

WITHDRAWAL AND DISTRIBUTION OF WATER BY PUBLIC WATER SUPPLIES IN OHIO, 1985

By Vance E. Nichols

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CONVERSION FACTORS

<u>Multiply</u>	<u>By</u>	<u>To obtain</u>
gallon (gal)	3.785	liter (L)
gallon per day (gal/d)	3.785	liter per day (L/d)
million gallons per day (Mgal/d)	0.04381	cubic meter per second (m ³ /s)

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ABSTRACT

Public water supplies in Ohio withdrew 1,420 million gallons per day in 1985 to supply 83 percent of the population. The State ranked seventh in the Nation in public-water-supply withdrawals and sixth in the population (8.9 million) served by public-water suppliers. Ohio ranked 31st in total public-water-supply use per capita at 160 gallons per day, whereas the National average was 183 gallons per day.

Comparison of the population trend with the reservoir storage trend from 1880 to 1985 in Ohio indicates an increasing reliance by public water supplies on Ohio's surface-water sources. Counties reporting high per capita usage rates generally are in the northern part of the State and generally tap surface-water sources. Counties characterized by high per capita use also tend to be in areas of high population density.

The Ohio Department of Natural Resources and the Ohio Environmental Protection Agency maintain statewide inventories of water-use data and are the principal sources of public-water-supply data at the State level.

INTRODUCTION

On June 25, 1839, Cincinnati (fig. 1) became the first major municipality in Ohio to have a public water supply (Frost, 1985), when the citizens of that city voted to purchase a private water company following a 20-percent rate increase. Since then, public-water supplies have expanded to serve 83 percent of Ohio's population in 1985.

Public-water-supply data from a single, standardized source are needed by managers and planners to aid in resolving water source and distribution problems. Ohio public-water-supply data are collected, stored, and distributed through a State-Federal Cooperative Water-Use data base begun in 1978.

This report estimates withdrawals from Ohio's public water supplies, documents sources for the year 1985, and describes comparisons of estimated public-water-supply data for 1980 and 1985.

ESTIMATES OF WATER WITHDRAWN AND POPULATION SERVED BY PUBLIC WATER SUPPLIES

Public water suppliers in Ohio withdrew nearly 1,420 Mgal/d (million gallons per day) in 1985. Estimated total public-water-supply withdrawals consisted of 1,020 Mgal/d of surface water and 395 Mgal/d of ground water. Ohio ranked seventh in the Nation in public-water-supply withdrawals and sixth in the number of people served (8.9 million). Table 1 compares 1980 data with 1985 data and shows percentage differences between 1980 and 1985. A negative percentage indicates a decline from 1980 to 1985, whereas an unsigned percentage indicates an increase. The table shows a decrease in population, a

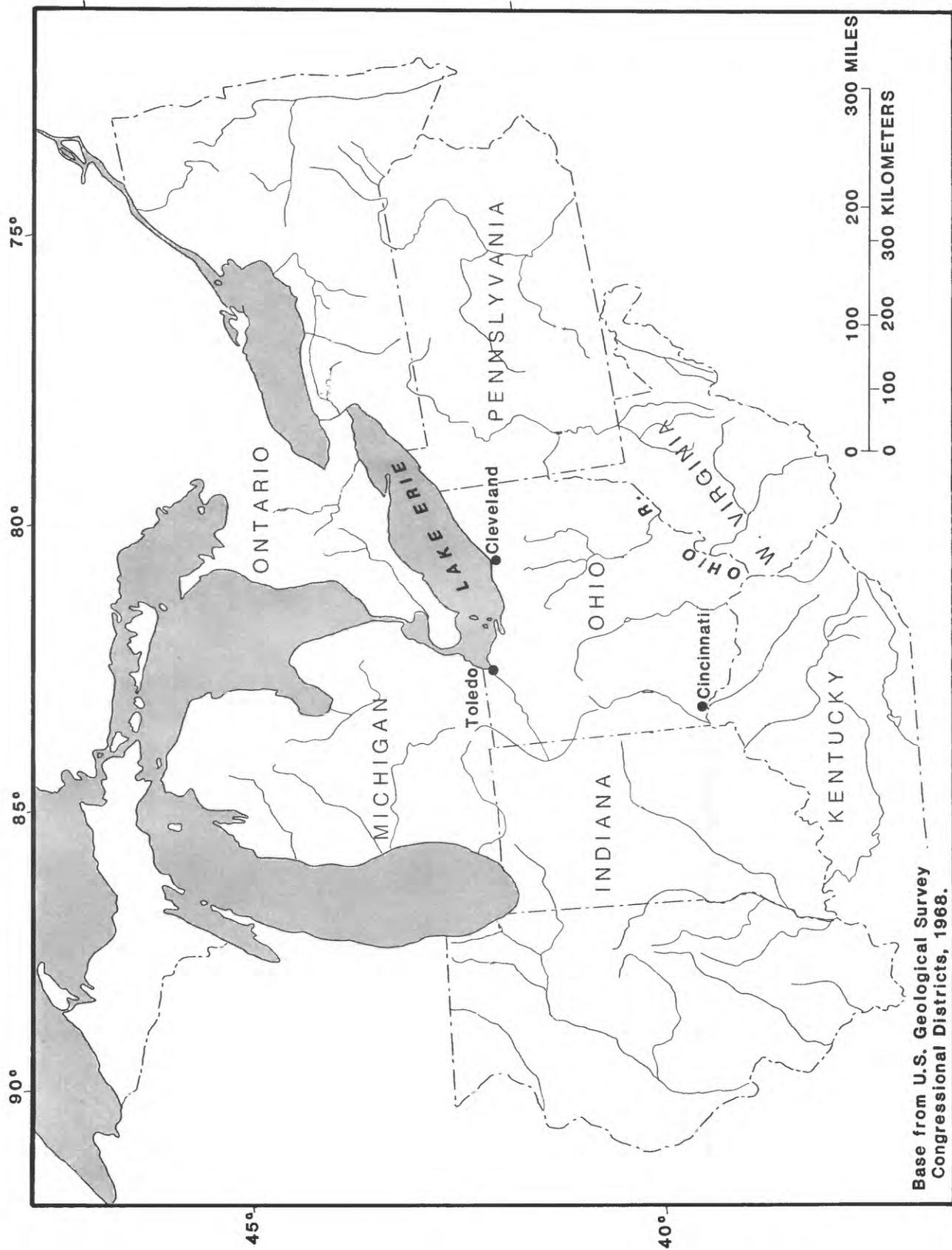


Figure 1.--Location of Ohio and major hydrologic features.

decrease in surface-water withdrawals, and a decrease in the population served by ground water and the total population served by public supplies. Increases are indicated in the ground water withdrawn for public supplies and the population served by surface water, which increased only slightly.

Ohio ranked 31st in total public-water-supply use per capita at 160 gal/d (gallons per day). Figure 2 shows the 26 counties of Ohio for which public-water-supply use was at least 150 gal/d per person. The 13 counties served primarily by surface water generally were in the northern half of the State, and the 13 counties served primarily by ground water generally were in central Ohio. The areas indicated on the map in figure 2 correspond to areas of high population density (fig. 3).

PRINCIPAL WATER SOURCES FOR PUBLIC WATER SUPPLIES

Availability of surface water or the productivity of aquifers and water quality determine the dominant water source in a given area of the State. Figure 4 shows the predominant source of water, by county, for public water supplies in Ohio. Ground water is the predominant source for public water supplies in 42 counties, whereas surface water is the predominant source for the remaining 46 counties.

Parts of southwestern Ohio are underlain by unconsolidated, buried-valley aquifers that generally produce more than half of the water tapped by public water supplies in that area. Parts of northeastern and central Ohio are also underlain by buried-valley aquifers, but the public water supplies there are less dependent on ground water. Eastern, southeastern, and southern counties withdraw ground water mostly from sandstones and limestones for public supplies because demands are relatively small and within the yields of local aquifers. Central, northern, and northwestern Ohio counties depend primarily on surface water for public supplies. Ground water, if available, is cheaper to develop than is surface water as a reliable water source in areas where the terrain is rugged and stream-flows are highly variable.

Ground water withdrawn by public water supplies in Ohio commonly comes from one of seven principal aquifers. Table 2 lists the aquifer types, the amounts of ground water withdrawn from the aquifers for all uses and by public water supplies, and public-water-supply use as a percentage of all uses. Table 2 indicates that coarse-grained alluvial aquifers (delineated on fig. 5) provide almost 70 percent of the ground water used by public-water supplies statewide. The counties whose public water supplies predominantly use ground water (fig. 4) are generally found in the areas of coarse-grained aquifers (fig. 5).

Water withdrawn from surface-water sources by public water supplies is grouped by drainage basin in table 3. (Basins are delineated on figure 6 and can be correlated with table 3.) Table 3 lists the State's drainage basins, amounts of surface water withdrawn for all uses and by public water supplies, and public-water-supply use as a percentage of all uses. Greater than 60 percent of the total amount of surface water used by public water supplies in Ohio is withdrawn in the area from Cleveland to Toledo (Southern and Western Lake Erie basins).

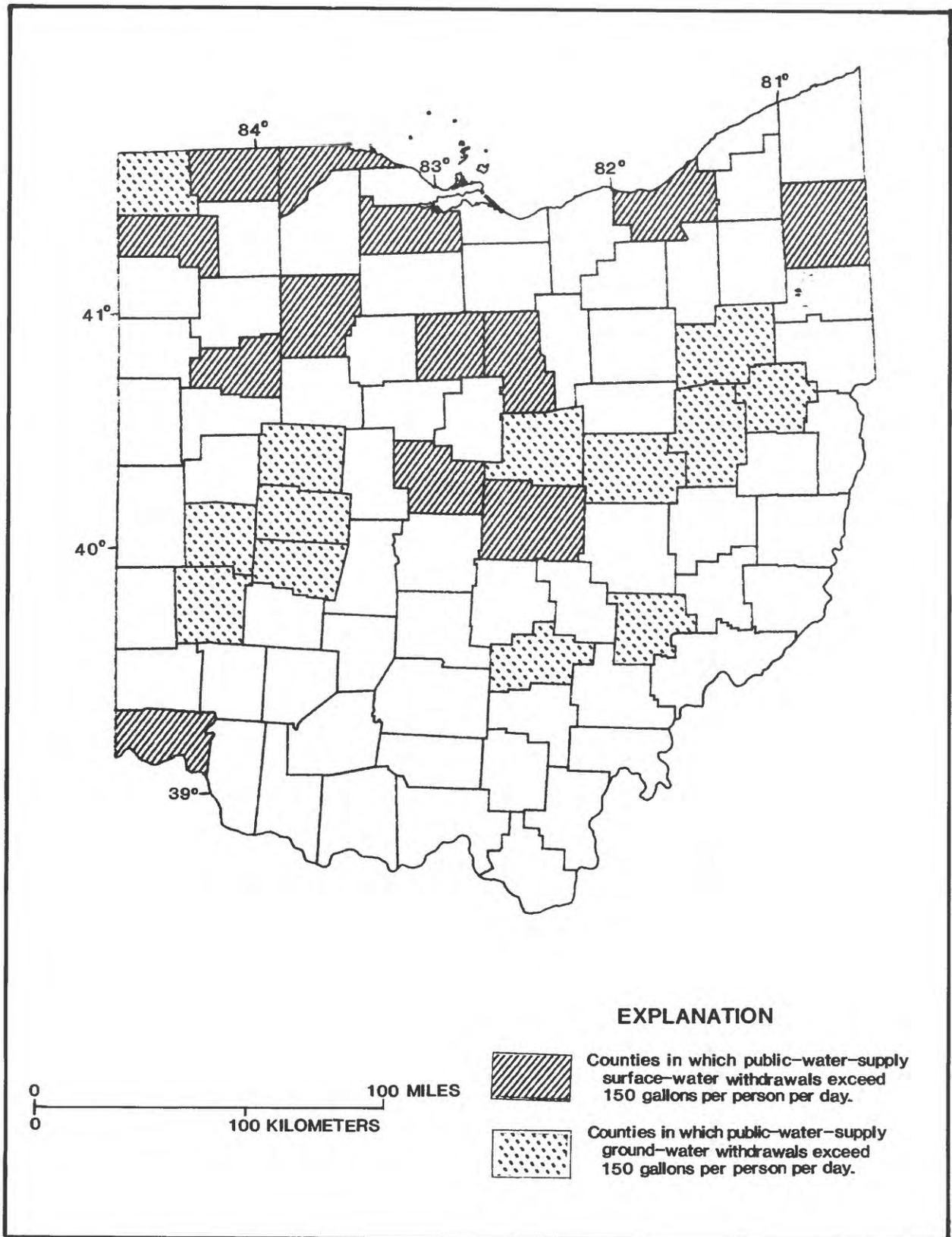
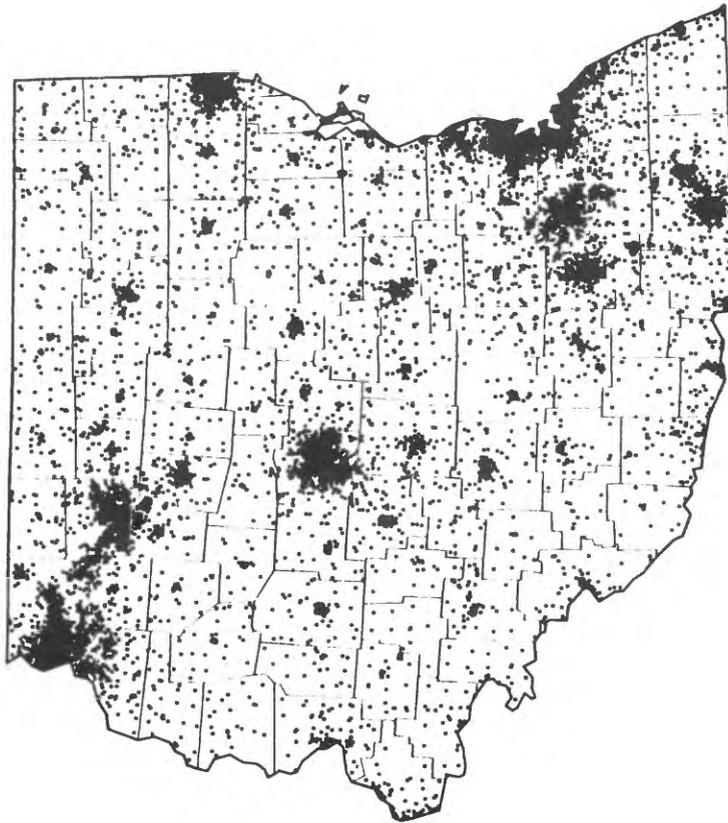


Figure 2.--Counties in Ohio in which public-water-supply use is more than 150 gallons per person per day.



0 50 MILES
0 50 KILOMETERS

EXPLANATION

• 1,000 people

Figure 3.—Population distribution of Ohio, 1985 (compiled by U.S. Geological Survey from U.S. Bureau of the Census, 1980 decennial census data, adjusted to the 1985 U.S. Bureau of the Census data for county populations).

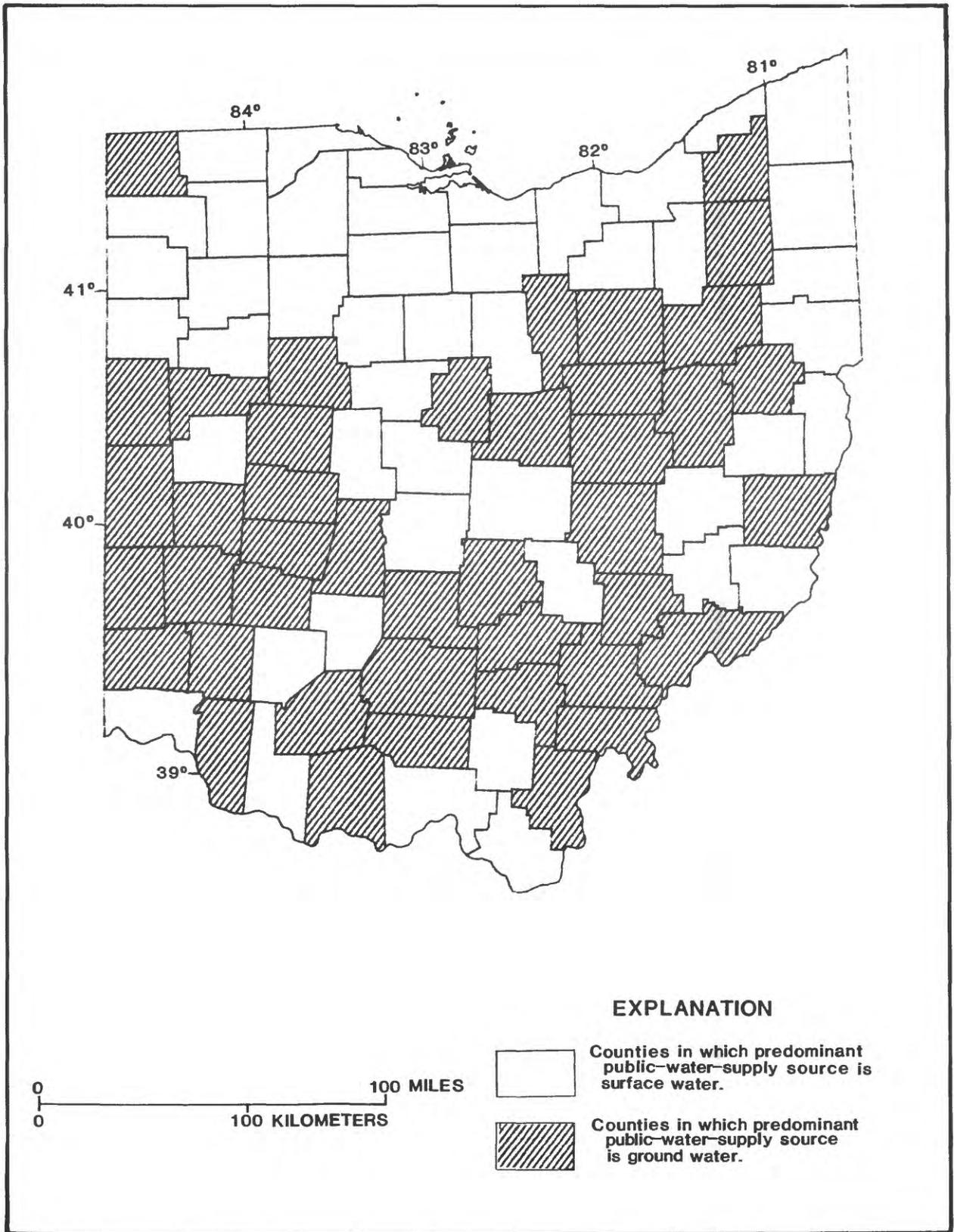


Figure 4.—Primary source of water for public water supplies in Ohio, by county.

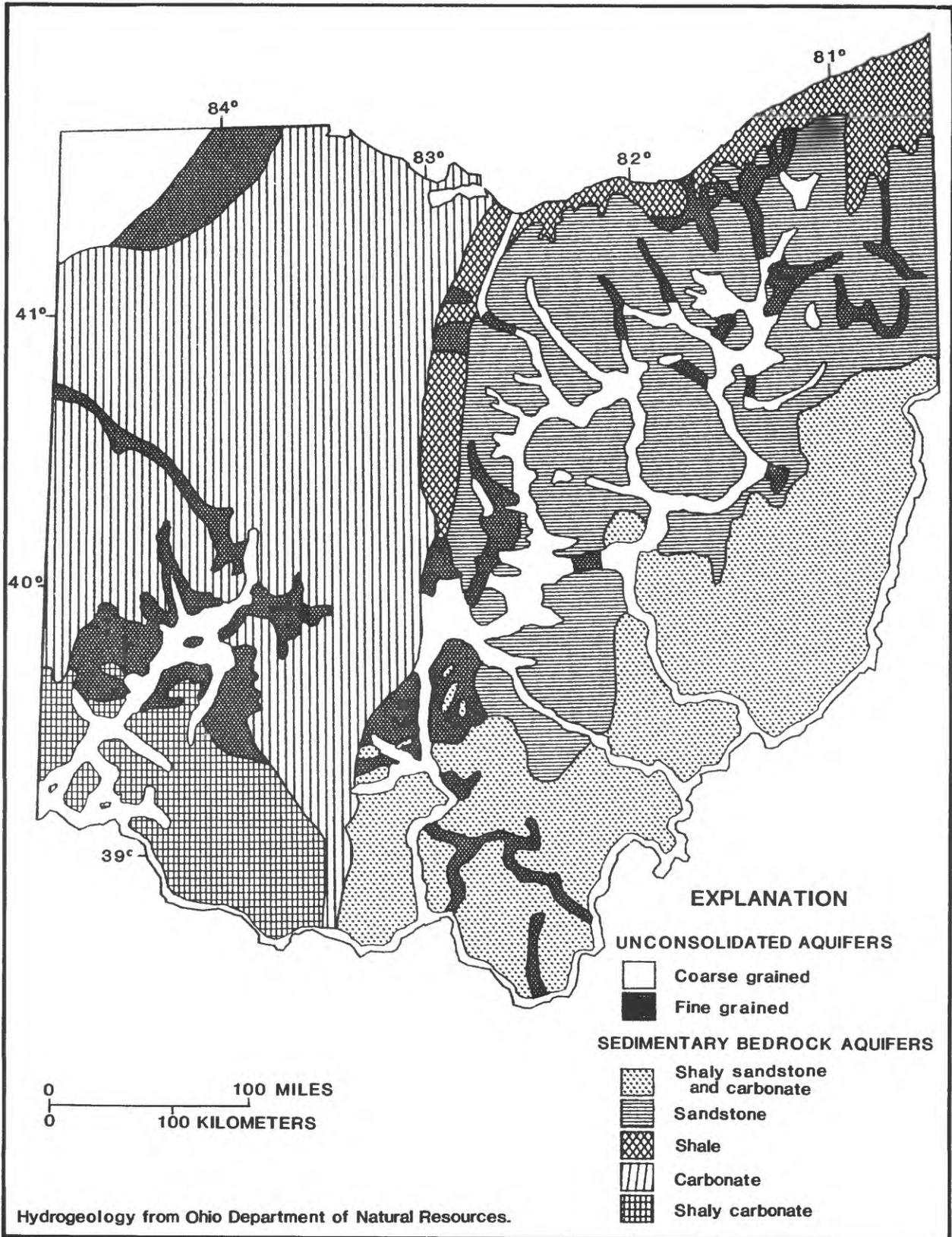


Figure 5.—Geographic distribution of principal aquifers in Ohio.

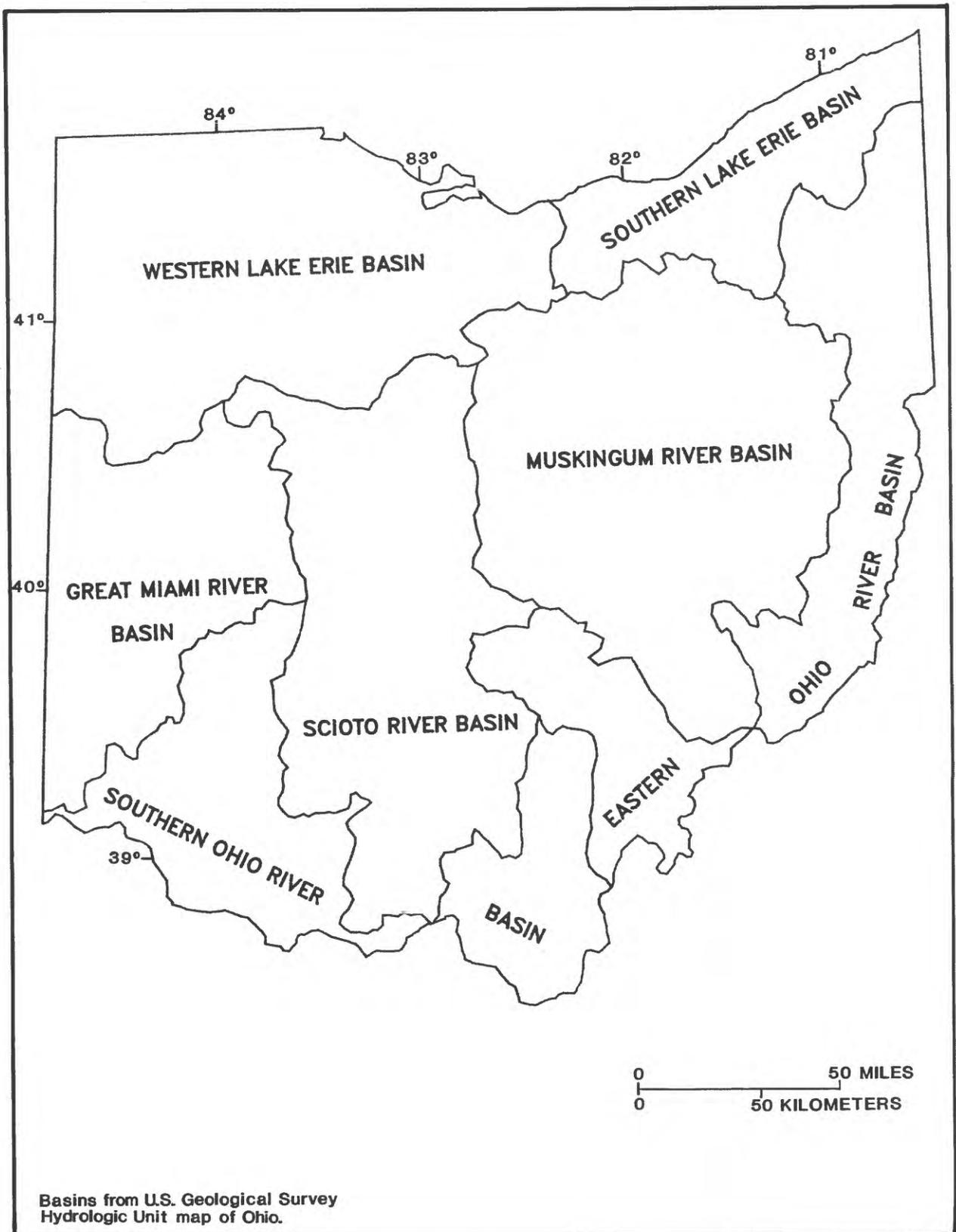


Figure 6.—Major drainage basins of Ohio.

SOURCES OF PUBLIC-WATER-SUPPLY DATA

Most of the State's public-water-supply data are collected by two State agencies--the Ohio Environmental Protection Agency (Ohio EPA) and the Ohio Department of Natural Resources (ODNR). The Ohio EPA is the principal regulatory agency for water quality in Ohio, and is the State Administrator of PL 95-217 (the Clean Water Act). The Ohio EPA Division of Public Water Supply keeps data on, reviews plans for, and issues plan approvals for construction of all public water systems and oversees compliance with and monitoring of maximum contaminant levels for public drinking water. The Division of Public Water Supply also has data for on-site sanitary survey investigations of public water systems and a laboratory-certification program for commercial, private, State, and industrial facilities conducting biological and (or) chemical analyses of potable water.

The ODNR, through its Division of Water, keeps data for investigations related to public water supplies and the distribution of water-resources information. The Division of Water coordinates State and regional water-resources programs such as water planning, ground-water and surface-water inventories, and others. The Division of Water also coordinates with the U.S. Army Corps of Engineers to prepare regional water-management plans and projects.

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Table 1.--Selected population and water-use data for Ohio

[Population data in millions of people; water-use data in million gallons per day. Data from Ohio Environmental Protection Agency, Divisions of Public Drinking Water, Ground Water, and Water Quality Monitoring and Assessment; Ohio Department of Natural Resources, Division of Water; and Eberle and McClure, 1984]

Category	1980	1985	Difference (percent)
<u>Population</u>	10,797	10,752	-0.4
<u>Public Water Supply</u>			
GW Withdrawals	383	395	3.1
SW Withdrawals	1,056	1,020	-3.5
Total	1,439	1,415	-1.7
<u>Population served</u>			
Ground water	2.95	2.84	-3.9
Surface water	6.04	6.06	.3
Total	8.99	8.90	-1.0
<u>Deliveries¹</u>			
Commerical	--	326	--
Industrial	--	340	--
Thermoelectric power generation	--	.33	--
Total	635	666	4.9

¹Commercial, industrial, and thermoelectric categories were combined in 1980.

Table 2.--Ground-water withdrawals by public water supplies in Ohio, 1985

[PWS, public water supply. Data from Ohio Environmental Protection Agency, Divisions of Public Drinking Water, Ground Water, and Water Quality Monitoring and Assessment; Ohio Department of Natural Resources, Division of Water; and Eberle and McClure,1984]

Aquifer type-- age, and formation	Total withdrawals (Mgal/d)	<u>PWS withdrawals</u>	
		Amount (Mgal/d)	Percentage of total
Coarse grained--alluvial; quaternary	434	299	68.9
Fine grained--alluvial; quaternary	41.0	20	48.8
Shaly sandstone and carbonate--Permian; Dunkard Formation	54.8	33	60.2
Sandstone--Pennsylvanian; Conemaugh, Pottsville, and Allegheny Formations	53.2	16	30.1
Shales--Devonian; Ohio Formation	16.0	3	18.8
Carbonates--Silurian; Monroe, Niagra, and Brassfield Formations	131	20	15.3
Shaly carbonates--Ordovician; Richmond Formation	10.1	4	39.6
Total	740	395	53.4

Table 3.--Surface-water withdrawals by public water supplies in Ohio, 1985

[DA, drainage area; mi², square miles; Mgal/d, million gallons per day; PWS, public water supply. Data from Ohio Environmental Protection Agency, Divisions of Public Drinking Water, Ground Water, and Water Quality Monitoring and Assessment; Ohio Department of Natural Resources, Division of Water; and Eberle and McClure, 1984]

Drainage basin	DA mi ²	Total withdrawals (Mgal/d)	<u>PWS withdrawals</u> Amount Mgal/d)	Percentage of total
Western Lake Erie	8,510	1,180	154	13.0
Southern Lake Erie	3,110	2,590	467	18.0
Eastern Ohio River	5,560	4,850	97	2.0
Muskingum River	8,040	1,150	31	2.7
Scioto River	6,510	259	132	51.0
Great Miami	4,230	143	6	4.2
Southern Ohio River	5,040	1,760	132	7.5
Totals	40,850	11,900	1,020	8.6