WATER WITHDRAWAL AND USE IN MARYLAND,

1988-89

By Judith C. Wheeler

U.S. GEOLOGICAL SURVEY

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CONVERSION FACTORS, ABBREVIATED WATER-QUALITY UNITS, AND SELECTED WATER RELATIONS

Multiply	*By*	*To*
acre	4,047	square meter
square mile (mi^2)	2.59	square kilometer
acre-foot [1] (acre-ft)	1,233	cubic meter
gallon per day (gal/d)	0.003785	cubic meter per day
Million gallons per day (Mgal/d)	0.04381	cubic meter per second
acre-foot per year [(acre-ft)/yr]	3.378	cubic meter per day
kilowatt hour (KWh)	3,600,000	joule

Abbreviated water-quality unit:
In this report, chemical concentration in water is given in the metric unit of milligrams per liter (mg/L).

Selected water relations used in this report:

1 million gallons	=	3.07 acre-foot
1 cubic foot of water	=	7.48 gallons
1 acre-foot	=	325,851 gallons
1 inch of rain per acre	=	27,154 gallons
1 inch of rain per square mile	=	17.4 million gallons

[1] One acre covered uniformly by 1 foot of water.

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GLOSSARY

[Definitions modified from Solley and others, 1988; Maryland Water Resources Administration, 1987; and Drever, 1982]

Agriculture (nonirrigation) water use.-- Water used for livestock watering, feedlots, dairy operations, and other farm needs. Livestock includes cattle, dairy cows, sheep, hogs, and poultry.

Aquaculture.-- The controlled production of finfish, shellfish, and aquatic plants in fresh and saline water; also called fish farming or fish culture.

Aquifer.-- A rock unit (including unconsolidated sediments) that will yield water in a usable quantity to wells or springs.

Brackish water.-- Water that is too saline to be potable, but is significantly less saline than seawater. Total dissolved solids (TDS) concentration in brackish water ranges from 1,000 to 20,000 mg/L (milligrams per liter), whereas TDS concentration in seawater is about 35,000 mg/L.

Commercial water use.-- Water withdrawn for motels, hotels, restaurants, office buildings, and other commercial facilities, and for educational, civilian, and military institutions. Laboratories and research facilities are also included in this category. Water can be obtained from a public supply or can be self-supplied.

Consumptive use (consumed water) .-- That quantity of water withdrawn that is evaporated, transpired, incorporated into products or absorbed by crops, consumed by humans or livestock, or otherwise removed from the immediate water environment.

Cooling water.-- Water used to cool condensers, nuclear reactors, and other commercial and industrial equipment.

Domestic water use .-- Water that is obtained from a public supply or is self-supplied and used for household purposes such as drinking, food preparation, bathing, washing dishes and clothes, flushing toilets, and watering lawns and gardens. Water withdrawn for home heating and cooling by ground-water heat pumps is also included in this category.

Evaporation.-- The process by which water is changed from a liquid to a vapor phase.

Freshwater.-- Water that contains less than 1,000 milligrams per liter (mg/L) of TDS; generally, more than 500 mg/L of TDS in water is undesirable for drinking and many industrial uses.

Ground water.-- Generally, all subsurface water, as distinct from surface water; specifically, that part of subsurface water in the saturated zone (a zone in which all interconnected openings are filled with water) where the water is under pressure equal to or greater than that of the atmosphere.

Hydroelectric water use.-- Water used in the generation of electricity at power plants where the turbine generators are driven by falling water; an instream use.

Industrial water use.-- Water used for manufacturing or processing purposes, such as fabrication; washing, cooling, and separation processes; and boiler make-up. Includes use by industries such as steel, chemical and allied products, shipbuilding, petroleum refining, truck assembly, printers and publishers, clothing manufacturers, paper and allied products plants, and food and seafood processors.

Instream use.-- Water use that takes place within the stream channel for such purposes as hydroelectric-power generation, navigation, water-quality improvement, fish propagation, and recreation.

Irrigation water use.-- Artificial application of water on the land surface to assist in the growing of farm and nursery crops or to maintain vegetative growth in recreational lands, such as parks and golf courses.

Mining water use.-- Water used for extracting minerals such as coal. Also includes uses associated with stone, sand, and gravel quarrying, dewatering, milling (crushing, screening, washing, flotation), and other preparations usually performed at the mine site or as part of a mining activity. Dewatering in the construction of subway tunnels is also included.

Public supply water use.-- Water withdrawn by public and private water suppliers and delivered for a variety of uses, such as domestic, commercial, and industrial. Public water suppliers include municipalities, towns, or counties having incorporated governments. Private water suppliers include unincorporated communities, subdivisions with central water supplies, trailer parks, apartment buildings, and migrant labor camps with independent supply systems.

Reclaimed wastewater.-- Wastewater-treatment-plant effluent that has been diverted or intercepted for use before it reaches a natural waterway or aquifer.

Saline water.-- Water that contains more than 1,000 mg/L of TDS ("slightly saline"--1,000 to 3,000 mg/L; "moderately saline"--3,000 to 10,000 mg/L; "very saline"--10,000-35,000 mg/L).

Self-supplied water.-- Water withdrawn by a user of a surface-water or ground-water source and not furnished by a public supply. Homes and small communities relying on individual wells are included in this category.

Surface water.-- A body of water on the land surface, such as a stream or a lake.

Thermoelectric-power water use.-- Water used in the process of the generation of electricity by other than hydroelectric processes.

Withdrawal.-- Water diverted from a surface-water source or removed from an aquifer for use.

WATER WITHDRAWAL AND USE IN MARYLAND, 1988-89

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ABSTRACT

This report summarizes the results of a study by the U.S. Geological Survey, in cooperation with the Maryland Water Resources Administration and the Maryland Geological Survey, to estimate amounts of fresh and saline water withdrawn and used in Maryland during 1988-89.

During 1988, about 1,480 Mgal/d (million gallons per day) of freshwater was withdrawn from surface-water and ground-water sources in Maryland. Of this amount, 1,240 Mgal/d (84 percent) was used in the State and 240 Mgal/d (16 percent) was transferred to surrounding States and the District of Columbia for water supply. About 7.50 Mgal/d of freshwater was imported from bordering States for use in Maryland.

During 1989, total freshwater withdrawals in Maryland decreased to 1,430 Mgal/d, with 1,196 Mgal/d used in the State and 234 Mgal/d transferred to surrounding States and the District of Columbia. About 7.15 Mgal/d of freshwater was imported from bordering States for use in Maryland.

During 1988-89, most freshwater withdrawals (about 1,240 Mgal/d during 1988 and 1,200 Mgal/d during 1989 or 84 percent of total for each year) were from surface-water sources. The largest surface-water withdrawals, greater than 100 Mgal/d, were in Montgomery and Baltimore Counties. These counties provided water sources for public suppliers that serve the Baltimore City and District of Columbia metropolitan areas. More than 70 percent of the fresh surface water (about 889 Mgal/d during 1988 and 852 Mgal/d during 1989) was withdrawn and used in the Potomac drainage basin whereas most ground water (about 172 Mgal/d during 1988 and 159 Mgal/d during 1989) was withdrawn and used in the Upper Chesapeake drainage basin. The Potomac Group aquifers were the largest source of ground water (24 percent of total ground-water withdrawals) in each year.

The population of Maryland served by public water-supply systems increased from 3.80 million (83 percent) during 1988 to 3.86 million (84 percent) during 1989. In addition, during the peak tourist season (from May to September), the Ocean City water-supply system served approximately 268,000 more individuals than the base population of about 12,000. During both years, surface water was used by about 69 percent of the State's population and ground water was used by the remaining 31 percent.

Ten water-use categories represent the major demands on the surface-water and ground-water resources of the State during 1988-89: Public supply, domestic, commercial, industrial, mining, thermoelectric power generation, hydroelectric power generation, agriculture (nonirrigation), irrigation, and aquaculture. Notable facts about these uses are:

- *Public supply--810 Mgal/d of freshwater was withdrawn in 1988 (791 Mgal/d during 1989) and delivered for use by residences, commercial establishments, and industries. Public suppliers withdrew the largest quantities of water in the State. Baltimore City received the largest public-supply deliveries, about 147 Mgal/d during 1988 and 145 Mgal/d during 1989.*

- *Domestic--488 Mgal/d of freshwater was used during 1988 (486 Mgal/d during 1989). About 425 Mgal/d during 1988 and 423 Mgal/d during 1989 were received from public suppliers and about 63.2 Mgal/d during 1988 and 63.1 Mgal/d during 1989 were self-supplied. All self-supplied domestic water withdrawals were from ground-water sources.*

- *Industrial–140 Mgal/d of freshwater was used during 1988 (138 Mgal/d during 1989). About 76.9 Mgal/d during 1988, and 75.9 Mgal/d during 1989 were self-supplied; the remaining water used was delivered by public suppliers. Industries also used 336 Mgal/d of saline surface water during 1988 (356 Mgal/d during 1989). About 80.0 Mgal/d of reclaimed municipal wastewater was used during each year.*

- *Mining--23.9 Mgal/d of freshwater was used during 1988-89. About 17.7 Mgal/d during 1988, and 6.77 Mgal/d during 1989 of brackish or saline surface water were withdrawn, primarily for dredging operations.*

- *Thermoelectric-power generation--418 Mgal/d of freshwater was used during 1988 (397 Mgal/d during 1989). Smaller quantities of saline surface water were used for cooling purposes during 1989 (4,760 Mgal/d) than during 1988 (6,090 Mgal/d), primarily because of inactivity at a nuclear power plant during most of 1989.*

- *Hydroelectric-power generation (instream water use)--15,800 Mgal/d of freshwater was used for the production of electricity during 1988 (21,900 Mgal/d during 1989). Although the amount of water diverted through some plants was considerable, the amount* **consumed**[1] *was negligible.*

- *Agriculture (nonirrigation)–About 10.4 Mgal/d of freshwater was used during each year of the 2-year period. About 2.44 Mgal/d was from surface-water sources and 7.95 was from ground-water sources.*

- *Irrigation--46.5 Mgal/d of freshwater was used during 1988 (36.9 Mgal/d during 1989). Most of the water (41.3 Mgal/d during 1988 and 33.5 Mgal/d during 1989) was used for irrigating farm crops.*

- *Aquaculture–7.35 Mgal/d of freshwater was used during 1988 (8.69 Mgal/d during 1989). Saline surface-water withdrawals increased from 4.32 Mgal/d during 1988 to 12.0 Mgal/d during 1989.*

1. Words that are **bold** are found in the "Glossary" section of the report.

INTRODUCTION

Maryland has a total land and water area of 12,303 mi^2 and is subdivided into 23 counties and Baltimore City (fig. 1). The State has abundant **surface-water** and **ground-water** resources. As the demand for water increases, however, additional stress is placed on these resources. Effective water-resource management depends, in part, on current and accurate water-withdrawal and use data. Such data are valuable for evaluating effects of withdrawals on the State's water resources, identifying current water-use patterns, and estimating future water demands. The study on which this report is based was conducted by the U.S. Geological Survey, as part of the National Water-Use Information Program of collecting and compiling reliable site-specific and aggregated water-use information at State and national levels. The study was conducted in cooperation with the Maryland Water Resources Administration (WRA) and the Maryland Geological Survey. The results of similar studies in 1986 and 1987 are summarized by Wheeler (1990; 1991).

Purpose and Scope

This report summarizes the amounts of fresh and **saline water** withdrawn and used in Maryland during 1988 and 1989. The water-use data are discussed briefly and presented in graphs, tables, and maps organized by counties, type of use, drainage basins, and **aquifers**.

In this report, the amount of water withdrawn from sources in each county is distinguished from the amount of water used in each county. Withdrawals in each county include all water withdrawn or transferred to another county or State. Water use is the amount of water actually used in a particular county, including (1) water withdrawn for use in the county and (2) water imported from another county or State. Amounts of self-supplied water and water delivered from **public-supply** systems are presented for each category of use.

The water-use categories discussed in this report are public supply, **domestic**, **commercial**, **industrial**, **mining**, **thermoelectric power generation**, **hydroelectric** power generation, **agriculture** (nonirrigation), **irrigation**, and **aquaculture**. Water withdrawn by a public or private water utility and delivered to a variety of users is designated as a "public supply." If a public supply is not available or is not used, the water is classified

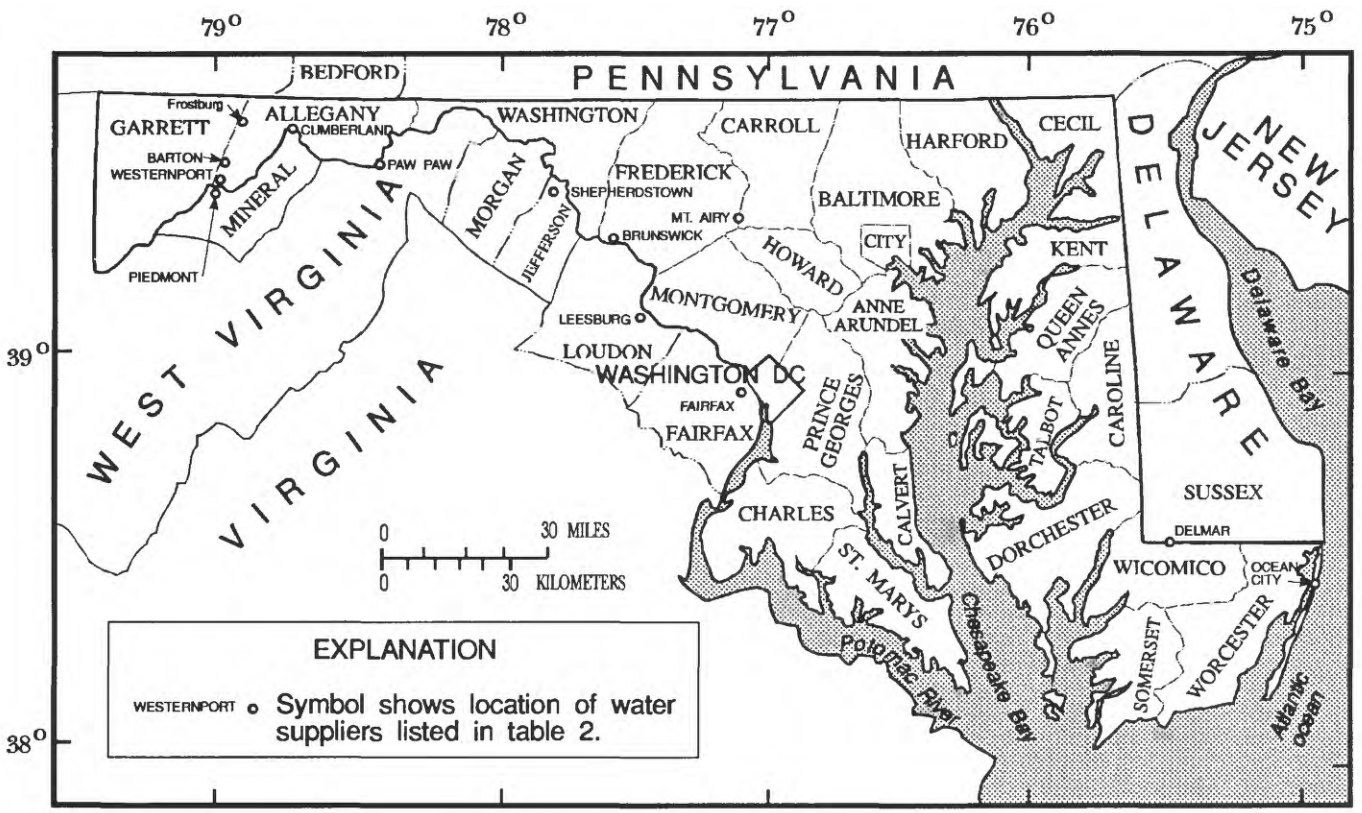


Figure 1.--The counties of Maryland and selected counties of Virginia, West Virginia, and Pennsylvania.

as **"self-supplied."** Homes and small communities relying on individual wells are classified as domestic self-supplied water users. Thermoelectric power generation is defined as electrical energy generated in steam-electric plants including those using nuclear fuel. Water used for the generation of electricity by hydroelectric power plants is also discussed in this report but the quantities of water used are not included in the **freshwater** totals because this is considered an **"instream"** water use and not a withdrawal--that is, water use takes place within the stream channel at the dam, where turbine generators are driven by falling water.

Methods of Data Collection and Estimation

Most of the water-use data on public suppliers, commercial and industrial facilities, mines, and thermoelectric power plants were obtained from pumpage reports submitted to WRA by users withdrawing 0.01 Mgal/d or more. Monthly and annual withdrawal data are stored in a computerized data base by WRA. The U.S. Geological Survey, in cooperation with WRA and the Maryland Department of the Environment (MDE), maintains the Maryland Site-Specific State Water-Use Data System (SSWUDS), a computerized data base designed to store water-withdrawal data from the WRA and return-flow data from the MDE for users that withdraw or return 0.01 Mgal/d or more. The WRA's data base and SSWUDS were used in the preparation of this report. Water-use data for users of less than 0.01 Mgal/d were estimated from the average daily allocations established in water-appropriation and use permits issued by WRA.

Data on domestic, hydroelectric-power-generation, agricultural, and irrigation water use were estimated using the following methods:

Self-supplied domestic withdrawal was estimated by determining the population not served by public

suppliers (based on data from individual county water and sewerage plans), subtracting that number from the total population for each county (compiled from Maryland Department of State Planning, 1987 or from county water and sewerage reports), and multiplying the result by 80 gal/d, the estimated per capita water use in Maryland (J.R. Herring, Maryland Water Resources Administration, oral commun., 1991).

Hydroelectric-power-generation water use was estimated based on annual electric power generation data obtained from the Energy Information Administration and a coefficient for water used per KWh (kilowatt hour) (S.B. Weisberg, Martin Marietta Environmental Systems, written commun., 1986).

Agriculture (nonirrigation) water use was estimated based on the number of farm animals in each county (U.S. Department of Commerce, 1988) and the average amount of water used per animal (U.S. Environmental Protection Agency, 1973, p. 15). Because the most recent agricultural census was conducted during 1987, the same number of animals was assumed for 1988-89. The estimates also are based on the assumption that grazing animals such as cattle and sheep consumed surface water, and poultry, hogs, and dairy cows consumed ground water.

Irrigation water use was estimated from the number of acres irrigated, using a water-application rate of 0.75 (acre-ft)/yr per acre or about 670 gal/d per acre during 1988 and 0.6 (acre-ft)/year per acre or about 536 gal/d per acre during 1989 (L.E. Carr, Maryland Cooperative Extension Service, oral commun., 1991).

Population and Water-Use Trends

The population of Maryland increased from about 4,560,000 during 1988 to 4,620,000 in 1989 (estimates based on projections from Maryland Department of State Planning, 1987). Population and water-use facts for 1988 and 1989 are presented in table 1. The population served by public water-supply systems increased from about 3.80 million (83 percent) during 1988 to 3.86 million (84 percent) during 1989. During each year, surface water was used by about 69 percent of the population and ground water was used by 31 percent of the population.

Table 1.--*Population and water use in Maryland, 1988-89*

[Population data rounded to three significant figures and may not add to totals because of independent rounding. Percentages rounded to two significant figures]

	1988	1989
TOTAL POPULATION:	4,560,000	4,620,000
Population served by public-supply systems	3,800,000	3,860,000
Percentage of population served	83	84
Population served by self-supplied systems	762,000	759,000
Percentage of population self-supplied	17	16
SURFACE-WATER SUPPLY:		
Percentage of total population served by surface water	69	69
Number served by public-supply systems	3,130,000	3,170,000
Percentage of total population	69	69
Number served by self-supplied systems	0	0
Percentage of total population	0	0
GROUND-WATER SUPPLY:		
Percentage of total population served by ground water	31	31
Number served by public-supply systems	672,000	692,000
Percentage of total population	15	15
Number served by self-supplied system	762,000	759,000
Percentage of total population	17	16

Population and water-use trends in Maryland from 1950 to 1989 are shown in figure 2. During 1950, about 2.34 million people used approximately 400 Mgal/d of freshwater. Population and water use increased steadily through the 1950's and 1960's. Subsequently, however, population growth slowed, increasing from 3.92 million people in 1970 to 4.6 million in 1989. Water use during the same period leveled off in the early 1970's at about 1,500 Mgal/d, then decreased over the rest of the decade. During 1980, water use was about 1,400 Mgal/d. Possible explanations for the decrease in water use include changing economic conditions, declining water use among certain industries, and increasing use of conservation techniques and fixtures. However, water use increased from 1985 to 1988, from about 1,400 Mgal/d to about 1,480 Mgal/d, primarily because of increased withdrawals for **cooling** purposes by power plants, and for irrigation and public-supply distribution. During 1989, water use decreased to 1,430 Mgal/d, primarily because of decreased withdrawals for irrigation and cooling purposes by power plants.

WATER USE

During 1988, approximately 1,480 Mgal/d of freshwater was withdrawn from surface-water and ground-water sources in Maryland. Of this amount, 1,240 Mgal/d (84 percent) was used in the State and 240 Mgal/d (16 percent) was transferred to surrounding States and the District of Columbia for water supply. About 7.50 Mgal/d of freshwater was imported from bordering States for use in Maryland. During 1989, about 1,430 Mgal/d of freshwater was withdrawn. Of this amount, 1,196 Mgal/d (84 percent) was used in the State and 234

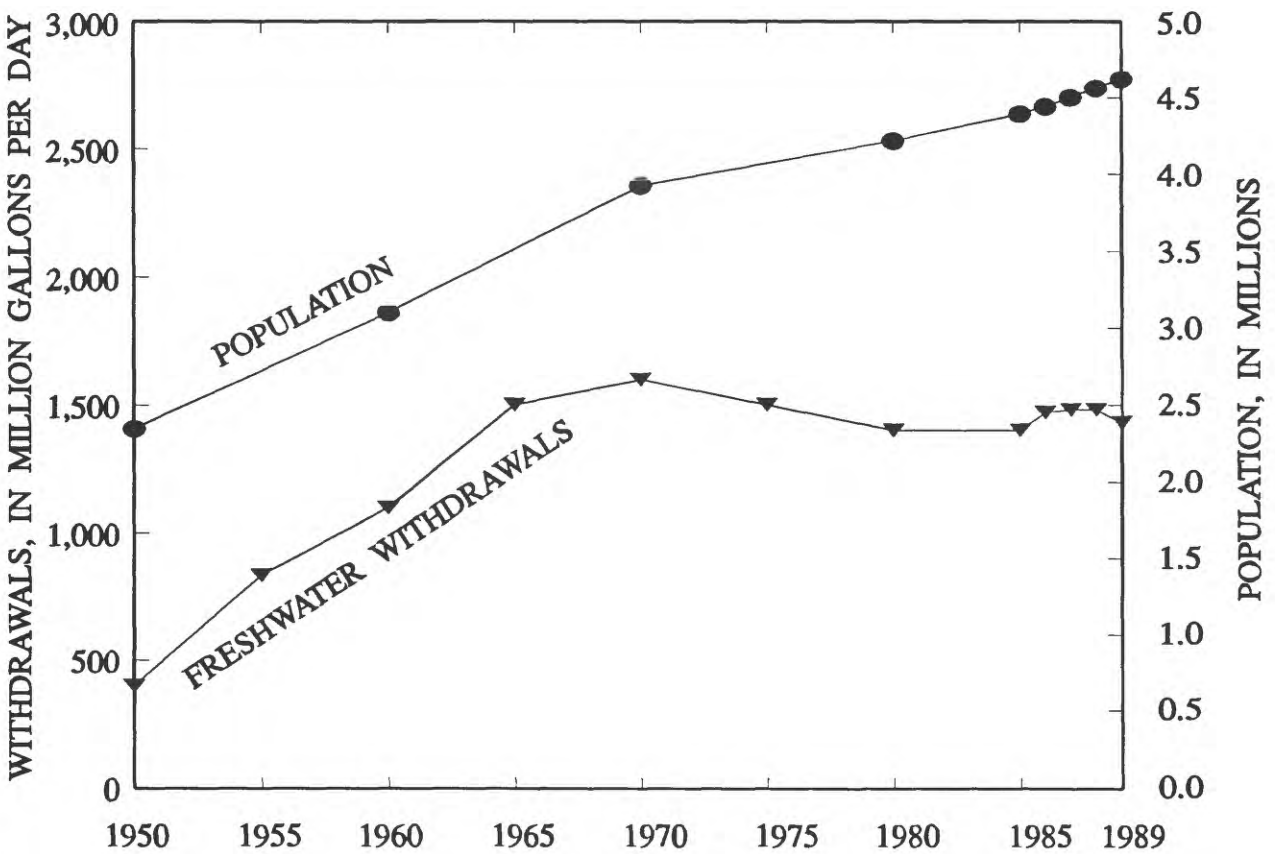


Figure 2.--Population and freshwater withdrawals in Maryland, 1950-89.

Mgal/d (16 percent) was transferred to surrounding areas. About 7.15 Mgal/d of freshwater was imported from bordering States for use in Maryland. In addition, some public suppliers in Maryland withdraw or deliver water across county and State boundaries. Suppliers that withdraw or deliver water across county and State boundaries and the quantities delivered are shown in table 2.

Withdrawals of fresh surface water and ground water by county are shown in figure 3. The largest water withdrawals (more than 100 Mgal/d) were in Baltimore and Montgomery Counties. These counties provide water sources for public suppliers that serve the Baltimore City and District of Columbia metropolitan areas. The smallest water withdrawals (less than 4.50 Mgal/d) were in Baltimore City and Howard County because the principal public-supply sources for Baltimore City are located in Baltimore County, and because Howard County is served primarily by the Baltimore City public-supply system and the Washington Suburban Sanitary Commission (WSSC) system with water sources in Montgomery and Prince Georges Counties.

Freshwater withdrawals by type of use are summarized in figure 4. Withdrawal and use data by county in 1988 and 1989 are presented in tables 3-13 in the appendix at the end of this report. Table 3a summarizes total withdrawals by county in 1988; table 3b summarizes total withdrawals by county in 1989.

A comparison of total fresh surface-water and ground-water withdrawals by county during 1988 and 1989 is shown in figure 5. During each year, approximately 84 percent (1,240 Mgal/d during 1988 and 1,200 Mgal/d during 1989) of the freshwater withdrawn was from surface-water sources,

Table 2.--*Maryland water suppliers cross-boundary withdrawals and deliveries, 1988-89*

[See fig. 1 for locations]

Water supplier	County and State of withdrawal	County and State of use	Amount delivered, in million gallons per day 1988	1989
Baltimore City	Baltimore, Md.	Anne Arundel, Md.	4.00	9.12
		Baltimore City	146.93	144.74
		Carroll, Md.	1.20	1.21
		Howard, Md.	14.80	14.07
Barton	Garrett, Md.	Allegany, Md.	.09	.09
Brunswick	Washington, Md.	Frederick, Md.	.25	.27
	Loudoun, Va.	Frederick, Md.	.08	.08
Cumberland	Bedford, Pa.	Allegany, Md.	7.07	7.07
Delmar	Sussex, Del.	Wicomico, Md.	.35	.35
Fairfax County				
Frostburg	Garrett, Md.	Allegany, Md.	.84	.84
Water Authority	Montgomery, Md.	Fairfax, Va.	49.73	48.22
Leesburg	Montgomery, Md.	Loudoun, Va.	1.32	1.32
Mt. Airy	Frederick, Md.	Carroll, Md.	.23	.23
Paw Paw	Allegany, Md.	Morgan, W. Va.	.04	.04
Piedmont	Garrett, Md.	Mineral, W. Va.	.09	.09
Shepherdstown	Washington, Md.	Jefferson, W. Va.	.35	.37
Washington Suburban				
Sanitary Commision	Montgomery, Md.	Prince Georges, Md.	49.93	46.72
	Prince Georges, Md.	Howard, Md.	1.50	2.25
Washington Aqueduct	Montgomery, Md.	District of Columbia	188.63	184.02
Westernport	Garrett, Md.	Allegany, Md.	.69	.71

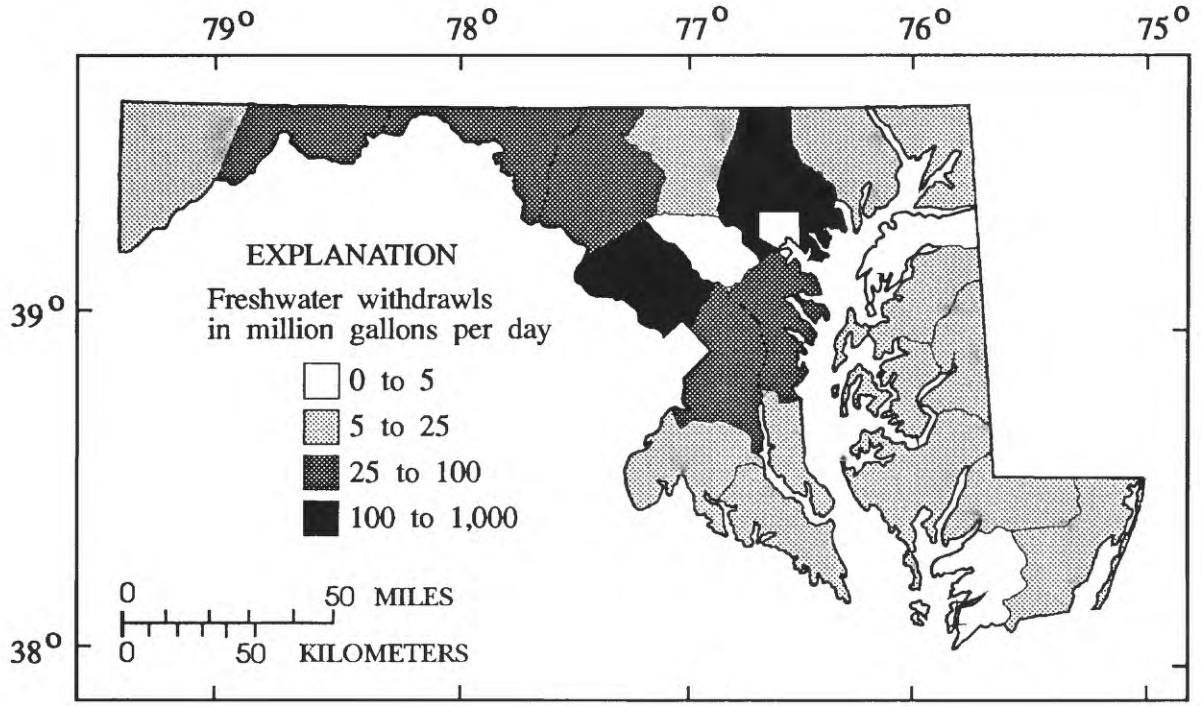


Figure 3.-- Freshwater withdrawals in Maryland, by county, 1988-89.

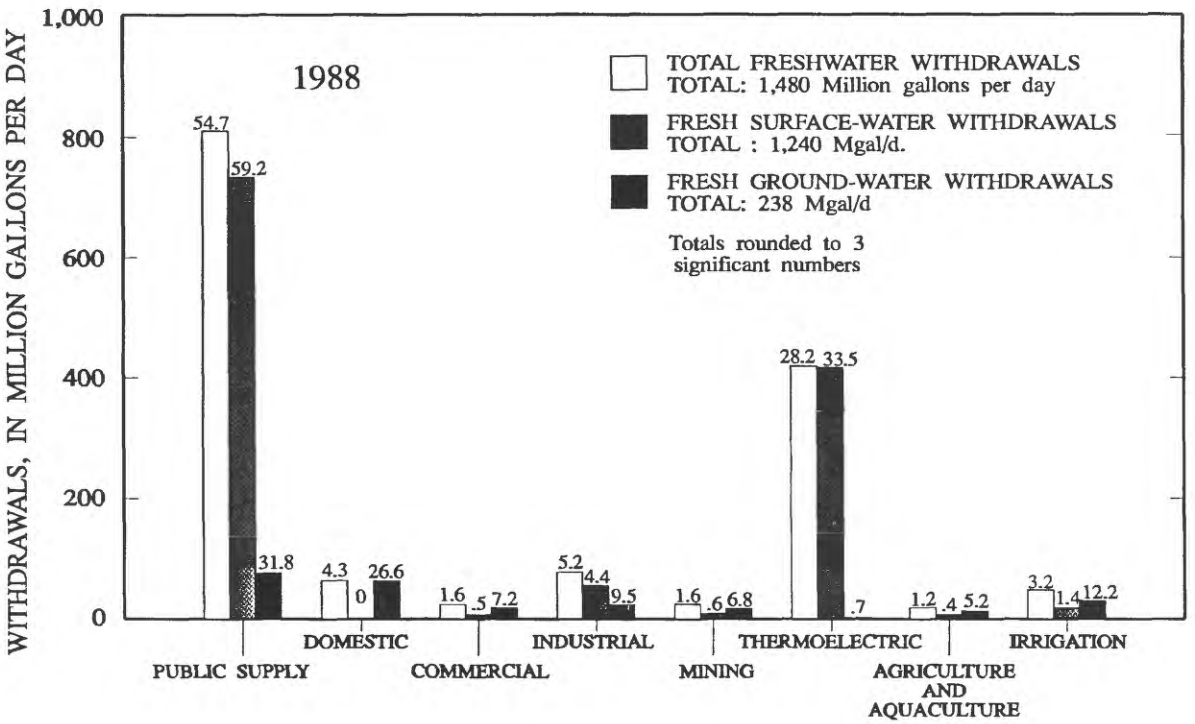
compared to 16 percent (238 Mgal/d during 1988 and 228 Mgal/d during 1989) withdrawn from ground-water sources. Most fresh surface water (more than 25 Mgal/d) was withdrawn in Montgomery, Baltimore, Washington, Allegany, and Prince Georges Counties (tables 3a and 3b), whereas most ground water (more than 25 Mgal/d) was withdrawn in Anne Arundel County.

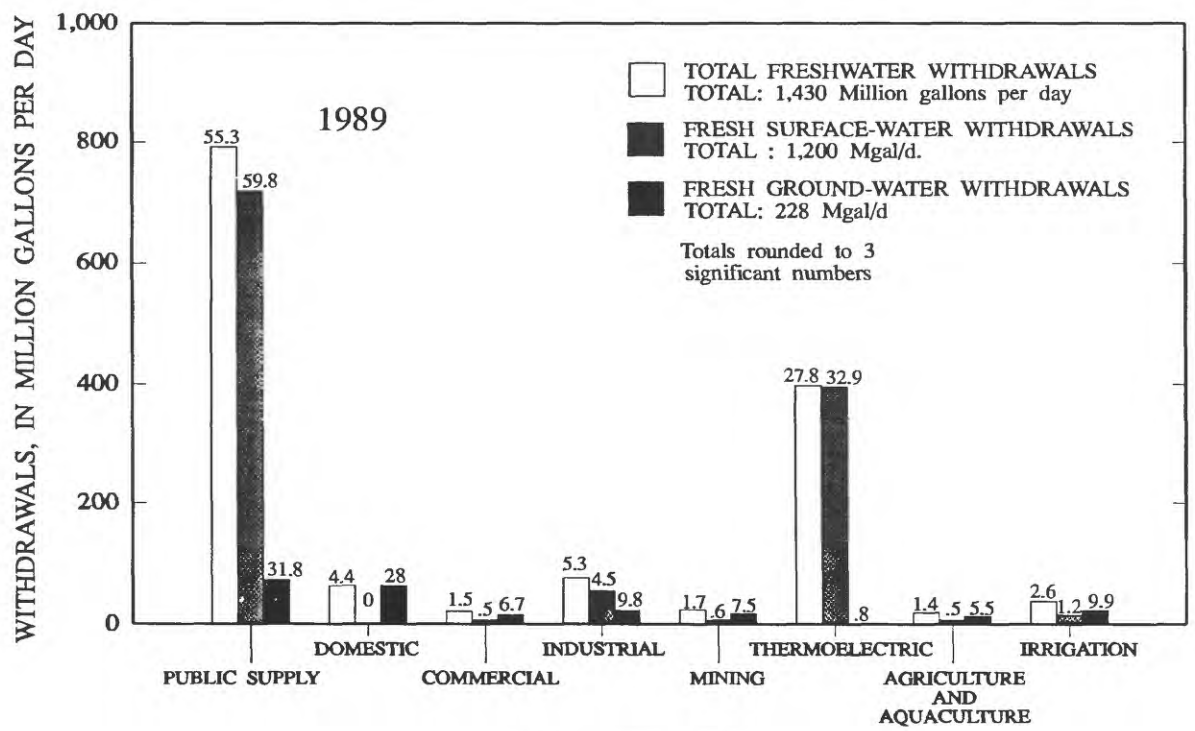
The largest drainage basins in Maryland are the Potomac and the Upper Chesapeake (fig. 6). During 1988 and 1989, about 71 percent of total fresh surface-water withdrawals were from streams in the Potomac basin. During 1988, about 889 Mgal/d of fresh surface water was withdrawn and used in this basin compared to 344 Mgal/d (28 percent) withdrawn and used in the Upper Chesapeake basin. In addition, about 16.5 Mgal/d of fresh surface water was withdrawn in the Potomac basin and transferred to the Chesapeake basin. About 34 Mgal/d of fresh surface water was withdrawn in the Upper Chesapeake basin and transferred to the Potomac basin for use.

During 1989, about 852 Mgal/d of fresh surface water was withdrawn and used in the Potomac basin compared to 341 Mgal/d (about 28 percent) withdrawn and used in the Upper Chesapeake basin. In addition, about 15.6 Mgal/d of fresh surface water was withdrawn in the Potomac basin and transferred to the Chesapeake basin for use. About 38 Mgal/d of fresh surface water was withdrawn in the Upper Chesapeake basin, and transferred to the Potomac basin for use. Each year, less than 1 percent of all fresh surface water withdrawn was from the parts of the Monongahela, Susquehanna, and Delaware River drainage basins in Maryland.

During 1988, about 72 percent (172 Mgal/d) of total fresh ground-water withdrawals were in the Upper Chesapeake basin, compared to about 26 percent (61 Mgal/d) in the Potomac basin. During 1989, total ground-water withdrawals decreased to 70 percent (159 Mgal/d) in the Upper Chesapeake basin and increased to 28 percent (63 Mgal/d) in the Potomac basin. Only about 2 percent of total ground-water withdrawals were from sites in the Monongahela, Susquehanna, and Delaware drainage basins.

Estimated percentages of ground-water withdrawals by principal aquifers during 1988 and 1989 are shown in figure 7. The map and hydrogeologic section show the geographic distribution of the principal aquifers in Maryland (U.S. Geological

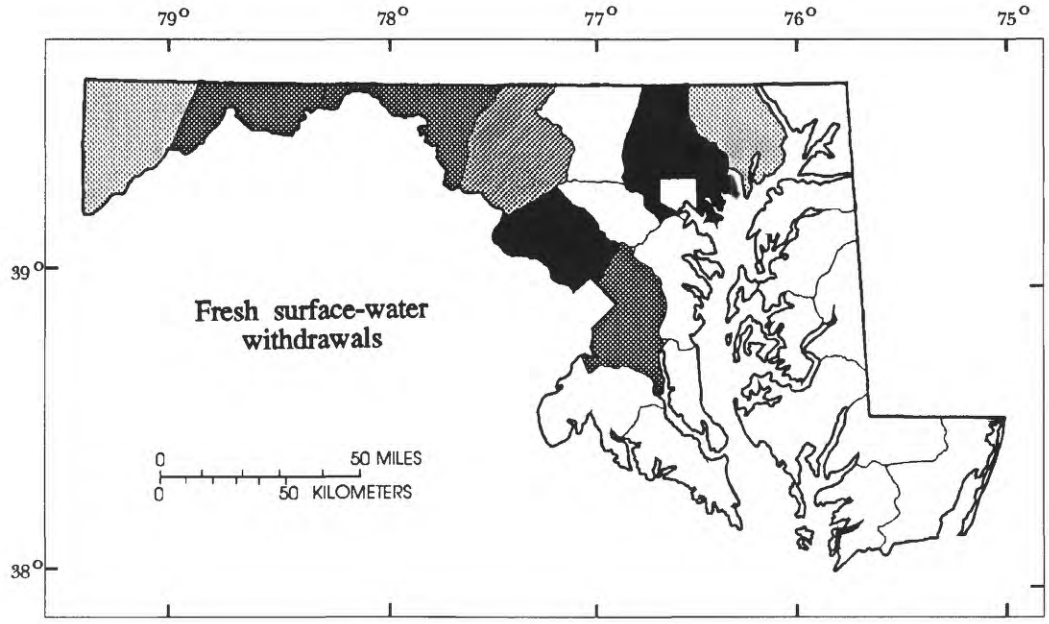


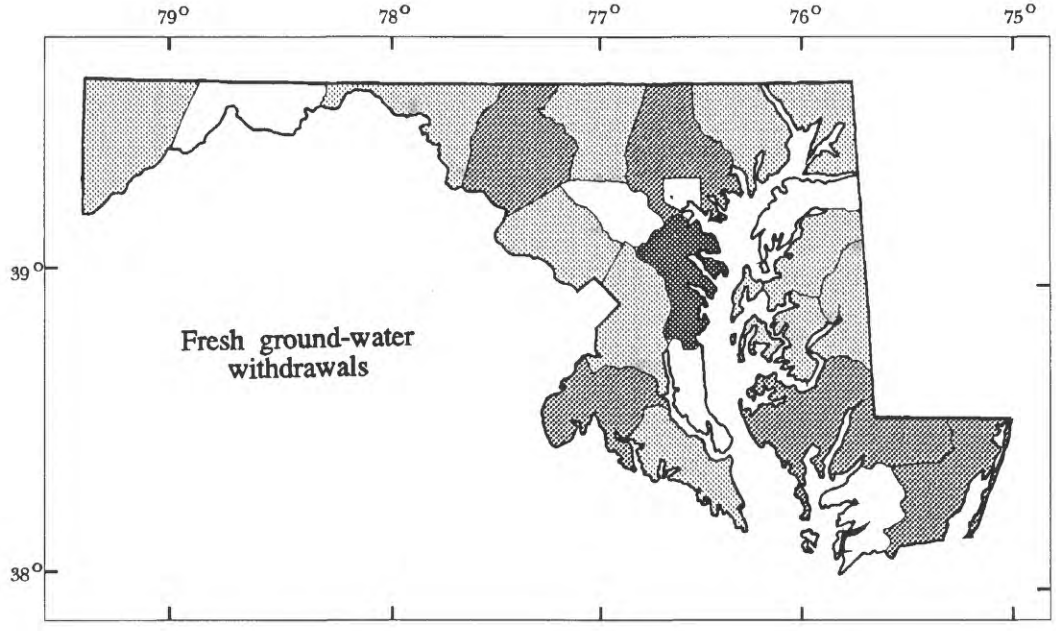


EXPLANATION

4.4 NUMBER INDICATES PERCENTAGE OF TOTAL WATER WITHDRAWALS FOR EACH TYPE OF USE.

Figure 4.-- Freshwater withdrawals and source of water in Maryland, by type of use, 1988-89.





EXPLANATION

FRESHWATER WITHDRAWALS, IN MILLION GALLONS PER DAY

- 0 to 5
- 5 to 10
- 10 to 25
- 25 to 100
- 100 to 1,000

PERCENTAGE OF TOTAL FRESHWATER WITHDRAWALS

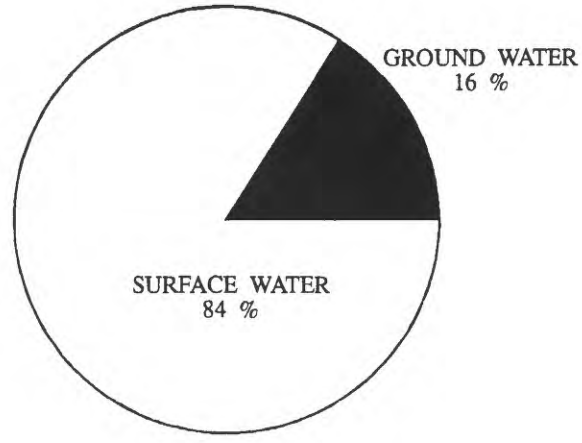


Figure 5.--Fresh surface-water and ground-water withdrawals in Maryland, by county, 1988-89.

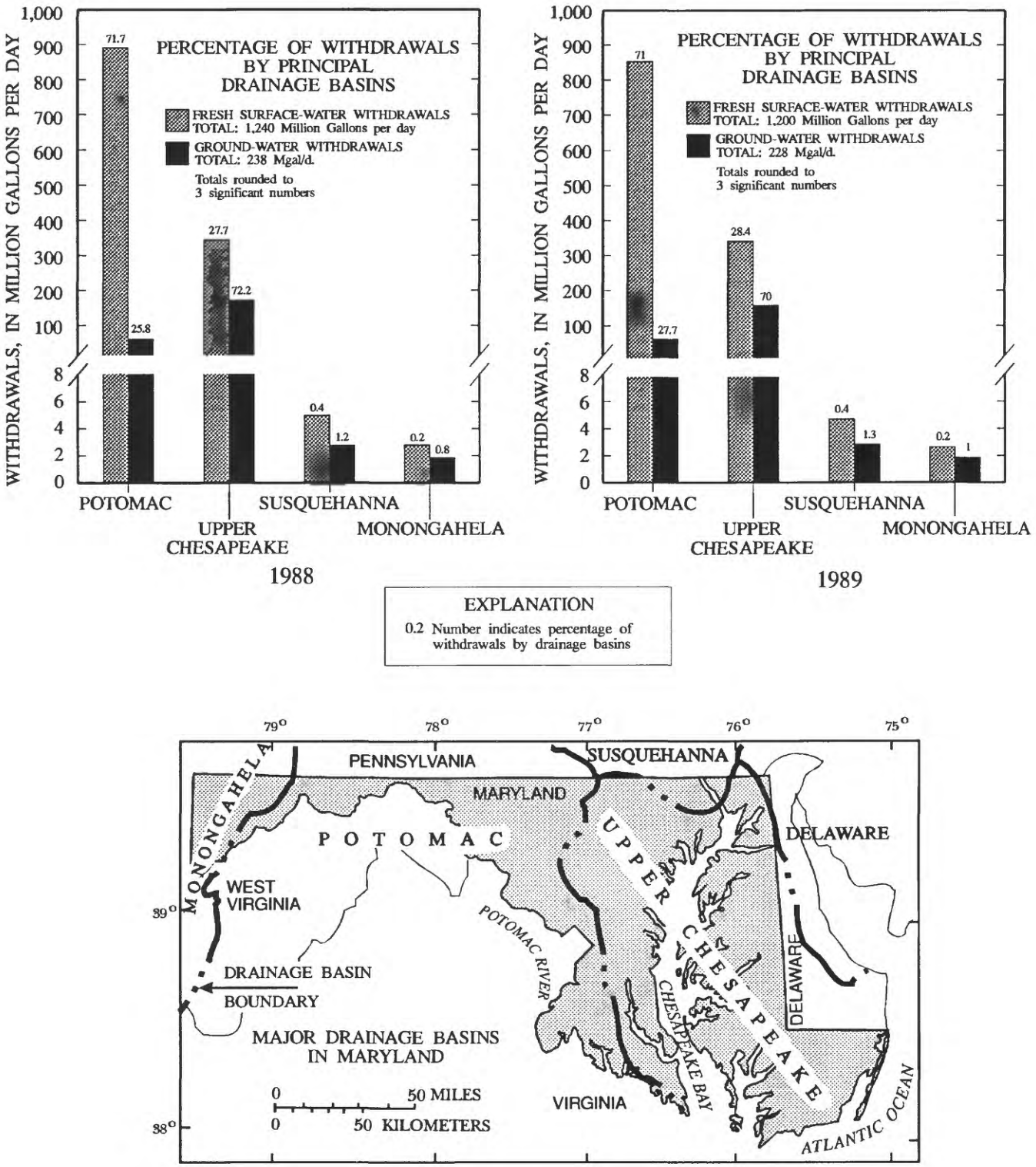


Figure 6.-- Fresh surface-water and ground-water withdrawals in Maryland, by principal drainage basin, 1988-89.

Survey, 1990, p. 294). The Potomac Group aquifers were the largest source of ground water with 57 Mgal/d withdrawn during 1988 and 55 Mgal/d during 1989 (about 24 percent), followed by the Columbia aquifer with 45 Mgal/d during 1988 and 43 Mgal/d during 1989 (about 19 percent). The smallest amount of water was derived from the Newark Group aquifers with about 2 Mgal/d withdrawn each year (1 percent).

Public Supply

The largest amount of water withdrawn in the State, 810 Mgal/d during 1988 and 791 Mgal/d during 1989 (55 percent of total freshwater withdrawals; fig. 4), was by public-supply systems operated by municipalities, counties and towns, and private utilities. Public suppliers delivered water to 83 percent of the total population during 1988 and to 84 percent during 1989 (table 1). Water was delivered to a variety of users, including residences for domestic use, commercial establishments, and industries (tables 4a and 4b). In addition, each year during the peak tourist season (May through September), the Ocean City water-supply system in Worcester County served about 268,000 more people than the base population of about 12,000 (Andrews, Miller & Assoc., Inc., 1990, p. 2-9).

Most public suppliers in central and western Maryland rely on surface-water sources. Some of these suppliers withdraw and deliver water across county and State boundaries as shown in table 2 (page 6). The largest user of surface water for public supply is Baltimore City. During 1988, about 147 Mgal/d was withdrawn for use by the City compared to about 145 Mgal/d during 1989. In addition, Baltimore City supplied about 131 Mgal/d during 1988 and 128 Mgal/d during 1989 to parts of Baltimore, Howard, Anne Arundel, and Carroll Counties. Another large user of surface water for public supply in Maryland is the WSSC, which withdrew 177 Mgal/d during 1988 and 172 Mgal/d during 1989 and delivered water to most of Montgomery and Prince Georges Counties and part of Howard County.

The Potomac River in Maryland is a water source for several public suppliers in Virginia and West Virginia and for the Washington Aqueduct, which delivers water to the District of Columbia and several areas of northern Virginia. During 1988, about 51.5 Mgal/d of fresh surface water was withdrawn from the river and transferred to Virginia and West Virginia for use, compared to 50 Mgal/d withdrawn and transferred during 1989. During 1988, the Washington Aqueduct withdrew 189 Mgal/d from the Potomac River for public-supply deliveries to the District, compared to 184 Mgal/d withdrawn during 1989.

Several municipalities in Maryland obtained all or part of their water supply from bordering States during 1988 and 1989, including Cumberland in Allegany County, which received about 7.07 Mgal/d of water each year from a surface-water source in Bedford County, Pennsylvania; Brunswick in Frederick County, which received about 0.08 Mgal/d each year from springs in Loudoun County, Virginia; and Delmar in Wicomico County, which received 0.35 Mgal/d each year from wells in Sussex County, Delaware.

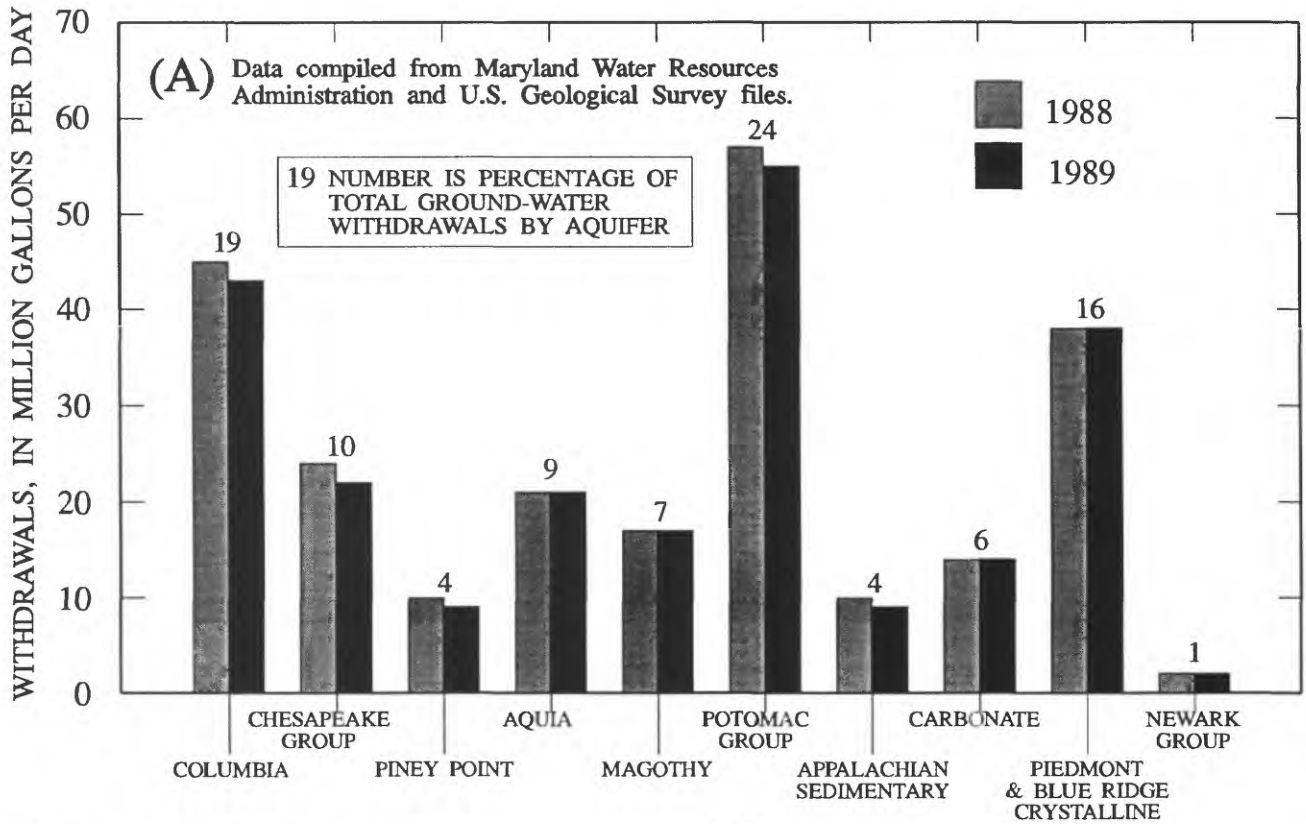
Most public suppliers that rely on ground-water sources are in the eastern and southern parts of Maryland. In counties east of Chesapeake Bay, all public suppliers rely on ground water. The largest ground-water withdrawals for public supply, however, are in Anne Arundel County. During 1988, about 28.4 Mgal/d was withdrawn by public suppliers in the County compared to 24.1 Mgal/d during 1989. A possible reason for the 4.3 Mgal/d decrease in withdrawals was the increase in water deliveries to the northern part of the County by the City of Baltimore system (about 4.0 Mgal/d delivered during 1988 and 9.1 Mgal/d during 1989).

Domestic

Domestic users in Maryland receive water from public-supply systems and from self-supplied sources (tables 5a and 5b). During 1988, total use (withdrawals plus deliveries) was 488 Mgal/d, of which 425 Mgal/d was delivered by public suppliers. Seventeen percent of the total population (762,000 people) withdrew about 63.2 Mgal/d from privately owned wells. Domestic water use during 1989 totaled 486 Mgal/d, of which 423 Mgal/d was delivered by public suppliers and about 63.1 Mgal/d was withdrawn from privately owned wells. Because the amount of surface water used for domestic purposes was negligible, all self-supplied water withdrawn for domestic use was assumed to originate from ground-water sources.

Commercial

Commercial users, including educational institutions and military installations, receive water from public-supply systems and from privately



(B) U.S. Geological Survey, 1985.

(C) AQUIFERS Modified from U.S. Geological Survey, 1990.

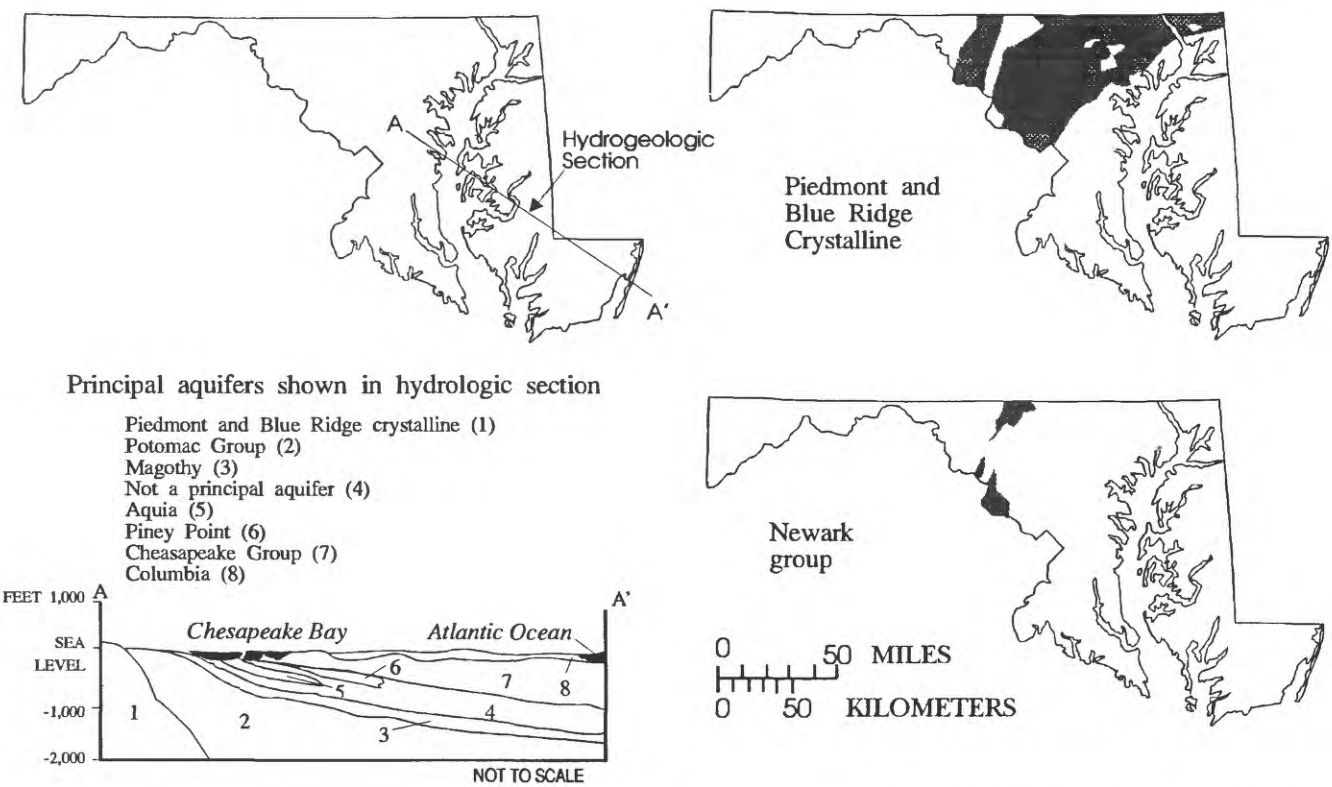


Figure 7.-- Ground-water withdrawals in Maryland, by principal aquifers, 1988-89. (A) Withdrawals by aquifer. (B) Trace of generalized hydrologic section (A-A'). (C) Geographic distribution of use for principal aquifers.

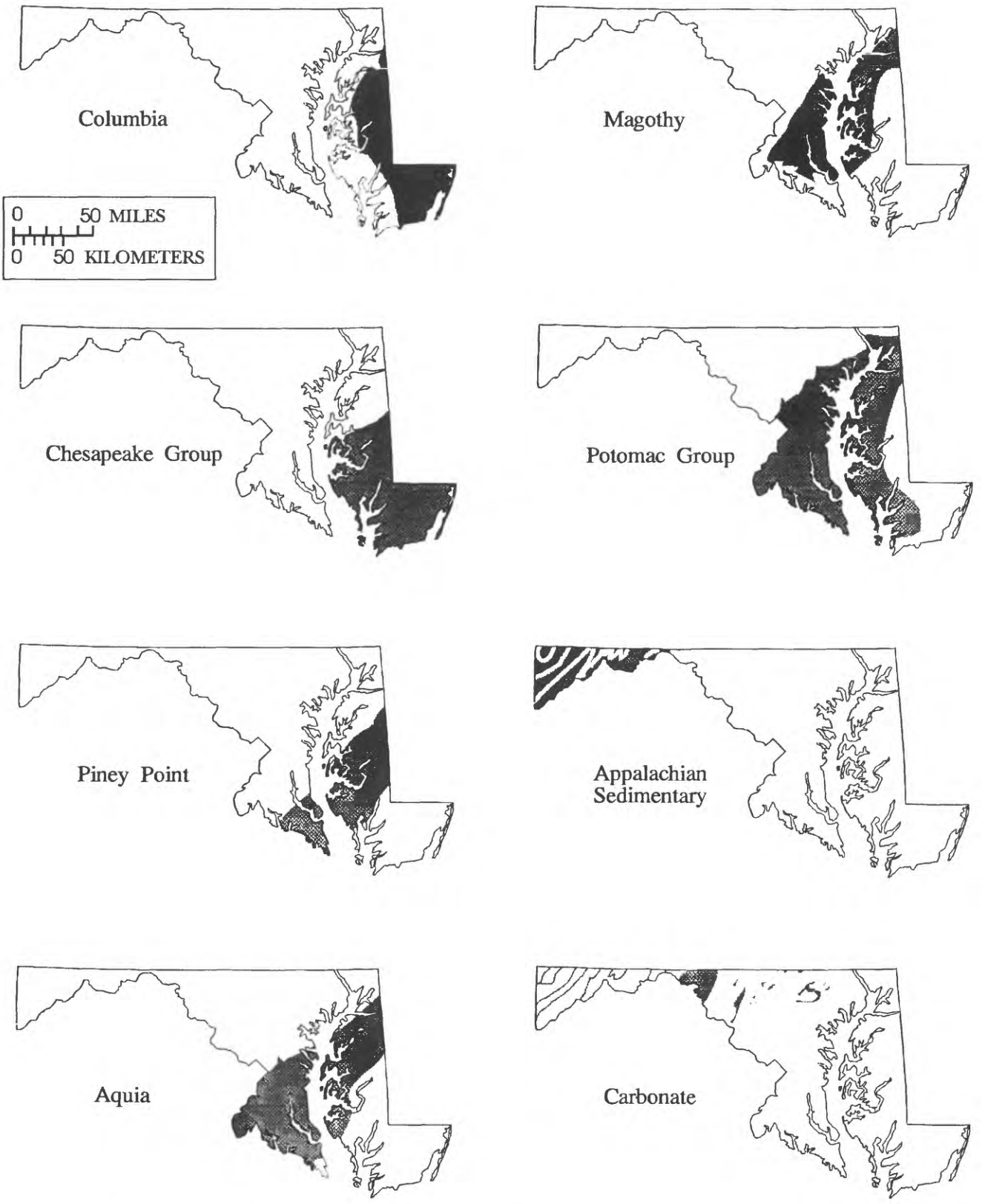


Figure 7.-- Ground-water withdrawals in Maryland, by principal aquifers, 1988-89. (A) Withdrawals by aquifer. (B) Trace of generalized hydrologic section (A-A'). (C) Geographic distribution of use for principal aquifers. --Continued

owned wells. Total commercial use during 1988 was 102 Mgal/d (table 6a), of which about 79.3 Mgal/d (78 percent) was provided by public suppliers and about 23.2 (22 percent) was self-supplied. During 1989, total commercial use decreased to 100 Mgal/d (table 6b), of which about 79.1 Mgal/d (79 percent) was provided by public suppliers and about 21.2 Mgal/d (21 percent) was self-supplied.

Industrial

Maryland is located within a regional manufacturing belt which extends along the eastern seaboard of the United States. Heavy and light industries are important to the State's economy. Heavy industries include steel, chemical and allied products, shipbuilding, petroleum refining, and truck- assembly. Prominent light industries include food processing, printing, publishing, and clothing manufacturing. Water used by industries is both self-supplied and from public-supply systems. Major water uses include washing and separation, cooling of industrial machinery, refrigeration, boiler make-up, product manufacturing, and dust control.

During 1988, about 140 Mgal/d of freshwater was used by industries in Maryland (table 7a). Of that amount, 76.9 Mgal/d or 55 percent was self-supplied and 63.1 Mgal/d (45 percent) was provided by public suppliers. Industries used less water during 1989, about 138 Mgal/d (table 7b), of which 75.9 Mgal/d (55 percent) was self-supplied and 62.4 Mgal/d (45 percent) was provided by public suppliers. Industries also used 336 Mgal/d during 1988 and 356 Mgal/d during 1989 of **brackish** or saline surface water. About 80.0 Mgal/d of **reclaimed wastewater** was used each year in the production of steel.

Mining

Mining is a major economic activity in Maryland. The mineral resources extracted are those primarily used for building materials and fuels and include stone, sand, gravel, and bituminous coal. Water withdrawn in mining operations is primarily used for dewatering and washing. During 1988, about 23.9 Mgal/d of freshwater was withdrawn for mining purposes (table 8a). Of that amount, 7.75 Mgal/d was from surface-water sources and 16.2 Mgal/d was from ground-water sources. An additional 17.7 Mgal/d of brackish or saline water was withdrawn, of which 17.2 Mgal/d was for dredging operations. Total freshwater withdrawals for mining during 1989 were equivalent to withdrawals during 1988 (23.9 Mgal/d; table 8b). Of that amount, however, 6.74 Mgal/d was from surface-water sources and 17.2 Mgal/d was from ground-water sources. Smaller amounts (6.77 Mgal/d) of brackish or saline water were withdrawn during 1989 than during 1988.

Thermoelectric-Power Generation

Fourteen thermoelectric power plants operate in Maryland; 13 are fossil-fueled and 1 is nuclear-fueled. Freshwater use by these plants during 1988 was 418 Mgal/d, of which about 416 Mgal/d was from surface-water sources and 1.74 Mgal/d was from ground-water sources (table 9a). In addition, 6,090 Mgal/d of saline surface water was used by the plants for cooling condensers, of which more than 98 percent was returned to the water source.

During 1989, thermoelectric power plants used about 397 Mgal/d of freshwater, of which about 395 Mgal/d was from surface-water sources and 1.84 Mgal/d was from ground-water sources (table 9b). Smaller quantities of saline surface water (4,760 Mgal/d) were used for cooling condensers during 1989, primarily because the nuclear power plant was inactive during most of the year.

Hydroelectric-Power Generation

Water used for the generation of electricity by hydroelectric power plants is discussed here but the quantities of water used are not included in the freshwater totals because this is considered an "instream" water use--that is, water use takes place within the stream channel at the dam, where turbine generators are driven by falling water. Twelve plants are currently producing or are licensed to produce hydroelectric power in Maryland (Weisberg and Rose, 1985, p. 1), the largest of which is in Harford County.

During 1988, about 15,800 Mgal/d of freshwater passed through these plants for the production of electricity (table 10a); during 1989, the amount increased to 21,900 Mgal/d. Although the amount of water diverted through some plants is considerable, the amount consumed is negligible, because water is not withdrawn from the stream or incorporated into a product. Any consumption is by **evaporation** during the generation process and from storage reservoirs.

Agriculture (Nonirrigation)

During 1988 and 1989, about 10.4 Mgal/d of freshwater was used for agricultural (nonirrigation) activities, mainly livestock watering and feedlot and dairy operations; 2.44 Mgal/d was from surface-water sources and 7.95 Mgal/d was from ground-water sources (table 11). The major types of livestock raised in Maryland are poultry, cattle, dairy cows, hogs, and sheep. The four counties (Dorchester, Somerset, Wicomico, and Worcester) of the lower Eastern Shore account for about 34 percent of total agricultural revenue in the State, because this area is one of the nation's leading producers of broiler chickens (Di Lisio, 1983, p. 80).

Irrigation

The amount of water used for irrigation can vary greatly by year and among users during a particular year. In addition to differences in soils and rainfall distribution, other factors including type of crop or turf grown, timing and length of planting and growing seasons, and watering schedule affect the amount of water used for irrigation (Brodie and others, 1984, p. 7).

Freshwater use for irrigating farm crops; commercial, municipal, and institutional lawns and parks; golf courses; and nursery plants was about 46.5 Mgal/d during 1988 (table 12a). Of this amount, 41.3 Mgal/d was used for irrigating crops including corn, soybeans, tobacco, grains, tomatoes, and melons. In addition, 4.24 Mgal/d of brackish surface water was used for farm irrigation. Brackish water is too saline to be potable, but is less saline than sea water--that is, total dissolved solids (TDS) concentrations range from about 1,000 to 20,000 mg/L; the TDS concentrations in sea water is about 35,000 mg/L (Drever, 1982, p. 12).

About 68,000 acres of cropland in Maryland were irrigated in the State during 1988, of which about 61,330 acres or 90 percent were in the eight counties east of Chesapeake Bay (fig. 1). During 1988, about 17.5 Mgal/d of fresh surface water was used to irrigate about 24,000 acres and 28.9 Mgal/d of ground water was used to irrigate about 38,000 acres.

During 1989, total freshwater used for irrigation was 36.9 Mgal/d (table 12b), of which 33.5 Mgal/d was used for irrigating farm crops. More land (about 69,000 acres) was irrigated during 1989 than during 1988, but less water was used during 1989. About 14.4 Mgal/d of fresh surface water was used to irrigate about 24,000 acres and 22.6 Mgal/d of fresh ground water was used to irrigate about 38,000 acres. In addition, about 3.44 Mgal/d of brackish surface water was used for irrigating crops.

The largest irrigated acreage in the State was in Caroline County--19,130 acres during 1988 and 19,420 acres during 1989 (28 percent of total irrigated land). The largest freshwater withdrawals for irrigation were in Dorchester County, with 11.4 Mgal/d during 1988 and 9.29 Mgal/d during 1989.

Aquaculture

Aquaculture, also known as fish farming or fish culture, is the controlled production of finfish, shellfish, and aquatic plants in fresh and saline water (Maryland Department of Agriculture, 1988). In Maryland, aquaculture includes production of ornamental fish, oysters, soft-shell crabs, crawfish, hybrid striped bass, catfish, tilapia, trout, aquatic plants, and other aquatic species such as perch and sturgeon.

During 1988, about 7.35 Mgal/d of freshwater was withdrawn for aquaculture in the State, of which 3.04 Mgal/d was from surface-water sources and 4.32 Mgal/d was from ground-water sources (table 13a). In addition, 4.74 Mgal/d of saline surface water was used for this purpose. Freshwater withdrawals for aquaculture increased during 1989 to 8.69 Mgal/d, of which 4.00 Mgal/d was from surface-water sources and 4.69 was from ground-water sources (table 13b). Use of saline surface water also increased during 1989 to 12.0 Mgal/d.

SUMMARY

During 1988, about 1,480 Mgal/d of freshwater was withdrawn from surface-water and ground-water sources in Maryland, compared to about 1,430 Mgal/d withdrawn during 1989. About 1,240 Mgal/d during 1988 and 1,196 Mgal/d during 1989 (84 percent for each year) was used in the State. About 240 Mgal/d during 1988 and 234 Mgal/d during 1989 (16 percent for each year) was transferred to surrounding States and the District of Columbia for water supply. More than 7 Mgal/d of freshwater was imported from bordering States for use in Maryland during the period.

Most freshwater withdrawals (about 1,240 Mgal/d during 1988 and 1,200 Mgal/d during 1989 or 84 percent of total for each year) were from surface-water sources. The largest surface-water

withdrawals, more than 100 Mgal/d, were in Montgomery and Baltimore Counties. These counties provide water sources for public suppliers that serve the Baltimore City and District of Columbia metropolitan areas. Most fresh surface water (about 889 Mgal/d during 1988 and 852 Mgal/d during 1989 or more than 70 percent) was withdrawn and used in the Potomac drainage basin, whereas most ground water (about 172 Mgal/d during 1988 and 159 Mgal/d during 1989) was withdrawn and used in the Upper Chesapeake drainage basin. The Potomac Group aquifers were the largest source of ground water (24 percent of total ground-water withdrawals) each year.

The population of Maryland served by public water-supply systems increased from 3.80 million (83 percent) during 1988 to 3.86 million (84 percent) during 1989. In addition, during the peak tourist season (from May to September), the Ocean City water-supply system served approximately 268,000 more individuals than the base population of about 12,000. During each year, surface water was used by about 69 percent of the State's population and ground water was used by remaining 31 percent.

Ten water-use categories represent the major demands on the surface-water and ground-water resources of the State during 1988-89: Public supply, domestic, commercial, industrial, mining, thermoelectric-power generation, hydroelectric-power generation, agriculture (nonirrigation), irrigation, and aquaculture.

Public-supply systems withdrew the largest quantity of water in the State (810 Mgal/d during 1988 and 791 Mgal/d during 1989) during 1988-89. This water was used by residences, commercial establishments, and industries. Baltimore City received the largest public-supply deliveries, about 147 Mgal/d during 1988 and 145 Mgal/d during 1989, of all municipalities in Maryland.

Domestic water use decreased from about 488 Mgal/d during 1988 to 486 Mgal/d during 1989. About 425 Mgal/d during 1988 and 423 Mgal/d during 1989 were received from public suppliers and about 63.2 Mgal/d during 1988 and 63.1 Mgal/d during 1989 were self-supplied. All self-supplied domestic water withdrawals were from ground-water sources.

Fresh surface-water and ground-water use by industries decreased from 140 Mgal/d during 1988 to 138 Mgal/d during 1989. About 76.9 Mgal/d during 1988 and 75.9 Mgal/d during 1989 were self-supplied. The remaining water used was delivered by public suppliers.

Industries also used saline surface water--336 Mgal/d during 1988 and 356 Mgal/d during 1989. About 80.0 Mgal/d of reclaimed municipal wastewater was used for industrial purposes each year.

Fresh surface-water and ground-water use for mining remained constant at 23.9 Mgal/d during 1988-89. About 17.7 Mgal/d during 1988 and 6.77 Mgal/d during 1989 of brackish or saline surface water were withdrawn, primarily for dredging operations.

Fresh surface-water and ground-water withdrawals for thermoelectric-power generation decreased from 418 Mgal/d during 1988 to 397 Mgal/d during 1989. Smaller quantities of saline surface water were used for cooling purposes during 1989 (4,760 Mgal/d) than during 1988 (6,090 Mgal/d), primarily because of inactivity at a nuclear power plant during most of 1989.

Fresh surface-water use for hydroelectric-power generation increased from 15,800 Mgal/d during 1988 to 21,900 Mgal/d during 1989. Although the amount of water diverted through some plants was considerable, the amount consumed was negligible.

Fresh surface-water and ground-water use for agriculture (nonirrigation) was about 10.4 Mgal/d during each year of the 2-year period. About 2.44 Mgal/d was from surface-water sources and 7.95 Mgal/d was from ground-water sources.

Fresh surface-water and ground-water use for irrigation decreased from 46.5 Mgal/d during 1988 to 36.9 Mgal/d during 1989. Most of the water (41.3 Mgal/d during 1988 and 33.5 Mgal/d during 1989) was used for irrigating farm crops.

Fresh surface-water and ground-water withdrawals for aquaculture increased from 7.35 Mgal/d during 1988 to 8.69 Mgal/d during 1989. Saline surface-water withdrawals for aquaculture also increased from 4.32 Mgal/d during 1988 to 12.0 Mgal/d during 1989.

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(p. 19 follows)

APPENDIX

WATER WITHDRAWAL AND USE DATA

Table 3a.--*Total water withdrawals (excluding hydroelectric-power-generation) in Maryland, by county, 1988*

[State totals rounded to three significant figures. (Sources: Withdrawals, data compiled from Maryland Water Resources Administration and U.S. Geological Survey site-specific data bases, and the University of Maryland Cooperative Extension Service; Population projections, data compiled from Maryland Department of State Planning, 1987]

County or city	Population in thousands	Water withdrawals, in million gallons per day									
		Source									
		Surface water			Ground water				Total excluding reclaimed wastewater		
		Fresh	Saline	Total	Fresh	Saline	Total	Reclaimed wastewater	Fresh	Saline	Total
Allegany	74.50	47.65	0.00	47.65	1.57	0.00	1.57	0.00	49.22	0.00	49.22
Anne Arundel	415.36	3.85	826.83	830.68	44.25	.00	44.25	.00	48.10	826.83	874.93
Baltimore	678.42	280.04	787.91	1,067.95	14.04	.00	14.04	80.00	294.08	787.91	1,081.99
Calvert	45.82	.38	2,896.54	2,896.92	4.85	.00	4.85	.00	5.23	2,896.54	2,901.77
Caroline	24.38	4.53	.00	4.53	9.87	.00	9.87	.00	14.40	.00	14.40
Carroll	115.40	4.88	.00	4.88	9.84	.00	9.84	.00	14.72	.00	14.72
Cecil	68.34	3.06	.00	3.06	5.36	.00	5.36	.00	8.42	.00	8.42
Charles	94.04	.66	1,217.07	1,217.73	11.21	.00	11.21	.00	11.87	1,217.07	1,228.94
Dorchester	29.98	2.90	1.30	4.20	15.27	.00	15.27	.00	18.17	1.30	19.47
Frederick	137.06	14.48	.00	14.48	16.95	.00	16.95	.00	31.43	.00	31.43
Garrett	26.96	5.39	.00	5.39	5.68	.00	5.68	.00	11.07	.00	11.07
Harford	161.56	9.58	.00	9.58	9.11	.00	9.11	.00	18.69	.00	18.69
Howard	172.40	.41	.00	.41	3.19	.00	3.19	.00	3.60	.00	3.60
Kent	16.92	.10	.00	.10	5.89	.00	5.89	.00	5.99	.00	5.99
Montgomery	681.86	756.19	.00	756.19	6.11	.00	6.11	.00	762.30	.00	762.30
Prince Georges	696.70	37.36	603.68	641.04	7.39	.00	7.39	.00	44.75	603.68	648.43
Queen Annes	31.38	3.23	.00	3.23	6.60	.00	6.60	.00	9.83	.00	9.83
St. Marys	69.26	.76	.01	.77	7.89	.00	7.89	.00	8.65	.01	8.66
Somerset	20.88	.22	.00	.22	4.50	.00	4.50	.00	4.72	.00	4.72
Talbot	28.05	.75	.00	.75	5.27	.00	5.27	.00	6.02	.00	6.02
Washington	117.50	63.39	.00	63.39	9.34	.00	9.34	.00	72.73	.00	72.73
Wicomico	71.10	.83	.00	.83	15.15	.00	15.15	.00	15.98	.00	15.98
Worcester	37.27	.82	.53	1.35	14.21	.00	4.21	.00	15.03	.53	15.56
Baltimore City	749.48	- .01	111.47	111.48	4.10	.00	4.10	.00	4.11	111.47	115.58
State Total	4,560	1,240	6,440	7,690	238	0.00	238	80.0	1,480	6,450	7,920

Table 3b.--*Total water withdrawals (excluding hydroelectric-power-generation) in Maryland, by county, 1989*

[State totals rounded to three significant figures. (Sources: Withdrawals, data compiled from Maryland Water Resources Administration and U.S. Geological Survey site-specific data bases, and the University of Maryland Cooperative Extension Service; Population projections, data compiled from Maryland Department of State Planning, 1987]

		Water withdrawals, in million gallons per day									
		Source									
		Surface water			Ground water				Total excluding reclaimed wastewater		
County or city	Population in thousands	Fresh	Saline	Total	Fresh	Saline	Total	Reclaimed wastewater	Fresh	Saline	Total
Allegany	79.75	48.46	0.00	48.46	1.55	0.00	1.55	0.00	50.01	0.00	50.01
Anne Arundel	421.68	3.83	926.85	930.68	38.61	.00	38.61	.00	42.44	926.85	969.29
Baltimore	682.71	275.18	1,151.01	1,426.19	14.47	.00	14.47	80.00	289.65	1,151.01	1,440.66
Calvert	47.41	.31	1,237.78	1,238.09	4.77	.00	4.77	.00	5.08	1,237.78	1,242.86
Caroline	24.54	3.93	3 .00	3.93	8.66	.00	8.66	.00	12.59	.00	12.59
Carroll	118.10	3.84	.00	3.84	7.88	.00	7.88	.00	11.72	.00	11.72
Cecil	69.27	3.22	.00	3.22	5.20	.00	5.20	.00	8.42	.00	8.42
Charles	97.12	.56	1,158.12	1,158.68	11.55	.00	11.55	.00	12.11	1,158.12	1,170.23
Dorchester	30.02	2.45	1.59	4.04	13.31	.00	13.31	.00	15.76	1.59	17.35
Frederick	140.17	14.71	.00	14.71	19.42	.00	19.42	.00	34.13	.00	34.13
Garrett	27.13	5.26	.00	5.26	5.93	.00	5.93	.00	11.19	.00	11.19
Harford	164.48	9.44	.00	9.44	9.32	.00	9.32	.00	18.76	.00	18.76
Howard	174.25	.38	.00	.38	2.77	.00	2.77	.00	3.15	.00	3.15
Kent	16.96	.09	.00	.09	3.95	.00	3.95	.00	4.04	.00	4.04
Montgomery	695.92	718.20	.00	718.20	6.20	.00	6.20	.00	724.40	.00	724.40
Prince Georges	703.85	41.62	536.09	577.71	7.60	.00	7.60	.00	49.22	536.09	585.31
Queen Annes	32.34	2.64	.00	2.64	6.58	.00	6.58	.00	9.22	.00	9.22
St. Marys	70.58	.64	.00	.64	8.07	.00	8.07	.00	8.71	.00	8.71
Somerset	21.49	.18	.00	.18	4.22	.00	4.22	.00	4.40	.00	4.40
Talbot	28.43	.61	.00	.61	5.12	.00	5.12	.00	5.73	.00	5.73
Washington	118.40	64.07	.00	64.07	9.81	.00	9.81	1 .00	73.88	.00	73.88
Wicomico	72.20	.69	.00	.69	15.12	.00	15.12	.00	15.81	.00	15.81
Worcester	38.36	.67	.47	1.14	13.25	.00	13.25	.00	13.92	.47	14.39
Baltimore City	747.29	.01	111.24	111.25	4.19	.00	4.19	.00	4.20	111.24	115.44
State Total	4,620	1,200	5,120	6,320	228	0.00	228	80.0	1,430	5,120	6,550

Table 4a.--*Public-supply water withdrawals and deliveries in Maryland, by county, 1988*

[State totals rounded to three significant figures. (Sources: Withdrawals, data compiled from Maryland Water Resources Administration and U.S. Geological Survey site-specific data bases; Population projections, data compiled from Maryland Department of State Planning, 1987]

County or city	Population served, in thousand			Water withdrawals, in million gallons per day			Water deliveries, by type of use, in million gallons per day			Water transfer into or out (-) of county or city
	Source			Source						
	Surface water	Ground water	Total	Surface water	Ground water	Total	Domestic	Commercial	Industrial	Total, in million gallons per day
Allegany	53.50	7.80	61.30	0.50	0.29	0.79	6.91	0.95	1.60	8.67
Anne Arundel	89.00	235.95	324.95	1.56	28.37	29.93	25.57	5.02	3.34	4.00
Baltimore	618.82	1.00	619.82	278.22	.02	278.24	77.90	16.69	16.70	166.95 (-)
Calvert	.00	10.85	10.85	.00	1.27	1.27	1.15	.12	.00	.00
Caroline	.00	8.98	8.98	.00	1.26	1.26	1.13	.06	.07	.00
Carroll	34.61	19.70	54.31	3.01	1.36	4.37	5.01	.28	.28	1.20
Cecil	19.38	14.45	33.83	1.96	1.08	3.04	2.59	.15	.30	.00
Charles	.00	62.02	62.02	.00	5.84	5.84	5.26	.58	.00	.00
Dorchester	.00	18.21	18.21	.00	3.47	3.47	2.08	.52	.87	.00
Frederick	45.03	20.33	65.36	9.15	2.55	11.70	9.62	1.21	1.20	.33
Garrett	4.37	3.94	8.31	2.12	.52	2.64	.73	.09	.09	1.73
Harford	32.36	92.42	124.78	4.73	4.34	9.07	7.71	.9	1.45	.00
Howard	141.00	.00	141.00	.00	.00	.00	13.04	1.63	1.63	16.30
Kent	.00	7.70	7.70	.00	.99	.99	.89	.05	.05	.00
Montgomery	620.49	4.12	624.61	387.40	.31	387.71	76.36	10.65	1.78	298.92 (-)
Prince Georges	643.59	28.15	671.74	34.03	2.95	36.98	68.33	8.54	8.54	48.43
Queen Annes	.00	5.50	5.50	.00	.60	.60	.48	.06	.06	.00
St. Marys	.00	24.37	24.37	.00	2.55	2.55	2.42	.13	.00	.00
Somerset	.00	13.36	13.36	.00	1.79	1.79	1.61	.09	.09	.00
Talbot	.00	13.10	13.10	.00	2.24	2.24	1.91	.22	.11	.00
Washington	78.66	7.43	86.09	11.36	1.09	12.45	8.30	1.18	2.37	.60
Wicomico	.00	47.38	47.38	.00	5.65	5.65	4.20	.10	1.20	.15
Worcester	.00	25.26	25.26	.00	7.08	7.08	6.02	.71	.35	.00
Baltimore City	749.48	.00	749.48	.00	.00	.00	95.50	29.39	22.04	146.93
State Total	3,130	672	3,800	734	75.6	810	425	79.3	63.1	694

Table 4b.--*Public-supply water withdrawals and deliveries in Maryland, by county, 1989*

[State totals rounded to three significant figures. (Sources: Withdrawals, data compiled from Maryland Water Resources Administration and U.S. Geological Survey site-specific data bases; Population projections, data compiled from Maryland Department of State Planning, 1987]

County or city	Population served, in thousand			Water withdrawals, in million gallons per day			Water deliveries, by type of use, in million gallons per day			Water transfer into or out (-) of county or city
	Source			Source						
	Surface water	Ground water	Total	Surface water	Ground water	Total	Domestic	Commercial	Industrial	Total, in million gallons per day
Allegany	60.10	8.00	68.10	0.48	0.37	0.85	6.96	0.95	1.62	8.68
Anne Arundel	189.30	241.81	331.11	1.93	24.10	26.03	26.36	5.27	3.52	9.12
Baltimore	621.95	1.00	622.95	274.22	.02	274.24	72.49	15.53	15.54	170.68 (-)
Calvert	.00	11.57	11.57	.00	1.24	1.24	1.12	.12	.00	.00
Caroline	.00	9.12	9.12	.00	1.24	1.24	1.12	.06	.06	.00
Carroll	40.15	24.33	64.48	2.97	1.27	4.24	4.91	.27	.27	1.21
Cecil	22.44	16.09	38.53	2.16	1.12	3.28	2.72	.20	.36	.00
Charles	.00	62.02	62.02	.00	6.14	6.14	5.53	.61	.00	.00
Dorchester	.00	18.37	18.37	.00	3.10	3.10	1.87	.46	.77	.00
Frederick	45.41	20.76	66.17	8.88	2.64	11.52	9.50	1.19	1.18	.35
Garrett	4.58	4.08	8.66	2.15	.52	2.67	.77	.09	.09	1.72 (-)
Harford	32.50	93.50	126.00	4.64	5.03	9.67	8.22	.97	.48	.00
Howard	146.37	.00	146.37	.00	.00	.00	13.06	1.63	1.63	16.32
Kent	.00	8.00	8.00	.00	1.04	1.04	.94	.05	.05	.00
Montgomery	633.03	4.12	637.15	372.12	.35	372.47	80.46	11.20	1.85	278.96 (-)
Prince Georges	649.03	28.03	677.06	38.39	2.77	41.16	68.54	8.55	8.54	44.47
Queen Annes	.00	5.71	5.71	.00	.57	.57	.46	.06	.05	.00
St. Marys	.00	25.28	25.28	.00	2.72	2.72	2.58	.13	.00	.01
Somerset	.00	13.36	13.36	.00	1.65	1.65	1.49	.08	.08	.00
Talbot	.00	14.05	14.05	.00	2.20	2.20	1.86	.23	.11	.00
Washington	79.27	8.08	87.35	10.79	1.18	11.97	7.93	1.13	2.27	.64
Wicomico	.00	48.48	48.48	.00	6.10	6.10	4.61	.64	1.20	.35
Worcester	.00	25.98	25.98	.00	7.22	7.22	6.14	.72	.36	.00
Baltimore City	747.29	.00	747.29	.00	.00	.00	93.41	28.95	22.38	144.74
	3,170	692	3,860	719	72.6	791	423	79.1	62.4	677

Table 5a.--*Domestic water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1988*

[State totals rounded to three significant figures. (Sources: Withdrawals, estimated using population projection data compiled fromMaryland Department of State Planning, 1987, using per capita use of 80 gallons per day; Population projections, data compiled from Maryland Department of State Planning, 1987]

County or city	Self-supplied		Public-supplied		Total
	Population (self-supplied), in thousands	Ground-water withdrawals, in million gallons per day	Population served, in thousands	Water deliveries, in millions gallons per day	Withdrawals and deliveries, in millions gallons per day
Allegany	13.20	1.06	61.30	6.91	7.97
Anne Arundel	90.41	7.91	324.95	25.57	33.48
Baltimore	58.60	4.72	619.82	77.90	82.62
Calvert	34.97	2.87	10.85	1.15	4.02
Caroline	15.40	1.29	8.98	1.13	2.42
Carroll	61.09	4.93	54.31	5.01	9.94
Cecil	34.51	2.77	33.83	2.59	5.36
Charles	32.02	2.58	62.02	5.26	7.84
Dorchester	11.77	.95	18.21	2.08	3.03
Frederick	71.70	5.79	65.36	9.62	15.41
Garrett	18.65	1.49	8.31	.73	2.22
Harford	36.78	3.02	124.78	7.71	10.73
Howard	31.40	2.55	141.00	13.04	15.59
Kent	9.22	.76	7.70	.89	1.65
Montgomery	57.25	4.87	624.61	76.36	81.23
Prince Georges	24.96	2.02	671.74	68.33	70.35
Queen Annes	25.88	2.18	5.50	.48	2.66
St. Marys	44.89	3.66	24.37	2.42	6.08
Somerset	7.52	.60	13.36	1.61	2.21
Talbot	14.95	1.29	13.10	1.91	3.20
Washington	31.41	2.53	86.09	8.30	10.83
Wicomico	23.72	2.28	47.38	4.20	6.48
Worcester	12.01	1.11	25.26	6.02	7.13
Baltimore City	.00	.00	749.48	95.50	95.50
State Total	762	63.2	3,800	425	488

Table 5b.--*Domestic water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1989*

[State totals rounded to three significant figures. (Sources: Withdrawals, estimated using population projection data compiled from Maryland Department of State Planning, 1987, using per capita use of 80 gallons per day; Population projections, data compiled from Maryland Department of State Planning, 1987]

	Self-supplied		Public-supplied		Total
County or city	Population (self-supplied), in thousands	Ground-water withdrawals, in million gallons per day	Population served, in thousands	Water deliveries, in millions gallons per day	Withdrawals and deliveries, in millions gallons per day
Allegany	11.65	0.94	68.10	6.96	7.90
Anne Arundel	90.57	7.96	331.11	26.36	34.32
Baltimore	59.76	4.78	622.95	72.49	77.27
Calvert	35.84	2.95	11.57	1.12	4.07
Caroline	15.42	1.29	9.12	1.12	2.41
Carroll	53.62	4.34	64.48	4.91	9.25
Cecil	30.74	2.47	38.53	2.72	5.19
Charles	35.10	2.83	62.02	5.53	8.36
Dorchester	11.65	.94	18.37	1.87	2.81
Frederick	74.00	5.98	66.17	9.50	15.48
Garrett	18.47	1.48	8.66	.77	2.25
Harford	38.48	3.16	126.00	8.22	11.38
Howard	27.88	2.27	146.37	13.06	15.33
Kent	8.96	.74	8.00	.94	1.68
Montgomery	58.77	5.00	637.15	80.46	85.46
Prince Georges	26.79	2.16	677.06	68.54	70.70
Queen Annes	26.63	2.24	5.71	.46	2.70
St. Marys	45.30	3.70	25.28	2.58	6.28
Somerset	8.13	.65	13.36	1.49	2.14
Talbot	14.38	1.27	14.05	1.86	3.13
Washington	31.05	2.51	87.35	7.93	10.44
Wicomico	23.72	2.31	48.48	4.61	6.92
Worcester	12.38	1.15	25.98	6.14	7.29
Baltimore City	.00	.00	747.29	93.41	93.41
State Total	759	63.1	3,860	423	486

Table 6a.--*Commercial freshwater withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1988*

[State totals rounded to three significant figures. (Source: Data compiled from Maryland Water Resources Administration files]

County or city	Self-supplied			Public-supplied	Total
	Water withdrawals in million gallons per day			Water deliveries in million gallons per day	Withdrawals and deliveries, in million gallons per day
	Source				
	Surface water	Ground water	Total		
Allegany	0.02	0.17	0.19	0.95	1.14
Anne Arundel	.39	4.75	5.14	5.02	10.16
Baltimore	.04	.62	.66	16.69	17.35
Calvert	.01	.38	.39	.12	.51
Caroline	.00	.17	.17	.06	.23
Carroll	.31	.41	.72	.28	1.00
Cecil	.34	.50	.84	.15	.99
Charles	.00	1.98	1.98	.58	2.56
Dorchester	.00	.14	.14	.52	.66
Frederick	.03	1.00	1.03	1.21	2.24
Garrett	.38	.47	.85	.09	.94
Harford	4.22	.38	4.60	.91	5.51
Howard	.05	.32	.37	1.63	2.00
Kent	.00	.12	.12	.05	.17
Montgomery	.03	.44	.47	10.65	11.12
Prince Georges	.19	1.30	1.49	8.54	10.03
Queen Annes	.01	.51	.52	.06	.58
St. Marys	.00	1.52	1.52	.13	1.65
Somerset	.00	.42	.42	.09	.51
Talbot	.00	.35	.35	.22	.57
Washington	.05	.23	.28	1.18	1.46
Wicomico	.00	.47	.47	.10	.57
Worcester	.00	.44	.44	.71	1.15
Baltimore City	.00	.00	.00	29.39	29.39
State Total	6.07	17.1	23.2	79.3	102

Table 6b.--*Commercial freshwater withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1989*

[State totals rounded to three significant figures. (Source: Data compiled from Maryland Water Resources Administration files]

County or city	Self-supplied			Public-supplied	Total
	Water withdrawals in million gallons per day			Water deliveries in million gallons per day	Withdrawals and deliveries, in million gallons per day
	Source				
	Surface water	Ground water	Total		
Allegany	0.04	0.18	0.22	0.95	1.17
Anne Arundel	.39	3.34	3.73	5.27	9.00
Baltimore	.06	.58	.64	15.53	16.17
Calvert	.01	.44	.45	.12	.57
Caroline	.00	.24	.24	.06	.30
Carroll	.32	.45	.77	.27	1.04
Cecil	.35	.53	.88	.20	1.08
Charles	.001	.77	1.77	.61	2.38
Dorchester	.00	.20	.20	.46	.66
Frederick	.04	.81	.85	1.19	2.04
Garrett	.31	.52	.83	.09	.92
Harford	4.25	.39	4.64	.97	5.61
Howard	.04	.35	.39	1.63	2.02
Kent	.00	.14	.14	.05	.19
Montgomery	.01	.44	.45	11.20	11.65
Prince Georges	.03	.97	1.00	8.5	59.55
Queen Annes	.01	.55	.56	.06	.62
St. Marys	.00	1.49	1.49	.13	1.62
Somerset	.00	.40	.40	.08	.48
Talbot	.00	.38	.38	.23	.61
Washington	.07	.22	.29	1.13	1.42
Wicomico	.00	.45	.45	.64	1.09
Worcester	.00	.48	.48	.72	1.20
Baltimore City	.00	.00	.00	28.95	28.95
State Total	5.93	15.3	21.2	79.1	100

Table 7a.--*Industrial water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1988*

[State totals rounded to three significant figures. (Sources: Data compiled from Maryland Water Resources Administration files]

County or city	Self-supplied withdrawals, in million gallons per day								Public-supplied deliveries of freshwater, in million gallons per day	Total withdrawals and deliveries of freshwater, in million gallons per day
	Source									
	Surface water		Ground water		Reclaimed wastewater	Total excluding reclaimed wastewater				
	Fresh	Saline	Fresh	Saline		Fresh	Saline	Total		
Allegany	46.94	0.00	0.03	0.00	0.00	46.97	0.00	46.97	1.60	48.57
Anne Arundel	.02	.01	3.02	.00	.00	3.04	.01	3.05	3.34	6.38
Baltimore	.27	325.85	4.08	.00	80.00	4.35	325.85	330.20	16.70	21.05
Calvert	.00	.00	.02	.00	.00	.02	.00	.02	.00	.02
Caroline	.00	.00	.67	.00	.00	.67	.00	.67	.07	.74
Carroll	.95	.00	.07	.00	.00	1.02	.00	1.02	.28	1.30
Cecil	.03	.00	.04	.00	.00	.07	.00	.07	.30	.37
Charles	.01	.00	.00	.00	.00	.01	.00	.01	.00	.01
Dorchester	.06	.00	.91	.00	.00	.97	.00	.97	.87	1.84
Frederick	2.85	.00	1.27	.00	.00	4.12	.00	4.12	1.20	5.32
Garrett	.00	.00	.02	.00	.00	.02	.00	.02	.09	.11
Harford	.02	.00	.50	.00	.00	.52	.00	.52	.45	.97
Howard	.18	.00	.21	.00	.00	.39	.00	.39	1.63	2.02
Kent	.00	.00	.44	.00	.00	.44	.00	.44	.05	.49
Montgomery	.00	.00	.05	.00	.00	.05	.00	.05	1.78	1.83
Prince Georges	.00	.00	.02	.00	.00	.02	.00	.02	8.54	8.56
Queen Anne	.00	.00	.25	.00	.00	.25	.00	.25	.06	.31
St. Marys	.01	.01	.04	.00	.00	.05	.01	.06	.00	.05
Somerset	.00	.00	.08	.00	.00	.08	.00	.08	.09	.17
Talbot	.00	.00	.57	.00	.00	.57	.00	.57	.11	.68
Washington	2.94	.00	.01	.00	.00	2.95	.00	2.95	2.37	5.32
Wicomico	.00	.00	2.74	.00	.00	2.74	.00	2.74	1.20	3.94
Worcester	.00	.00	3.45	.00	.00	3.45	.00	3.45	.35	3.80
Baltimore City	.00	10.23	4.10	.00	.00	4.10	10.23	14.33	22.04	26.14
State Total	54.3	336	22.6	0.00	80.0	76.9	336	413	63.1	140

Table 7b.--*Industrial water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1989*

[State totals rounded to three significant figures. (Sources: Data compiled from Maryland Water Resources Administration files]

County or city	Self-supplied withdrawals, in million gallons per day								Public-supplied deliveries of freshwater, in million gallons per day	Total withdrawals and deliveries of freshwater, in million gallons per day
	Source									
	Surface water		Ground water			Total excluding reclaimed wastewater				
	Fresh	Saline	Fresh	Saline	Reclaimed wastewater	Fresh	Saline	Total		
Allegany	47.78	0.00	0.03	0.00	0.00	47.81	0.00	47.81	1.62	49.43
Anne Arundel	.02	.01	2.98	.00	.00	3.00	.01	3.01	3.52	6.52
Baltimore	.10	348.71	3.71	.00	80.00	3.81	348.71	352.52	15.54	19.35
Calvert	.00	.00	.02	.00	.00	.02	.00	.02	.00	.02
Caroline	.00	.00	.55	.00	.00	.55	.00	.55	.06	.61
Carrol	1.00	.00	.07	.00	.00	.07	.00	.07	.27	.34
Cecil	.02	.00	.05	.00	.00	.07	.00	.07	.36	.43
Charles	.01	.00	.01	.00	.00	.02	.00	.02	.00	.02
Dorchester	.06	.00	1.06	.00	.00	1.12	.00	1.12	.77	1.89
Frederick	2.37	.00	2.76	.00	.00	5.13	.00	5.13	1.18	6.31
Garrett	.00	.00	.03	.00	.00	.03	.00	.03	.09	.12
Harford	.02	.00	.25	.00	.00	.27	.00	.27	.48	.75
Howard	.18	.00	.21	.00	.00	.23	.00	.23	1.63	1.86
Kent	.00	.00	.49	.00	.00	.49	.00	.49	.05	.54
Montgomery	.00	.00	.05	.00	.00	.05	.00	.05	1.85	1.90
Prince Georges	.00	.00	.02	.00	.00	.02	.00	.02	8.54	8.56
Queen Anne	.00	.00	.28	.00	.00	.28	.00	.28	.05	.33
St. Marys	.01	.00	.03	.00	.00	.04	.00	.04	.00	.04
Somerset	.00	.00	.06	.00	.00	.06	.00	.06	.08	.14
Talbot	.00	.00	.58	.00	.00	.58	.00	.58	.11	.69
Washington	3.06	.00	.03	.00	.00	3.09	.00	3.09	2.27	5.36
Wicomico	.00	.00	2.70	.00	.00	2.70	.00	2.70	1.20	3.90
Worcester	.00	.00	2.48	.00	.00	2.48	.00	2.48	.36	2.84
Baltimore City	.00	7.70	4.02	.00	.00	4.02	7.70	11.72	22.38	26.40
State Total	53.6	356	22.5	0.00	80.0	75.9	356	432	62.4	138

Table 8a.--*Mining water withdrawals in Maryland, by county, 1988*

[State totals rounded to three significant figures. Sources: Data compiled from Maryland Water Resources Administration files]

County or city	Water withdrawals, in million gallons per day								
	Source								
	Surface water			Ground water			Total		
	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Allegany	0.02	0.00	0.02	0.00	0.00	0.00	0.02	0.00	0.02
Anne Arundel	1.44	.00	1.44	.06	.00	.06	1.50	.00	1.50
Baltimore	.68	17.19	17.87	4.23	.00	4.23	4.91	17.19	22.10
Calvert	.00	.00	.00	.00	.00	.00	.00	.00	.00
Caroline	.00	.00	.00	.00	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	2.56	.00	2.56	2.56	.00	2.56
Cecil	.44	.00	.44	.26	.00	.26	.70	.00	.70
Charles	.12	.00	.12	.01	.00	.01	.13	.00	.13
Dorchester	.89	.00	.89	.00	.00	.00	.89	.00	.89
Frederick	.00	.00	.00	4.92	.00	4.92	4.92	.00	4.92
Garrett	.96	.00	.96	2.94	.00	2.94	3.90	.00	3.90
Harford	.04	.00	.04	.55	.00	.55	.59	.00	.59
Howard	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00	.00	.00	.00	.00
Montgomery	.23	.00	.23	.01	.00	.01	.24	.00	.24
Prince Georges	2.63	.00	2.63	.14	.00	.14	2.77	.00	2.77
Queen Annes	.00	.00	.00	.00	.00	.00	.00	.00	.00
St. Marys	.27	.00	.27	.02	.00	.02	.29	.00	.29
Somerset	.00	.00	.00	.00	.00	.00	.00	.00	.00
Talbot	.00	.00	.00	.00	.00	.00	.00	.00	.00
Washington	.03	.00	.03	.46	.00	.46	.49	.00	.49
Wicomico	.00	.00	.00	.01	.00	.01	.01	.00	.01
Worcester	.00	.53	.53	.01	.00	.01	.01	.53	.54
Baltimore City	.00	.01	.01	.00	.00	.00	.00	.01	.01
State Total	7.75	17.7	25.5	16.2	0.00	16.2	23.9	17.7	41.7

Table 8b.--*Mining water withdrawals in Maryland, by county, 1989*

[State totals rounded to three significant figures. Sources: Data compiled from Maryland Water Resources Administration files]

County or city	Water withdrawals, in million gallons per day								
	Source								
	Surface water			Ground water			Total		
	Fresh	Saline	Total	Fresh	Saline	Total	Fresh	Saline	Total
Allegany	0.02	0.00	0.02	0.01	0.00	0.01	0.03	0.00	0.03
Anne Arundel	.96	.00	.96	.10	.00	.10	1.06	.00	1.06
Baltimore	.17	6.29	6.46	5.09	.00	5.09	5.26	6.29	11.55
Calvert	.00	.00	.00	.00	.00	.00	.00	.00	.00
Caroline	.00	.00	.00	.00	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	1.25	.00	1.25	1.25	.00	1.25
Cecil	.44	.00	.44	.27	.00	.27	.71	.00	.71
Charles	.11	.00	.11	.01	.00	.01	.12	.00	.12
Dorchester	.84	.00	.84	.00	.00	.00	.84	.00	.84
Frederick	.02	.00	.02	5.80	.00	5.80	5.82	.00	5.82
Garrett	.92	.00	.92	3.14	.00	3.14	4.06	.00	4.06
Harford	.04	.00	.04	.19	.00	.19	.23	.00	.23
Howard	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00	.00	.00	.00	.00
Montgomery	.02	.00	.02	.04	.00	.04	.06	.00	.06
Prince Georges	2.93	.00	2.93	.54	.00	.54	3.47	.00	3.47
Queen Annes	.00	.00	.00	.01	.00	.01	.01	.00	.01
St. Marys	.24	.00	.24	.02	.00	.02	.26	.00	.26
Somerset	.00	.00	.00	.01	.00	.01	.01	.00	.01
Talbot	.00	.00	.00	.00	.00	.00	.00	.00	.00
Washington	.02	.00	.02	.53	.00	.53	.55	.00	.55
Wicomico	.01	.00	.01	.00	.00	.00	.01	.00	.01
Worcester	.00	.47	.47	.01	.00	.01	.01	.47	.48
Baltimore City	.00	.01	.01	.17	.00	.17	.17	.01	.18
State Total	6.74	6.77	13.5	17.2	0.00	17.2	23.9	6.77	30.7

Table 9a.--*Thermoelectric-power-generation water withdrawals in Maryland, by county, 1988*

[State totals rounded to three significant figures. Sources: Data compiled from Maryland Water Resources Administration files]

County or city	Water withdrawals, in million gallons per day				
	Source				
	Surface Water			Fresh ground water	Total freshwater withdrawals
	Fresh	Saline	Total		
Allegany	0.00	0.00	0.00	0.00	0.00
Anne Arundel	.00	826.82	826.82	.00	.00
Baltimore	.00	444.87	444.87	.00	.00
Calvert	.00	2,896.54	2,896.54	.25	.25
Caroline	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	.00	.00
Cecil	.00	.00	.00	.00	.00
Charles	.00	1,217.07	1,217.07	.67	.67
Dorchester	.00	1.30	1.30	.03	.03
Frederick	.00	.00	.00	.00	.00
Garrett	.00	.00	.00	.00	.00
Harford	.00	.00	.00	.00	.00
Howard	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00
Montgomery	367.84	.00	367.84	.00	367.84
Prince Georges	.00	603.68	603.68	.79	.79
Queen Annes	.00	.00	.00	.00	.00
St. Marys	.00	.00	.00	.00	.00
Somerset	.00	.00	.00	.00	.00
Talbot	.00	.00	.00	.00	.00
Washington	48.48	.00	48.48	.00	48.48
Wicomico	.00	.00	.00	.00	.00
Worcester	.00	.00	.00	.00	.00
Baltimore City	.00	101.23	101.23	.00	.00
State Total	416	6,090	6,510	1.74	418

Table 9b.--*Thermoelectric-power-generation water withdrawals in Maryland, by county, 1989*

[State totals rounded to three significant figures. Sources: Data compiled from Maryland Water Resources Administration files]

County or city	Water withdrawals, in million gallons per day				
	Source				
	Surface Water			Fresh ground water	Total freshwater withdrawals
	Fresh	Saline	Total		
Allegany	0.00	0.00	0.00	0.00	0.00
Anne Arundel	.00	926.84	926.84	.00	.00
Baltimore	.00	796.01	796.01	.00	.00
Calvert	.00	1,237.78	1,237.78	.07	.07
Caroline	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	.00	.00
Cecil	.00	.00	.00	.00	.00
Charles	.00	1,158.12	1,158.12	.73	.73
Dorchester	.00	1.59	1.59	.04	.04
Frederick	.00	.00	.00	.00	.00
Garrett	.00	.00	.00	.00	.00
Harford	.00	.00	.00	.00	.00
Howard	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00
Montgomery	345.53	.00	345.53	.00	345.53
Prince Georges	.00	536.09	536.09	1.00	1.00
Queen Annes	.00	.00	.00	.00	.00
St. Marys	.00	.00	.00	.00	.00
Somerset	.00	.00	.00	.00	.00
Talbot	.00	.00	.00	.00	.00
Washington	49.64	.00	49.64	.00	49.64
Wicomico	.00	.00	.00	.00	.00
Worcester	.00	.00	.00	.00	.00
Baltimore City	.00	103.53	103.53	.00	.00
State Total	395	4,760	5,160	1.84	397

Table 10a.--Hydroelectric-power-generation water use in Maryland, by county, 1988

[State totals rounded to three significant figures. (Sources: Withdrawals estimated based on annual power generation data obtained from Energy Informations Administration, 1989, and Weisberg and Rose, 1985]

County or city	Freshwater use	
	Million gallons per day	Thousand acre-feet per year
Allegany	0.00	0.00
Anne Arundel	.00	.00
Baltimore	.00	.00
Calvert	.00	.00
Caroline	.00	.00
Carroll	.00	.00
Cecil	5.05	5.66
Charles	.00	.00
Dorchester	.00	.00
Frederick	.00	.00
Garrett	60.84	68.20
Harford	14,753.42	16,538.58
Howard	.00	.00
Kent	.00	.00
Montgomery	.00	.00
Prince Georges	.00	.00
Queen Annes	.00	.00
St. Marys	.00	.00
Somerset	.00	.00
Talbot	.00	.00
Washington	932.00	1,044.77
Wicomico	.00	.00
Worcester	.00	.00
Baltimore City	.00	.00
State Total	15,800	17,700

Table 10b.--Hydroelectric-power-generation water use in Maryland, by county, 1989

[State totals rounded to three significant figures. (Sources: Withdrawals estimated based on annual power generation data obtained from Energy Informations Administration, 1989, and Weisberg and Rose, 1985]

County or city	Freshwater use	
	Million gallons per day	Thousand acre-feet per year
Allegany	0.00	0.00
Anne Arundel	.00	.00
Baltimore	.00	.00
Calvert	.00	.00
Caroline	.00	.00
Carroll	.00	.00
Cecil	8.97	10.06
Charles	.00	.00
Dorchester	.00	.00
Frederick	.00	.00
Garrett	60.84	68.20
Harford	20,473.97	22,951.32
Howard	.00	.00
Kent	.00	.00
Montgomery	.00	.00
Prince Georges	.00	.00
Queen Annes	.00	.00
St. Marys	.00	.00
Somerset	.00	.00
Talbot	.00	.00
Washington	1,327.00	1,487.67
Wicomico	.00	.00
Worcester	.00	.00
Baltimore City	.00	.00
State Total	21,900	24,500

Table 11.--*Agriculture (nonirrigation) water withdrawals in Maryland, by county, 1988-89*

[State totals rounded to three significant figures. (Source: Withdrawals estimated based on data from U.S. Department of Commerce, 1988 and U.S. Environmental Protection Agency, 1973)]

County or city	Freshwater withdrawals in, million gallons per day		
	Million gallons per day	Thousand acre-feet per year	Total
Allegany	0.05	0.02	0.08
Anne Arundel	.04	.02	.07
Baltimore	.13	.16	.29
Calvert	.02	.00	.02
Caroline	.04	.28	.32
Carroll	.31	.46	.77
Cecil	.10	.20	.30
Charles	.04	.04	.08
Dorchester	.01	.19	.20
Frederick	.48	1.40	1.88
Garrett	.22	.24	.46
Harford	.17	.21	.38
Howard	.10	.08	.18
Kent	.06	.21	.27
Montgomery	.11	.14	.25
Prince Georges	.04	.02	.06
Queen Annes	.06	.22	.28
St Marys	.05	.08	.13
Somerset	.02	.79	.81
Talbot	.03	.18	.21
Washington	.31	.71	1.02
Wicomico	.02	1.15	1.17
Worcester	.03	1.15	1.18
Baltimore City	.00	.00	.00
State Total	2.44	7.95	10.4

Table 12a.--*Irrigation water withdrawals in Maryland, by county, 1988*

[State totals rounded to three significant figures. Source: Withdrawals and acreage irrigated estimated based on data from L.E. Carr, Maryland Cooperative Extension Service, oral commun., 1991]

County or city	Irrigated land by type of water, in thousand acres		Water withdrawals, in million gallons per day					
			Source			Million gallons per day		
			Surface		Ground	Total		
	Fresh	Saline	Fresh	Brackish	Fresh	Fresh	Brackish	Total
Allegany	0.10	0.00	0.11	0.00	0.00	0.11	0.00	0.11
Anne Arundel	.16	.00	.40	.00	.11	.51	.00	.51
Baltimore	.91	.02	.70	.01	.20	.90	.01	.91
Calvert	.58	.04	.35	.03	.06	.41	.03	.44
Caroline	15.95	3.18	4.49	2.13	6.20	10.69	2.13	12.82
Carroll	.51	.00	.30	.00	.05	.35	.00	.35
Cecil	.32	.00	.19	.00	.51	.70	.00	.70
Charles	.74	.02	.49	.01	.09	.58	.01	.59
Dorchester	17.09	.90	1.90	.61	9.55	11.45	.61	12.06
Frederick	.28	.00	.44	.00	.02	.46	.00	.46
Garrett	.27	.00	.25	.00	.00	.25	.00	.25
Harford	.75	.00	.40	.00	.11	.51	.00	.51
Howard	.16	.00	.08	.00	.03	.11	.00	.11
Kent	2.27	.25	.04	.17	3.37	3.41	.17	3.58
Montgomery	.39	.00	.58	.00	.29	.87	.00	.87
Prince Georges	.33	.00	.47	.00	.15	.62	.00	.62
Queen Annes	8.90	.93	3.16	.62	2.84	6.00	.62	6.62
St. Marys	.64	.20	.43	.14	.02	.45	.14	.59
Somerset	1.51	.06	.20	.04	.82	1.02	.04	1.06
Talbot	1.86	.00	.72	.00	.64	1.36	.00	1.36
Washington	.33	.00	.22	.00	.05	.27	.00	.27
Wicomico	5.36	.60	.81	.40	2.85	3.66	.40	4.06
Worcester	2.35	.12	.79	.08	.97	1.76	.08	1.84
Baltimore City	.00	.00	.01	.00	.00	.01	.00	.01
State Total	61.7	6.32	17.5	4.24	28.9	46.5	4.24	50.7

Table 12b.--*Irrigation water withdrawals in Maryland, by county, 1989*

[State totals rounded to three significant figures. Source: Withdrawals and acreage irrigated estimated based on data from L.E. Carr, Maryland Cooperative Extension Service, oral commun., 1991]

County or city	Irrigated land by type of water, in thousand acres		Water withdrawals, in million gallons per day					
			Source			Million gallons per day		
			Surface		Ground	Total		
	Fresh	Saline	Fresh	Brackish	Fresh	Fresh	Brackish	Total
Allegany	0.10	0.00	0.08	0.00	0.00	0.08	0.00	0.08
Anne Arundel	.16	.00	.49	.00	.10	.59	.00	.59
Baltimore	.91	.02	.50	.01	.10	.60	.01	.61
Calvert	.59	.04	.28	.02	.05	.33	.02	.35
Caroline	16.19	3.23	3.89	1.73	5.06	8.95	1.73	10.68
Carroll	.51	.00	.24	.00	.04	.28	.00	.28
Cecil	.32	.00	.15	.00	.56	.71	.00	.71
Charles	.74	.02	.40	.01	.02	.42	.01	.43
Dorchester	17.35	.92	1.54	.49	7.75	9.29	.49	9.78
Frederick	.28	.00	.41	.00	.03	.44	.00	.44
Garrett	.27	.00	.18	.00	.00	.18	.00	.18
Harford	.75	.00	.32	.00	.09	.41	.00	.41
Howard	.16	.00	.06	.00	.02	.08	.00	.08
Kent	2.30	.25	.03	.14	1.33	1.36	.14	1.50
Montgomery	.39	.00	.41	.00	.18	.59	.00	.59
Prince Georges	.33	.00	.23	.00	.12	.35	.00	.35
Queen Annes	9.03	.94	2.57	.50	2.71	5.28	.50	5.78
St. Marys	.64	.20	.34	.11	.03	.37	.11	.48
Somerset	1.53	.06	.16	.03	.66	.82	.03	.85
Talbot	1.88	.00	.58	.00	.51	1.09	.00	1.09
Washington	.33	.00	.18	.00	.02	.20	.00	.20
Wicomico	5.44	.61	.66	.33	2.41	3.07	.33	3.40
Worcester	2.39	.12	.64	.07	.76	1.40	.07	1.47
Baltimore City	.00	.00	.01	.00	.00	.01	.00	.01
State Total	62.6	6.41	14.4	3.44	22.6	36.9	3.44	40.3

Table 13a.--*Aquaculture water withdrawals in Maryland, by county, 1988*

[State totals rounded to three significant figures. Sources: Data compiled from Maryland Water Resources Administration files]

County or city	Water withdrawals, in million gallons per day				
	Source				
	Surface Water			Fresh ground water	Total freshwater withdrawals
	Fresh	Saline	Total		
Allegany	0.01	0.00	0.01	0.00	0.01
Anne Arundel	.00	.00	.00	.01	.01
Baltimore	.00	3.11	3.11	.01	.01
Calvert	.00	.002	.002	.00	.00
Caroline	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	.00	.00
Cecil	.00	.00	.00	.00	.00
Charles	.00	.00	.00	.00	.00
Dorchester	.04	.00	.04	.03	.07
Frederick	1.53	.00	1.53	.004	1.534
Garrett	1.46	.00	1.46	.00	1.46
Harford	.00	.00	.00	.00	.00
Howard	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00
Montgomery	.00	.00	.00	.00	.00
Prince Georges	.00	.00	.00	.00	.00
Queen Annes	.00	.00	.00	.00	.00
St. Marys	.00	1.62	1.62	.001	.001
Somerset	.00	.003	.003	.00	.00
Talbot	.00	.00	.00	.00	.00
Washington	.00	.00	.00	4.26	4.26
Wicomico	.00	.001	.001	.00	.00
Worcester	.00	.00	.00	.00	.00
Baltimore City	.00	.00	.00	.00	.00
State Total	3.04	4.74	7.78	4.32	7.35

Table 13b.--*Aquaculture water withdrawals in Maryland, by county, 1989*

[State totals rounded to three significant figures. Sources: Data compiled from Maryland Water Resources Administration files]

County or city	Water withdrawals, in million gallons per day				
	Source				
	Surface Water			Fresh ground water	Total freshwater withdrawals
	Fresh	Saline	Total		
Allegany	0.01	0.00	0.01	0.00	0.01
Anne Arundel	.00	.00	.00	.01	.01
Baltimore	.00	2.87	2.87	.03	.03
Calvert	.00	.002	.002	.00	.00
Caroline	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	.00	.00
Cecil	.00	.00	.00	.00	.00
Charles	.00	.00	.00	.00	.00
Dorchester	.00	7.24	7.24	.03	.03
Frederick	2.51	.00	2.51	.004	2.514
Garrett	1.48	.00	1.48	.00	1.48
Harford	.003	.00	.003	.00	.003
Howard	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00
Montgomery	.00	.00	.00	.00	.00
Prince Georges	.00	.00	.00	.00	.00
Queen Annes	.00	.00	.00	.004	.004
St. Marys	.00	1.93	1.93	.00	.001
Somerset	.00	.003	.003	.00	.00
Talbot	.00	.00	.00	.00	.00
Washington	.00	.00	.00	4.61	4.61
Wicomico	.00	.001	.001	.00	.00
Worcester	.00	.00	.00	.00	.00
Baltimore City	.00	.00	.00	.00	.00
State Total	4.00	12.0	16.0	4.69	8.69