WATER WITHDRAWAL AND USE IN MARYLAND, 1990-91

By Judith C. Wheeler

U.S. GEOLOGICAL SURVEY

Water-Resources Investigations Report 93-4225

Prepared in cooperation with the

MARYLAND WATER RESOURCES ADMINISTRATION and the

MARYLAND GEOLOGICAL SURVEY

Towson, Maryland

1995

U.S. DEPARTMENT OF THE INTERIOR

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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Commercial water use.-- Water withdrawn for motels, hotels, restaurants, office buildings, and other commercial facilities, and for educational, civilian, and military institutions.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Consumptive use (consumed water) .-- That quantity of water withdrawn that is evaporated, transpired, incorporated into products or absorbed by crops, consumed by humans or livestock, or otherwise removed from the immediate water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 Water withdrawn for home heating and cooling by ground-water heat pumps is also included in this category.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.

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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 1990-91.

During 1990, about 1,460 Mgal/d (million gallons per day) of freshwater was withdrawn from surface-water and ground-water sources in Maryland. Of this amount, 1,210 Mgal/d (83 percent) was used in the State and 248 Mgal/d (17 percent) was transferred to surrounding States and the District of Columbia for water supply. About 7.5 Mgal/d of freshwater was imported from bordering States for use in Maryland.

During 1991, total freshwater withdrawals in Maryland increased to about 1,500 Mgal/d, with 1,250 Mgal/d used in the State and 249 Mgal/d transferred to surrounding States and the District of Columbia. About 6.6 Mgal/d of freshwater was imported from bordering States for use in Maryland.

During 1990-91, most freshwater withdrawals (1,220 Mgal/d during 1990 and 1,250 Mgal/d during 1991 or about 83 percent of total for each year) were from surface-water sources. The largest surface-water withdrawals in the State, greater than 100 Mgal/d, were in Montgomery and Baltimore Counties. Reservoirs and rivers in these counties were the 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 870 Mgal/d during 1990 and 875 Mgal/d during 1991) was withdrawn and used in the Potomac drainage basin whereas most ground water (about 170 Mgal/d during 1990 and 184 Mgal/d during 1991) was withdrawn and used in the Upper Chesapeake drainage basin. The Potomac Group aquifers were the largest source of ground water (26.6 percent of total ground-water withdrawals) in each year.

The population of Maryland served by public water-supply systems increased slightly from 3.94 million during 1990 to 3.97 million during 1991. 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 1990-91: Public supply, domestic, commercial, industrial, mining, thermoelectric power, hydroelectric power, livestock, irrigation, and aquaculture.

Notable facts about these uses are:

- *Public supply*--798 Mgal/d of freshwater was withdrawn in 1990 (826 Mgal/d during 1991) and delivered for use to residences, commercial establishments, and industries. Public suppliers withdrew the largest quantities of water in the State. The largest user of surface water for public supply was Baltimore City with about 135 Mgal/d withdrawn for use during 1990 and 127 Mgal/d during 1991.
- *Domestic*--484 Mgal/d of freshwater was used during 1990 (490 Mgal/d during 1991). About 414 Mgal/d during 1990 and 420 Mgal/d during 1991 were received from public suppliers. About 69.9 Mgal/d during 1990 and 71.4 Mgal/d during 1991 were self-supplied. All self-supplied domestic

water withdrawals were from ground-water sources.

- *Industrial*--123 Mgal/d of freshwater was used during 1990 (116 Mgal/d during 1991). About 70.1 Mgal/d during 1990 and 67.2 Mgal/d during 1991 were self-supplied; the remaining water used was delivered by public suppliers. Industries also used 379 Mgal/d of saline or brackish surface water during 1990 (312 Mgal/d during 1991). About 62.5 Mgal/d of reclaimed wastewater was used during each year.
- *Mining*--28.0 Mgal/d of freshwater was used during 1990 (25.3 Mgal/d during 1991). Brackish or saline surface-water withdrawals used in mining operations decreased 82 percent from 21.3 Mgal/d in 1990 to 3.77 Mgal/d in 1991 due mainly to reduced dredging operations.
- *Thermoelectric power*--421 Mgal/d of freshwater was used during 1990 (416 Mgal/d during 1991). In addition, about 4,550 Mgal/d of saline surface water was withdrawn for cooling condensers during 1990. During 1991, saline surface-water withdrawals increased to 5,760 Mgal/d.
- *Hydroelectric power (instream water use)*--25,900 Mgal/d of freshwater was used for the production of electricity during 1990 (21,900 Mgal/d during 1991). Although the amount of water diverted through some plants was considerable, the amount of consumptive use was negligible.
- *Livestock*--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 Mgal/d was from ground-water sources.
- *Irrigation*--29.1 Mgal/d of freshwater was used during 1990 (50.4 Mgal/d during 1991). Most of the water (22.8 Mgal/d during 1990 and 41.1 Mgal/d during 1991) was used for irrigating farm crops.
- *Aquaculture*--9.37 Mgal/d of freshwater was used during 1990 (11.6 Mgal/d during 1991). Saline surface-water withdrawals increased from 9.58 Mgal/d during 1990 to 12.5 Mgal/d during 1991.

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*** [1] 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 aggregate 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, 1987, and 1988-89 are summarized by Wheeler (1990, 1991, and 1992).

Purpose and Scope

This report summarizes the amounts of fresh and ***saline*** water withdrawn and used in Maryland during 1990 and 1991. 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 whether or not it is transferred to another county or State. Water use is the amount of water actually used in a particular county or drainage basin, including (1) water withdrawn for use in the county or basin and (2) water imported from another county, basin, 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, hydroelectric power, livestock, 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 as "***self-supplied.***" Homes and small communities relying on individual wells are classified as domestic self-supplied water users. Commercial use not only includes typical businesses such as restaurants, motels, car washes, and office buildings, but also institutions such as schools, churches, and military installations. Thermoelectric power includes electrical energy generated in steam-electric plants and those using nuclear fuel. Water used for the generation of electricity by hydroelectric

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

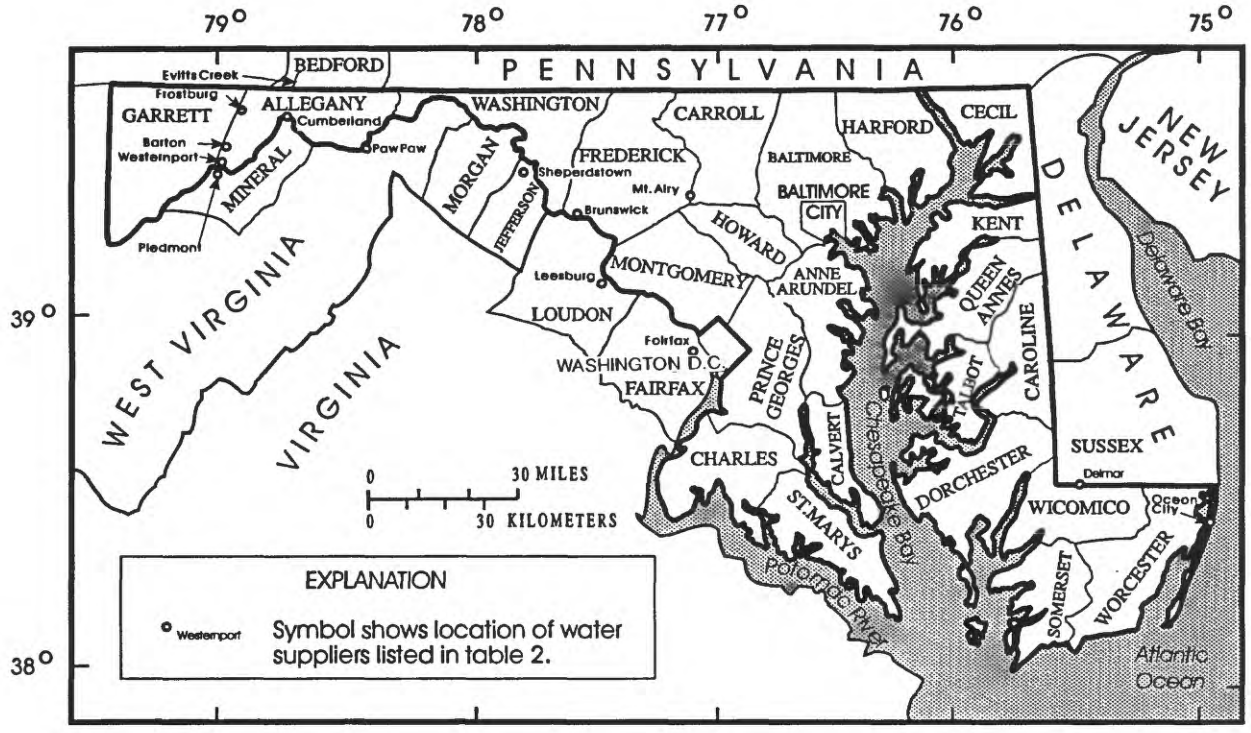


Figure 1. The counties of Maryland and selected adjacent counties of Virginia, West Virginia, and Pennsylvania.

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 Water-Use Data System (SSWUDS), that is designed to store monthly 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 which are required by WRA for all water users except self-supplied domestic users and agricultural irrigators using less than 0.01 Mgal/d.

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

Self-supplied domestic withdrawals were estimated by determining the percentage of year-round housing units not served by public suppliers (U.S. Department of Commerce, 1990b, p. 92) and multiplying that percentage by the total population for each county (1990 county population data from U.S. Department of Commerce, 1990a, table 1, p. 1-12 and 1991 county population data compiled from Maryland Department of State Planning, 1990). The total

unserved population number was then multiplied by 80 gal/d, the estimated per capita water use in Maryland (J.R. Herring, Maryland Water Resources Administration, oral commun., 1992).

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

Livestock 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 for drinking and maintenance 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 and the same water use were assumed for 1990-91. 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 for crops was estimated from the number of acres irrigated and amount of rainfall during the growing season (based on Carr, 1991). For 1990, a water-application rate of 0.5 (acre-ft)/yr per acre or about 446 gal/d per acre was used for counties on the lower Eastern Shore of Maryland (Dorchester, Somerset, Wicomico, and Worcester), and 0.3 (acre-ft)/yr per acre or about 295 gal/d per acre was used for counties on the upper Eastern Shore (Caroline, Kent, Queen Annes, and Talbot) and the rest of the State. Irrigation water use for 1991 was estimated using 0.75 (acre-ft)/yr per acre or about 670 gal/d per acre during 1991 (L.E. Carr, Maryland Cooperative Extension Service, oral commun., 1991 and 1992).

WATER USE

During 1990, approximately 1,460 Mgal/d of freshwater was withdrawn from surface-water and ground-water sources in Maryland. Of this amount, 1,210 Mgal/d (83 percent) was used in the State and 248 Mgal/d (17 percent) was transferred to surrounding States and the District of Columbia for water supply. About 7.5 Mgal/d of freshwater was imported from bordering States for use in Maryland. During 1991, about 1,500 Mgal/d of freshwater was withdrawn. Of this amount, 1,250 Mgal/d (84 percent) was used in the State and 249 Mgal/d (16 percent) was transferred to surrounding areas. About 6.6 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 1.

Withdrawals of freshwater by county are shown in figure 2. The largest surface-water withdrawals (more than 100 Mgal/d) were in Baltimore and Montgomery Counties. The reservoirs and rivers in these counties provide water sources for public suppliers that serve the Baltimore City and District of Columbia metropolitan areas. The smallest withdrawals (less than 4.5 Mgal/d) were in Howard County. The 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 category of use are summarized in figure 3. Withdrawal and use data by county in 1990 and 1991 are presented in tables 3-13 in the appendix. Table 3a summarizes total withdrawals by county in 1990; table 3b summarizes total withdrawals by county in 1991.

A comparison of total fresh surface-water and ground-water withdrawals by county during 1990 and 1991 is shown in figure 4. During each year, approximately 83 percent (1,220 Mgal/d during 1990 and 1,250 Mgal/d during 1991) of the freshwater withdrawn was from surface-water sources, compared to 17 percent (240 Mgal/d during 1990 and 255 Mgal/d during 1991) withdrawn from ground-water sources. Most fresh surface water (more than 100 Mgal/d) was withdrawn in Montgomery and Baltimore Counties (tables 3a and 3b), whereas most ground water (more than 25 Mgal/d) was withdrawn in Anne Arundel County.

Table 1.--*Maryland water suppliers cross-boundary withdrawals and deliveries, 1990-91*
[See fig. 1 for locations]

Water supplier	County and State of withdrawal	County and State of use	Amount delivered, in million gallons per day 1990	1991
Baltimore City	Baltimore, Md.	Anne Arundel, Md.	9.12	10.00
		Baltimore City	135.22	127.19
		Carroll, Md.	1.18	1.27
		Howard, Md.	13.92	16.43
Barton	Garrett, Md.	Allegany, Md.	.09	.09
Brunswick	Washington, Md.	Frederick, Md.	.16	.22
	Loudoun, Va.	Frederick, Md.	.08	.08
Cumberland	Bedford, Pa.	Allegany, Md.	7.08	6.20
Delmar	Sussex, Del.	Wicomico, Md.	.35	.35
Frostburg	Garrett, Md.	Allegany, Md.	.84	.84
Mt. Airy	Frederick, Md.	Carroll, Md.	.23	.23
Washington Suburban Sanitary Commision	Montgomery, Md.	Prince Georges, Md.	42.06	42.05
	Prince Georges, Md.	Howard, Md.	3.00	3.00
Westernport	Garrett, Md.	Allegany, Md.	.78	.76
Fairfax County Water Authority	Montgomery, Md.	Fairfax, Va.	49.30	52.88
Leesburg	Montgomery, Md.	Loudoun, Va.	1.40	1.68
Paw Paw	Allegany, Md.	Morgan, W. Va.	.04	.04
Piedmont	Garrett, Md.	Mineral, W. Va.	.09	.09
Shepherdstown	Washington, Md.	Jefferson, W. Va.	.36	.35
Washington Aqueduct	Montgomery, Md.	District of Columbia	196.39	194.24

The largest drainage basins in Maryland are the Potomac and the Upper Chesapeake (fig. 5). During 1990 and 1991, over 70 percent of total fresh surface-water withdrawals were from streams in the Potomac Basin. During 1990, about 870 Mgal/d of fresh surface water was withdrawn and used in this basin compared to 300 Mgal/d withdrawn and used in the Upper Chesapeake Basin. In addition, about 17 Mgal/d of fresh surface water was withdrawn in the Potomac Basin and transferred to the Chesapeake Basin. About 27 Mgal/d of fresh surface water was withdrawn in the Upper Chesapeake Basin and transferred to the Potomac Basin for use.

During 1991, about 875 Mgal/d of fresh surface water was withdrawn and used in the Potomac Basin compared to 318 Mgal/d withdrawn and used in the Upper Chesapeake Basin. In addition, about 17 Mgal/d of fresh surface water was withdrawn in the Potomac Basin and transferred to the Upper Chesapeake Basin for use. About 31 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 (amount too small to show on graph) drainage basins in Maryland.

During 1990, about 71 percent (170 Mgal/d) of fresh ground-water was withdrawn and used in the Upper Chesapeake Basin, compared to about 27 percent (65 Mgal/d) in the Potomac Basin. During 1991, total ground-water withdrawals increased to 184 Mgal/d (72 percent) in the Upper Chesapeake Basin and remained the same at 65 Mgal/d (25 percent) in the Potomac Basin. Only about 2 percent of total ground-water withdrawals were from sites in the Monongahela, Susquehanna, and Delaware River (amount too small to show on graph) drainage basins.

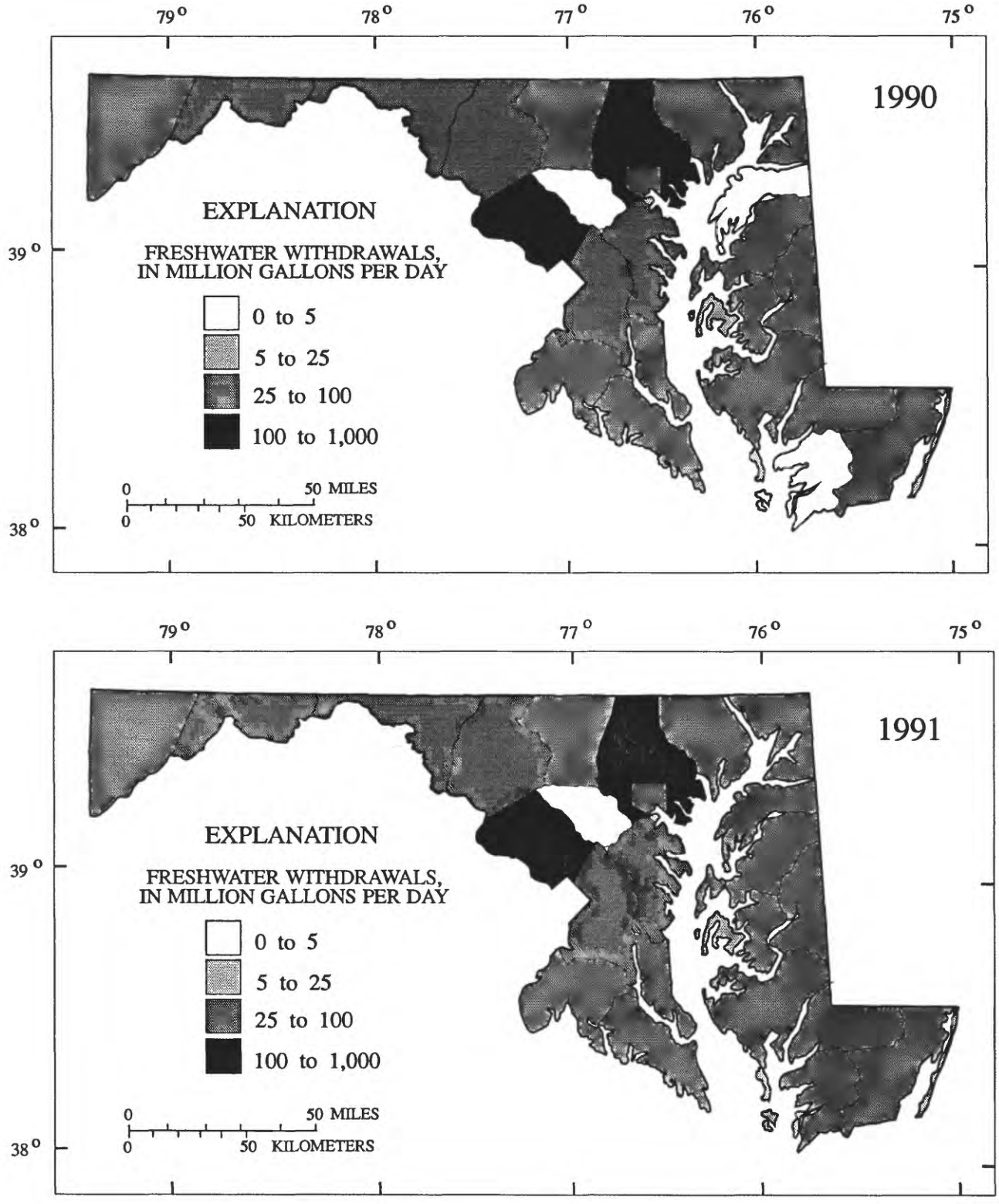
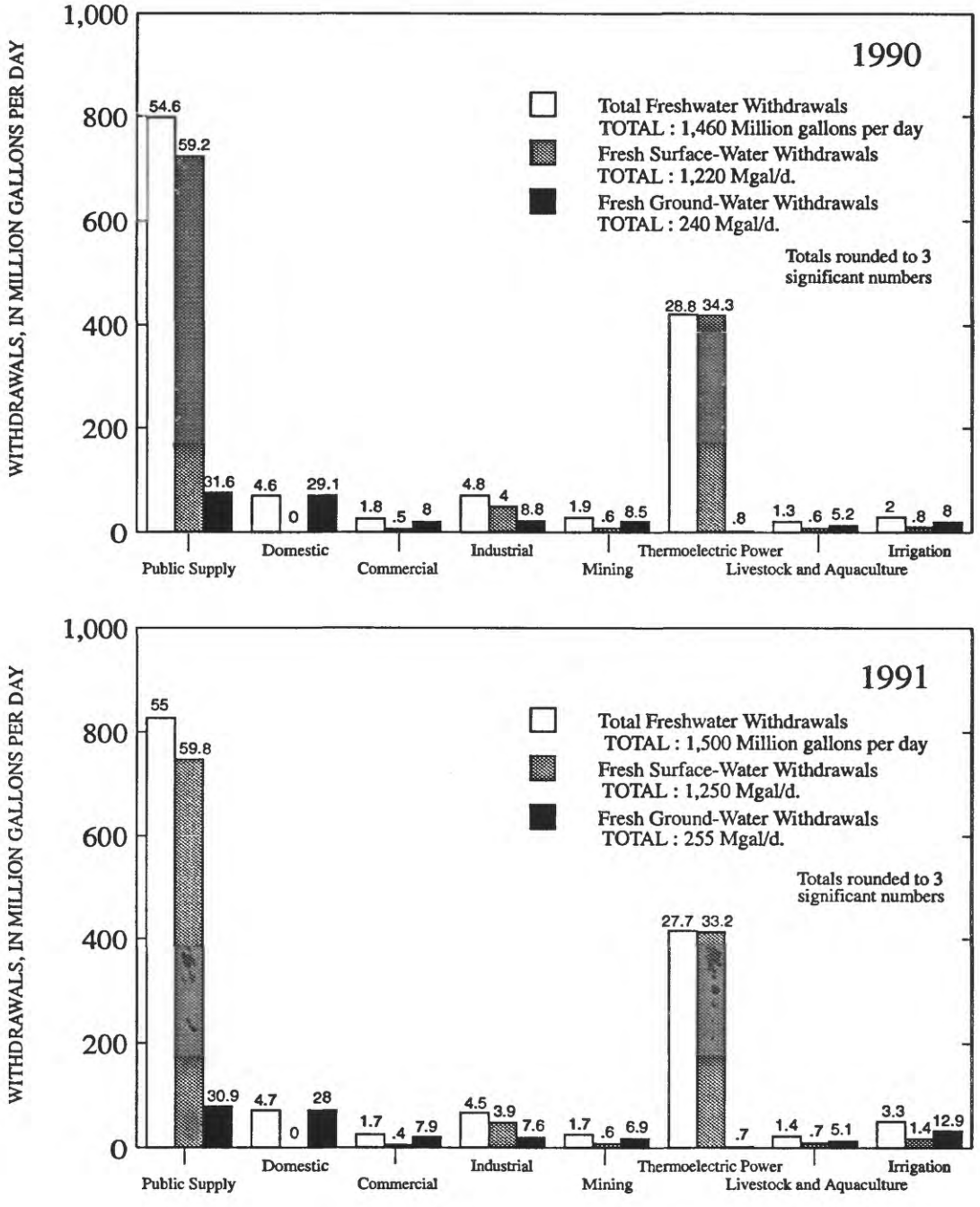
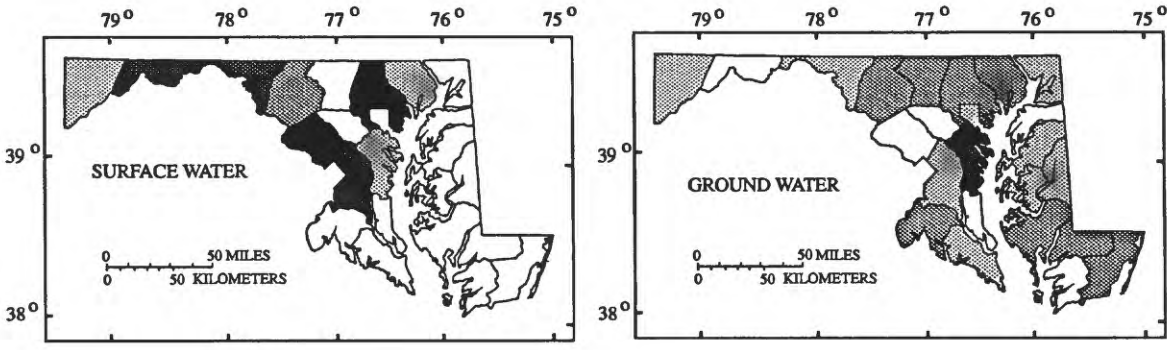


Figure 2. Freshwater withdrawals in Maryland, by county, 1990-91.

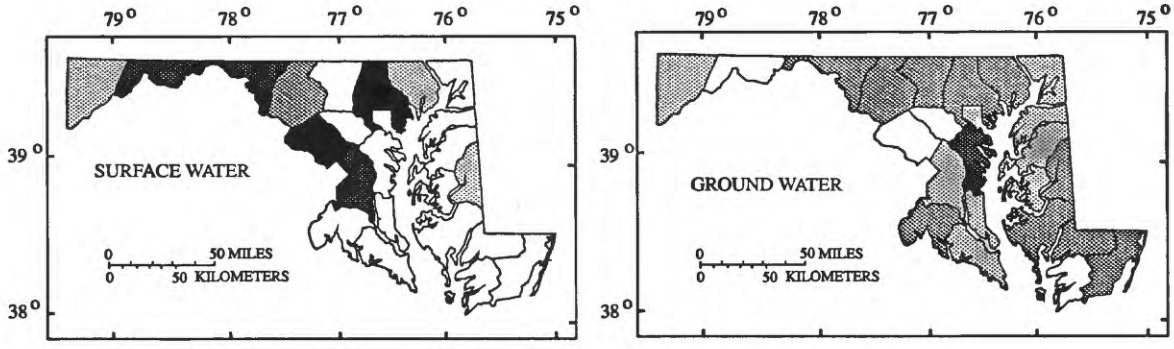


4.5 Number indicates percentage of water withdrawals by source for each category of use.

Figure 3. Freshwater withdrawals and source of water in Maryland, by category of use, 1990-91.



1990



1991

EXPLANATION

FRESHWATER WITHDRAWALS, IN MILLION GALLONS PER DAY

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

PERCENT OF TOTAL FRESHWATER WITHDRAWALS

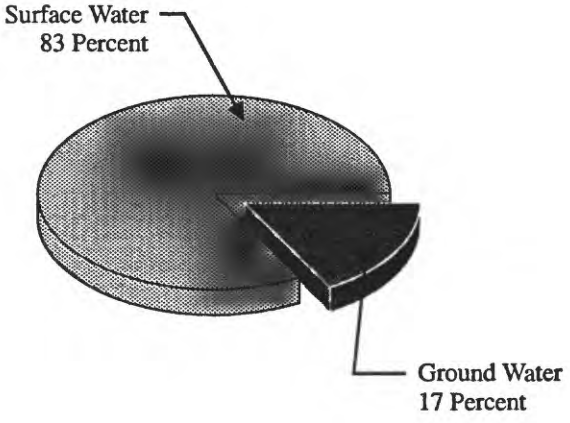


Figure 4. Fresh surface-water and ground-water withdrawals in Maryland, by county, 1990-91.

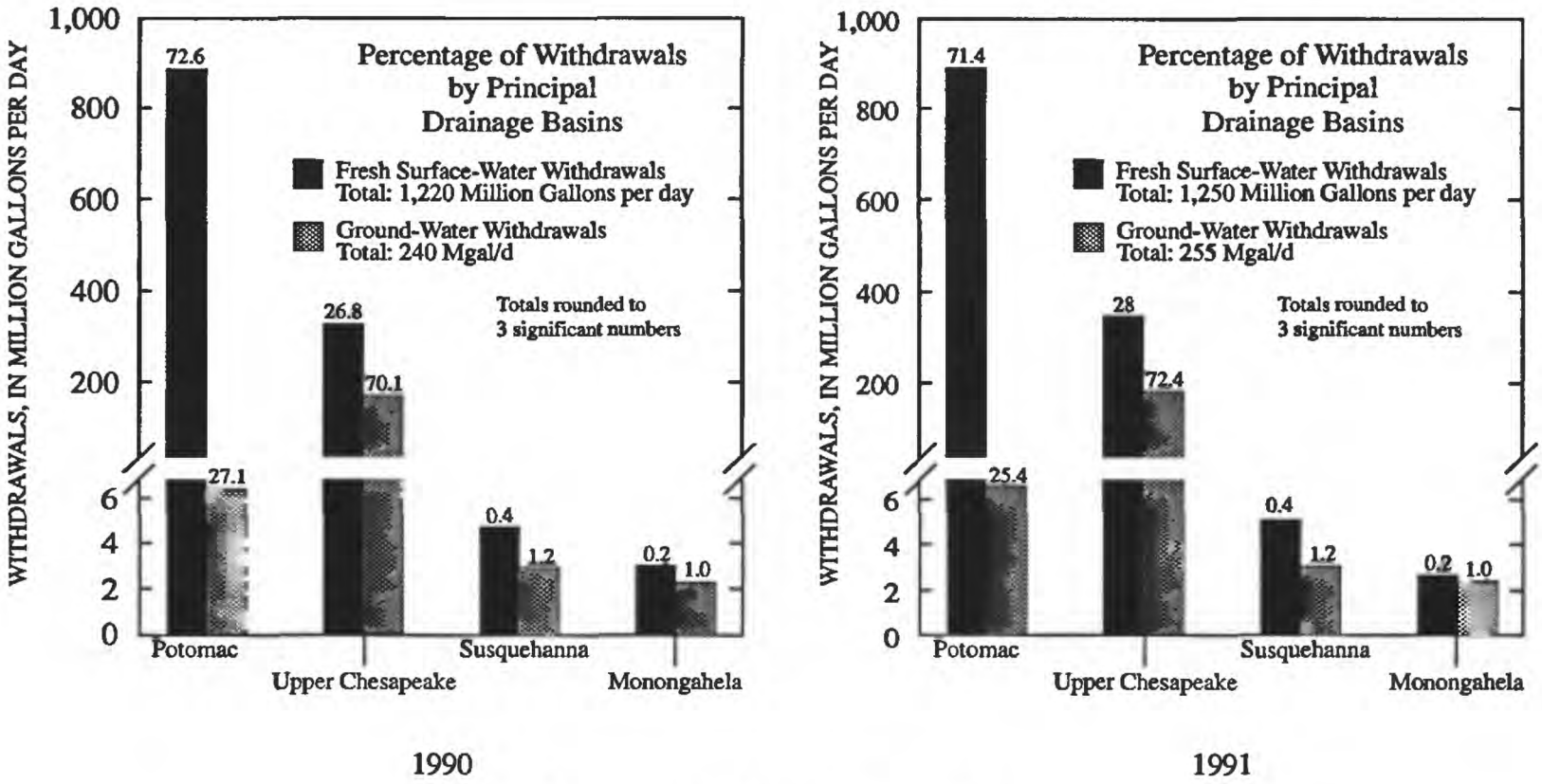


Figure 5. Fresh surface-water and ground-water withdrawals in Maryland, by principal drainage basin, 1990-91.

Estimated percentages of ground-water withdrawals by principal aquifers during 1990 and 1991 are shown in figure 6. The map and hydrogeologic section show the geographic distribution of the principal aquifers in Maryland (U.S. Geological Survey, 1990, p. 294). The Potomac Group aquifers were the largest source of ground water with 64 Mgal/d withdrawn during 1990 and 68 Mgal/d during 1991 (26.6 percent of total ground-water withdrawals), followed by the Columbia and Piedmont aquifers with about 36 Mgal/d during 1990 and 38 Mgal/d during 1991 (about 15 percent). The smallest amount of water was withdrawn from the Newark Group aquifers with about 2 Mgal/d withdrawn each year (0.9 percent).

Population and Water-Use Trends

The population of Maryland increased from 4,780,000 during 1990 (U.S Department of Commerce, 1990a) to 4,830,000 in 1991 (estimates based on projections from Maryland Department of State Planning, 1990). Population and water-use data for 1990 and 1991 are presented in table 2. The population served by public water-supply systems increased from 3.94 million during 1990 to 3.97 million during 1991. 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.

Population and water-use trends in Maryland from 1950 to 1991 are shown in figure 7. 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 4.83 million in 1991. 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, freshwater use increased overall from 1985 to 1991, from about 1,400 Mgal/d to about 1,500 Mgal/d, primarily because of increased withdrawals for cooling purposes by power plants, and for irrigation and public-supply distribution.

Public Supply

The largest amount of water withdrawn in the State, 798 Mgal/d during 1990 and 826 Mgal/d during 1991 (55 percent of total freshwater withdrawals; fig. 3), was by public-supply systems operated by municipalities, counties and towns, and private utilities. Public suppliers delivered water to 82 percent of the total population during both 1990 and 1991 (table 2). Water was delivered for a variety of uses including domestic, commercial, and industrial uses (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 1. The largest user of surface water for public supply is Baltimore City. During 1990, about 135 Mgal/d was withdrawn for use by the city compared to about 127 Mgal/d during 1991. In addition, Baltimore City supplied about 127 Mgal/d during 1990 and 121 Mgal/d during 1991 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 174 Mgal/d during 1990 and 180 Mgal/d during 1991 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 U.S. Army Corps of Engineers, who delivers water to the District of Columbia through the Washington Aqueduct. During 1990, about 50.7 Mgal/d of fresh surface water was withdrawn from the river and transferred to Virginia and West Virginia for use, compared to 54.6 Mgal/d withdrawn and transferred during 1991. During 1990, the Washington Aqueduct conveyed about 196 Mgal/d from the Potomac River for public-supply deliveries to the District, compared to 194 Mgal/d conveyed during 1991.

Several municipalities in Maryland obtained all or part of their water supply from bordering States during 1990 and 1991, including Cumberland in Allegany County, which received 7.08 Mgal/d of surface-water during 1990 (6.20 Mgal/d during 1991) from two impoundments on Evitts Creek 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 1990, about 26 Mgal/d was withdrawn by public suppliers in the county compared to 27.8 Mgal/d during 1991.

Domestic

Domestic users in Maryland receive water from public-supply systems and from self-supplied sources (tables 5a and 5b). During 1990, total use (withdrawals plus deliveries) was 484 Mgal/d, of which 414 Mgal/d was delivered by public suppliers. Eighteen percent of the total population (843,000 people) withdrew about 69.9 Mgal/d from privately owned wells (self-supplied). Domestic water use increased during 1991 to 490 Mgal/d, of which 420 Mgal/d was delivered by public suppliers. As in 1990, 18 percent of the total population (860,000 people) withdrew about 71.4 Mgal/d from self-supplied sources. All self-supplied water withdrawn for domestic use was assumed to be from ground water.

Commercial

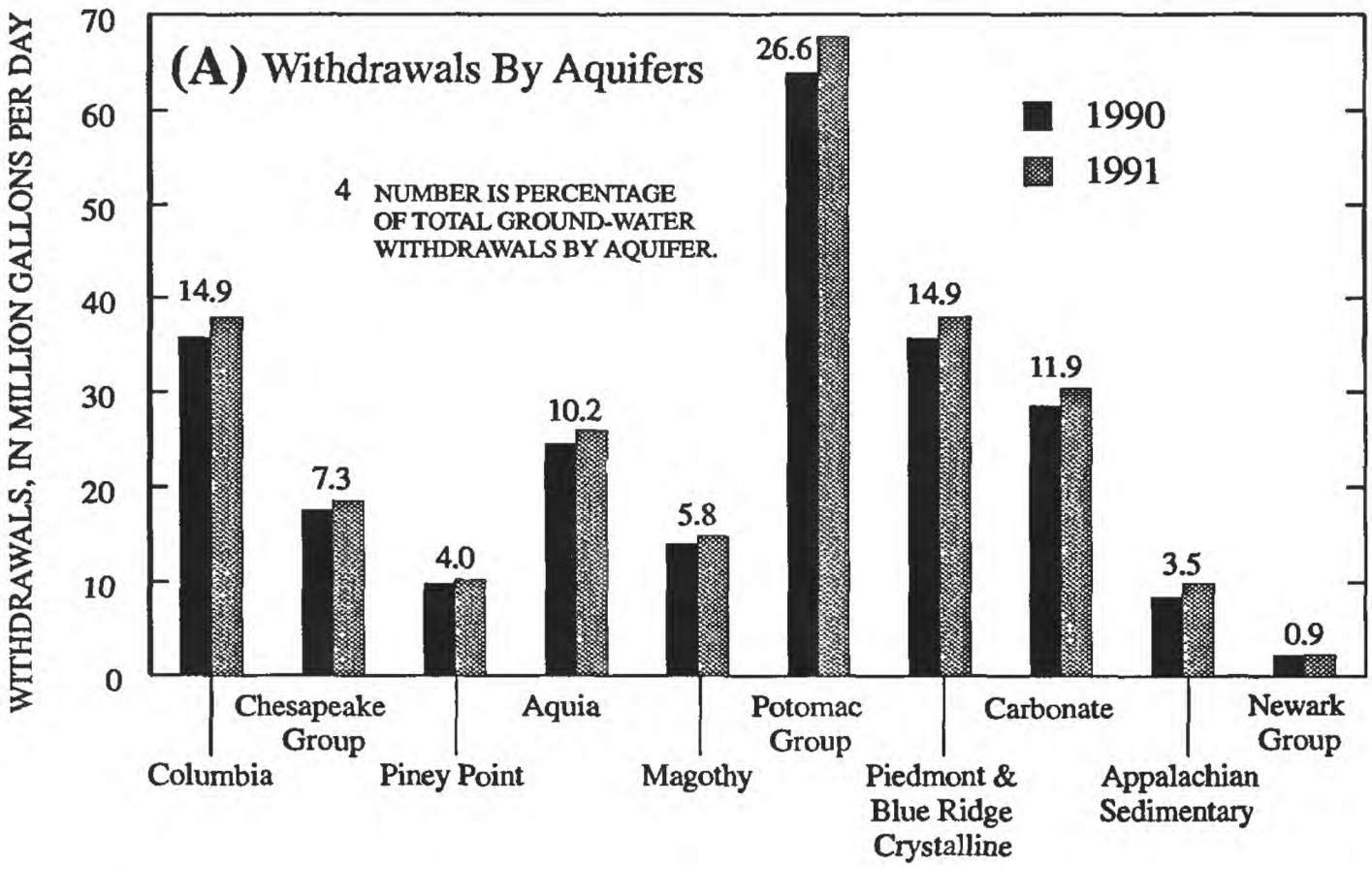
Commercial users, including educational institutions and military installations, receive water from public-supply systems and from privately owned wells. Total commercial use during 1990 was 113 Mgal/d (table 6a), of which about 87.1 Mgal/d (77 percent) was provided by public suppliers and about 25.8 Mgal/d (23 percent) was self-supplied. During 1991, total commercial use was 112 Mgal/d (table 6b), of which about 86.8 Mgal/d (78 percent) was provided by public suppliers and about 25.1 Mgal/d (22 percent) was self-supplied.

Industrial

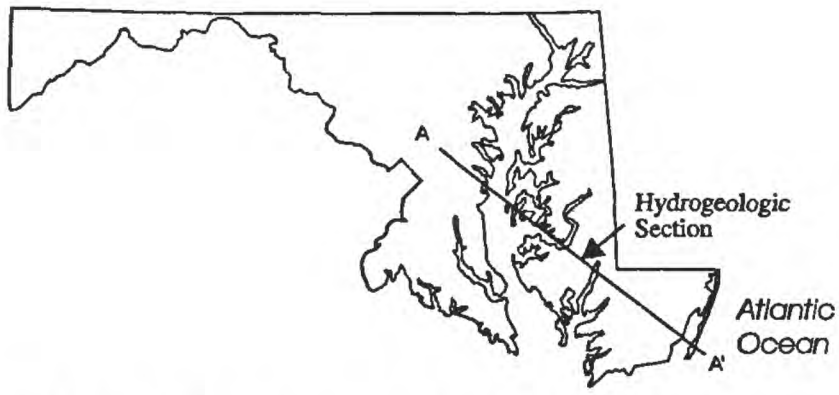
Maryland is located within a regional manufacturing belt that extends along the eastern seaboard of the United States. Heavy and light industries are important to the State's economy. Heavy industries include steel, chemical and allied products, shipbuilding, petroleum refining, and truck-assembly. Prominent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

During 1990, about 123 Mgal/d of fresh-water was used by industries in Maryland (table 7a). Of that amount, 70.1 Mgal/d or 57 percent was self-supplied and 52.4 Mgal/d (43 percent) was provided by public suppliers. Industries used less water during 1991, about 116 Mgal/d (table 7b), of which 67.2 Mgal/d (58 percent) was self-supplied and 49.2 Mgal/d (42 percent) was provided by public suppliers. Industries also used 379 Mgal/d during 1990 and 312 Mgal/d during 1991 of ***brackish*** or saline surface water. About 62.5 Mgal/d of ***reclaimed wastewater*** was used each year in steel production primarily for two types of purposes. The first is noncontact cooling--that is, the water is used for heat exchange such as in the cooling of machinery or furnace structures. The second is contact cooling and cleaning of steel in the production process. Some reclaimed wastewater is also treated then recycled.

Industries in Allegany County had the largest fresh surface-water withdrawals during both years (45.06 Mgal/d in 1990 and 44.99 Mgal/d in 1991). Baltimore County had the largest saline-surface water withdrawals--372.6 Mgal/d (1990) and 304.8 Mgal/d (1991), as well as the largest reclaimed wastewater use (62.5 Mgal/d) for the period. The largest ground-water withdrawals for industrial use for both years were in Baltimore City with 4.52 Mgal/d in 1990 and 4.68 Mgal/d in 1991.

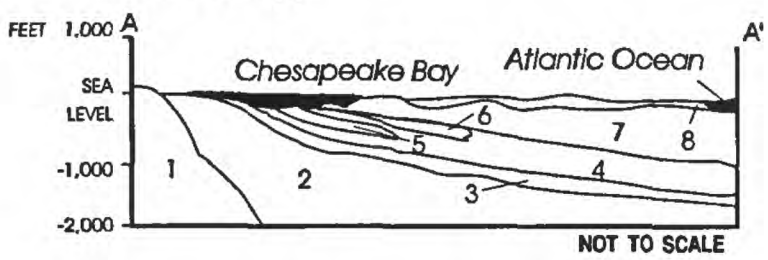


(B) Hydrogeologic Section



Principal aquifers shown in hydrogeologic section

Piedmont and Blue Ridge crystalline (1)
Potomac Group (2)
Magothy (3)
Not a principal aquifer (4)
Aquia (5)
Piney Point (6)
Cheasapeake Group (7)
Columbia (8)



(C) Aquifers

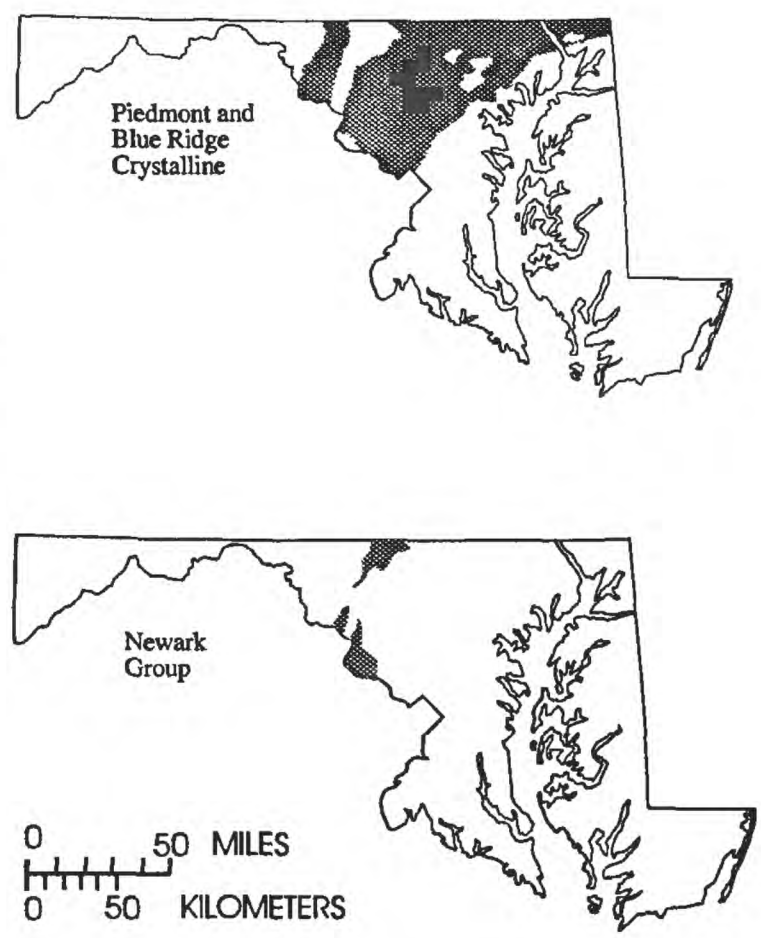


Figure 6. Ground-water withdrawals in Maryland, by principal aquifers, 1990-91. (A) Withdrawals by aquifer. (B) Trace of generalized hydrologic section (A-A'). (C) Geographic distribution of use for principal aquifers.

AQUIFERS

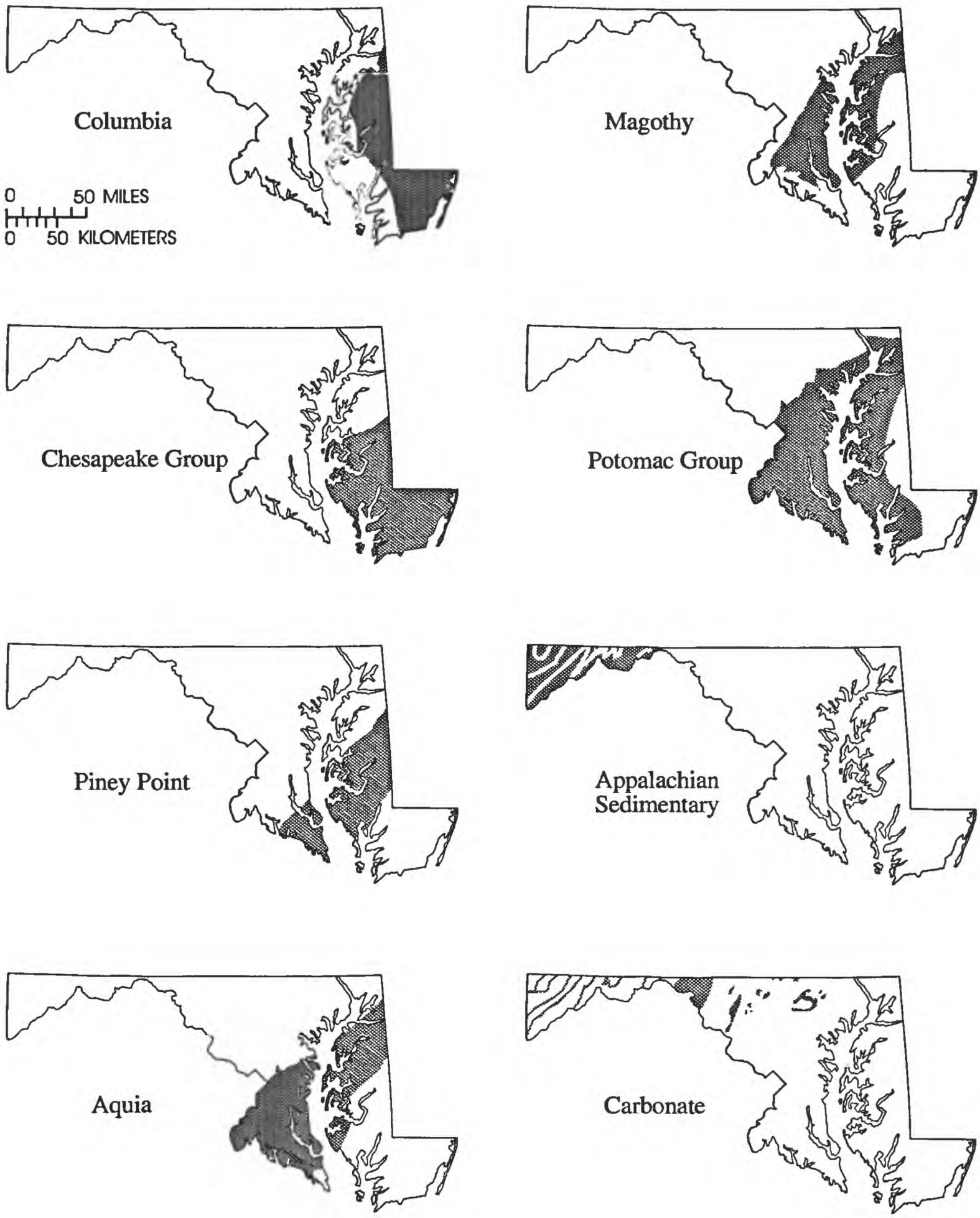
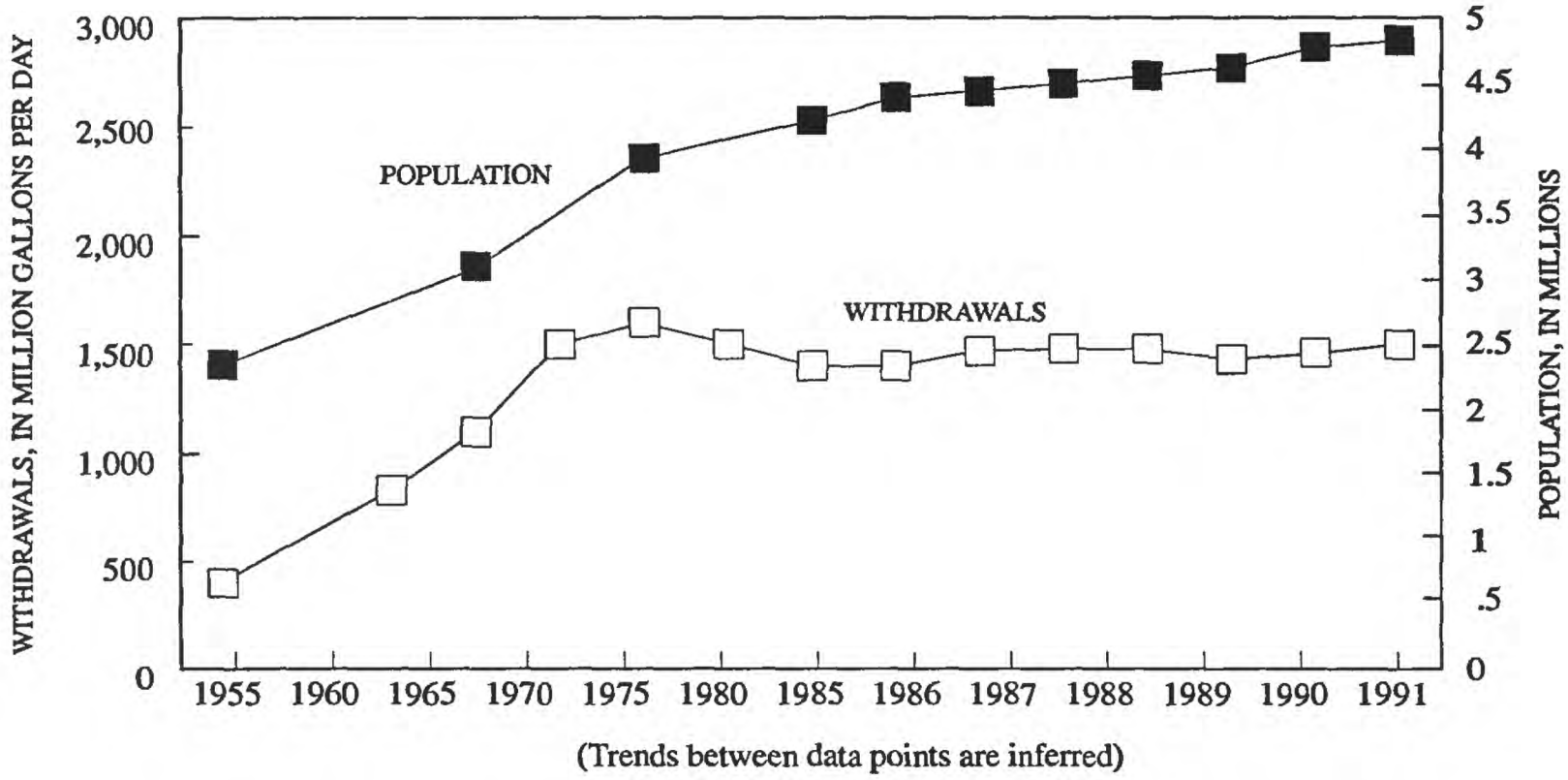


Figure 6. Ground-water withdrawals in Maryland, by principal aquifers, 1990-91.--Continued

Table 2.--*Population and water use in Maryland, 1990-91*

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

	1990	1991
Total population:	4,780,000	4,830,000
Population served by public-supply systems	3,940,000	3,970,000
Percentage of population served	82	82
Population served by self-supplied systems	843,000	860,000
Percentage of population self-supplied	18	18
Surface-water supply:		
Percentage of total population served by surface water	69	69
Number served by public-supply systems	3,290,000	3,310,000
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	645,000	657,000
Percentage of total population	13	14
Number served by self-supplied systems	843,000	860,000
Percentage of total population	18	18



Sources: MacKichan, 1951; MacKichan and Kammerer, 1957; MacKichan and Kammerer, 1961; Murray, 1968; Murray and Reeves, 1972; Murray and Reeves, 1977; Solley and others, 1983; Solley and others, 1988; Solley and others, 1993; Maryland Water Resources Administration water-use data base; and data compiled from the Maryland Department of State Planning.

Figure 7. Population and freshwater withdrawals in Maryland, 1950-91.

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 1990, 28 Mgal/d of freshwater was withdrawn for mining purposes (table 8a). Of that amount, 7.50 Mgal/d was from surface-water sources and 20.5 Mgal/d was from ground-water sources. An additional 21.3 Mgal/d of brackish or saline surface water was withdrawn, of which about 20.6 Mgal/d was for dredging operations. Total freshwater withdrawals for mining during 1991 were 25.3 Mgal/d (table 8b). Of that amount, 7.76 Mgal/d was from surface-water sources and 17.5 Mgal/d was from ground-water sources. Brackish or saline surface-water withdrawals decreased 82 percent in 1991 to 3.77 Mgal/d due mainly to reduced dredging operations.

Thermoelectric Power

Fourteen thermoelectric power plants operate in Maryland; 13 are fossil-fueled and 1 is nuclear-fueled. The demand for electricity and consequently, the amount of water used by power plants, is influenced by various economic, demographic and technological factors such as appliance holdings, weather, household size, income, and the price of electricity. In general, electricity demand is expected to increase in Maryland (Maryland Power Plant Research Program, 1993).

Freshwater use by power plants during 1990 was 421 Mgal/d, of which about 419 Mgal/d was from surface-water sources and 1.85 Mgal/d was from ground-water sources (table 9a). In addition, 4,550 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 1991, thermoelectric power plants used about 416 Mgal/d of freshwater, of which about 414 Mgal/d was from surface-water sources and 1.65 Mgal/d was from ground-water sources (table 9b). Larger quantities of saline surface water (5,760 Mgal/d) were used for cooling condensers during 1991 than in 1990.

Hydroelectric Power

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 use 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 the 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 1990, about 25,900 Mgal/d of freshwater passed through these plants for the production of electricity (table 10a); during 1991, the amount decreased to 21,900 Mgal/d (table 10b). Although the amount of water diverted through some plants is considerable, ***consumptive use*** 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 and this quantity is unknown.

Livestock

During 1990 and 1991, an estimated 10.4 Mgal/d of freshwater was used for livestock 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 30 percent of total agricultural revenue in the State, because this area is one of the Nation's leading producers of broiler chickens (Maryland Department of Agriculture, 1990b).

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 29.1 Mgal/d during 1990 (table 12a). Of this amount, 22.8 Mgal/d was used for irrigating crops including corn, soybeans, tobacco, grains, tomatoes, and melons. In addition, 2.20 Mgal/d of brackish surface water was used for farm irrigation. Brackish water is too saline to be potable, but is less saline than seawater--that is, total dissolved solids (TDS) concentrations range from about 1,000 to 20,000 mg/L; the TDS concentrations in seawater are about 35,000 mg/L (Drever, 1982, p. 12).

About 70,000 acres of cropland in Maryland were irrigated in the State during 1990, of which about 63,500 acres or 90 percent were in the eight counties east of Chesapeake Bay (fig. 1). During 1990, about 9.95 Mgal/d of fresh surface water was used to irrigate about 24,700 acres and 19.2 Mgal/d of ground water was used to irrigate about 38,900 acres.

During 1991, total freshwater used for irrigation increased to 50.4 Mgal/d (table 12b), of which 41.1 Mgal/d was used for irrigating farm crops. More land (about 71,700 acres) was irrigated during 1991 than during 1990. About 17.5 Mgal/d of fresh surface water was used to irrigate about 25,100 acres and 32.8 Mgal/d of fresh ground water was used to irrigate about 39,600 acres. In addition, about 4.78 Mgal/d of brackish surface water was used for irrigating crops.

The county with the largest total irrigated acreage in the State was Caroline County--19,700 acres during 1990 and 20,100 acres during 1991 (about 28 percent of total irrigated land). The largest freshwater withdrawals for irrigation were in Dorchester County, with 7.86 Mgal/d during 1990 and 12.05 Mgal/d during 1991.

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, 1990a). 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 1990, about 9.37 Mgal/d of freshwater was withdrawn for aquaculture in the State, of which 4.84 Mgal/d was from surface-water sources and 4.53 Mgal/d was from ground-water sources (table 13a). In addition, 9.58 Mgal/d of saline surface water was used for this purpose. Freshwater withdrawals for aquaculture increased during 1991 to 11.6 Mgal/d, of which 6.56 Mgal/d was from surface-water sources and 5.00 Mgal/d was from ground-water sources (table 13b). Use of saline surface water also increased during 1991 to 12.5 Mgal/d.

SUMMARY

During 1990, about 1,460 Mgal/d of freshwater was withdrawn from surface-water and ground-water sources in Maryland, compared to about 1,500 Mgal/d withdrawn during 1991. About 1,210 Mgal/d (83 percent) during 1990 and 1,250 Mgal/d (84 percent) during 1991 were used in the State. About 248 Mgal/d (17 percent) during 1990 and 249 Mgal/d (16 percent) during 1991 were transferred to surrounding States and the District of Columbia for water supply. About 7.5 Mgal/d of freshwater during 1990 and 6.6 Mgal/d during 1991 were imported from bordering States for use in Maryland.

Most freshwater withdrawals (about 1,220 Mgal/d during 1990 and 1,250 Mgal/d during 1991 or 83 percent of total freshwater withdrawals) were from surface-water sources. The largest surface-water withdrawals, more than 100 Mgal/d, were in Montgomery and Baltimore Counties. The reservoirs and rivers in these counties provide water sources for public suppliers that serve the Baltimore City and District of Columbia metropolitan areas. Most fresh surface water (about 870 Mgal/d during 1990 and 875 Mgal/d during 1991 or more than 70 percent of total surface-water withdrawals) was withdrawn and used in the Potomac drainage basin, whereas most ground water (about 170 Mgal/d during 1990 and 184 Mgal/d during 1991) was withdrawn and used in the Upper Chesapeake drainage basin. The Potomac Group aquifers were the largest source of ground water (26.6 percent of total ground-water withdrawals) each year.

The population of Maryland served by public water-supply systems increased slightly from 3.94 million during 1990 to 3.97 million during

1991 (82 percent of the total population). 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 1990-91, 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 1990-91: Public supply, domestic, commercial, industrial, mining, thermoelectric power, hydroelectric power, livestock, irrigation, and aquaculture. Freshwater withdrawals for public supply, self-supplied domestic use, aquaculture, and irrigation increased during 1990-91, whereas withdrawals for commercial, industrial, thermo-electric power, and mining uses decreased.

Public-supply systems withdrew the largest quantity of water in the State (798 Mgal/d during 1990 and 826 Mgal/d during 1991) during 1990-91. This water was delivered for a variety of uses including domestic, commercial, and industrial uses. The largest user of surface water for public supply was Baltimore City. During 1990, about 135 Mgal/d was withdrawn for use by the City compared to about 127 Mgal/d during 1991.

Domestic water use increased from about 484 Mgal/d during 1990 to 490 Mgal/d during 1991. About 414 Mgal/d during 1990 and 420 Mgal/d during 1991 were received from public suppliers and about 69.9 Mgal/d during 1990 and 71.4 Mgal/d during 1991 were self-supplied. All self-supplied domestic water withdrawals were from ground-water sources.

Total commercial use during 1990 was 113 Mgal/d, of which about 87.1 Mgal/d was provided by public suppliers and about 25.8 Mgal/d was self-supplied. During 1991, total commercial use decreased to 112 Mgal/d, of which about 86.8 Mgal/d was provided by public suppliers and about 25.1 Mgal/d was self-supplied.

Fresh surface-water and ground-water use by industries decreased from 123 Mgal/d during 1990 to 116 Mgal/d during 1991. About 70.1 Mgal/d during 1990 and 67.2 Mgal/d during 1991 were self-supplied. The remaining water used was delivered by public suppliers. Industries also used saline surface water--379 Mgal/d during 1990 and 312 Mgal/d during 1991. About 62.5 Mgal/d of reclaimed wastewater was used for industrial purposes each year.

Fresh surface-water and ground-water use for mining decreased from 28 Mgal/d during 1990 to 25.3 Mgal/d during 1991. About 21.3 Mgal/d during 1990 and 3.77 Mgal/d during 1991 of brackish or saline surface water were withdrawn, primarily for dredging operations.

Fresh surface-water and ground-water withdrawals for thermoelectric power decreased from 421 Mgal/d during 1990 to 416 Mgal/d during 1991. Larger quantities of saline surface water were used for cooling purposes during 1991 (5,760 Mgal/d) than during 1990 (4,550 Mgal/d).

Fresh surface-water use for hydroelectric power decreased from 25,900 Mgal/d during 1990 to 21,900 Mgal/d during 1991. Although the amount of water diverted through some plants was considerable, the amount consumed was negligible.

Fresh surface-water and ground-water use for livestock 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 increased from 29.1 Mgal/d during 1990 to 50.4 Mgal/d during 1991. Most of the water (22.8 Mgal/d during 1990 and 41.1 Mgal/d during 1991) was used for irrigating farm crops.

Fresh surface-water and ground-water withdrawals for aquaculture increased from 9.37 Mgal/d during 1990 to 11.6 Mgal/d during 1991. Saline surface-water withdrawals for aquaculture also increased from 9.58 Mgal/d during 1990 to 12.5 Mgal/d during 1991.

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APPENDIX

WATER WITHDRAWAL AND USE DATA FOR MARYLAND, 1990-91

Table 3a.--*Total water withdrawals (excluding hydroelectric power) in Maryland, by county, 1990*

[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, 1990]

County or city	Population, in thousands	Water withdrawals, in million gallons per day									
		Source									
		Surface water			Ground water			Reclaimed wastewater	Total excluding reclaimed wastewater		
		Fresh	Saline	Total	Fresh	Saline	Total		Fresh	Saline	Total
Allegany	74.95	45.77	0.00	45.77	1.73	0.00	1.73	0.00	47.50	0.00	47.50
Anne Arundel	427.24	5.06	772.97	778.03	44.87	.00	44.87	.00	49.93	772.97	822.90
Baltimore	692.13	267.13	1,055.23	1,322.36	13.82	.00	13.82	62.50	280.95	1,055.23	1,336.18
Calvert	51.37	.19	1,127.77	1,127.96	4.96	.00	4.96	.00	5.15	1,127.77	1,132.92
Caroline	27.03	2.35	.00	2.35	6.73	.00	6.73	.00	9.08	.00	9.08
Carroll	123.37	4.50	.00	4.50	10.83	.00	10.83	.00	15.33	.00	15.33
Cecil	71.35	3.24	.00	3.24	6.49	.00	6.49	.00	9.73	.00	9.73
Charles	101.15	.27	1,196.27	1,196.54	12.87	.00	12.87	.00	13.14	1,196.27	1,209.41
Dorchester	30.24	2.22	1.46	3.68	12.22	.00	12.22	.00	14.44	1.46	15.90
Frederick	150.21	13.34	.00	13.34	18.02	.00	18.02	.00	31.36	.00	31.36
Garrett	28.14	5.83	.00	5.83	8.49	.00	8.49	.00	14.32	.00	14.32
Harford	182.13	8.75	.00	8.75	11.93	.00	11.93	.00	20.68	.00	20.68
Howard	187.33	.42	.00	.42	2.49	.00	2.49	.00	2.91	.00	2.91
Kent	17.84	.08	.00	.08	4.60	.00	4.60	.00	4.68	.00	4.68
Montgomery	757.03	764.99	.00	764.99	4.14	.00	4.14	.00	769.13	.00	769.13
Prince Georges	729.27	37.63	615.15	652.78	7.57	.00	7.57	.00	45.20	615.15	660.35
Queen Annes	33.95	1.51	.00	1.51	6.21	.00	6.21	.00	7.72	.00	7.72
St. Marys	75.97	.54	.01	.55	7.89	.00	7.89	.00	8.52	.01	8.53
Somerset	23.44	.16	.00	.16	4.44	.00	4.44	.00	4.60	.00	4.60
Talbot	30.55	.36	.01	.37	5.24	.00	5.24	.00	5.60	.01	5.61
Washington	121.39	56.12	.00	56.12	9.86	.00	9.86	.00	65.98	.00	65.98
Wicomico	74.34	.59	.00	.59	16.32	.00	16.32	.00	16.91	.00	16.91
Worcester	35.03	.61	.64	1.25	12.51	.00	12.51	.00	13.12	.64	13.76
Baltimore City	736.01	.01	182.65	182.66	5.92	.00	5.92	.00	5.93	182.65	188.58
State Total	4,780	1,220	4,950	6,170	240	0.00	240	62.5	1,460	4,950	6,410

Table 3b.--*Total water withdrawals (excluding hydroelectric power) in Maryland, by county, 1991*

[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, 1990]

County or city	Population, in thousands	Water withdrawals, in million gallons per day									
		Source									
		Surface water			Ground water			Reclaimed wastewater	Total excluding reclaimed wastewater		
		Fresh	Saline	Total	Fresh	Saline	Total		Fresh	Saline	Total
Allegany	74.98	45.75	0.00	45.75	1.73	0.00	1.73	0.00	47.48	0.00	47.48
Anne Arundel	431.67	4.67	991.94	996.61	47.36	.00	47.36	.00	52.03	991.94	1,043.97
Baltimore	694.15	276.46	603.50	879.96	11.55	.00	11.55	62.50	288.01	603.50	891.51
Calvert	53.35	.19	2,607.12	2,607.31	5.27	.00	5.27	.00	5.46	2,607.12	2,612.58
Caroline	27.27	5.06	.00	5.06	10.40	.00	10.40	.00	15.46	.00	15.46
Carroll	127.43	4.15	.00	4.15	11.30	.00	11.30	.04	15.45	.00	15.45
Cecil	72.64	3.20	.00	3.20	6.59	.00	6.59	.00	9.79	.00	9.79
Charles	104.47	.27	1,166.63	1,166.90	12.30	.00	12.30	.00	12.57	1,166.63	1,179.20
Dorchester	30.26	2.93	1.11	4.04	15.42	.00	15.42	.00	18.35	1.11	19.46
Frederick	154.42	13.92	.00	13.92	17.05	.00	17.05	.00	30.97	.00	30.97
Garrett	28.32	6.41	.00	6.41	8.33	.00	8.33	.00	14.74	.00	14.74
Harford	185.31	8.97	.00	8.97	12.17	.00	12.17	.00	21.14	.00	21.14
Howard	192.84	.51	.00	.51	2.58	.00	2.58	.00	3.09	.00	3.09
Kent	17.86	.32	.00	.32	5.87	.00	5.87	.00	6.19	.00	6.19
Montgomery	769.51	735.98	.00	735.98	4.65	.00	4.65	.00	740.63	.00	740.63
Prince Georges	735.08	43.46	582.04	625.50	7.14	.00	7.14	.00	50.60	582.04	632.64
Queen Annes	35.01	3.58	.00	3.58	9.00	.00	9.00	.00	12.58	.00	12.58
St. Marys	77.19	.57	.00	.57	8.41	.00	8.41	.00	8.98	.00	8.98
Somerset	23.75	.23	.96	1.19	4.89	.00	4.89	.00	5.12	.96	6.08
Talbot	30.85	.79	.01	.80	5.66	.00	5.66	.00	6.45	.01	6.46
Washington	121.80	88.61	.00	88.61	10.56	.00	10.56	.00	99.17	.00	99.17
Wicomico	75.10	.90	.00	.90	17.22	.00	17.22	.00	18.12	.00	18.12
Worcester	35.69	1.12	.67	1.79	13.08	.00	13.08	.00	14.20	.67	14.87
Baltimore City	732.32	.01	118.73	118.74	6.17	.00	6.17	.00	6.18	118.73	124.91
State Total	4,830	1,250	6,070	7,320	255	0.00	255	62.50	1,500	6,070	7,580

Table 4a.--*Public-supply water withdrawals and deliveries in Maryland, by county, 1990*

[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, 1990]

County or city	Population served, in thousands			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	58.51	2.20	60.71	0.52	0.35	0.87	7.05	0.97	1.6	8.79
Anne Arundel	80.79	235.37	316.16	2.75	26.03	28.78	30.33	5.69	1.88	9.12
Baltimore	635.76	1.00	636.76	266.45	.03	266.48	71.83	15.39	15.39	163.87 (-)
Calvert	.00	14.38	14.38	.00	1.32	1.32	1.19	.13	.00	.00
Caroline	.00	9.73	9.73	.00	1.18	1.18	1.07	.06	.05	.00
Carroll	24.51	10.03	34.54	3.59	1.31	4.90	5.48	.30	.30	1.18
Cecil	15.58	10.82	26.40	2.21	1.24	3.45	2.86	.21	.38	.00
Charles	.00	63.72	63.72	.00	6.28	6.28	5.66	.62	.00	.00
Dorchester	.00	15.42	15.42	.00	3.04	3.04	1.83	.45	.76	.00
Frederick	56.08	26.54	82.62	8.14	2.49	10.63	8.70	1.09	1.08	.24
Garrett	4.84	1.91	6.75	2.21	.64	2.85	.84	.11	.09	1.81 (-)
Harford	31.68	84.88	116.56	4.77	5.47	10.24	8.71	1.02	.51	.00
Howard	161.10	.00	161.10	.00	.00	.00	14.86	1.70	.51	17.07
Kent	.00	7.67	7.67	.00	1.11	1.11	1.01	.05	.05	.00
Montgomery	722.89	3.86	726.75	386.60	.36	386.96	74.13	21.45	1.94	289.44 (-)
Prince Georges	686.77	27.91	714.68	34.32	2.74	37.06	64.70	7.61	3.81	39.06
Queen Annes	.00	5.09	5.09	.00	.60	.60	.48	.06	.06	.00
St. Marys	.00	28.11	28.11	.00	2.45	2.45	2.21	.24	.00	.00
Somerset	.00	9.84	9.84	.00	1.56	1.56	1.40	.08	.08	.00
Talbot	.00	14.05	14.05	.00	2.19	2.19	1.86	.22	.11	.00
Washington	79.32	8.08	87.40	10.68	1.18	11.86	8.51	1.13	1.70	.52
Wicomico	.00	35.68	35.68	.00	6.58	6.58	4.85	.69	1.39	.35
Worcester	.00	28.37	28.37	.00	7.68	7.68	6.53	.77	.38	.00
Baltimore City	736.01	.00	736.01	.00	.00	.00	87.89	27.04	20.29	135.22
State Total	3,290	645	3,940	722	75.8	798	414	87.1	52.4	667

Table 4b.--*Public-supply water withdrawals and deliveries in Maryland, by county, 1991*

[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, 1990]

County or city	Population served, in thousands			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	58.68	2.03	60.71	0.55	0.34	0.89	6.21	0.85	1.45	7.62
Anne Arundel	82.02	237.42	319.44	3.12	27.82	30.94	32.75	6.14	2.05	10.00
Baltimore	638.62	1.00	639.62	275.71	.03	275.74	65.50	14.04	14.03	182.17 (-)
Calvert	.00	14.94	14.94	.00	1.43	1.43	1.29	.14	.00	.00
Caroline	.00	9.82	9.82	.00	1.21	1.21	1.09	.07	.05	.00
Carroll	25.49	10.19	35.68	3.24	1.74	4.98	5.63	.31	.31	1.27
Cecil	15.98	10.90	26.88	2.02	1.31	3.33	2.77	.20	.36	.00
Charles	.00	65.82	65.82	.00	6.54	6.54	5.89	.65	.00	.00
Dorchester	.00	15.43	15.43	.00	2.83	2.83	1.92	.42	.49	.00
Frederick	57.14	27.82	84.96	10.49	2.12	12.61	1 .33	1.29	1.29	.30
Garrett	4.87	1.98	6.85	2.13	.67	2.80	.90	.12	.09	1.69 (-)
Harford	32.24	86.35	118.59	5.16	5.53	10.69	9.09	1.07	.53	.00
Howard	165.84	.00	165.84	.00	.00	.00	17.10	1.94	.39	19.43
Kent	.00	7.68	7.68	.00	1.19	1.19	1.07	.06	.06	.00
Montgomery	731.03	4.00	735.03	393.99	.40	394.39	78.85	22.64	2.05	290.85 (-)
Prince Georges	690.98	29.40	720.38	40.16	2.95	43.11	70.67	8.21	3.28	39.05
Queen Annes	.00	5.25	5.25	.00	.66	.66	.53	.07	.06	.00
St. Marys	.00	28.56	28.56	.00	2.80	2.80	2.53	.27	.00	.00
Somerset	.00	9.98	9.98	.00	1.60	1.60	1.44	.08	.08	.00
Talbot	.00	14.91	14.91	.00	2.28	2.28	1.94	.23	.11	.00
Washington	79.54	8.10	87.64	10.77	1.27	12.04	8.60	1.15	1.72	.57
Wicomico	.00	36.05	36.05	.00	6.40	6.40	4.76	.64	1.35	.35
Worcester	.00	28.91	28.91	.00	7.75	7.75	6.59	.78	.38	.00
Baltimore City	732.32	.00	732.32	.00	.00	.00	82.67	25.44	19.08	127.19
State Total	3,310	657	3,970	747	78.9	826	420	86.8	49.2	680

Table 5a.--*Domestic water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1990*

[State totals rounded to three significant figures. (Sources: Withdrawals, estimated using population projection data compiled from Maryland Department of State Planning, 1990, using per capita use of 80 gallons per day; Population projections, data compiled from Maryland Department of State Planning, 1990]

County or city	Self-supplied		Public-supplied		Total
	Population, 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	14.24	1.15	60.71	7.05	8.20
Anne Arundel	111.08	9.61	316.16	30.33	39.94
Baltimore	55.37	4.46	636.76	71.83	76.29
Calvert	36.99	3.05	14.38	1.19	4.24
Caroline	17.30	1.44	9.73	1.07	2.51
Carroll	88.83	7.16	34.54	5.48	12.64
Cecil	44.95	3.61	26.40	2.86	6.47
Charles	37.43	3.01	63.72	5.66	8.67
Dorchester	14.82	1.20	15.42	1.83	3.03
Frederick	67.59	5.47	82.62	8.70	14.17
Garrett	21.39	1.71	6.75	.84	2.55
Harford	65.57	5.32	116.56	8.71	14.03
Howard	26.23	2.14	161.10	14.86	17.00
Kent	10.17	.84	7.67	1.01	1.85
Montgomery	30.28	2.72	726.75	74.13	76.85
Prince Georges	14.59	1.19	714.68	64.70	65.89
Queen Annes	28.86	2.43	5.09	.48	2.91
St. Marys	47.86	3.91	28.11	2.21	6.12
Somerset	13.60	1.09	9.84	1.40	2.49
Talbot	16.50	1.43	14.05	1.86	3.29
Washington	33.99	2.74	87.40	8.51	11.25
Wicomico	38.66	3.50	35.68	4.85	8.35
Worcester	6.66	.70	28.37	6.53	7.23
Baltimore City	.00	.00	736.01	87.89	87.89
State Total	843	69.9	3,940	414	484

Table 5b.--*Domestic water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1991*

[State totals rounded to three significant figures. (Sources: Withdrawals, estimated using population projection data compiled from Maryland Department of State Planning, 1990, using per capita use of 80 gallons per day; Population projections, data compiled from Maryland Department of State Planning, 1990]

County or city	Self-supplied		Public-supplied		Total
	Population, 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	14.27	1.15	60.71	6.21	7.36
Anne Arundel	112.23	9.72	319.44	32.75	42.47
Baltimore	54.53	4.39	639.62	65.50	69.89
Calvert	38.41	3.17	14.94	1.29	4.46
Caroline	17.45	1.45	9.82	1.09	2.54
Carroll	91.75	7.39	35.68	5.63	13.02
Cecil	45.76	3.67	26.88	2.77	6.44
Charles	38.65	3.11	65.82	5.89	9.00
Dorchester	14.83	1.22	15.43	1.92	3.14
Frederick	69.46	5.62	84.96	10.33	15.95
Garrett	21.47	1.72	6.85	.90	2.62
Harford	66.72	5.42	118.59	9.09	14.51
Howard	27.00	2.20	165.84	17.10	19.30
Kent	10.18	.85	7.68	1.07	1.92
Montgomery	34.48	3.07	735.03	78.85	81.92
Prince Georges	14.70	1.20	720.38	70.67	71.87
Queen Annes	29.76	2.50	5.25	.53	3.03
St Marys	48.63	3.97	28.56	2.53	6.50
Somerset	13.77	1.11	9.98	1.44	2.55
Talbot	15.94	1.45	14.91	1.94	3.39
Washington	34.16	2.75	87.64	8.60	11.35
Wicomico	39.05	3.57	36.05	4.76	8.33
Worcester	6.78	.71	28.91	6.59	7.30
Baltimore City	.00	.00	732.32	82.67	82.67
State Total	860	71.4	3,970	420	490

Table 6a.--*Commercial freshwater withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1990*

[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				
	Source				
	Surface water	Ground water	Total	Water deliveries, in millions gallons per day	Withdrawals and deliveries, in millions gallons per day
Allegany	0.03	0.16	0.19	0.97	1.16
Anne Arundel	.38	6.52	6.90	5.69	12.59
Baltimore	.06	.54	.60	15.39	15.99
Calvert	.01	.37	.38	.13	.51
Caroline	.00	.20	.20	.06	.26
Carroll	.46	.46	.92	.30	1.22
Cecil	.40	.54	.94	.21	1.15
Charles	.00	2.78	2.78	.62	3.40
Dorchester	.00	.20	.20	.45	.65
Frederick	.97	.76	1.73	1.09	2.82
Garrett	.28	.61	.89	.11	1.00
Harford	3.52	.37	3.89	1.02	4.91
Howard	.04	.20	.24	1.70	1.94
Kent	.00	.13	.13	.05	.18
Montgomery	.02	.41	.43	21.45	21.88
Prince Georges	.15	1.12	1.27	7.61	8.88
Queen Annes	.01	.58	.59	.06	.65
St. Marys	.00	1.46	1.46	.24	1.70
Somerset	.00	.36	.36	.08	.44
Talbot	.00	.42	.42	.22	.64
Washington	.08	.21	.29	1.13	1.42
Wicomico	.00	.56	.56	.69	1.25
Worcester	.00	.45	.45	.77	1.22
Baltimore City	.00	.00	.00	27.04	27.04
State Total	6.41	19.4	25.8	87.1	113

Table 6b.--*Commercial freshwater withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1991*

[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				
	Source				
	Surface water	Ground water	Total	Water deliveries, in millions gallons per day	Withdrawals and deliveries, in millions gallons per day
Allegany	0.03	0.16	0.19	0.85	1.04
Anne Arundel	.07	7.38	7.45	6.14	13.59
Baltimore	.07	.56	.63	14.04	14.67
Calvert	.01	.39	.40	.14	.54
Caroline	.00	.20	.20	.07	.27
Carroll	.43	.48	.91	.31	1.22
Cecil	.43	.56	.99	.20	1.19
Charles	.00	1.92	1.92	.65	2.57
Dorchester	.00	.24	.24	.42	.66
Frederick	.04	.72	.76	1.29	2.05
Garrett	.26	.63	.89	.12	1.01
Harford	3.36	.40	3.76	1.07	4.83
Howard	.05	.24	.29	1.94	2.23
Kent	.00	.13	.13	.06	.19
Montgomery	.01	.43	.44	22.64	23.08
Prince Georges	.15	1.27	1.42	8.21	9.63
Queen Annes	.01	.67	.68	.07	.75
St. Marys	.01	1.49	1.50	.27	1.77
Somerset	.00	.46	.46	.08	.54
Talbot	.00	.42	.42	.23	.65
Washington	.10	.24	.34	1.15	1.49
Wicomico	.00	.59	.59	.64	1.23
Worcester	.00	.47	.47	.78	1.25
Baltimore City	.00	.00	.00	25.44	25.44
State Total	5.03	20.0	25.1	86.8	112

Table 7a.--*Industrial water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1990*

[State totals rounded to three significant figures. Source: 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	45.06	0.00	0.04	0.00	0.00	45.10	0.00	45.10	1.64	46.74
Anne Arundel	.03	.01	2.46	.00	.00	2.49	.01	2.50	1.88	4.37
Baltimore	.00	372.61	3.51	.00	62.50	3.51	372.61	376.12	15.39	18.90
Calvert	.00	.00	.02	.00	.00	.02	.00	.02	.00	.02
Caroline	.00	.00	.52	.00	.00	.52	.00	.52	.05	.57
Carroll	.00	.00	.08	.00	.04	.08	.00	.08	.30	.38
Cecil	.02	.00	.05	.00	.00	.07	.00	.07	.38	.45
Charles	.00	.00	.01	.00	.00	.01	.00	.01	.00	.01
Dorchester	.06	.00	.95	.00	.00	1.01	.00	1.01	.76	1.77
Frederick	.94	.00	2.64	.00	.00	3.58	.00	3.58	1.08	4.66
Garrett	.00	.00	.03	.00	.00	.03	.00	.03	.09	.12
Harford	.02	.00	.32	.00	.00	.34	.00	.34	.51	.85
Howard	.21	.00	.05	.00	.00	.26	.00	.26	.51	.77
Kent	.00	.00	.51	.00	.00	.51	.00	.51	.05	.56
Montgomery	.00	.00	.06	.00	.00	.06	.00	.06	1.94	2.00
Prince Georges	.00	.00	.02	.00	.00	.02	.00	.02	3.81	3.83
Queen Anne	.00	.00	.28	.00	.00	.28	.00	.28	.06	.34
St. Marys	.01	.01	.03	.00	.00	.04	.01	.05	.00	.04
Somerset	.00	.00	.06	.00	.00	.06	.00	.06	.08	.14
Talbot	.00	.00	.59	.00	.00	.59	.00	.59	.11	.70
Washington	2.67	.00	.21	.00	.00	2.88	.00	2.88	1.70	4.58
Wicomico	.00	.00	2.29	.00	.00	2.29	.00	2.29	1.39	3.68
Worcester	.00	.00	1.83	.00	.00	1.83	.00	1.83	.38	2.21
Baltimore City	.00	6.86	4.53	.00	.00	4.53	6.86	11.39	20.29	24.82
State Total	49.0	379	21.1	0.00	62.5	70.1	379	450	52.4	123

Table 7b.--*Industrial water withdrawals (self-supplied) and deliveries from public suppliers in Maryland, by county, 1991*

[State totals rounded to three significant figures. Source: 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	44.99	0.00	0.04	0.00	0.00	45.03	0.00	45.03	1.45	46.48
Anne Arundel	.02	.01	2.19	.00	.00	2.21	.01	2.22	2.05	4.26
Baltimore	.00	304.80	2.63	.00	62.50	2.63	304.80	307.43	14.03	16.66
Calvert	.00	.00	.02	.00	.00	.02	.00	.02	.00	.02
Caroline	.00	.00	.42	.00	.00	.42	.00	.42	.05	.47
Carroll	.00	.00	.07	.00	.04	.07	.00	.07	.31	.38
Cecil	.01	.00	.05	.00	.00	.06	.00	.06	.36	.42
Charles	.00	.00	.02	.00	.00	.02	.00	.02	.00	.02
Dorchester	.06	.00	.83	.00	.00	.89	.00	.89	.49	1.38
Frederick	.08	.00	2.54	.00	.00	2.62	.00	2.62	1.29	3.91
Garrett	.00	.00	.03	.00	.00	.03	.00	.03	.09	.12
Harford	.02	.00	.36	.00	.00	.38	.00	.38	.53	.91
Howard	.24	.00	.03	.00	.00	.27	.00	.27	.39	.66
Kent	.00	.00	.26	.00	.00	.26	.00	.26	.06	.32
Montgomery	.00	.00	.07	.00	.00	.07	.00	.07	2.05	2.12
Prince Georges	.00	.00	.02	.00	.00	.02	.00	.02	3.28	3.30
Queen Anne	.00	.00	.28	.00	.00	.28	.00	.28	.06	.34
St. Marys	.01	.00	.03	.00	.00	.04	.00	.04	.00	.04
Somerset	.00	.96	.06	.00	.00	.06	.96	1.02	.08	.14
Talbot	.00	.00	.55	.00	.00	.55	.00	.55	.11	.66
Washington	2.36	.00	.14	.00	.00	2.50	.00	2.50	1.72	4.22
Wicomico	.00	.00	2.24	.00	.00	2.24	.00	2.24	1.35	3.59
Worcester	.00	.00	1.86	.00	.00	1.86	.00	1.86	.38	2.24
Baltimore City	.00	6.46	4.68	.00	.00	4.68	6.46	11.14	19.08	23.76
State Total	47.8	312	19.4	0.00	62.5	67.2	312	379	49.2	116

Table 8a.--*Mining water withdrawals in Maryland, by county, 1990*

[State totals rounded to three significant figures. Source: 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	1.31	.00	1.31	.07	.00	.07	1.38	.00	1.38
Baltimore	.12	20.56	20.68	4.90	.00	4.90	5.02	20.56	25.58
Calvert	.00	.00	.00	.00	.00	.00	.00	.00	.00
Caroline	.01	.00	.01	.00	.00	.00	.01	.00	.01
Carroll	.00	.00	.00	1.30	.00	1.30	1.30	.00	1.30
Cecil	.42	.00	.42	.32	.00	.32	.74	.00	.74
Charles	.00	.13	.13	.01	.00	.01	.01	.13	.14
Dorchester	.85	.00	.85	.00	.00	.00	.85	.00	.85
Frederick	.00	.00	.00	5.21	.00	5.21	5.21	.00	5.21
Garrett	1.49	.00	1.49	5.26	.00	5.26	6.75	.00	6.75
Harford	.06	.00	.06	.19	.00	.19	.25	.00	.25
Howard	.00	.00	.00	.00	.00	.00	.00	.00	.00
Kent	.00	.00	.00	.00	.00	.00	.00	.00	.00
Montgomery	.02	.00	.02	.27	.00	.27	.29	.00	.29
Prince Georges	2.89	.00	2.89	.91	.00	.91	3.80	.00	3.80
Queen Annes	.00	.00	.00	.01	.00	.01	.01	.00	.01
St. Marys	.29	.00	.29	.02	.00	.02	.31	.00	.31
Somerset	.00	.00	.00	.01	.00	.01	.01	.00	.01
Talbot	.00	.01	.01	.00	.00	.00	.00	.01	.01
Washington	.01	.00	.01	.62	.00	.62	.63	.00	.63
Wicomico	.01	.00	.01	.00	.00	.00	.01	.00	.01
Worcester	.00	.64	.64	.01	.00	.01	.01	.64	.65
Baltimore City	.00	.01	.01	1.39	.00	1.39	1.39	.01	1.40
State Total	7.50	21.3	28.8	20.5	0.00	20.5	28.0	21.3	49.4

Table 8b.--*Mining water withdrawals in Maryland, by county, 1991*

[State totals rounded to three significant figures. Source: 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	.79	.00	.79	.04	.00	.04	.83	.00	.83
Baltimore	.13	3.00	3.13	3.42	.00	3.42	3.55	3.00	6.55
Calvert	.00	.00	.00	.00	.00	.00	.00	.00	.00
Caroline	.01	.00	.01	.01	.00	.01	.02	.00	.02
Carroll	.00	.00	.00	1.06	.00	1.06	1.06	.00	1.06
Cecil	.55	.00	.55	.23	.00	.23	.78	.00	.78
Charles	.00	.08	.08	.01	.00	.01	.01	.08	.09
Dorchester	.87	.00	.87	.01	.00	.01	.88	.00	.88
Frederick	.00	.00	.00	4.55	.00	4.55	4.55	.00	4.55
Garrett	2.20	.00	2.20	5.04	.00	5.04	7.24	.00	7.24
Harford	.03	.00	.03	.17	.00	.17	.20	.00	.20
Howard	.00	.00	.00	.00	.00	.00	.00	.00	.00
Keut	.00	.00	.00	.00	.00	.00	.00	.00	.00
Montgomery	.00	.00	.00	.10	.00	.10	.10	.00	.10
Prince Georges	2.81	.00	2.81	.45	.00	.45	3.26	.00	3.26
Queen Annes	.00	.00	.00	.01	.00	.01	.01	.00	.01
St. Marys	.31	.00	.31	.01	.00	.01	.32	.00	.32
Somerset	.00	.00	.00	.01	.00	.01	.01	.00	.01
Talbot	.00	.01	.01	.02	.00	.02	.02	.01	.03
Washingtou	.01	.00	.01	.86	.00	.86	.87	.00	.87
Wicomico	.03	.00	.03	.00	.00	.00	.03	.00	.03
Worcester	.00	.67	.67	.01	.00	.01	.01	.67	.68
Baltimore City	.00	.01	.01	1.49	.00	1.49	1.49	.01	1.50
State Total	7.76	3.77	11.5	17.5	0.00	17.5	25.3	3.77	29.0

Table 9a.--*Thermoelectric power water withdrawals in Maryland, by county, 1990*

[State totals rounded to three significant figures. Source: 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	772.96	772.96	.00	.00
Baltimore	.00	662.06	662.06	.00	.00
Calvert	.00	1,127.77	1,127.77	.09	.09
Caroline	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	.00	.00
Cecil	.00	.00	.00	.00	.00
Charles	.00	1,196.14	1,196.14	.68	.68
Dorchester	.00	1.46	1.46	.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	377.79	.00	377.79	.00	377.79
Prince Georges	.00	615.15	615.15	1.04	1.04
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	41.48	.00	41.48	.00	41.48
Wicomico	.00	.00	.00	.00	.00
Worcester	.00	.00	.00	.00	.00
Baltimore City	.00	175.78	175.78	.00	.00
State Total	419	4,550	4,970	1.85	421

Table 9b.--*Thermoelectric power water withdrawals in Maryland, by county, 1991*

[State totals rounded to three significant figures. Source: 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	991.93	991.93	.00	.00
Baltimore	.00	295.70	295.70	.00	.00
Calvert	.00	2,607.12	2,607.12	.15	.15
Caroline	.00	.00	.00	.00	.00
Carroll	.00	.00	.00	.00	.00
Cecil	.00	.00	.00	.00	.00
Charles	.00	1,166.55	1,166.55	.57	.57
Dorchester	.00	1.11	1.11	.01	.01
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	341.32	.00	341.32	.01	341.33
Prince Georges	.00	582.04	582.04	.91	.91
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	72.55	.00	72.55	.00	72.55
Wicomico	.00	.00	.00	.00	.00
Worcester	.00	.00	.00	.00	.00
Baltimore City	.00	112.26	112.26	.00	.00
State Total	414	5,760	6,170	1.65	416

Table 10a.--*Hydroelectric power water use in Maryland, by county, 1990*

[State totals rounded to three significant figures. Sources: Withdrawals estimated based on annual power generation data obtained from Energy Information Administration, 1990, 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	0.00	0.00
Baltimore	0.00	0.00
Calvert	0.00	0.00
Caroline	0.00	0.00
Carroll	0.00	0.00
Cecil	9.47	10.61
Charles	0.00	0.00
Dorchester	0.00	0.00
Frederick	0.00	0.00
Garrett	60.84	68.17
Harford	25,616.44	28,704.50
Howard	0.00	0.00
Kent	0.00	0.00
Montgomery	0.00	0.00
Prince Georges	0.00	0.00
Queen Annes	0.00	0.00
St. Marys	0.00	0.00
Somerset	0.00	0.00
Talbot	0.00	0.00
Washington	225.19	252.34
Wicomico	0.00	0.00
Worcester	0.00	0.00
Baltimore City	0.00	0.00
State Total	25,900	29,000

Table 10b.--*Hydroelectric power water use in Maryland, by county, 1991*

[State totals rounded to three significant figures. Sources: Withdrawals estimated based on annual power generation data obtained from Energy Information Administration, 1991, andWeisberg 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.--*Livestock water withdrawals in Maryland, by county, 1990-91*

[State totals rounded to three significant figures. Sources: Withdrawals estimated based on data from U.S. Department of Commerce, 1990 and U.S. Environmental Protection Agency, 1973]

County or city	Freshwater withdrawals, in million gallons per day		
	Source		Total
	Surface water	Ground water	
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, 1990*

[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					
			Surface water		Ground water	Total		
	Fresh	Saline	Fresh	Brackish	Fresh	Fresh	Brackish	Total
Allegany	0.09	0.00	0.08	0.00	0.00	0.08	0.00	0.08
Anne Arundel	.16	.00	.55	.00	.15	.70	.00	.70
Baltimore	.96	.02	.37	.006	.20	.57	.006	.57
Calvert	.61	.04	.16	.01	.03	.19	.01	.19
Caroline	16.43	3.27	2.30	.96	3.11	5.41	.96	5.41
Carroll	.52	.00	.14	.00	.06	.20	.00	.20
Cecil	.33	.00	.09	.00	.53	.62	.00	.62
Charles	.76	.02	.23	.01	.06	.29	.01	.29
Dorchester	17.60	.93	1.30	.42	6.56	7.86	.42	7.86
Frederick	.28	.00	.30	.00	.05	.35	.00	.35
Garrett	.27	.00	.11	.00	.00	.11	.00	.11
Harford	.76	.00	.21	.00	.05	.26	.00	.26
Howard	.16	.00	.07	.00	.02	.09	.00	.09
Kent	2.34	.26	.02	.08	1.80	1.82	.08	1.82
Montgomery	.39	.00	.45	.00	.18	.63	.00	.63
Prince Georges	.34	.00	.23	.00	.53	.76	.00	.76
Queen Annes	9.17	.95	1.44	.28	1.89	3.33	.28	3.33
St. Marys	.65	.20	.19	.06	.03	.22	.06	.22
Somerset	1.56	.06	.14	.03	.57	.71	.03	.71
Talbot	1.91	.00	.33	.00	.43	.76	.00	.76
Washington	.33	.00	.09	.00	.04	.13	.00	.13
Wicomico	5.53	.62	.56	.28	2.22	2.78	.28	2.78
Worcester	2.42	.12	.58	.06	.69	1.27	.06	1.27
Baltimore City	.00	.00	.01	.00	.00	.01	.00	.01
State Total	63.6	6.49	9.95	2.20	19.2	29.1	2.20	31.3

Table 12b.--*Irrigation water withdrawals in Maryland, by county, 1991*

[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					
			Surface water		Ground water	Total		
	Fresh	Saline	Fresh	Brackish	Fresh	Fresh	Brackish	Total
Allegany	0.09	0.00	0.10	0.00	0.01	0.11	0.00	0.11
Anne Arundel	.16	.00	.63	.00	.18	.81	.00	.81
Baltimore	.96	.02	.42	.01	.29	.71	.01	.72
Calvert	.61	.04	.16	.01	.03	.19	.01	.20
Caroline	16.76	3.34	5.01	2.24	6.81	11.82	2.24	14.06
Carroll	.52	.00	.17	.00	.10	.27	.00	.27
Cecil	.33	.00	.09	.00	.57	.66	.00	.66
Charles	.76	.02	.23	.01	.09	.32	.01	.33
Dorchester	17.96	.95	1.99	.64	10.06	12.05	.64	12.69
Frederick	.28	.00	.32	.00	.10	.42	.00	.42
Garrett	.27	.00	.12	.00	.00	.12	.00	.12
Harford	.76	.00	.23	.00	.08	.31	.00	.31
Howard	.16	.00	.12	.00	.03	.15	.00	.15
Kent	2.38	.26	.26	.17	3.23	3.49	.17	3.66
Montgomery	.39	.00	.55	.00	.43	.98	.00	.98
Prince Georges	.34	.00	.30	.00	.32	.62	.00	.62
Queen Annes	9.35	.97	3.51	.65	4.46	7.97	.65	8.62
St. Marys	.65	.20	.44	.13	.03	.47	.13	.60
Somerset	1.59	.42	.21	.42	.86	1.07	.42	1.49
Talbot	1.95	.00	.76	.00	.76	1.52	.00	1.52
Washington	.33	.00	.10	.00	.03	.13	.00	.13
Wicomico	5.63	.63	.85	.42	3.25	4.10	.42	4.52
Worcester	2.47	.13	.94	.08	1.13	2.07	.08	2.15
Baltimore City	.00	.00	.01	.00	.00	.01	.00	.01
Sate Total	64.7	6.98	17.5	4.78	32.8	50.4	4.78	55.2

Table 13a.--*Aquaculture water withdrawals in Maryland, by county, 1990*

[State totals rounded to three significant figures. Source: 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	1.59	1.59	.02	.02
Calvert	.00	.002	.002	.08	.08
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	7.60	7.60	.04	.04
Frederick	2.51	.00	2.51	.004	2.514
Garrett	1.52	.00	1.52	.00	1.52
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	.25	.25	.20	.20
St. Marys	.00	.13	.13	.002	.002
Somerset	.00	.003	.003	.00	.00
Talbot	.00	.00	.00	.00	.00
Washington	.80	.00	.80	4.15	4.95
Wicomico	.00	.001	.001	.02	.02
Worcester	.00	.00	.00	.002	.002
Baltimore City	.00	.00	.00	.00	.00
State Total	4.84	9.58	14.4	4.53	9.37

Table 13b.--*Aquaculture water withdrawals in Maryland, by county, 1991*

[State totals rounded to three significant figures. Source: 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	3.27	3.27	.07	.07
Calvert	.00	.002	.002	.08	.08
Caroline	.00	.00	.00	.02	.02
Carroll	.00	.00	.00	.003	.003
Cecil	.00	.00	.00	.00	.00
Charles	.00	.00	.00	.00	.00
Dorchester	.00	8.81	8.81	.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	.25	.25	.20	.20
St. Marys	.00	.17	.17	.001	.001
Somerset	.00	.003	.003	.00	.00
Talbot	.00	.00	.00	.00	.00
Washington	2.41	.00	2.41	4.56	6.97
Wicomico	.00	.001	.001	.02	.02
Worcester	.15	.00	.15	.004	.154
Baltimore City	.00	.00	.00	.00	.00
State Total	6.56	12.5	19.1	5.00	11.6

*U.S. GOVERNMENT PRINTING OFFICE: 1995-390-803/30030