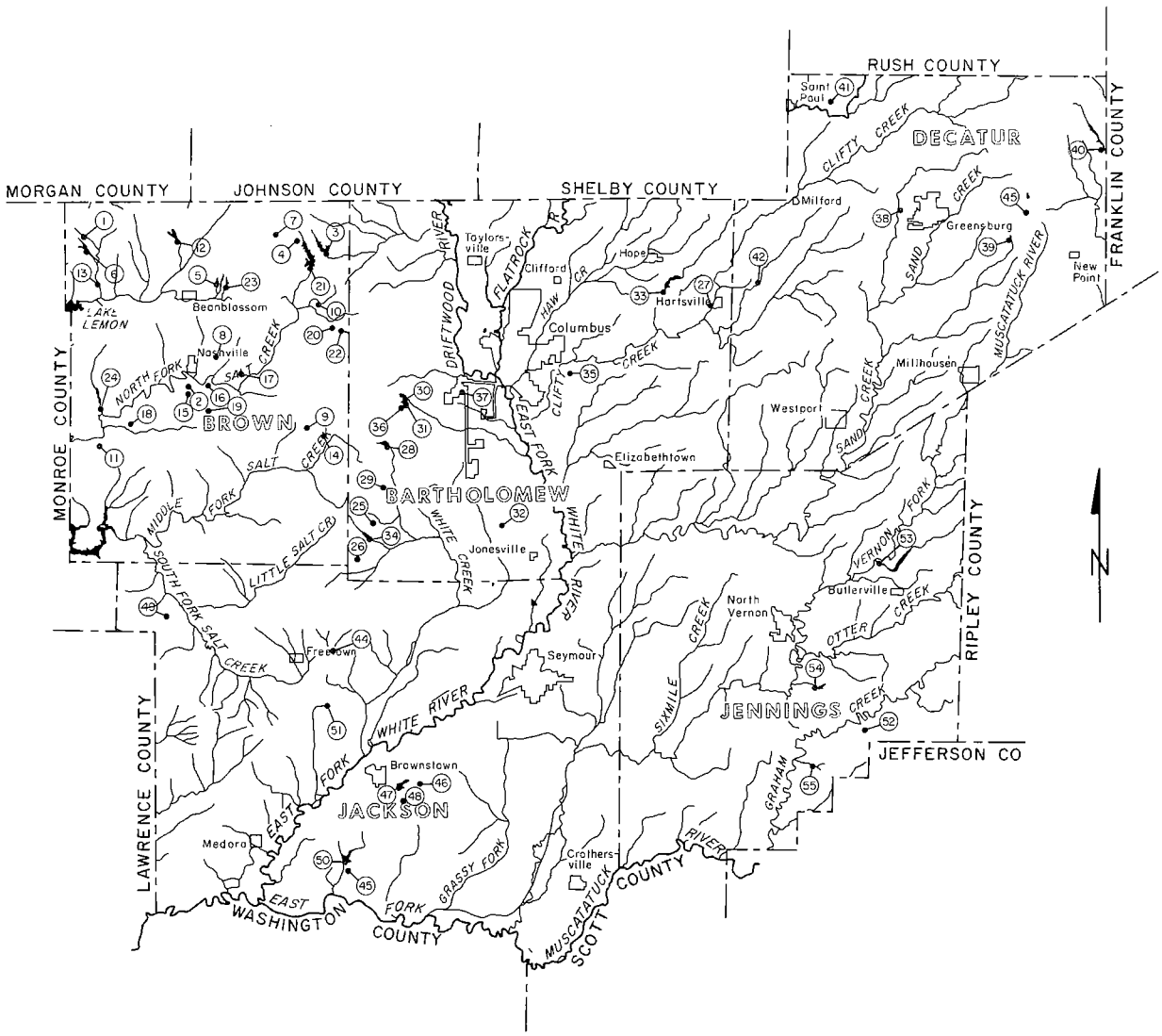

Figure 195
Map of Region Eleven showing the location of lakes that are at least 50.0 acres in size or that have a storage capacity of 32.5 million gallons or more.

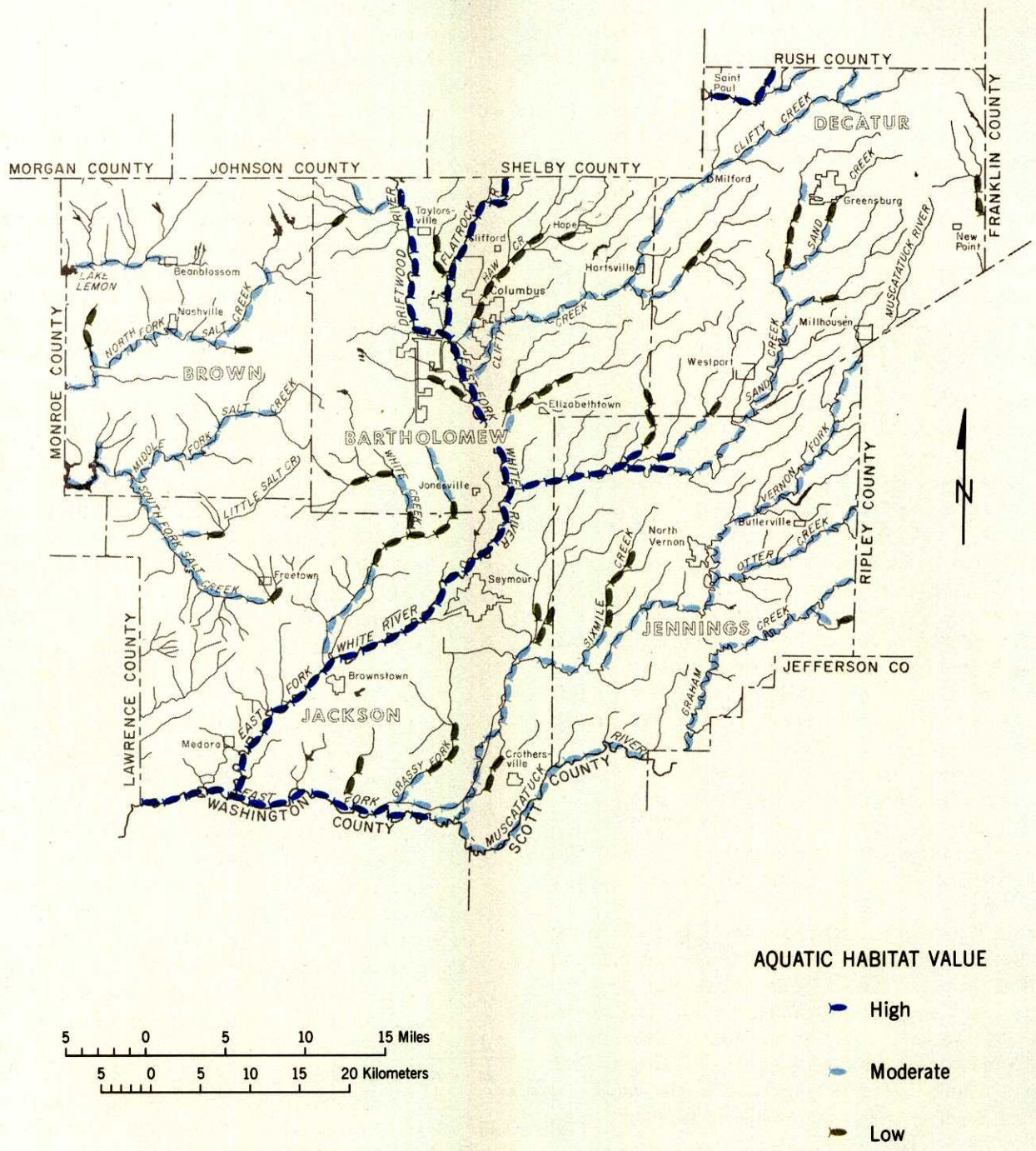

Figure 196
Map of Region Eleven showing the quality of the fisheries habitat.

warmwater fish. Brush Creek Lake is noted for excellent sunfish populations and Starve Hollow Lake offers northern pike sunfish and catfish.

State-owned public fishing sites are available on the East Fork of the White River, Driftwood River, and the East Fork and Vernon Fork of the Muscatatuck River. Other state properties offering fishing access are Greensburg Lake, Grouse Ridge, Cypress Lake and Brownstown Fishing Areas, Brush Creek, and Crosby Fish and Wildlife Areas, Brown County State Park, and Yellowwood and Jackson-Washington State Forests. The Muscatatuck National Wildlife Refuge and Hoosier National Forest offer additional public fishing areas. According to estimates, the existing water acreage meets only fifty-four percent of the current demand for fishing water by residents of the region.

Riparian Habitat The quality of the riparian habitat associated with lakes and streams is indicated in Figure 197. The streams that have not been channelized, such as Big Graham Creek, Vernon Fork Muscatatuck River, and the Fall Fork of Clifty Creek, provide very good wildlife habitat. Ninevah Creek in Camp Atterbury has excellent habitat, which has been undisturbed for nearly forty years. Streams in agricultural areas that are channelized and farmed to their edge have low wildlife value. Other channelized streams, such as Grassy Fork, Grassy, Mutton, and Storm Creeks (in Jackson County) have higher values for wildlife habitat due to revegetated banks. A variety of wildlife use the riparian habitat including furbearers, upland game, shorebirds, songbirds, and waterfowl. The less developed lakes in the region, especially on state and federal properties, provide good to excellent wildlife habitat. Most lakes are surrounded by hardwoods and are frequented by upland game species and various birds.

The most extensive wetlands in the region are in the Muscatatuck National Wildlife Refuge and the wet woods at the upper end of Monroe Lake. Wetlands also occur in the older oxbows. Waterfowl and furbearers, especially muskrat, use the wetland habitat. Public hunting in riparian habitat is permitted at Muscatatuck National Wildlife Refuge, Crosby and Brush State Creek Fish and Wildlife Areas, and Yellowwood State Forest.

Withdrawal Uses

Public Water Supplies Bartholomew, Brown, Decatur, Jackson, and Jennings Counties are served by twenty-seven public water utilities. Approximately 78,500 residents of Region Eleven were served by a public utility in 1975. Approximately 32,800 residents of Bartholomew County are served by public water utilities. At sixty-four percent, Jackson County has the highest percentage of population served.

Fifteen of the public water utilities have service areas consisting primarily of a single urban area. Figure 198 indicates the service areas and withdrawals by public water utilities in Region Eleven. The Columbus system, the largest single public water utility in the region, served approximately 27,500 customers in 1975 and withdrew an average of 5.3 million-gallons-per-day. Other large urban systems include Seymour, providing 13,700 customers with 1.3 mgd; Greensburg, providing 8,500 customers with 1.4 mgd; and North Vernon, providing 4,500 customers with 1.3 mgd. The Freeman Field Utility withdraws an average of 630,000 gallons-per-day primarily for an industrial park, but also supplies approximately 700 persons in adjacent areas.

The remaining twelve public water utilities are primarily rural water systems, which consist of a source of supply and miles of small diameter pipe running along the county roads in the area. The largest rural water system, the Jackson County Water Utility, withdraws approximately 0.5 mgd. Two large systems serve Bartholomew County and several smaller systems radiate out from North Vernon in Jennings County. There are no rural systems in Decatur County, due to a slightly better ground water resource and lack of an adequate supply source for a rural system within the county.

In 1975, public water utilities withdrew an average of 12.4 mgd. Bartholomew County accounted for 5.8 mgd, Jackson County 3.2 mgd, Decatur County 1.7 mgd, Jennings County 1.4 mgd, and Brown County withdrew 0.3 mgd. Not all the water used in the region is withdrawn within the five counties. Some is imported into the region from the Batesville Reservoir, Monroe Reservoir, and from well fields along the Ohio River.

Ground-water sources provide raw water to several of the systems in Region Eleven. All of the utilities in Bartholomew County obtain their water from wells in the East Fork of the White River and Flatrock River aquifers. Crothersville obtains its water from an aquifer within the city limits. Greensburg has developed several wells in less productive aquifers in the area, and from an intake on Flatrock River about six miles from town. Hope, St. Paul, and Edinburgh all use local well fields. Well water is imported into Brown County from the north, and a small amount of well water from along the Ohio River is now being imported into southern Jennings County.

Rural systems that depend on ground water include those in Brownstown and Jackson Counties, which tap into aquifers in the valleys of the East Fork of the White River and the Flatrock River. A well field is being developed in the northeast corner of Jackson County

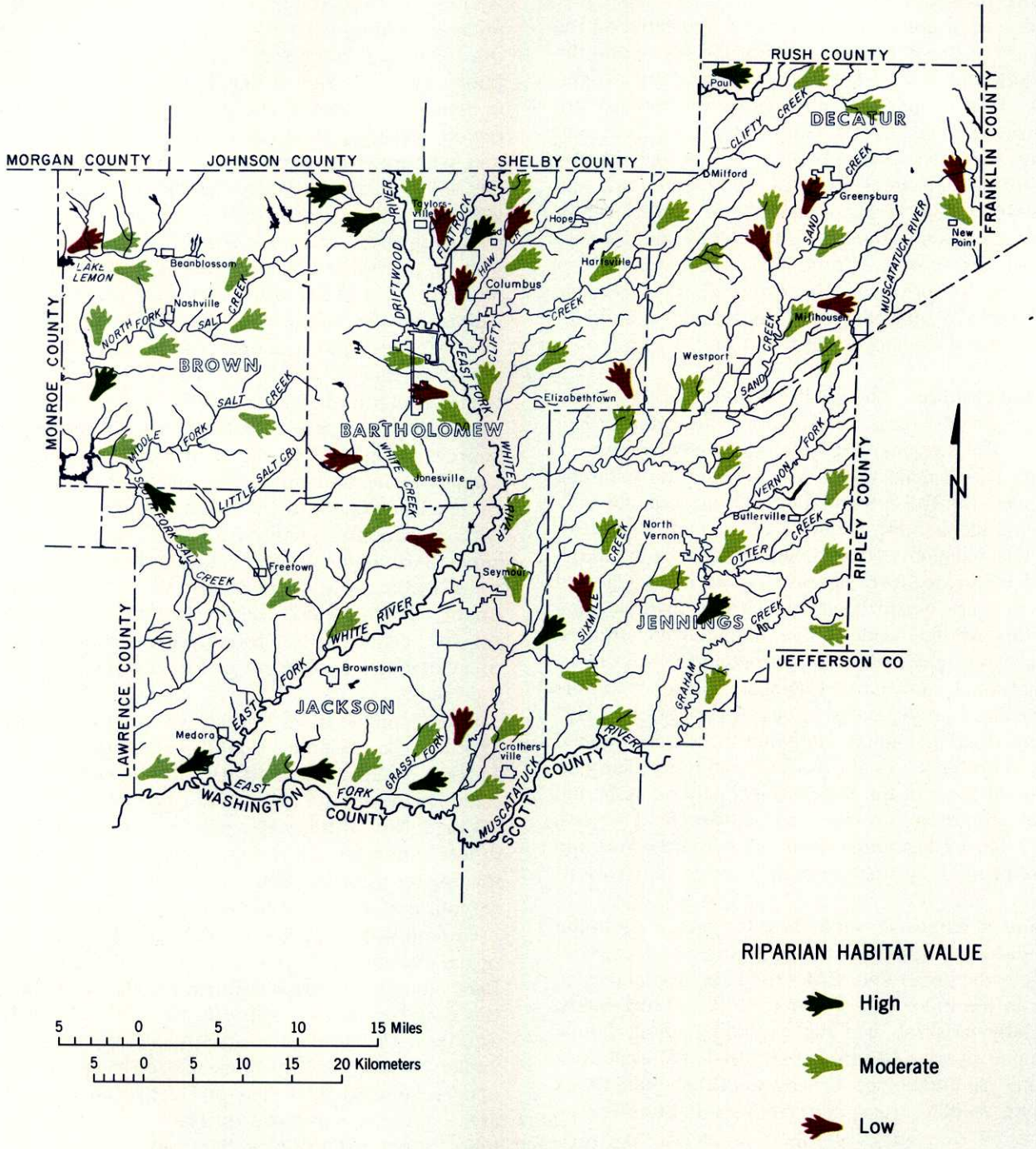

Figure 197
Map of Region Eleven showing the quality of the riparian habitat.

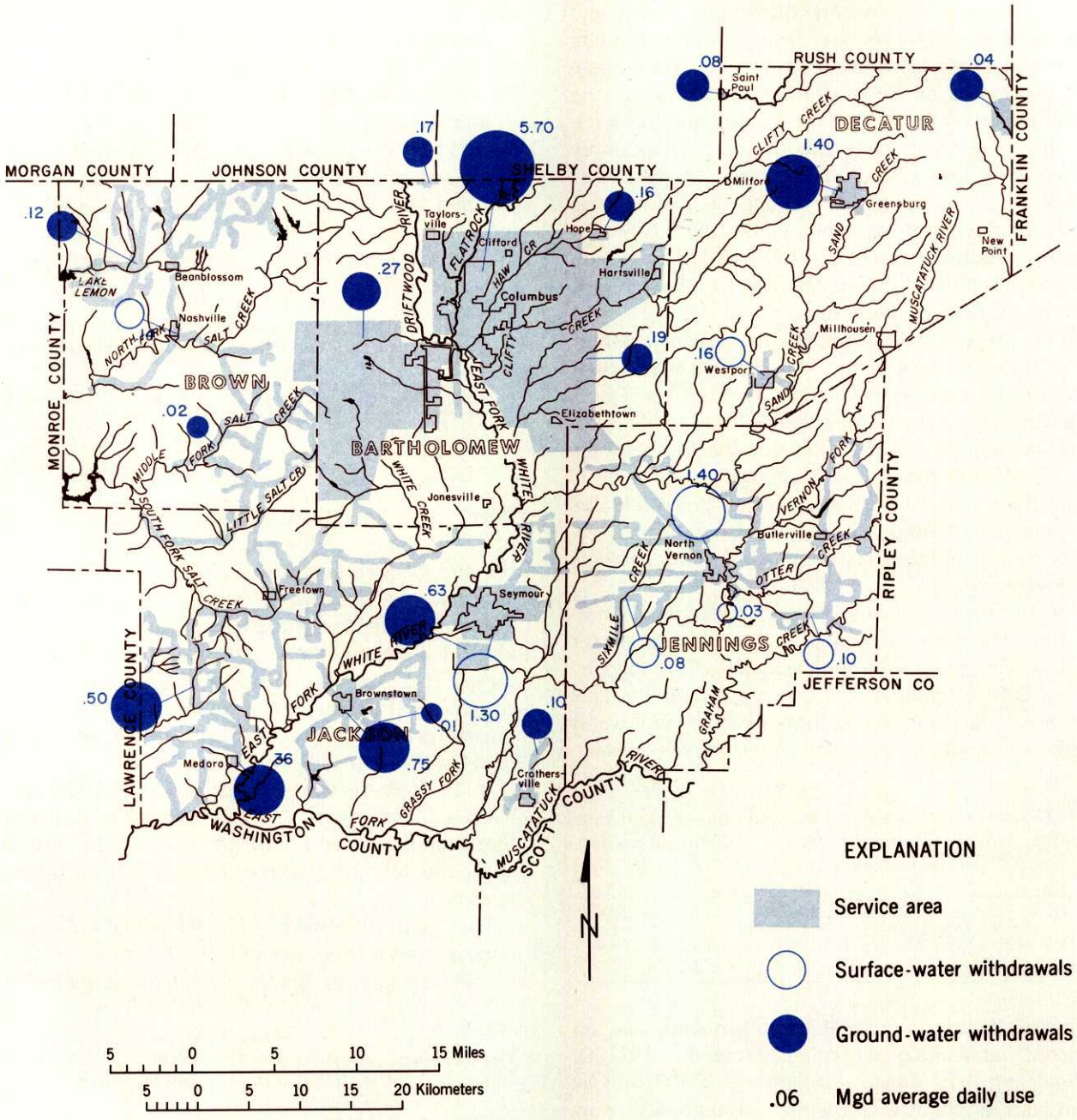

Figure 198
Map of Region Eleven showing the service areas of the public water utilities and average daily use in million-gallons-per-day.