NEW JERSEY GEOLOGICAL SURVEY
OPEN-FILE REPORT 00-1

NEW JERSEY WATER WITHDRAWALS

1990 - 1996

N.J. Department of Environmental Protection - Division of Science, Research and Technology

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Cover illustration: The Round Valley Reservoir in Hunterdon County holds surface water withdrawn from the Raritan River. This water is released back to the Raritan during low-flow periods if needed to meet potable-water demands downstream. No water is withdrawn from the Raritan River for the reservoir if no releases were required the previous year. The reservoir is also a popular recreation spot. Photo courtesy of the DEP's Division of Parks and Forestry.

New Jersey Geological Survey
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New Jersey Water Withdrawals 1990 - 1996

by

Jeffrey L. Hoffman and Steven E. Lieberman

New Jersey Department of Environmental Protection
Division of Science, Research and Technology
Geological Survey
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Conversion Factors

Multiply inch-pound units	by	to obtain metric (SI) units	Multiply inch-pound units	by	to obtain metric (SI) units
VOLUME			**FLOW RATE**		
cubic inches (in^3)	0.06102	cubic centimeters (cm^3)	million gallons/day (mgd)	0.04381	cubic meters/second (m^3/s)
cubic feet (ft^3)	0.02832	cubic meters (m^3)	million gallons/year (mgy)	3.785	cubic meters/year(m^3/y)
gallons (gal)	3.785	liters (L)	gallons/minute (gpm)	0.06309	liters/second (L/s)
gallons (gal)	$3.785X10^{-3}$	cubic meters (m^3)			

Note: In this report 1 billion = 1,000 million; 1 trillion = 1,000 billion

History Of The Decline And Fall Of The Roman Empire by Edward Gibbon:
"The solitudes of Asia and Africa were once covered with flourishing cities, whose populousness, and even whose existence, was derived from such artificial supplies of a perennial stream of fresh water."

Robert C. Shinn, Jr., Commissioner, NJDEP:
"If you can't measure it, you can't manage it."

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Note

In 2000 the boundaries of Watershed Management Areas 17 and 18 changed significantly. Withdrawal volumes assigned to these areas in the report should now be considered rough approximations. The boundaries of Watershed Management Areas 4, 6, and 20 changed only slightly and values reported for them are still accurate. No water region boundaries changed, but Water Region 1 is now called the Northeast Region and Water Region 4 the Northwest Region.

New Jersey Water Withdrawals 1990 - 1996

ABSTRACT

This report details fresh-water withdrawals in New Jersey between 1990 and 1996. It is intended for planners, regulators, and others interested in the State's water supply. The Bureau of Water Allocation (BWA) in the New Jersey Department of Environmental Protection (NJDEP) regulates fresh-water withdrawals for public community water supplies and for users who can produce 100,000 gallons per day or more. Based on reports from these users, and estimates of withdrawals by household wells, water withdrawals in New Jersey have averaged 966 billion gallons (bg) annually during the period 1990-96. This includes water intended for power generation, mining, industrial, commercial, potable supply, irrigation and agricultural uses. This report is primarily concerned with where water is withdrawn, not where it is used. Potable water accounts for the greatest demand, from 400 to 450 bg a year. Power generation is the second, from 300 to 430 bg annually. Such use may or may not be consumptive depending on the cooling methodology.

On average, 75 percent of all freshwater and 59 percent of potable water are withdrawn from surface water. The relative importance of ground and surface water as a source of potable water varies by counties. Ground-water supplied 100 percent of the potable water physically *withdrawn in* Camden, Cape May, Cumberland, Gloucester, Hudson and Warren Counties during the period 1990-96 but only 4 percent of the potable water withdrawn in Passaic County in the same period. A complication arises in that these numbers are not always indicative of the source of water actually *consumed in* each county. For example, most of the surface water withdrawn in Passaic County is exported to Hudson and Bergen Counties.

The highest one-year total was in Passaic County where 235 bg was withdrawn in 1990. Of this, 231 bg was surface water, the largest such annual withdrawal. Most of this water was used nonconsumptively for power generation. Burlington County reported the greatest annual ground-water withdrawal, 32 bg in 1994 (mostly for potable supply and agricultural use). Hudson County withdrew the lowest, 88 million gallons (mg) in 1995, all of it ground water and most of it for industrial use.

Under the DEP's watershed management approach, New Jersey is divided into twenty watershed management areas which are grouped into five water regions. The Central Delaware watershed management area reported the greatest one-year withdrawal, 256 bg in 1990. The Upper Delaware water region reported the greatest one-year withdrawal, 377 bg in 1990.

New Jersey consists of four physiographic provinces: Valley & Ridge, Highlands, Piedmont and Coastal Plain. In terms of total annual withdrawals, the Coastal Plain supplies the most surface and ground water, on average 293 and 145 bg respectively. However, if only withdrawals for potable use are considered, then the Piedmont province supplies the most surface water (157 bg annually on average) while the Coastal Plain supplies the most ground water (an average of 100 bg annually).

The Potomac-Raritan-Magothy (PRM) aquifer system supplied the most ground water as reported by water purveyors, an average of 72 bg annually. Undoubtedly the PRM additionally supplies a significant volume of water to domestic wells. However, it is not possible to determine what percentage of the 30 bg withdrawn statewide annually for domestic purposes is from the PRM.

Total withdrawals in New Jersey correspond to approximately 15 percent of rainfall, on a statewide average. Withdrawals for potable use are between 5 percent and 8 percent of precipitation. Withdrawals for potable use, irrigation and agriculture show a strong seasonal inverse correlation with precipitation during the growing season.

In water-supply critical area 1 in the northeastern Coastal Plain of New Jersey, withdrawals in the central depleted zone declined from 9 bg in 1990 to 6.5 bg in 1996. Declines were most pronounced in the middle-PRM aquifer which has shown a 53 percent reduction in withdrawals. Significant withdrawal reductions in critical area 2 had not yet been implemented through 1996.

The data reported here have five important qualifications: (1) Withdrawals are reported on the basis of water source, not the place of water use. (2) Water withdrawn is not equivalent to water consumed - the reported volume of surface-water withdrawals does not imply an equivalent volume in streamflows reductions. (3) Only fresh-water withdrawals are summarized here; saline withdrawals are not included. (4) All nondomestic withdrawals are summarized from reports filed by the water purveyors with the New Jersey Department of Environmental Protection. Inaccuracies in these reports were corrected where possible but some may carry over to the data in this report. (5) The destination of the water after it is used, such as discharge to the ocean or to a stream, is beyond the scope of this report. Thus analysis of consumptive and depletive water use is omitted.

The withdrawal data are summarized in a series of tables and figures. Detailed analysis of withdrawals by county, water region and watershed management area are shown in the appendixes.

INTRODUCTION

Purpose and Scope

Water is withdrawn from a variety of sources in New Jersey and used for a variety of purposes. It is necessary to understand both the current sources and uses of the water in order to plan for the future. To assist this planning, water withdrawals are described in this report on five different physical bases: statewide, by county, by watershed, by physiographic province, and (for groundwater withdrawals) by aquifer. The focus here is on where water is withdrawn, not where it is used.

The report presents the withdrawal data in several different ways. This is intentional because water planners often need the data summarized in different categories for different analyses. The hope is that planners will find needed data in one table instead of having to cross reference two or more tables.

One of the major distinctions in this report is between total water withdrawals and withdrawals for potable-water supply. Both types of water demand are of great interest to water planners. For that reason, some of the tables in this report are grouped in pairs, the first summarizing total water withdrawals, the second, potable water only.

Description of area

New Jersey consists of 21 counties (fig. 1). They vary considerably in size, population, water demand and water availability. Withdrawals in each county are presented in various tables throughout this report.

Under the DEP's watershed management approach, five water regions and twenty watershed management areas make up New Jersey (Cohen, 1997). These are designed to be the basis for the DEP's data-gathering and management programs. They are shown in figure 2.

New Jersey is divided into four physiographic provinces which are shown on figure 3 (Wolfe, 1977). They are, from northwest to southeast, the Valley & Ridge, Highlands, Piedmont and Coastal Plain. Each province is generally characterized by underlying rocks of a predominant type and age and each exhibits a distinct topography. The provinces are generally oriented in a northeast-southwest direction, following the general trend of the underlying geologic formations.

Ground-water is withdrawn from water-bearing units called aquifers. The water-bearing abilities of different geologic units vary widely. On a statewide basis, the sand-and-gravel units of southeastern New Jersey are the most heavily pumped. Figure 3 shows the outcrop areas of the aquifer groups used in this report. Figure 4 is a cross section of the New Jersey Coastal Plain. More information on the aquifers of New Jersey is in Herman and others (1998).

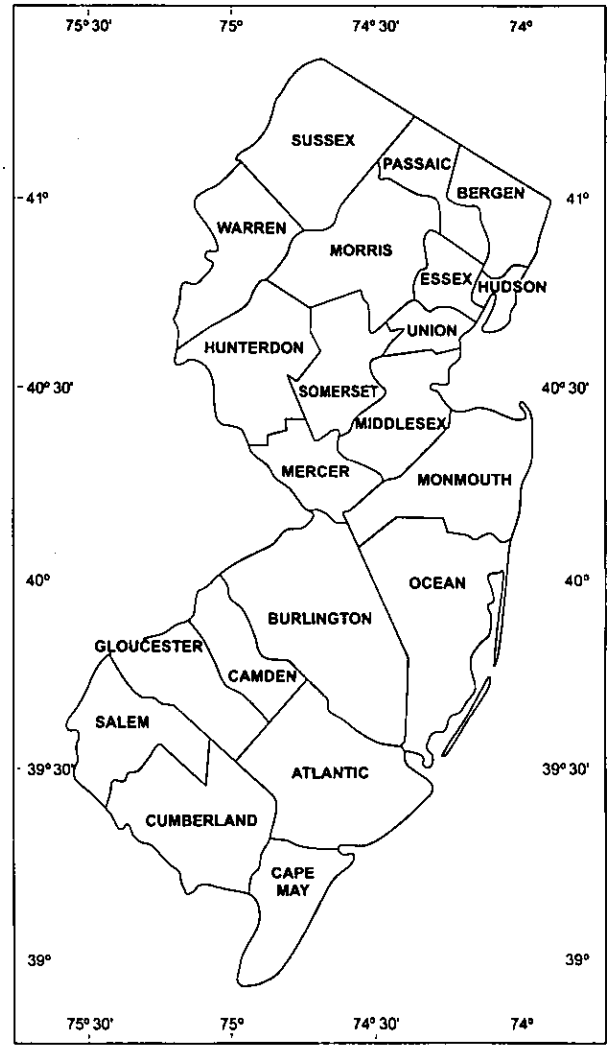

Figure 1. New Jersey's Counties.

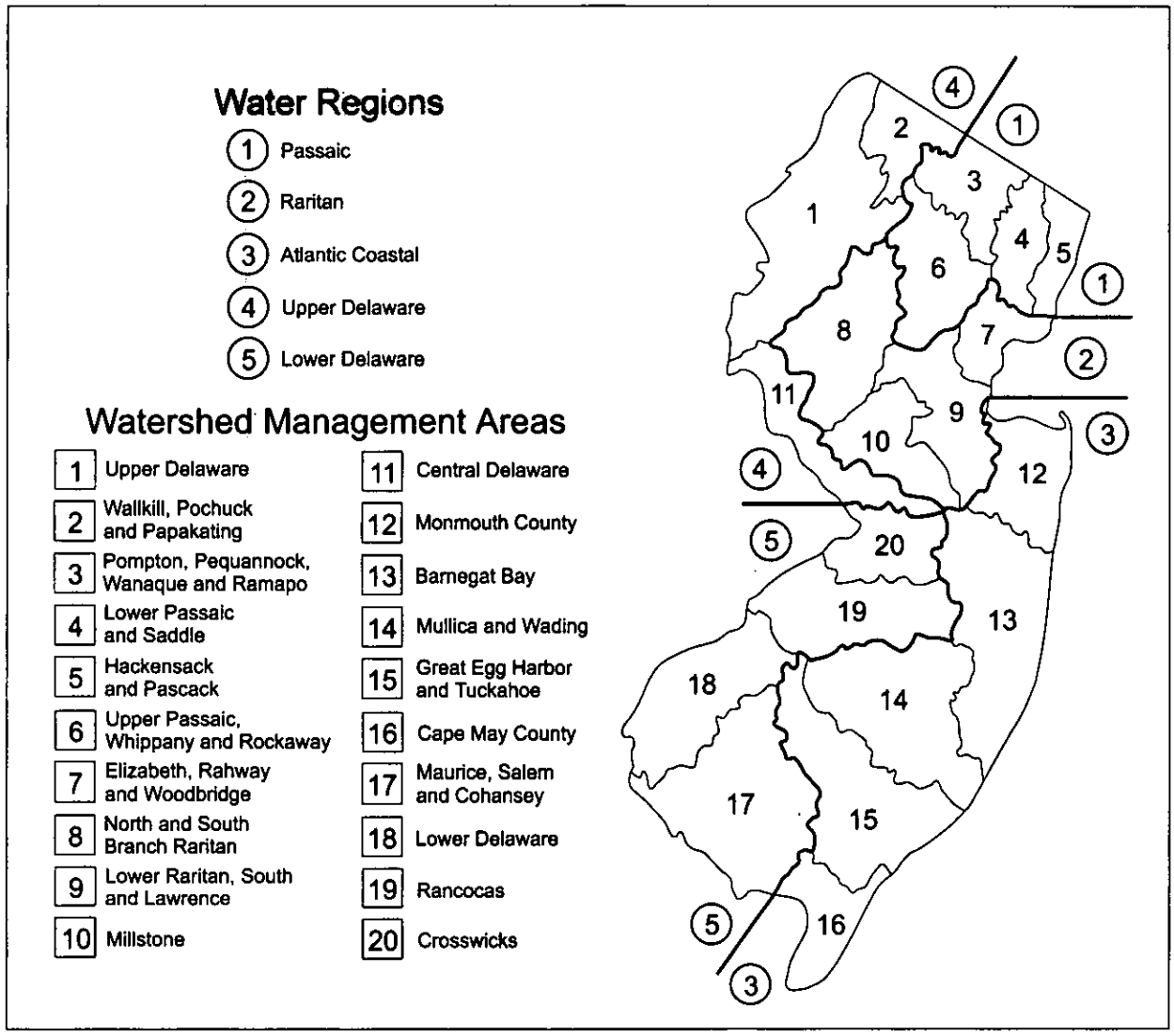

Figure 2. DEP water regions and watershed management areas (after Cohen, 1997)

Methods of investigation

The data in this report are based on reports submitted to the Bureau of Water Allocation (BWA), Water Supply Element, New Jersey Department of Environmental Protection. Under DEP regulations (N.J.A.C. 7:19 *et seq*) all nonagricultural water users capable of withdrawing more than 100,000 gallons per day must obtain water-allocation permits. As a condition of these permits, the users must submit summaries of volumes withdrawn on an annual or quarterly basis, depending on the type of allocation permit. Agricultural users must obtain a certification from BWA (N.J.A.C. 7:20A-1 *et seq*) and meet some of the reporting requirements imposed on permit holders. These data, along with data on the allocation permits and the specific withdrawal locations, are maintained by the BWA in computer data bases. (Note: generally only fresh-water withdrawals are regulated. Withdrawals of saline water are not regulated unless they could impact fresh-water resources.)

BWA currently maintains three data bases using the database software Knowledgeman. These are WATERA, WSOURCE and USAGE. WATERA contains information about each water allocation permit or certification. Each has one entry in WATERA. WSOURCE contains information on each withdrawal point. A user may withdraw water from more than one point and may withdraw a mixture of surface and ground water. An allocation permit or certification may have as many entries in WSOURCE as it has physical water withdrawal points.

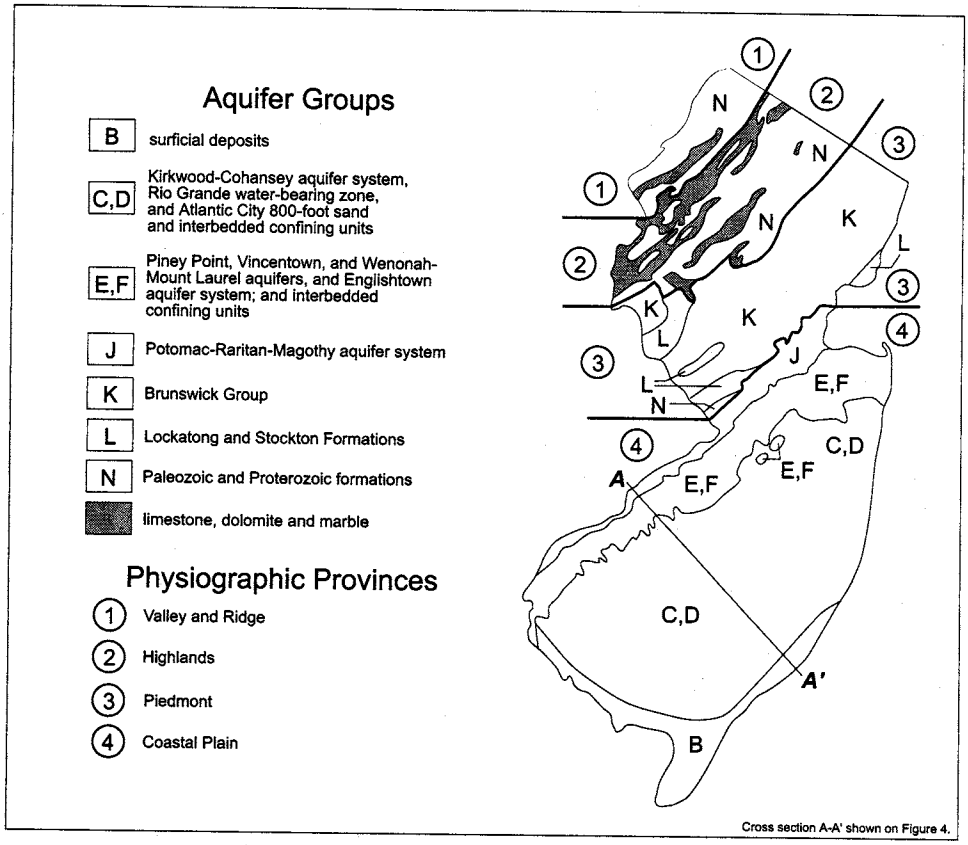

Figure 3. Aquifer group outcrop areas and physiographic provinces

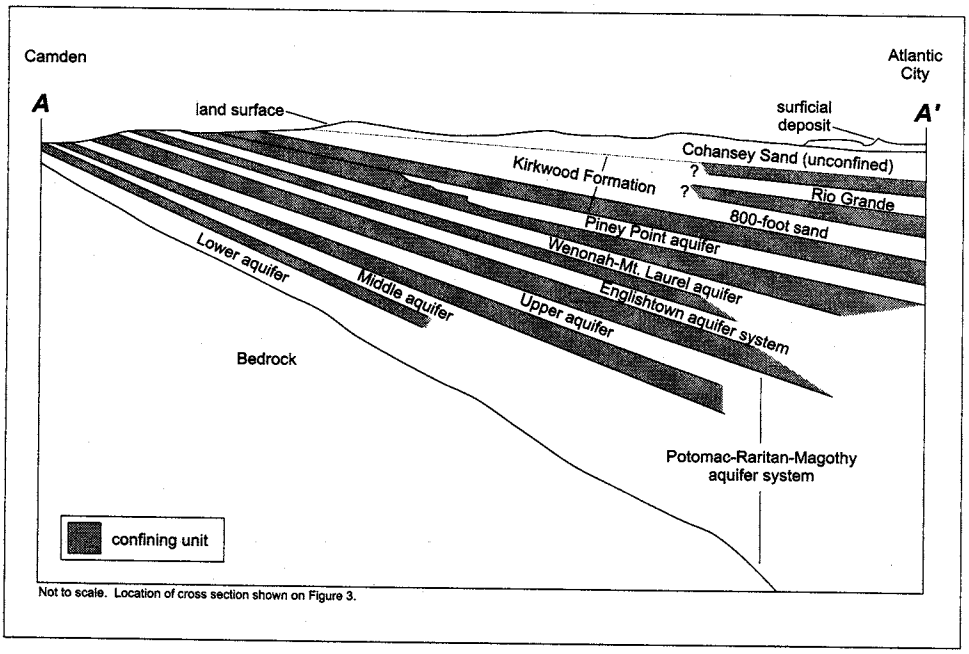

Figure 4. Generalized cross section of the Coastal Plain

USAGE contains the actual withdrawal data. Each entry in it contains data for one specific year for one specific water withdrawal source. Thus each water allocation permit or certification may have as many entries in USAGE as the number of withdrawal points multipled by the number of available years of data.

The NJ Geological Survey translated these three data bases into a Microsoft ACCESS' data base. Records for 1990-96 were corrected for duplicate entries. They were also examined to identify data gaps and the paper records then researched for missing values. If additional research did not uncover the missing data the data gap was preserved. More research accurately defined the watershed and the physiographic province of each withdrawal point. Some purveyors did not report enough information to allow a water source to be assigned to the withdrawal. These include withdrawals by purveyors which have gone out of business as well as some agricultural withdrawals. These withdrawals are assumed to break out according to the statewide average, with 75 percent of the water coming from surface water and 25 percent from ground water.

Previous investigations

Volumes of withdrawals have been reported and summarized in a series of state water-supply plans. The 1980 state water supply plan (Havens and Emerson, Inc. and others, 1980) summarizes historical withdrawals for the period 1925-1975. The most recent water supply plan (CH2M Hill and others, 1993) did not continue this historical analysis but rather concentrated on estimating future demands.

The Bureau of Water Allocation issued its own summary of reported withdrawals in 1987 (Merend, 1989) and 1988 (Saarela, 1992).

The N.J. Geological Survey issued a report on 1995 withdrawals (Hoffman and Mennel, 1997). That report is superceded by information in this publication which corrects errors discovered in the earlier. Annual average domestic withdrawals for 1995 had been overestimated by using maximum estimated daily demand instead of average daily demand. In addition, the water regions had been assigned incorrect numbers. Since the report on 1995 withdrawals was issued the data have been quality checked more thoroughly and some errors corrected. Thus the reported 1995 withdrawals in Hoffman and Mennel (1997) and those for the same year reported below do not match exactly.

The U. S. Geological Survey (USGS) also summarizes water withdrawals for its national data base of water use. Their previous reports cover the years 1989-1994 (Nawyn and Clawges, 1995; Nawyn 1997a, 1997b, 1998). The USGS approach is slightly different from the one in this report. Water used by instream hydroelectric power plants is excluded from the USGS tabulation. For some counties, especially Passaic and Warren Counties, this creates a significant difference in estimations of surface water used. Additionally, the USGS considers all water withdrawn from ponds to be surface water. The approach in this report, however, follows that of the DEP's Bureau of Water Allocation which considers water from off-stream ponds to be a ground-water withdrawal. (An off-stream pond does not have a surface-water entrance or exit and is thus supplied primarily by ground water.) A withdrawal from a pond with a surface-water feeder stream is considered to be a surface-water withdrawal.

Acknowledgments

Many individuals have contributed to this report. William Mennel maintains the NJGS's databases and data exchanges. Mary Santarsiero and Douglas Rivedal helped with data entry and research. Diane Zalaskus, Michael Bleicher, Scott Tyrell, Bart Cerami and Jan Gheen of the Bureau of Water Allocation provided the basic data, answered many questions about water withdrawals in New Jersey, and provided extremely helpful reviews at all stages of the process. John Nawyn provided information on the U.S. Geological Survey's approach to analyzing water withdrawals in New Jersey.

DATA RELIABILITY AND QUALIFICATIONS

The withdrawal data are self-reported by the water purveyors. They are required to recalibrate flow meters every 5 years; their data are considered to be accurate to within 5 percent (Diane Zalaskus, Bureau of Water Allocation, oral communication, 1998). Similar analysis of these data (Nawyn and Clawges, 1995) consider the data from these purveyors to be 'highly reliable.' The reported withdrawals for industrial and commercial use are considered to be of the same order of accuracy. The records of agricultural withdrawals are less accurate and

may be significantly in error because reported water use is estimated, not metered. The Bureau of Water Allocation cannot estimate percentage of error in these records. In some counties agricultural withdrawals are a significant percentage of total withdrawals. However, on a statewide average, agricultural use is less than 5 percent of total withdrawals.

The data reported here have five important qualifications: (1) Withdrawals are reported on the basis of water source, not the location of eventual water use. For example, Hudson County is supplied almost entirely by surface water withdrawn in Passaic and Morris Counties (Nawyn and Clawges, 1995). Thus, water consumed in Hudson County is reported under Passaic and Morris counties in this report. In general, those counties and watersheds from which water is exported show withdrawals that are disproportionally high for their population. Conversely, counties which import water have water withdrawals that are disproportionally low for their population. (2) Water withdrawn is not equivalent to water consumed. Many purveyors, especially thermoelectric generators and in particular instream hydroelectric plants, are nonconsumptive. In 1988 approximately 79 percent of surface-water use was nonconsumptive (Saarela, 1992). Thus, the reported volume of surface-water withdrawals does not imply an equivalent reduction in stream-flow volumes. (3) Only fresh-water withdrawals are summarized here. Saline-water users are not required to obtain a water allocation permit unless the diversion impacts fresh water. Thus, the saline-water withdrawals for cooling at the Oyster Creek and Salem nuclear power plants are omitted from this report. (4) All nondomestic well data are from purveyor reports of volumes of water withdrawn. The data here repeat any inaccuracies in these reports. (5) This report does not supply information on the destination of water withdrawn, such as discharge back to the same watershed, transfer to another watershed or evaporation to the atmosphere. It thus cannot supply estimates on what percentage of water withdrawn goes to consumptive or depletive uses. Zripko and Hasan (1994) discuss in detail depletive water use in New Jersey.

WITHDRAWALS

Domestic Withdrawals

Domestic wells are an important potable water-supply source in New Jersey. In some rural areas all potable water comes from wells. Estimating the volume of water supplied by domestic wells is necessary in order to account for all sources of water.

Domestic withdrawals in this report are based on data from the New Jersey Statewide Water Supply Plan (CH2M Hill and others, 1993). Each person supplied by a domestic well is assumed to use 75 gallons per day. The number of people in each county that depended on water from domestic wells comes from 1990 census data. Domestic withdrawals for 1991-1996 are estimated by modifying the 1990 withdrawals by the same percentage as the estimated county population increases. These yearly withdrawal data are shown in table 1.

Estimates of domestic withdrawals by watershed management area (WMA) and physiographic province are based on percentages of each county in each WMA and province. These percentages were generated by using a geographical information system (GIS) to overlay digital representations of the counties, WMAs and provinces. This process assumes that domestic well use is evenly distributed in each county, WMA and physiographic province.

Statewide Withdrawals

Total annual withdrawals in New Jersey between 1990 and 1996 ranged from 877 billion gallons (bg) in 1996 to a high of 1 trillion gallons in 1990. Approximately 75 percent of was surface water and the remainder ground water (table 2, fig. 5)

Withdrawal for domestic and related purposes ranged from a low of 418 bg in 1996 to a high of 445 bg in 1994. Surface water supplied an average of 59 percent of the water withdrawn for potable use statewide.

Table 1. Domestic pumpage estimates in 1990 – 1996 by county (millions of gallons)

County	Year						
	1990	1991	1992	1993	1994	1995	1996
Atlantic	2,222	2,253	2,271	2,287	2,299	2,314	2,332
Bergen	773	774	779	783	786	790	792
Burlington	2,371	2,393	2,393	2,399	2,419	2,448	2,466
Camden	1,184	1,190	1,192	1,193	1,193	1,194	1,193
Cape May	1,307	1,326	1,336	1,335	1,344	1,349	1,351
Cumberland	1,450	1,459	1,460	1,460	1,458	1,447	1,428
Essex	141	140	140	140	139	138	137
Gloucester	1,570	1,598	1,612	1,626	1,649	1,657	1,666
Hudson	4	4	4	4	4	4	4
Hunterdon	2,059	2,084	2,132	2,172	2,203	2,220	2,268
Mercer	868	871	872	876	877	880	880
Middlesex	679	684	689	694	700	706	710
Monmouth	1,506	1,521	1,541	1,558	1,575	1,594	1,610
Morris	2,604	2,614	2,637	2,671	2,712	2,745	2,776
Ocean	3,209	3,247	3,278	3,333	3,387	3,453	3,512
Passaic	1,040	1,041	1,045	1,054	1,060	1,063	1,066
Salem	754	753	752	752	748	753	780
Somerset	1,807	1,845	1,879	1,923	1,962	1,995	2,031
Sussex	2,343	2,374	2,407	2,442	2,472	2,503	2,529
Union	42	42	42	42	42	42	42
Warren	1,136	1,149	1,160	1,170	1,183	1,196	1,209
Yearly total	29,069	29,361	29,621	29,913	30,213	30,490	30,782

County Withdrawals

Table 3 summarizes *total water withdrawals* by county for 1990-96. Mercer County showed the greatest average annual total withdrawals (195 bg) and surface-water withdrawals (190 bg). However, the largest reported 1-year surface-water withdrawal was 231 bg in 1990 from Passaic County. Burlington County had the greatest average annual ground-water withdrawal (29 bg) as well as the largest 1-year ground-water withdrawal (32 bg in 1994). Table 6 gives the area of each county and its percentage of New Jersey's total area. Figure 6 graphically shows average annual total withdrawals by county.

Table 4 summarizes *potable water withdrawals* by county. During the period 1990-96 Passaic County shows the greatest average annual withdrawals (82 bg) and surface-water withdrawals (79 bg) for potable use. Camden County has the greatest average potable ground-water withdrawal (24 bg). The largest 1-year potable surface-water withdrawal was 89 bg in 1995 in Passaic County; the largest 1-year potable ground-water withdrawal was 25 bg in 1995 in Camden County. Figure 7 graphically shows average annual potable withdrawals by county.

In appendix A, tables A1 through A21 detail county withdrawals for 1990-96. These tables summarize total withdrawals, withdrawals by use, and ground-water withdrawals by aquifer group.

The importance of ground and surface water as a source of potable water varies by counties (table 5). During the period 1990-96 ground water supplied 100 percent of potable water withdrawn in Camden, Cape May, Cumberland, Gloucester, Hudson and Warren

Counties. This does account for imports to these counties. For example, most of the water consumed in Hudson County is surface water imported from Passaic County. In contrast, ground water supplied only 4 percent of the potable water withdrawn in Passaic County during this period. Figure 8 shows the average percentages of surface and ground water withdrawn in each county during the period 1990-96. In general, counties in southern New Jersey are more dependent on ground water for potable supply than the counties in northern New Jersey.

These numbers are not always indicative of the source of potable water consumed in each county. For example, most of the surface water withdrawn in Passaic County is exported to Hudson and Bergen Counties.

Table 2. Total and potable withdrawals, 1990 – 1996

Year	Withdrawals (millions of gallons)					
	Total water withdrawals			Potable water withdrawals		
	Surface water	*Ground water*	combined	Surface water	*Ground water*	combined
1990	809,816	*227,674*	1,037,490	248,861	*171,130*	419,991
1991	744,611	*238,367*	982,978	260,357	*180,951*	441,308
1992	723,285	*231,286*	954,571	256,104	*175,038*	431,142
1993	719,359	*245,504*	964,864	260,956	*183,672*	444,627
1994	723,764	*249,583*	973,347	261,016	*184,128*	445,145
1995	721,956	*246,724*	968,680	267,647	*184,563*	452,210
1996	645,824	*230,759*	876,582	243,866	*174,148*	418,014
average	726,945	*238,557*	965,502	256,972	*179,090*	436,063
(percent)	(75)	(25)		(59)	(41)	

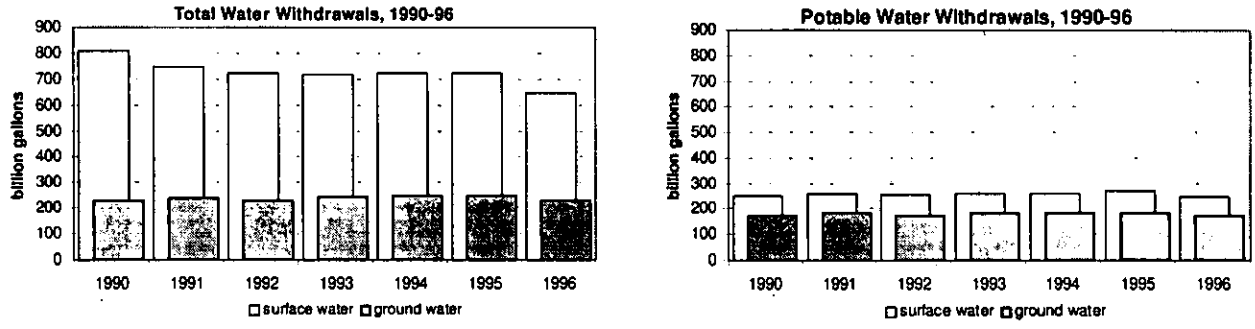

Figure 5. Total and potable water withdrawals by source

Table 3. Total water withdrawals in 1990-1996 by county and water source (millions of gallons)

County	YEAR																					Average 1990-1996		
	1990			1991			1992			1993			1994			1995			1996					
	Source			Source			Source			Source			Source			Source			Source			Source		
	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total
Atlantic	1,240	*14,126*	15,366	1,787	*16,972*	18,759	1,099	*16,817*	17,916	1,384	*17,616*	18,999	414	*16,854*	17,268	725	*17,478*	18,203	1,888	*15,742*	17,630	1,220	*16,515*	17,735
Bergen	53,294	*9,575*	62,869	51,637	*10,313*	61,950	48,743	*10,021*	58,764	47,726	*11,946*	59,672	52,632	*10,931*	63,563	46,638	*10,787*	57,425	49,994	*10,539*	60,533	50,095	*10,587*	60,682
Burlington	33,602	*27,713*	61,315	35,429	*28,619*	64,049	22,307	*27,970*	50,277	40,975	*28,855*	69,829	64,146	*32,069*	96,215	77,902	*29,216*	107,118	58,629	*26,231*	84,860	47,570	*28,668*	76,238
Camden	2,356	*24,591*	26,947	1,847	*25,523*	27,369	1,791	*25,226*	27,017	1,255	*25,752*	27,007	948	*25,212*	26,160	1,045	*25,979*	27,024	906	*21,793*	22,699	1,450	*24,868*	26,318
Cape May	1,020	*7,873*	8,893	1,020	*7,595*	8,615	1,037	*7,658*	8,695	958	*8,375*	9,333	837	*8,189*	9,026	372	*8,211*	8,582	531	*7,906*	8,437	825	*7,972*	8,797
Cumberland	12,487	*13,927*	26,414	18,671	*15,190*	33,861	26,646	*13,510*	40,155	18,439	*15,698*	34,137	21,482	*17,124*	38,606	21,863	*16,990*	38,853	14,886	*15,069*	29,954	19,210	*15,358*	34,569
Essex	6,225	*10,760*	16,985	3,717	*9,344*	13,061	2,861	*9,550*	12,411	3,538	*9,302*	12,840	2,764	*9,657*	12,422	3,698	*9,058*	12,756	3,014	*9,260*	12,274	3,688	*9,562*	13,250
Gloucester	19,968	*13,981*	33,949	25,187	*14,057*	39,243	25,489	*13,729*	39,218	21,330	*13,838*	35,168	13,455	*13,880*	27,335	15,265	*14,312*	29,576	13,251	*14,446*	27,697	19,135	*14,035*	33,170
Hudson	0	*370*	370	0	*267*	267	0	*172*	172	0	*220*	220	0	*222*	222	0	*97*	97	0	*88*	88	0	*205*	205
Hunterdon	59,912	*4,388*	64,300	54,364	*4,521*	58,885	46,110	*4,875*	50,985	41,446	*5,112*	46,557	42,528	*5,172*	47,701	54,440	*4,989*	59,428	39,729	*5,153*	44,881	48,361	*4,887*	53,248
Mercer	207,104	*4,339*	211,444	178,390	*4,782*	183,172	195,647	*4,619*	200,266	202,713	*4,797*	207,510	195,779	*4,707*	200,486	180,148	*4,773*	184,921	172,960	*4,245*	177,205	190,392	*4,609*	195,001
Middlesex	511	*16,200*	16,711	768	*18,677*	19,445	388	*17,924*	18,312	477	*21,009*	21,486	456	*22,152*	22,608	745	*20,213*	20,958	1,986	*20,838*	22,824	762	*19,573*	20,335
Monmouth	17,964	*12,386*	30,350	17,385	*9,878*	27,263	18,735	*7,946*	26,681	18,702	*8,854*	27,556	18,266	*8,702*	26,969	19,989	*9,055*	29,044	16,825	*7,984*	24,809	18,267	*9,258*	27,525
Morris	20,186	*18,619*	38,805	19,957	*20,990*	40,947	19,700	*20,105*	39,804	19,124	*22,038*	41,161	17,617	*22,608*	40,225	17,392	*22,333*	39,725	18,597	*22,397*	40,994	18,939	*21,299*	40,238
Ocean	4,285	*19,913*	24,198	1,737	*21,080*	22,817	986	*21,142*	22,128	1,206	*21,555*	22,761	1,854	*21,916*	23,770	2,064	*22,043*	24,107	2,113	*22,160*	24,273	2,035	*21,401*	23,436
Passaic	231,211	*3,420*	234,631	203,372	*3,341*	206,713	188,519	*3,134*	191,653	192,871	*3,234*	196,104	169,523	*3,031*	172,554	150,328	*3,141*	153,469	126,517	*3,012*	129,529	180,334	*3,187*	183,522
Salem	4,814	*4,074*	8,888	8,239	*4,526*	12,765	5,266	*4,491*	9,757	8,337	*4,514*	12,850	7,131	*4,860*	11,991	7,430	*5,187*	12,617	6,905	*3,880*	10,785	6,874	*4,505*	11,379
Somerset	37,090	*2,677*	39,767	35,456	*2,902*	38,359	33,944	*2,935*	36,879	36,772	*3,275*	40,047	42,649	*3,020*	45,669	42,712	*2,899*	45,611	41,546	*2,808*	44,354	38,596	*2,931*	41,527
Sussex	641	*5,898*	6,538	683	*5,664*	6,346	609	*5,805*	6,414	706	*6,279*	6,986	472	*6,241*	6,714	479	*6,520*	6,999	561	*7,131*	7,692	593	*6,220*	6,813
Union	4,833	*5,626*	10,459	6,414	*6,374*	12,788	4,722	*5,923*	10,645	4,340	*5,509*	9,849	4,531	*5,183*	9,714	4,681	*5,468*	10,149	3,951	*5,186*	9,137	4,782	*5,610*	10,391
Warren	91,074	*7,217*	98,291	78,552	*7,751*	86,303	78,686	*7,735*	86,422	57,062	*7,727*	64,789	66,279	*7,852*	74,131	74,039	*7,976*	82,015	71,033	*4,892*	75,925	73,818	*7,307*	81,125
Yearly total:	809,816	*227,674*	1,037,490	744,611	*238,367*	982,978	723,285	*231,286*	954,571	719,359	*245,504*	964,864	723,764	*249,583*	973,347	721,956	*248,724*	968,680	645,824	*230,759*	876,582	726,945	*238,557*	965,502

Table 4. Potable water withdrawals in 1990-1996 by county and water source (millions of gallons)

County	YEAR																					Average 1990-1996		
	1990			1991			1992			1993			1994			1995			1996					
	Source			Source			Source			Source			Source			Source			Source			Source		
	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total
Atlantic	916	*11,755*	12,671	0	*12,671*	12,671	294	*12,523*	12,817	428	*12,581*	13,009	147	*13,322*	13,469	5	*13,086*	13,091	913	*12,521*	13,434	386	*12,637*	13,023
Bergen	52,455	*8,450*	60,905	50,765	*9,166*	59,932	47,763	*8,963*	56,725	46,917	*10,371*	57,289	51,982	*9,661*	61,643	46,023	*9,517*	55,540	49,482	*9,671*	59,153	49,341	*9,400*	58,741
Burlington	1,268	*15,481*	16,749	1,075	*16,365*	17,441	850	*15,574*	16,424	728	*16,035*	16,763	972	*16,254*	17,226	831	*16,720*	17,551	4,251	*15,127*	19,378	1,425	*15,937*	17,362
Camden	0	*23,511*	23,511	0	*24,798*	24,798	0	*24,692*	24,692	0	*24,985*	24,985	0	*24,524*	24,524	0	*25,273*	25,273	0	*21,165*	21,165	0.0	*24,135*	24,135
Cape May	0	*5,809*	5,809	0	*5,869*	5,869	0	*5,726*	5,726	0	*6,181*	6,181	0	*5,882*	5,882	0	*5,778*	5,778	0	*5,941*	5,941	0.0	*5,884*	5,884
Cumberland	0	*7,044*	7,044	0	*7,660*	7,660	0	*7,363*	7,363	0	*7,874*	7,874	0	*8,033*	8,033	0	*7,793*	7,793	0	*7,030*	7,030	0.0	*7,542*	7,542
Essex	6,207	*10,328*	16,535	3,682	*8,840*	12,521	2,832	*9,061*	11,893	3,467	*8,750*	12,217	2,703	*9,160*	11,863	3,630	*8,478*	12,108	2,975	*8,784*	11,759	3,642	*9,057*	12,700
Gloucester	0	*8,827*	8,827	0	*9,437*	9,437	0	*9,118*	9,118	0	*9,541*	9,541	0	*9,566*	9,566	0	*9,983*	9,983	0	*9,370*	9,370	0	*9,406*	9,406
Hudson	0	*4*	4	0	*4*	4	0	*4*	4	0	*4*	4	0	*4*	4	0	*4*	4	0	*4*	5	0.1	*4.4*	4.4
Hunterdon	33,984	*3,474*	37,458	31,600	*3,524*	35,124	30,897	*3,567*	34,465	32,928	*3,699*	36,627	31,287	*3,819*	35,106	32,837	*3,802*	36,640	29,020	*3,942*	32,961	31,793	*3,690*	35,483
Mercer	11,246	*4,034*	15,280	12,557	*4,322*	16,879	11,091	*4,282*	15,374	11,826	*4,396*	16,223	11,757	*4,384*	16,141	11,625	*4,404*	16,029	11,133	*3,987*	15,120	11,605	*4,259*	15,863
Middlesex	303	*10,144*	10,447	590	*12,479*	13,070	219	*12,347*	12,566	318	*14,025*	14,343	202	*15,078*	15,280	446	*14,672*	15,119	1,880	*13,614*	15,494	566	*13,194*	13,760
Monmouth	17,660	*11,828*	29,488	16,846	*9,294*	26,140	18,235	*7,304*	25,538	17,926	*8,070*	25,996	17,546	*7,936*	25,481	19,006	*8,192*	27,197	16,467	*7,362*	23,830	17,669	*8,569*	26,239
Morris	19,804	*16,501*	36,305	19,526	*19,023*	38,548	19,253	*18,043*	37,296	18,586	*19,550*	38,136	17,120	*19,249*	36,369	16,851	*19,027*	35,878	18,124	*19,057*	37,181	18,466	*18,636*	37,102
Ocean	1,766	*15,973*	17,739	906	*18,314*	19,219	681	*17,908*	18,590	867	*18,876*	19,743	1,628	*18,854*	20,482	1,811	*19,213*	21,024	1,726	*18,403*	20,129	1,340	*18,220*	19,561
Passaic	63,334	*3,164*	66,498	84,599	*3,129*	87,728	87,192	*2,977*	90,170	87,220	*3,074*	90,294	80,212	*2,936*	83,148	89,121	*2,983*	92,104	63,708	*2,861*	66,568	79,341	*3,018*	82,359
Salem	479	*2,233*	2,712	469	*2,409*	2,878	567	*2,225*	2,792	549	*2,181*	2,731	494	*2,154*	2,648	492	*2,223*	2,715	412	*2,015*	2,427	495	*2,206*	2,700
Somerset	37,048	*2,222*	39,271	35,357	*2,283*	37,640	33,895	*2,244*	36,139	36,694	*2,344*	39,037	42,534	*2,406*	44,940	42,626	*2,327*	44,953	41,466	*2,300*	43,766	38,517	*2,304*	40,821
Sussex	607	*3,368*	3,975	624	*3,531*	4,155	589	*3,629*	4,218	669	*3,805*	4,475	441	*4,113*	4,554	457	*4,084*	4,541	437	*4,138*	4,575	546	*3,810*	4,356
Union	1,768	*3,734*	5,502	1,748	*4,509*	6,258	1,738	*4,166*	5,904	1,805	*3,880*	5,685	1,954	*3,529*	5,483	1,887	*3,808*	5,695	1,873	*3,608*	5,481	1,825	*3,891*	5,715
Warren	17	*3,245*	3,262	14	*3,320*	3,334	6	*3,320*	3,327	28	*3,448*	3,476	37	*3,265*	3,302	0	*3,194*	3,194	0	*3,247*	3,247	15	*3,292*	3,306
Yearly total:	248,861	*171,130*	419,991	260,357	*180,951*	441,308	256,104	*175,038*	431,142	260,956	*183,672*	444,627	261,016	*184,128*	445,145	267,647	*184,563*	452,210	243,866	*174,148*	418,014	256,972	*179,090*	436,063

Table 5. Average total and potable water withdrawals by county and source, 1990-1996

County	Average total withdrawals, 1990-96					Average potable water withdrawals, 1990-96				
	Source				Total	Source				Total
	surface water		ground water			surface water		ground water		
	million gallons	%	million gallons	%		million gallons	%	million gallons	%	
Atlantic	1,220	7	16,515	93	17,735	386	3	12,637	97	13,023
Bergen	50,095	83	10,587	17	60,682	49,341	84	9,400	16	58,741
Burlington	47,570	62	28,668	38	76,238	1,425	8	15,937	92	17,362
Camden	1,450	6	24,868	94	26,318	0	0	24,135	100	24,135
Cape May	825	9	7,972	91	8,797	0	0	5,884	100	5,884
Cumberland	19,210	56	15,358	44	34,569	0	0	7,542	100	7,542
Essex	3,688	28	9,562	72	13,250	3,642	29	9,057	71	12,700
Gloucester	19,135	58	14,035	42	33,170	0	0	9,406	100	9,406
Hudson	0	0	205	100	205	0	0	4	99	4
Hunterdon	48,361	91	4,887	9	53,248	31,793	90	3,690	10	35,483
Mercer	190,392	98	4,609	2	195,001	11,605	73	4,259	27	15,863
Middlesex	762	4	19,573	96	20,335	566	4	13,194	96	13,760
Monmouth	18,267	66	9,258	34	27,525	17,669	67	8,569	33	26,239
Morris	18,939	47	21,299	53	40,238	18,466	50	18,636	50	37,102
Ocean	2,035	9	21,401	91	23,436	1,340	7	18,220	93	19,561
Passaic	180,334	98	3,187	2	183,522	79,341	96	3,018	4	82,359
Salem	6,874	60	4,505	40	11,379	495	18	2,206	82	2,700
Somerset	38,596	93	2,931	7	41,527	38,517	94	2,304	6	40,821
Sussex	593	9	6,220	91	6,813	546	13	3,810	87	4,356
Union	4,782	46	5,610	54	10,391	1,825	32	3,891	68	5,715
Warren	73,818	91	7,307	9	81,125	15	0	3,292	100	3,306
Yearly total	726,945	75	238,557	25	965,502	256,972	59	179,090	41	436,063

Table 6. Approximate size of New Jersey Counties (square miles)

County	Area	Percent of State
Atlantic	611	7.8
Bergen	247	3.2
Burlington	819	10.5
Camden	227	2.9
Cape May	285	3.7
Cumberland	503	6.5
Essex	130	1.7
Gloucester	337	4.3
Hudson	62	0.8
Hunterdon	438	5.6
Mercer	229	2.9
Middlesex	323	4.1
Monmouth	484	6.2
Morris	480	6.2
Ocean	759	9.7
Passaic	197	2.5
Salem	348	4.5
Somerset	305	3.9
Sussex	537	6.9
Union	105	1.4
Warren	363	4.7

Withdrawals by use

Water has a variety of uses in New Jersey. The Bureau of Water Allocation (BWA) assigns a use code to each water allocation permit which describes the use of the withdrawn water. Table 7 lists the BWA use codes. For the purposes of this report, the uses are divided into 6 categories: power generation, mining, industrial, commercial, potable water supply, and agricultural. Table 7 also shows how the BWA codes are divided among these use groups. The use groups are defined below. Some permits, now closed but which reported pumpage in the early 1990's, do not have a use reported in BWA files. These were assumed to produce potable water.

The power generation use group includes water used for cooling coal- and gas-fired electrical generation plants as well as water used for instream hydroelectric power plants. Water used for cooling purposes may be partially evaporated and the remainder returned to the water source, commonly at an elevated temperature. Water use by instream hydroelectric plants is generally nonconsumptive.

The mining use group covers withdrawals primarily for sand and gravel mining operations in New Jersey's coastal plain sediments. The diversions are either for dewatering of open-pit mines or for transport of sand and gravel in a slurry mixture away from dredging operations (which rely on floating a barge in a water-filled gravel pit).

The industrial use group includes a variety of different uses of water. Some of this water may be used nonconsumptively but percentage returned to the water source is not indicated in BWA's files.

The commercial use group includes water used for purely commercial purposes as well as for fire protection and recreational use. This is, by far, the use group with the smallest volume of withdrawals.

Figure 6. Average annual total water withdrawals in each county, 1990-96

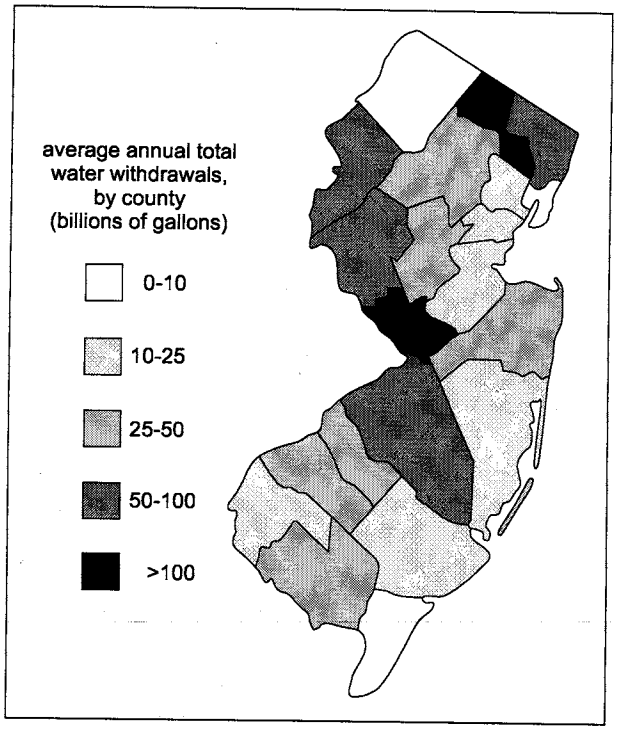

Figure 7. Average annual potable water withdrawals in each county, 1990-96, billions of gallons

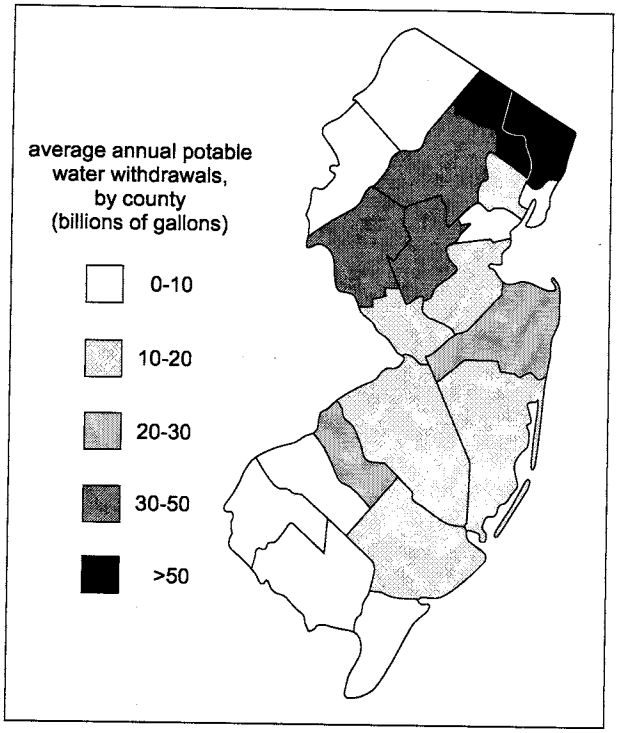

Figure 8. Average source of potable water withdrawn in each county, 1990-96

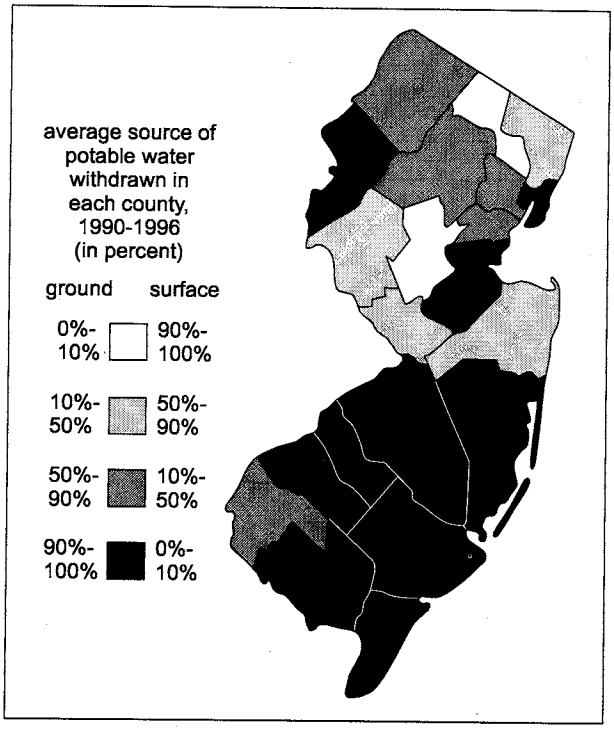

Table 7. Use group and Bureau of Water Allocation use codes

Use Group (this report)	Bureau of Water Allocation[1]	
	Code	Water use
power generation	E	power generation
	L	geothermal/heat pump
mining	K	mining
industrial	A	air conditioning
	D	dewatering
	J	cooling (industrial)
	N	industrial
	W	injection
	X	pollution control
commercial	C	commercial
	F	fire
	R	recreation

Use Group (this report)	Bureau of Water Allocation[1]	
	Code	Water use
potable supply	B	bottling
	H	domestic
	M	medicinal value
	O	public non-community
	P	public supply
	T	institutional
	U	unused
	Y	desalination
	Z	other
irrigation	G	golf
	I	irrigation
agricultural	Q	aquaculture
	S	agricultural

1. Bureau of Water Allocation, New Jersey Department of Environmental Protection

The potable supply use group includes water that ends up being used for a variety of purposes. Although eventual use by individuals for consumption is one intended use, some purveyors supply water to a variety of users, including both industrial and commercial users, under a permit that is classified as a potable supply. But because the water comes from one set of mains, and a person could consume any of it, the overall designation as potable supply is applicable. Estimated withdrawals from domestic wells are included in the potable supply use group.

The irrigation use group includes water used to irrigate golf courses and other nonagricultural irrigation uses. The agriculture water use group includes water used for general agricultural use, irrigation of crops and aquaculture.

Table 8 summarizes statewide water uses by use group and water source. During the period 1990-96 withdrawals for potable use were greater than for any other use, an average of 436 bg annually. This is about 45 percent of total withdrawals. Power generation is the next biggest user at an average annual use of 349 bg (36 percent of total withdrawals). In descending order the other use groups and their average annual water demands were industrial (94 bg or 10 percent), agricultural (49 bg or 5 percent), mining (33 bg or 3 percent), irrigation (3.5 bg or 0.4 percent) and commercial (0.6 bg or 0.06 percent). The volumes are shown in figure 9.

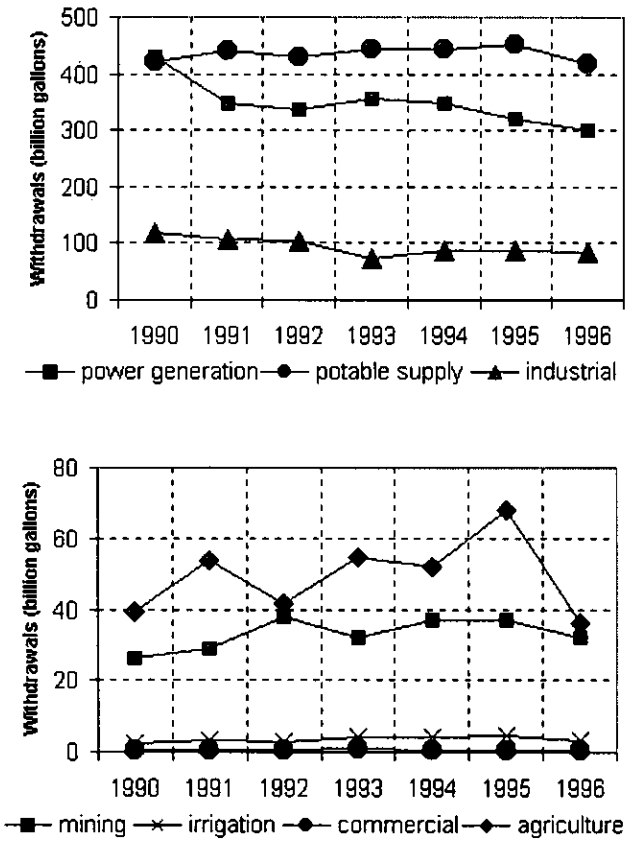

Figure 9. Annual total withdrawals by water use, 1990-96 (Note: Scales of the graphs differ in order to highlight the range of values.)

Appendix 1 shows yearly withdrawals for each use group in each county. Appendixes 2 and 3 show water withdrawals by water region and watershed management area, respectively, for each use group. Appendix 4 shows yearly withdrawals by watershed management area and use group by year.

Figure 10 shows demand by water region. This highlights some interesting differences in water use patterns. For example, the demand for water for power generation is almost entirely confined to the Upper Delaware and Passaic water regions whereas agricultural use of water is primarily in the Atlantic Coastal and Lower Delaware water regions.

Withdrawals by Water Region

Under the New Jersey Department of Environmental Protection watershed program the state has been divided into 5 water regions (WR) and 20 watershed management areas (WMA) (Cohen, 1997). These are shown in figure 2. The areas of the water regions are shown in table 13 and the watershed management areas are in table 12.

Tables 9 and 10 detail annual withdrawals for total and potable water uses, respectively, by water region and water source. Table 11 breaks out annual total withdrawals for each watershed management area. Appendix 4 shows, with one table per year for the period 1990-96, annual withdrawals by use group for each WMA. Appendix 2 and 3 show withdrawals for water regions and watershed management area, respectively, a detailed description of withdrawals.

Table 9 shows that during the period 1990-96 the Upper Delaware WR had the greatest average volume of total and surface-water withdrawals, 333 bg and 313 bg respectively. The Lower Delaware WR had the greatest average annual ground-water withdrawal, 74 bg. The greatest 1-year surface-water withdrawal was 359 bg in 1990 in the Upper Delaware WR, the greatest 1-year ground-water withdrawal was 80 bg in 1995 in the Lower Delaware WR.

If only the potable water withdrawals are examined the pattern is different (table 10). During the period

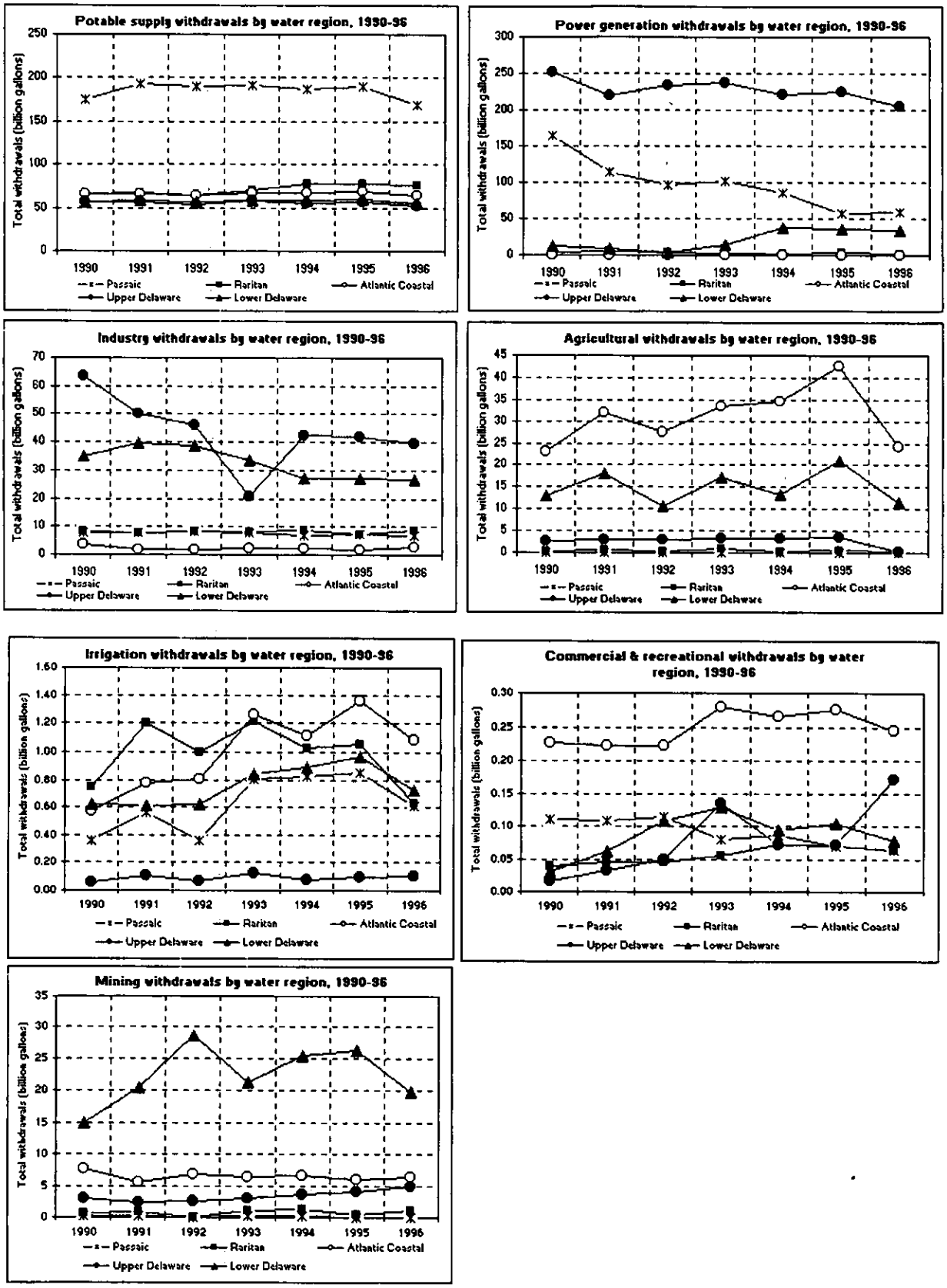

Figure 10. Annual total withdrawals by water use and water region, 1990-96 (Note: Scales of the graphs differ in order to highlight the range of values.)

Table 8. Total withdrawals in 1990-1996 by use and water source (millions of gallons)

Use Group	YEAR																					Average 1990-1996		
	1990			1991			1992			1993			1994			1995			1996					
	Source			Source			Source			Source			Source			Source			Source			Source		
	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total
Power generation	430,307	*129*	430,436	347,539	*153*	347,691	337,475	*149*	337,624	355,612	*181*	355,793	347,490	*222*	347,712	320,400	*257*	320,657	301,388	*261*	301,650	348,602	193	348,795
Mining	13,846	*12,480*	26,326	19,369	*9,836*	29,205	27,944	*10,168*	38,112	19,704	*12,255*	31,958	22,959	*14,283*	37,241	22,657	*14,223*	36,880	15,954	*16,420*	32,374	20,347	12,809	33,157
Industrial	94,201	*24,540*	118,741	84,667	*22,851*	107,518	79,774	*23,013*	102,787	49,420	*23,431*	72,852	63,731	*23,304*	87,034	64,968	*21,074*	86,042	61,421	*23,040*	84,461	71,169	23,036	94,205
Commercial	0	*422*	422	0	*470*	470	0	*541*	541	1	*677*	678	3	*585*	588	13	*580*	593	116	*503*	619	19	540	559
Potable water supply	248,861	*171,130*	419,991	260,357	*180,951*	441,308	256,104	*175,038*	431,142	260,956	*183,672*	444,627	261,016	*184,128*	445,145	267,647	*184,563*	452,210	243,866	*174,148*	418,014	256,972	179,090	436,063
Irrigation	436	*1,932*	2,368	721	*2,533*	3,255	525	*2,330*	2,855	879	*3,359*	4,238	883	*3,054*	3,937	955	*3,375*	4,330	664	*2,492*	3,156	723	2,725	3,448
Agriculture	22,165	*17,041*	39,206	31,958	*21,572*	53,530	21,464	*20,047*	41,510	32,788	*21,930*	54,718	27,684	*24,007*	51,690	45,316	*22,653*	67,969	22,414	*13,893*	36,307	29,113	20,163	49,276
Yearly total	809,816	*227,674*	1,037,490	744,611	*238,367*	982,978	723,285	*231,286*	954,571	719,359	*245,504*	964,864	723,764	*249,583*	973,347	721,956	*246,724*	968,680	645,824	*230,759*	876,582	726,945	238,557	965,502

Table 9. Total water withdrawals in 1990-1996 by water region and water source (millions of gallons)

Water region	YEAR																					Average total water withdrawals, 1990-1996		
	1990			1991			1992			1993			1994			1995			1996					
	Source			Source			Source			Source			Source			Source			Source			Source		
	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total
Passaic	310,090	*36,990*	347,080	278,171	*38,428*	316,599	259,171	*37,031*	296,201	262,589	*39,995*	302,584	241,917	*38,474*	280,391	217,453	*37,558*	255,012	197,564	*37,852*	235,416	252,422	*38,047*	290,469
Raritan	42,992	*36,083*	79,075	43,081	*39,312*	82,394	40,058	*37,362*	77,421	43,060	*40,883*	83,943	48,822	*42,271*	91,094	49,488	*40,337*	89,826	48,776	*39,693*	88,469	45,183	*39,420*	84,603
Atlantic Coastal	37,400	*63,642*	101,042	39,568	*66,634*	106,202	37,370	*64,637*	102,007	41,474	*69,360*	110,835	40,804	*71,424*	112,228	54,240	*66,707*	120,947	35,906	*63,904*	99,810	40,966	*66,616*	107,582
Upper Delaware	359,020	*18,463*	377,483	312,127	*19,195*	331,322	321,172	*19,617*	340,789	302,023	*20,630*	322,652	305,285	*21,347*	326,632	309,219	*21,952*	331,171	284,399	*19,303*	303,702	313,321	*20,072*	333,393
Lower Delaware	60,315	*72,495*	132,810	71,663	*74,798*	146,461	65,514	*72,639*	138,153	70,214	*74,636*	144,850	86,936	*76,067*	163,003	91,555	*80,170*	171,725	79,179	*70,006*	149,185	75,054	*74,402*	149,455
Yearly total	809,816	*227,674*	1,037,490	744,611	*238,367*	982,978	723,285	*231,286*	954,571	719,359	*245,504*	964,864	723,764	*249,583*	973,347	721,956	*246,724*	968,680	645,824	*230,759*	876,582	726,945	*238,557*	965,502

Table 10. Potable water withdrawals in 1990-1996 by water region and water source (millions of gallons)

Water region	YEAR																					Average potable water withdrawals, 1990-1996		
	1990			1991			1992			1993			1994			1995			1996					
	Source			Source			Source			Source			Source			Source			Source			Source		
	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total
Passaic	141,343	*33,445*	174,788	158,363	*34,857*	193,220	156,756	*33,823*	190,579	155,915	*36,216*	192,131	151,749	*35,238*	186,987	155,396	*34,428*	189,823	134,082	*35,273*	169,356	150,515	*34,754*	185,269
Raritan	39,271	*26,686*	65,956	37,700	*29,567*	67,266	36,392	*28,239*	64,630	39,757	*30,120*	69,877	45,450	*31,742*	77,191	45,780	*31,450*	77,230	46,117	*29,556*	75,674	41,495	*29,623*	71,118
Atlantic Coastal	20,342	*45,211*	65,553	17,752	*47,904*	65,656	18,785	*45,908*	64,693	18,382	*48,646*	67,028	18,575	*48,593*	67,168	20,034	*48,460*	68,495	18,286	*46,669*	64,955	18,879	*47,342*	66,221
Upper Delaware	46,159	*10,932*	57,091	44,998	*11,687*	56,685	42,754	*11,686*	54,439	45,625	*12,018*	57,644	43,777	*11,855*	55,631	45,114	*11,939*	57,054	40,718	*11,661*	52,379	44,164	*11,683*	55,846
Lower Delaware	1,747	*54,857*	56,603	1,544	*56,937*	58,481	1,417	*55,383*	56,801	1,278	*56,671*	57,949	1,466	*56,701*	58,167	1,323	*58,286*	59,609	4,663	*50,989*	55,652	1,920	*55,689*	57,609
Yearly total	248,861	*171,130*	419,991	260,357	*180,951*	441,308	256,104	*175,038*	431,142	260,956	*183,672*	444,627	261,016	*184,128*	445,145	267,647	*184,563*	452,210	243,866	*174,148*	418,014	256,972	*179,090*	436,063

Table 11. Total water withdrawals in 1990-96 by watershed management area (millions of gallons)

Watershed Management Area	YEAR																					Average withdrawals, 1990-1996		
	1990			1991			1992			1993			1994			1995			1996					
	Source			Source			Source			Source			Source			Source			Source			Source		
	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total
Passaic (Water Region 1)																								
Pompton, Pequannock, Wanaque and Ramapo	67,437	*5,745*	73,181	88,776	*5,945*	94,721	91,755	*5,513*	97,268	91,191	*6,270*	97,461	84,195	*5,780*	89,976	93,339	*5,872*	99,211	67,845	*5,679*	73,524	83,506	*5,829*	89,335
Lower Passaic and Saddle	183,218	*7,972*	191,191	134,628	*8,414*	143,042	116,556	*8,401*	124,957	120,781	*9,616*	130,397	103,377	*8,876*	112,253	76,701	*8,565*	85,266	76,118	*8,815*	84,933	115,911	*8,666*	124,577
Hackensack and Pascack	34,148	*2,079*	36,227	31,912	*2,133*	34,046	29,224	*2,057*	31,281	28,845	*2,346*	31,191	34,831	*2,125*	36,957	27,245	*2,193*	29,438	32,838	*1,998*	34,835	31,292	*2,133*	33,425
Upper Passaic, Whippany and Rockaway	25,287	*21,195*	46,482	22,855	*21,935*	44,790	21,636	*21,060*	42,696	21,772	*21,763*	43,535	19,513	*21,692*	41,205	20,168	*20,929*	41,097	20,765	*21,359*	42,124	21,714	*21,419*	43,133
sum	310,090	*36,990*	347,080	278,171	*38,428*	316,599	259,171	*37,031*	296,201	262,589	*39,995*	302,584	241,917	*38,474*	280,391	217,453	*37,558*	255,012	197,564	*37,852*	235,416	252,422	*38,047*	290,469
Raritan (Water Region 2)																								
Elizabeth, Rahway and Woodbridge	4,990	*6,093*	11,083	6,433	*6,781*	13,214	4,842	*6,408*	11,251	4,443	*6,030*	10,473	4,548	*5,954*	10,502	4,713	*5,803*	10,516	4,024	*5,228*	9,252	4,856	*6,042*	10,899
North and South Branch Raritan	456	*6,184*	6,640	386	*6,349*	6,735	397	*6,451*	6,847	460	*7,204*	7,664	441	*7,335*	7,776	470	*7,334*	7,804	411	*7,012*	7,423	432	*6,838*	7,270
Lower Raritan, South and Lawrence	37,374	*18,148*	55,522	36,054	*20,205*	56,260	34,611	*18,651*	53,262	37,913	*21,445*	59,358	43,625	*22,782*	66,407	43,994	*21,208*	65,202	44,245	*21,907*	66,153	39,688	*20,621*	60,309
Millstone	172	*5,658*	5,830	208	*5,977*	6,185	209	*5,852*	6,061	243	*6,205*	6,448	208	*6,200*	6,408	312	*5,993*	6,304	95	*5,546*	5,641	207	*5,919*	6,125
sum	42,992	*36,083*	79,075	43,081	*39,312*	82,394	40,058	*37,362*	77,421	43,060	*40,883*	83,943	48,822	*42,271*	91,094	49,488	*40,337*	89,826	48,776	*39,693*	88,469	45,183	*39,420*	84,603
Atlantic Coastal (Water Region 3)																								
Monmouth County	17,728	*9,827*	27,555	17,002	*7,091*	24,093	17,934	*6,072*	24,006	17,310	*6,771*	24,080	17,019	*6,321*	23,340	18,579	*6,290*	24,869	15,761	*5,667*	21,428	17,333	*6,862*	24,196
Barnegat Bay	4,166	*18,557*	22,724	1,591	*20,379*	21,969	863	*20,148*	21,011	1,103	*20,969*	22,072	1,817	*21,218*	23,035	1,984	*21,439*	23,423	1,893	*21,594*	23,487	1,917	*20,615*	22,532
Mullica and Wading	12,953	*14,719*	27,671	19,273	*14,815*	34,089	16,537	*13,865*	30,402	20,785	*15,850*	36,635	20,011	*19,249*	39,260	32,301	*14,696*	46,997	15,871	*13,840*	29,711	19,676	*15,291*	34,966
Great Egg Harbor and Tuckahoe	2,549	*15,415*	17,964	1,697	*18,902*	20,599	2,006	*19,243*	21,249	2,242	*19,924*	22,166	1,944	*19,261*	21,205	1,347	*18,745*	20,092	2,368	*17,222*	19,590	2,022	*18,387*	20,409
Cape May County	4	*5,124*	5,127	4	*5,448*	5,452	29	*5,310*	5,339	34	*5,846*	5,880	13	*5,376*	5,388	29	*5,537*	5,566	13	*5,581*	5,594	18	*5,460*	5,478
sum	37,400	*63,642*	101,042	39,568	*66,634*	106,202	37,370	*64,637*	102,007	41,474	*69,360*	110,835	40,804	*71,424*	112,228	54,240	*66,707*	120,947	35,906	*63,904*	99,810	40,966	*66,616*	107,582
Upper Delaware (Water Region 4)																								
Upper Delaware	105,323	*13,722*	119,045	91,807	*14,191*	105,998	86,799	*14,298*	101,097	57,309	*14,767*	72,077	68,092	*15,388*	83,479	88,868	*16,009*	104,877	76,432	*13,551*	89,982	82,090	*14,561*	96,651
Walkill, Pohuck and Papakating	605	*1,600*	2,205	646	*1,644*	2,290	591	*1,774*	2,365	663	*1,982*	2,646	445	*2,144*	2,589	448	*2,056*	2,504	547	*2,079*	2,625	564	*1,897*	2,461
Central Delaware	253,092	*3,141*	256,233	219,674	*3,359*	223,034	233,783	*3,545*	237,327	244,050	*3,880*	247,930	236,748	*3,816*	240,564	219,903	*3,887*	223,790	207,421	*3,673*	211,094	230,667	*3,614*	234,282
sum	359,020	*18,463*	377,483	312,127	*19,195*	331,322	321,172	*19,617*	340,789	302,023	*20,630*	322,652	305,285	*21,347*	326,632	309,219	*21,952*	331,171	284,399	*19,303*	303,702	313,321	*20,072*	333,393
Lower Delaware (Water Region 5)																								
Maurice, Salem and Cohansey	17,076	*18,891*	35,967	24,555	*18,985*	43,540	31,708	*17,096*	48,804	26,486	*19,751*	46,237	28,456	*22,259*	50,715	29,098	*23,007*	52,105	21,842	*20,623*	42,465	25,603	*20,087*	45,690
Lower Delaware	21,958	*25,027*	46,985	29,080	*26,420*	55,499	26,809	*20,467*	47,276	22,018	*20,594*	42,612	13,641	*19,386*	33,027	15,529	*19,764*	35,294	16,821	*23,570*	40,391	20,837	*22,175*	43,012
Rancocas	6,970	*23,486*	30,457	6,875	*23,839*	30,714	2,615	*29,437*	32,052	6,461	*28,398*	34,858	5,227	*28,886*	34,114	8,759	*31,802*	40,561	4,519	*20,205*	24,724	5,918	*26,579*	32,497
Crosswicks	14,311	*5,091*	19,402	11,153	*5,554*	16,708	4,382	*5,638*	10,020	15,249	*5,893*	21,143	39,612	*5,536*	45,147	38,169	*5,597*	43,766	35,997	*5,609*	41,606	22,696	*5,560*	28,256
sum	60,315	*72,495*	132,810	71,663	*74,798*	146,461	65,514	*72,639*	138,153	70,214	*74,636*	144,850	86,936	*76,067*	163,003	91,555	*80,170*	171,725	79,179	*70,006*	149,185	75,054	*74,402*	149,455
Source total withdrawals	809,816	*227,674*	1,037,490	744,611	*238,367*	982,978	723,285	*231,286*	954,571	719,359	*245,504*	964,864	723,764	*249,583*	973,347	721,956	*246,724*	968,680	645,824	*230,759*	876,582	726,945	*238,557*	965,502

1990-96 the Passiac WR had the greatest average volume of potable-water withdrawals, 185 bg as well as the greatest average volume of potable surface water withdrawals, 151 g. The Lower Delaware had, on average, the greatest volume of ground-water withdrawals for potable use, 56 bg.

Table 12. Size of watershed management areas

No.	Watershed Management Area	Area ($mi.^2$)	Percent of state
1	Upper Delaware	746	9.6
2	Walkill, Pohuck and Papakating	208	2.7
3	Pompton, Pequannock, Wanaque and Ramapo	238	3.1
4	Lower Passaic and Saddle	181	2.3
5	Hackensack and Pascack	165	2.1
6	Upper and Middle Passaic, Whippany and Rockaway	369	4.7
7	Elizabeth, Rahway and Woodbridge	180	2.3
8	North and South Branch Raritan	468	6.0
9	Lower Raritan, South and Lawrence	352	4.5
10	Millstone	285	3.7
11	Central Delaware	272	3.5
12	Monmouth County	333	4.3
13	Barnegat Bay	664	8.5
14	Mullica and Wading	626	8.0
15	Great Egg Harbor and Tuckahoe	590	7.6
16	Cape May County	241	3.1
17	Maurice, Salem and Cohansey	668	8.6
18	Lower Delaware	493	6.3
19	Rancocas	465	6.0
20	Crosswicks	246	3.2

During the period 1990-96 the Central Delaware WMA had the greatest average volume of total and surface-water withdrawals, 234 bg and 231 bg respectively. Most of this water was used for power generation as detailed in appendix 3, table 3-11. The Rancocas WMA had the greatest average annual ground-water withdrawal, 27 bg. The greatest 1-year surface-water withdrawal was 253 bg in 1990 in the Central Delaware WMA; the greatest 1-year ground-water withdrawal was 22 bg in 1995 in the Rancocas WMA.

Table 13. Size of water regions

No.	Water Region	Area ($mi.^2$)	Percent of state
1	Passaic	953	12.2
2	Raritan	1,284	16.5
3	Atlantic Coastal	2,453	31.5
4	Upper Delaware	1,226	15.7
5	Lower Delaware	1,872	24.0

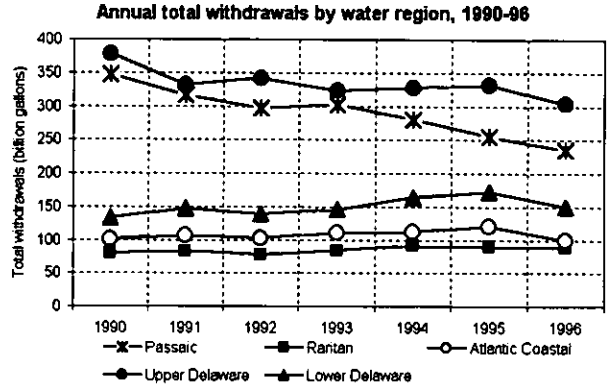

Figure 11. Annual total withdrawals by water region, 1990-96.

Withdrawals by Physiographic Province

New Jersey consists of four physiographic provinces. These are, from northwest to southeast, Valley & Ridge, Highlands, Piedmont, and Coastal Plain (fig. 3). Each province is generally marked by a distinctive topography and underlain by a characteristic geology. The area of each, and its percentage of New Jersey's total area, is shown in table 16. The following description of the provinces is excerpted from the NJ Geological Survey, 1994.

Table 16. Size of physiographic provinces

Province	Area ($mi.^2$)	Percent of state
Coastal Plain	4, 668	59.9
Highlands	1, 009	13.0
Piedmont	1, 582	20.3
Valley and Ridge	528	6.8

Table 14. Total water withdrawals in 1990-1996 by physiographic province and water source (millions of gallons)

Physiographic province	YEAR																					Average total withdrawals		
	1990			1991			1992			1993			1994			1995			1996					
	Source			Source			Source			Source			Source			Source			Source			Source		
	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total
Coastal Plain	292,710	*139,931*	432,642	275,874	*145,478*	421,352	283,505	*139,620*	423,125	295,331	*148,049*	443,380	305,992	*151,534*	457,526	315,566	*149,790*	465,356	278,540	*137,162*	415,702	292,503	*144,509*	437,012
Highlands	120,952	*22,651*	143,603	115,133	*23,493*	138,626	109,638	*23,509*	133,147	84,431	*25,322*	109,754	102,493	*26,352*	128,845	115,335	*26,525*	141,860	104,241	*23,882*	128,123	107,461	*24,534*	131,994
Piedmont	338,124	*48,185*	386,308	297,523	*52,278*	349,801	273,568	*50,834*	324,403	282,600	*54,675*	337,274	269,420	*54,082*	323,502	233,869	*52,544*	288,414	217,627	*51,766*	269,394	273,247	*52,052*	325,299
Valley & Ridge	58,030	*16,907*	74,937	56,081	*17,118*	73,199	56,574	*17,322*	73,896	56,998	*17,458*	74,456	45,859	*17,616*	63,474	57,185	*17,864*	75,050	45,416	*17,948*	63,364	53,735	*17,462*	71,197
Yearly total	809,816	*227,674*	1,037,490	744,611	*238,367*	982,978	723,285	*231,286*	954,571	719,359	*245,504*	964,864	723,764	*249,583*	973,347	721,956	*246,724*	968,680	645,824	*230,759*	876,582	726,945	*238,557*	965,502

Table 15. Potable water withdrawals in 1990-1996 by physiographic province and water source (millions of gallons)

Physiographic province	YEAR																					Average total withdrawals		
	1990			1991			1992			1993			1994			1995			1996					
	Source			Source			Source			Source			Source			Source			Source			Source		
	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total	surface water	*ground water*	Total
Coastal Plain	22,205	*98,124*	120,330	19,393	*102,946*	122,340	20,734	*98,258*	118,991	20,643	*102,695*	123,337	20,787	*102,533*	123,320	22,297	*104,312*	126,609	24,468	*93,945*	118,413	21,504	*100,402*	121,906
Highlands	72,991	*14,838*	87,829	78,543	*15,754*	94,297	78,570	*15,609*	94,179	83,147	*16,723*	99,870	79,632	*16,836*	96,468	82,879	*16,636*	99,515	72,355	*16,488*	88,843	78,303	*16,126*	94,429
Piedmont	153,041	*41,434*	194,475	161,783	*45,307*	207,089	156,207	*44,073*	200,281	156,490	*47,024*	203,513	160,147	*47,363*	207,510	162,015	*46,098*	208,113	146,607	*46,053*	192,660	156,613	*45,336*	201,949
Valley & Ridge	624	*16,734*	17,357	637	*16,944*	17,582	592	*17,098*	17,691	677	*17,230*	17,907	450	*17,396*	17,847	457	*17,517*	17,974	437	*17,662*	18,099	554	*17,226*	17,780
Yearly total	248,861	*171,130*	419,991	260,357	*180,951*	441,308	256,104	*175,038*	431,142	260,956	*183,672*	444,627	261,016	*184,128*	445,145	267,647	*184,563*	452,210	243,866	*174,148*	418,014	256,972	*179,090*	436,063

The Valley & Ridge Province occupies northwestern New Jersey. It is underlain by faulted and folded sedimentary layers of sandstone, shale and limestone that range in age from Cambrian to Devonian (570 to 345 million years old). Alternating belts of erosion-resistant sandstone and easily-eroded shale and limestone create the long, parallel northeast-southwest trending ridges and valleys characteristic of this province.

The Highlands Province is south and east of the Valley & Ridge. It is underlain predominantly by granite, gneiss and some marble of Precambrian age (1.3 billion to 750 million years old). Granite and gneiss are resistant to erosion and underlie a hilly upland dissected by the deep, steep-sided valleys of major streams. Several northeast-southwest trending belts of sedimentary rocks (equivalent in age to the rocks of the Valley & Ridge Province) are in the Highlands. These belts form long, parallel ridges and valleys. The Highlands is bounded on the southeast by the Piedmont Province and separated from it by a series of major faults, including the Ramapo and Flemington Faults.

The Piedmont Province is primarily underlain by interbedded sandstone, siltstone, mudstone, shale, conglomerate, basalt and diabase of Late Triassic and Early Jurassic age (230 to 190 million years old). Small areas are underlain by older carbonates and crystalline rocks. The land surface is a broad lowland interrupted by long, generally northeast-southwest trending ridges underlain by erosionally-resistant basalt and diabase.

The Coastal Plain Physiographic Province lies southeast of a line running from Trenton to Carteret (the 'Fall Line'). It is underlain by unconsolidated and semiconsolidated sediments ranging from Cretaceous to Miocene in age (135 to 5.3 million years old). These sediments consist of layers of sand, silt and clay that dip gently to the southeast and continue under the Atlantic Ocean (fig. 4). They range in thickness from a featheredge along their northwest border with the Piedmont Province to more than 4,500 feet near Atlantic City. The Coastal Plain is generally flat to very gently undulating. However, resistant gravel or iron-cemented sediments underlie upland areas and isolated hills.

Table 14 shows annual total withdrawals by physiographic province. The Coastal Plain supplies the surface and ground water, at an average annual rate of 293 and 145 bg respectively.

Table 15 shows annual withdrawals of potable water. The Piedmont Province supplies, on average, the largest volume of potable water (202) bg. It also supplies the most of surface water intended for potable use (157 bg). This is primarily due to several surface-water reservoirs located on this province in Morris and Passaic Counties. Aquifers in the Coastal Plain supply the largest volume ground water destined for potable use, an average of 101 bg annually during the period 1990-96.

Ground-Water Withdrawals by Aquifer

New Jersey is underlain by geologic units of many different types and ages. An aquifer is a geologic unit that can yield economically useful quantities of water. The ability of New Jersey's aquifers to yield water varies widely and depends on many factors. In general, sands and gravels and limestones form the most productive aquifers, whereas clays, silts and crystalline rocks are the poorest. Additional discussion of the aquifers of New Jersey is given in Herman and others (1998).

The aquifers of New Jersey are combined for this report into 14 different aquifer groups. Two additional groups are included, one for estimated withdrawals from domestic wells, and one for withdrawals from wells where the purveyor has not specified an aquifer.

Withdrawals from domestic wells cannot be assigned to individual units based on available data. Thus withdrawals assigned to each aquifer group are actually underreported. In counties with significant number of domestic wells and few public water systems (such as Warren and Sussex Counties) these small-diameter wells account for as much as 50 percent of total ground-water withdrawals.

Table 17 lists the aquifer groups and the general geologic units assigned to each. The Potomac-Raritan-Magothy (PRM) aquifer can be divided into three water-bearing units - upper, middle and lower. Where possible, PRM withdrawals are assigned to one of these units. However, some purveyors do not specify from which PRM unit a well is withdrawing water. Accordingly, a separate category is included for unspecified PRM withdrawals.

Table 17. Aquifer groups and aquifers

Aquifer group[1]	Aquifer
A	glacial deposits in northern New Jersey
B	surficial deposits in southern New Jersey
C	Kirkwood, Cohansey
D	Rio Grande, Atlantic City 800-foot sand
E	Piney Point, Vincentown
F	Wenonah, Mt Laurel, Englishtown
G	upper Potomac-Raritan-Magothy
H	middle Potomac-Raritan-Magothy
I	lower Potomac-Raritan-Magothy
J	undifferentiated Potomac-Raritan-Magothy
K	Brunswick Group
L	Lockatong, Stockton
M	limestone, dolomite and marble in the Valley and Ridge and Highlands Provinces
N	all other consolidated bedrock in the Valley and Ridge and Highlands Provinces
P	unknown (not specified in BWA records
Q	domestic well pumpage, no aquifer specified

1. From Hoffman and Mennel, 1997.

Table 18 lists total annual water withdrawals from the aquifer groups. Tables in Appendix 1 show annual ground-water withdrawals from each county by aquifer group. Appendix 5 summarizes withdrawals in seven tables (one for each year between 1990 and 1996) by county and aquifer group. A detailed list of all geologic units in New Jersey with reported withdrawals and which aquifer group each is assigned to is included as appendix 6.

The Potomac-Raritan-Magothy aquifer system supplies by far the largest volume of ground water, 72 bg annually, on average. The productivity of this unit is well known and relied upon by many municipalities in southern New Jersey.

Withdrawals In Water Supply Critical Areas

As a means of addressing significant ground-water declines in the New Jersey Coastal Plain the DEP instituted a 'water supply critical areas' program in the 1980s. Two water supply critical areas were defined, the first in the northeast Coastal Plain and the second in the Camden area (fig. 12). More information on these areas is available from the Bureau of Water Allocation (BWA), NJDEP.

Each water supply critical area applies to a specific set of aquifers. Each aquifer has a defined 'depleted zone' where ground-water levels have declined so significantly that the resource is in danger. Bordering each depleted zone is a 'threatened margin' where ground-water declines may accelerate salt-water intrusion. The DEP has ordered reductions in ground-water withdrawals in the depleted zones of the affected aquifers and no additional withdrawals in the threatened margins (table 19). The plan is that a reduction in withdrawals will allow ground-water levels to recover to acceptable levels. BWA assigns a code to all production wells based on well location, aquifer tapped, and withdrawal volums (table 20).

Water supply critical area 1 applies to four aquifers: the Wenonah-Mt. Laurel, the Englishtown, the upper

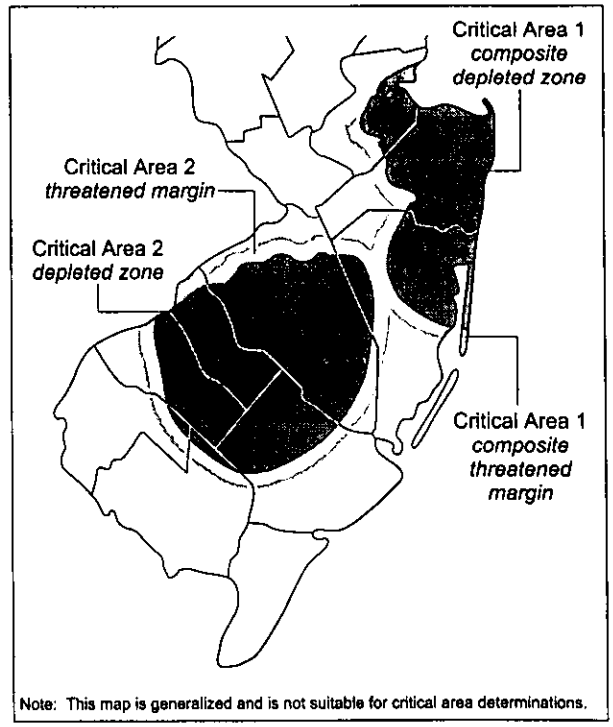

Figure 12. Water Supply critical areas on New Jersey

Table 18. Total water withdrawals in 1990-1996 by aquifer group (millions of gallons)

Year	AQUIFER GROUP																Total
	northern New Jersey surficial[a]	southern New Jersey surficial[a]	Kirkwood & Cohansey	Rio Grande, 800-foot-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Potomac-Raritan-Magothy				Brunswick supergroup	Lockatong, Stockton	Paleozoic and Proterzoic		Unknown	Domestic wells[a]	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	28,800	2,050	46,616	6,795	1,309	6,432	18,317	15,379	13,514	25,015	19,640	699	6,367	1,919	5,752	29,069	227,674
1991	32,889	2,144	51,954	6,511	2,032	5,692	23,758	21,621	20,898	8,362	23,375	992	6,092	2,136	551	29,361	238,367
1992	30,912	1,192	51,529	6,342	1,949	5,395	22,452	19,604	22,705	6,203	23,704	974	6,140	2,291	273	29,621	231,286
1993	33,613	3,349	53,358	7,155	1,987	5,899	22,753	20,166	21,828	9,177	25,544	1,050	6,649	2,424	639	29,913	245,504
1994	32,235	3,736	54,872	7,331	1,714	9,223	23,288	21,546	21,210	6,246	25,795	1,065	7,940	2,771	398	30,213	249,583
1995	31,784	3,507	53,811	7,442	2,229	6,844	23,768	21,484	22,411	5,517	24,426	877	8,403	2,933	797	30,490	246,724
1996	29,670	3,462	50,431	7,340	1,765	5,667	22,197	18,277	18,853	6,140	23,641	796	7,989	2,771	977	30,782	230,759
average	31,415	2,777	51,796	6,988	1,855	6,450	22,362	19,725	20,203	9,523	23,732	922	7,083	2,464	1,341	29,921	238,557

a) Not shown on figure 3.

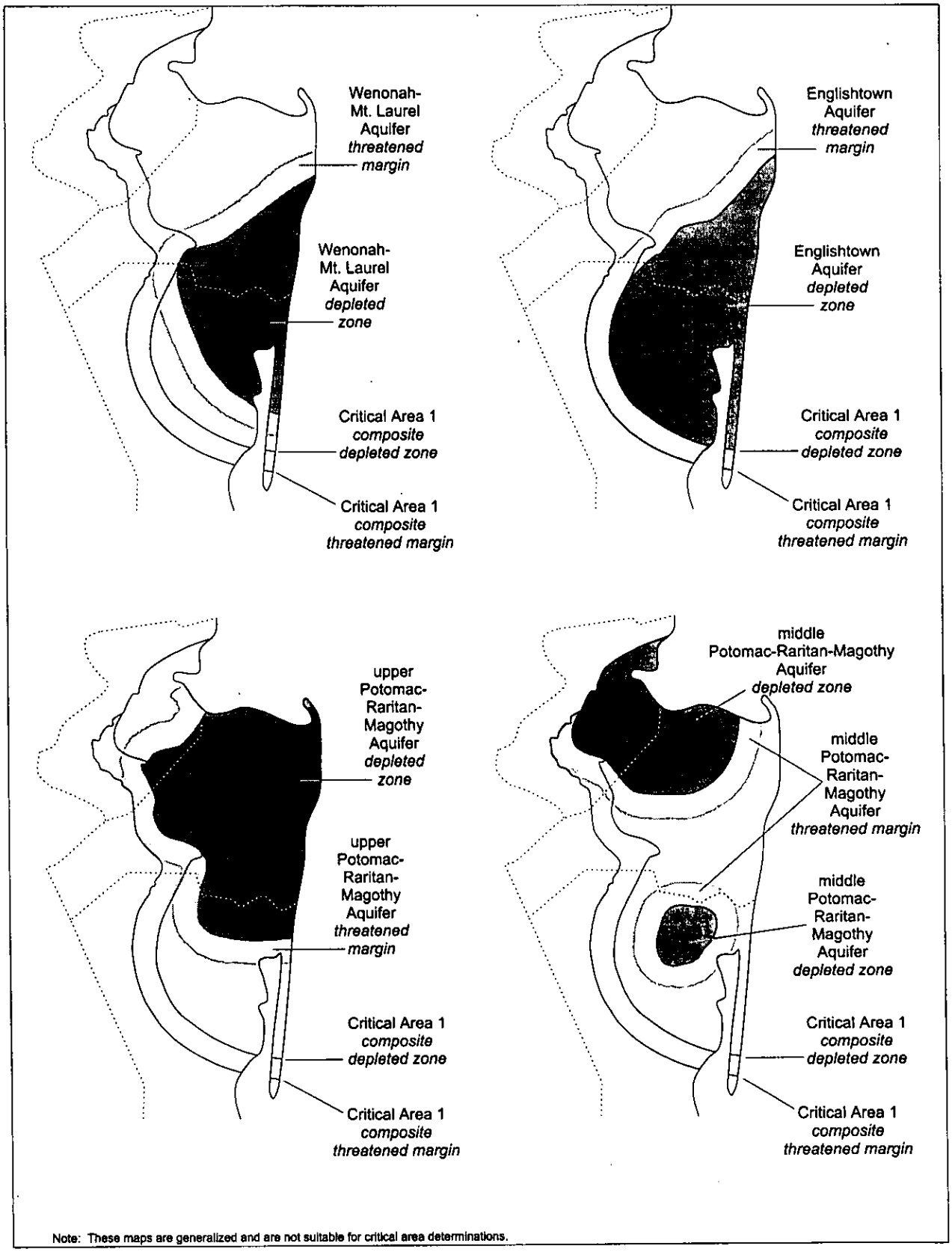

Figure 13. Depleted zones and threatened margins for water supply critical area 1.

Table 19. Pumping reductions ordered for regulated aquifers in Water Supply Critical Areas 1 and 2

Water Supply Critical Area	Aquifer	Zone or margin	Pumping reductions cutback to:
1	Mt. Laurel-Wenonah	Depleted zone	50 percent of 1983 rates
		Threatened margin	1983 rates
	Englishtown	Depleted zone	50 percent of 1983 rates
		Threatened margin	1983 rates
	Upper Potomac-Raritan-Magothy (Old Bridge Sand)	Depleted zone	60 percent of 1983 rates
		Threatened margin	1983 rates
	Middle Potomac-Raritan-Magothy (Farrington Sand)	Depleted zone	50 percent of 1983 rates
		Threatened margin	1983 rates
2	All Potomac-Raritan-Magothy units	Depleted zone	Average of 78 percent of 1983 rates
		Threatened margin	maximum yearly rate reported between 1983 and 1991

Potomac-Raritan-Magothy (PRM), and the middle PRM. Each aquifer has its own depleted zone and threatened margin (fig. 13). A 'composite' critical area consists of the surface expression of each of the four aquifers and is shown in figure 12. Most withdrawal reductions in water supply critical area 1 were implemented in 1990 as supplies from the new Manasquan Reservoir became available.

Table 20. Codes for Water Supply Critical Area wells

Code no.	Meaning
1	Well is in the depletd zone of a regulated aquifer
2	Well is in the threatened margin of a regulated aquifer
3	Well is within the composited area of a critical area but does not tap a regulated aquifer
4	Well is not loacated in a critical area
5	Well taps the depleted zone or threatened margin of a regulated aquifer but produces less than 3.1 million gallons per month

Water supply critical area 2 restricts withdrawals from three aquifers, the upper, middle and lower PRM aquifers in the Camden area (fig 12). The depleted zone and threatened margin for each aquifer are the same. Withdrawal reductions in water supply critical area 2 are being implemented as alternative water sources become available. By 1996 few of these alternative water sources had come online (Robert Oberthaler, NJDEP BWA, personal communication, 1998).

Table 21 and figure 14 show yearly withdrawals from the depleted zone and threatened margin for water supply critical area 1. Ground-water withdrawals from the depleted zones of the four aquifers declined from approximately 9 billion gallons in 1990 to 6.5 billion gallons in 1996. The most significant declines have been in middle PRM where withdrawals from the depleted zone have declined from 3.4 to 1.6 billion gallons between 1990 and 1996, a 53 percent reduction. Note that the middle PRM aquifer has two separate depleted zones and threatened margins (fig 13). The pumping reductions have resulted in a significant rise in water levels as indicated by the Allair observation well, tapping the Englishtown aquifer in Monmouth County (fig. 16).

Table 22 and figure 15 show yearly withdrawals from the depleted zone and threatened margin for water supply critical area 2. Although water supply critical area 2 includes parts of Ocean, Atlantic, Cumberland and Salem counties (fig. 12) no withdrawals are reported from the three regulated aquifers in these counties.

Tables 21 and 22 include withdrawals from the undifferentiated PRM. This is required because some purveyors do not report which specific PRM aquifer (upper, middle or lower) supplies water to the well. For water supply critical area 2 the depleted zone of each

Table 21. Withdrawals in water supply critical area 1, 1990-1996 (millions of gallons)

County	Aquifer	YEAR																		
		1990			1991			1992			1993			1994			1995			1996		
		Zone			Zone			Zone			Zone			Zone			Zone			Zone		
		Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL
Middlesex	PRM, upper	12	4,181	4,192	162	6,331	6,494	47	6,333	6,379	108	6,105	6,213	233	5,927	6,160	202	6,069	6,271	179	6,141	6,320
	PRM, middle&lower	1,141	163	1,304	2,427	125	2,551	2,625	114	2,739	3,160	199	3,359	3,354	206	3,560	2,445	64	2,509	1,964	52	2,016
	undifferentiated	0	205	205	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	county sum:	1,153	4,548	5,702	2,589	6,456	9,045	2,672	6,446	9,118	3,268	6,305	9,572	3,587	6,132	9,720	2,647	6,133	8,780	2,143	6,193	8,336
Monmouth	Wenonah-Mt Laurel	369	0	369	146	0	146	172	0	172	221	0	221	154	0	154	186	0	186	143	0	143
	Englishtown	1,231	9	1,240	497	10	507	423	5	428	502	14	515	586	11	597	632	15	647	544	9	552
	PRM, upper	2,758	28	2,786	3,329	25	3,355	2,454	23	2,477	2,838	26	2,863	2,779	44	2,823	3,050	50	3,100	2,613	37	2,650
	PRM, middle&lower	2,896	83	2,979	2,089	508	2,597	1,195	208	1,403	1,152	206	1,357	1,021	246	1,268	1,062	272	1,334	846	207	1,053
	undifferentiated	1,282	475	1,757	168	0	168	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	county sum:	8,536	596	9,132	6,229	543	6,771	4,245	236	4,481	4,712	245	4,957	4,540	302	4,841	4,931	336	5,267	4,145	253	4,398
Ocean	Englishtown	336	0	336	1,375	0	1,375	1,113	0	1,113	814	0	814	665	0	665	713	0	713	637	0	637
	PRM upper	135	0	135	656	40	695	558	72	630	611	114	726	701	50	751	631	46	677	682	47	728
	PRM, middle&lower	0	449	449	1,802	540	2,342	1,848	516	2,363	1,903	491	2,395	1,133	267	1,400	1,187	424	1,611	1,071	613	1,684
	county sum:	471	449	920	3,834	579	4,413	3,518	588	4,106	3,329	606	3,935	2,500	317	2,816	2,532	470	3,001	2,390	660	3,050
	GRAND TOTAL:	10,161	5,593	15,754	12,651	7,578	20,229	10,435	7,270	17,705	11,309	7,156	18,464	10,626	6,751	17,377	10,110	6,939	17,048	8,679	7,105	15,784

Table 22. Withdrawals in water supply critical area 2, 1990-1996 (millions of gallons)

County	Aquifer	YEAR																		
		1990			1991			1992			1993			1994			1995			1996		
		Zone			Zone			Zone			Zone			Zone			Zone			Zone		
		Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL	Depleted	Threatened	TOTAL
Burlington	PRM, upper	1,235	225	1,460	1,980	177	2,157	1,710	151	1,860	2,010	137	2,147	2,133	106	2,239	2,107	123	2,230	1,934	131	2,065
	PRM, middle	125	1,909	2,034	1,437	1,938	3,375	1,393	2,278	3,672	1,569	2,432	4,001	1,924	2,329	4,254	1,802	2,469	4,271	1,733	1,786	3,519
	PRM, lower	914	1,556	2,470	1,268	1,660	2,928	1,371	1,546	2,917	1,117	1,444	2,561	1,091	2,261	3,351	1,371	2,214	3,585	1,256	1,397	2,653
	undifferentiated	2,173	425	2,598	1,213	410	1,623	1,082	428	1,511	1,113	635	1,748	922	362	1,285	1,067	415	1,481	1,062	314	1,376
	county sum:	4,448	4,114	8,562	5,898	4,185	10,083	5,556	4,404	9,960	5,808	4,648	10,456	6,070	5,058	11,128	6,346	5,221	11,567	5,986	3,628	9,614
Camden	PRM, upper	3,799	0	3,799	4,219	0	4,219	4,289	0	4,289	4,211	0	4,211	4,427	0	4,427	4,211	0	4,211	2,993	0	2,993
	PRM, middle	1,546	8	1,554	2,527	0	2,527	2,772	0	2,772	2,460	0	2,460	2,534	4	2,539	2,700	2	2,702	1,785	0	1,785
	PRM, lower	6,574	0	6,574	6,582	24	6,605	7,818	9	7,828	7,574	5	7,579	7,397	8	7,405	7,549	37	7,586	5,511	43	5,555
	undifferentiated	2,164	750	2,914	1,170	1,166	2,335	872	4,568	5,440	915	4,647	5,562	933	4,722	5,655	901	5,628	6,529	1,122	791	1,913
	county sum:	14,082	758	14,840	14,497	1,189	15,686	15,752	4,577	20,329	15,160	4,652	19,812	15,291	4,735	20,026	15,360	5,667	21,027	11,412	834	12,247
Gloucester	PRM, upper	1,474	337	1,811	3,550	357	3,907	3,307	314	3,621	2,962	338	3,300	3,561	313	3,873	3,508	382	3,890	3,153	315	3,468
	PRM, middle	448	308	756	717	503	1,221	579	449	1,028	220	461	681	559	527	1,086	687	471	1,158	624	460	1,085
	PRM, lower	1,833	196	2,029	1,529	541	2,070	1,256	926	2,181	1,297	624	1,921	1,429	627	2,056	1,303	653	1,957	1,238	607	1,845
	undifferentiated	1,009	0	1,009	865	309	1,174	942	266	1,209	1,309	339	1,649	226	208	434	113	122	236	313	175	489
	county sum:	4,764	841	5,605	6,662	1,711	8,372	6,084	1,955	8,039	5,788	1,762	7,550	5,775	1,674	7,449	5,611	1,629	7,240	5,329	1,558	6,886
	GRAND TOTAL:	23,294	5,713	29,007	27,057	7,085	34,142	27,392	10,936	38,328	26,756	11,062	37,818	27,136	11,467	38,603	27,318	12,517	39,834	22,726	6,020	28,746

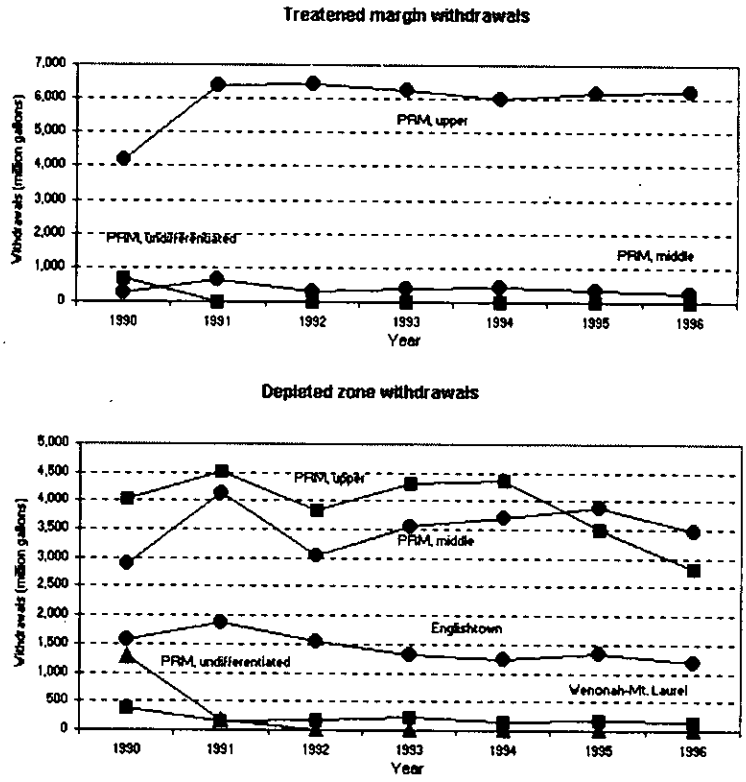

Figure 14. Withdrawals from water supply critical area 1's depleted zone and threatened margin (Note: Scales for graphs differ in order to highlight the range of values.)

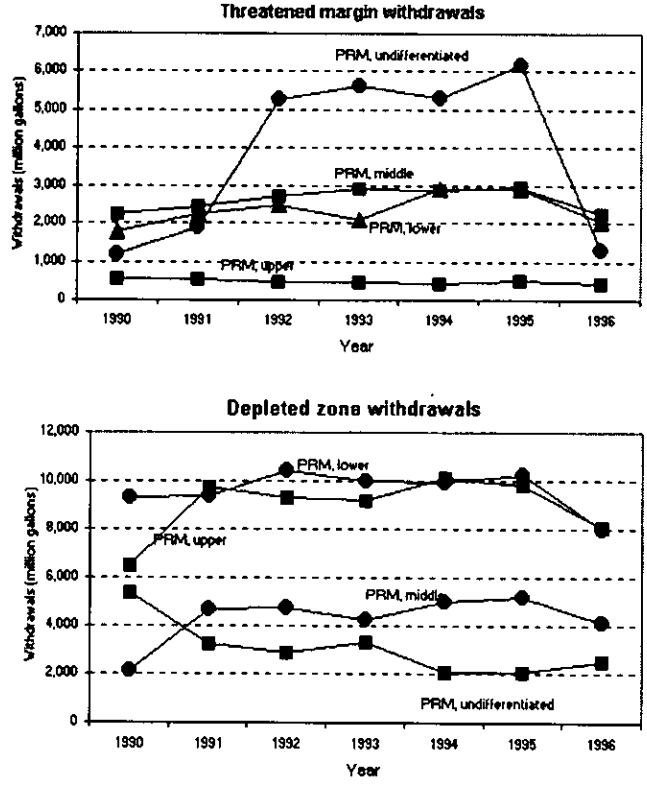

Figure 15. Withdrawals from water supply critical area 2's depleted zone and threatened margin (Note: Scales for graphs differ in order to highlight the range of values.)

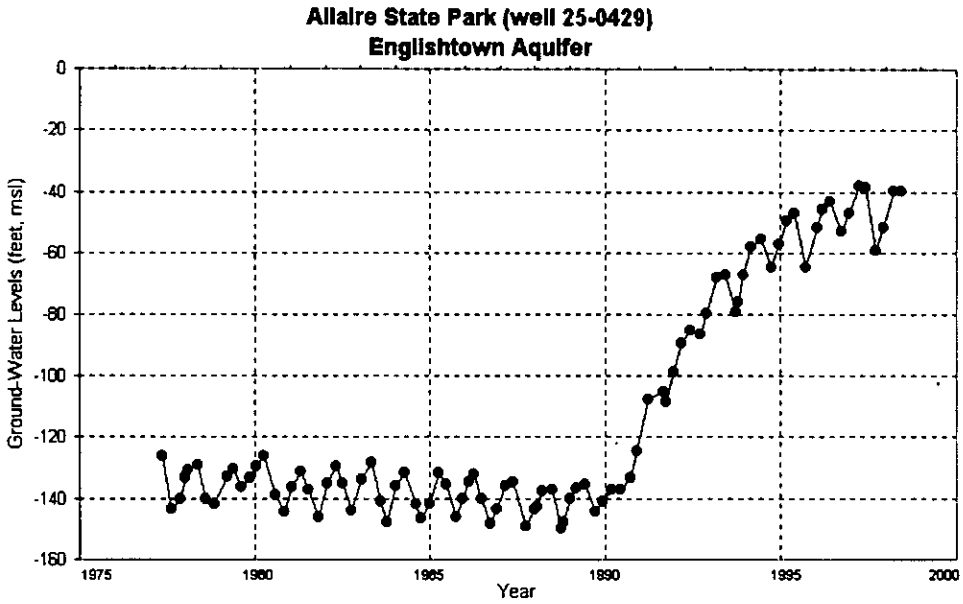

Figure 16. Water levels in the Allaire Observation well, Englishtown Aquifer.

PRM unit is identical so this uncertainty does not create a problem. But in water supply critical area 1 the depleted zone defined in the upper and middle PRM aquifers do not exactly coincide. The Bureau of Water Allocation determined which aquifer to assign the well to in these areas and thus determined if it fell within the regulated part of the affected aquifers.

Withdrawals By Allocation Permit

The Bureau of Water Allocation (BWA) regulates nondomestic withdrawals of fresh water in New Jersey. Domestic wells are not required to obtain a permit to withdraw water, but are required to obtain a permit for the well itself. All users with the capacity to pump 100,000 gallons per day or more are required to obtain an allocation permit, report withdrawals regularly and, depending on the volume of the withdrawals or other significant criteria, perhaps meet additional requirements.

The BWA tracks withdrawals under 1 registration, 3 permit and 1 certification series (table 23). Each is described briefly below and in table 23.

Table 23. Withdrawal summary by allocation registration, permit and certification series (billions of gallons)

Series	Year							Description of series
	1990	1991	1992	1993	1994	1995	1996	
10000W registrations	2.115	2.025	2.820	3.361	3.476	4.075	3.063	surface- & ground-water withdrawals at a rate less than or equal to 100,000 gallons per day
2000P & 2000E permits	142.577	136.890	134.960	99.234	120.461	125.119	115.490	surface- & ground-water withdrawals for industrial, golf-course, and institutional use
4000PS permits	479.743	393.485	390.477	409.525	396.983	367.123	342.858	surface-water withdrawals for industrial and public supply
5000 permits	347.047	370.442	358.155	371.046	373.579	376.934	348.086	surface- & ground-water withdrawals for public supplies
Agricultural certifications	36.939	50.775	38.538	51.785	48.636	64.939	36.303	surface- & ground-water withdrawals for agricultural use
Domestic withdrawals	29.069	29.361	29.621	29.913	30.213	30.490	30.782	ground-water withdrawals by domestic wells for household use
Sum	1,037.490	982.978	954.571	964.864	973.347	968.680	876.582	

The 10000W registration series applies to surface- and ground-water withdrawals at a rate of 100,000 gallons per day or less. This includes withdrawals for potable and nonpotable water supply. Annual withdrawals by the registrations in this series ranged from 2 billion gallons in 1991 to 4 billion gallons in 1995.

The 2000P and 2000E permit series applies to surface-and ground-water withdrawals greater than or equal to100,000 gallons per day for industrial, golf course, remediation and institutional use. Annual withdrawals sanctioned by the permits in this series ranged between 99 billion gallons (in 1993) and 143 billion gallons (in 1990).

The 4000PS permit series applies to surface-water withdrawals greater than or equal to 100,000 gallons per day for industrial and public supply use. Annual withdrawals sanctioned by all permits in this series ranged from 343 billion gallons (in 1996) to 480 billion gallons (in 1990).

The 5000 permit series applies to surface-and ground-water withdrawals greater than or equal to 100,000 gallons per day for public-supply purposes. Annual withdrawals sanctioned by all certifications in this series ranged from 347 billion gallons in 1990 to 377 billion gallons in 1995.

The agricultural certification series applies to surface-and ground-water withdrawals for agricultural use. Reported annual withdrawals sanctioned by all permits in this series range from 36 billion gallons in 1996 to 52 billion gallons in 1993.

Withdrawals from domestic wells are not regulated by the BWA. Withdrawals from these wells are estimated to have risen from 29 billion gallons in 1990 to about 31 billion gallons in 1996 (table 1).

PRECIPITATION AND WITHDRAWALS

Figure 17 and table 24 show precipitation in New Jersey for 1990-96. These data reflect statewide averages as reported by the New Jersey State Climatologist. The driest year was 1995, with an average of 40.81 inches of rain, 1996 the wettest, with 59.98 inches. It is possible to examine the relationship between withdrawals and precipitation. For this analysis withdrawals from domestic wells are excluded because no data are available to break them out by monthly values. The potable, irrigation and agricultural water demands were calculated based on reported monthly withdrawals in the files of the Bureau of Water Allocation.

It is assumed that potable, irrigation and agricultural water use has the strongest correlation with precipitation. Figure 18 is a plot of withdrawals vs. precipitation. In general, the wetter the year, the less water is needed. This correlation is not always exact; 1994 was the third wettest year between 1990 and 1996 but had second highest potable water demand.

Potable, irrigation and agricultural water demands have a strong seasonal component. During the growing season more water is needed. The potable water use group includes all water supplied to homes in New Jersey, including lawn watering in the summer The irrigation use group includes withdrawals for all nonagricultural watering purposes. The agricultural use group includes irrigation for crops and for golf courses. Figures 19, 20 and 21 show precipitation and seasonal water demands for potable, irrigation and agricultural uses, respectively. The data are also shown in table 25. For these tables, winter is defined as the months January-March, spring is April-June, summer is July-September and fall is October-December. The withdrawal data do not allow for a more exact representation of the seasons. Some purveyors did not report monthly withdrawals, only an annual volume. These purveyors were eliminated from the seasonal analysis.

The following analysis is based on data for 1990-96. It is valid only for the range of precipitation observed.

During the spring, withdrawals for potable purposes ranged between 99 and 111 billion gallons. On the average, for every inch of rain exceeding 8 inches received during the spring, the volume of water withdrawn for potable water use fell by 1.4 bg. During the summer (when withdrawals ranged between 104 and 116 bg) withdrawals declined by 1.6 bg for every inch of rain exceeding 11 inches. Fall and winter withdrawals ranged between 89 and 105 bg but do not appear to be correlated with precipitation.

During the spring, withdrawals for nonagricultural irrigation ranged between 0.7 and 1.5 bg. For every inch of rainfall received exceeding 8 inches withdrawals

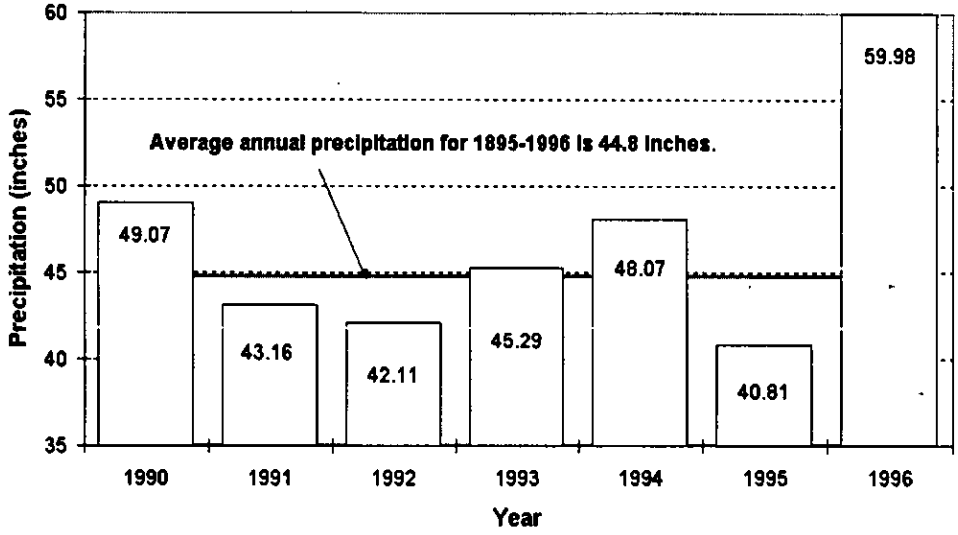

Figure 17. Average New Jersey precipitaton, 1990-1996.

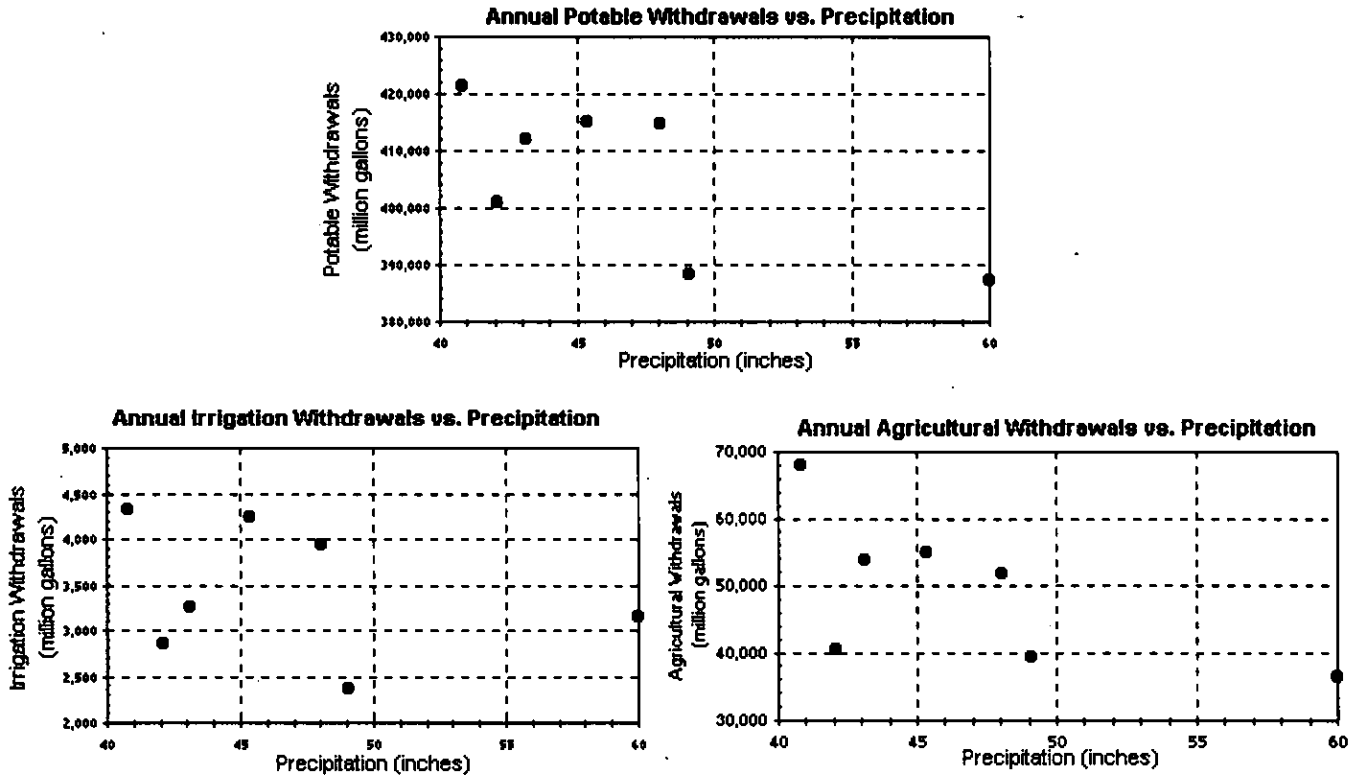

Figure 18. Annual potable, irrigation and agricultural water withdrawals vs. precipitation. (Note: Precipitation data are from the Office of the New Jersey State Climatologist, Rutgers University; withdrawal data are from this report; data for 1990-1996 are shown; scales of the graphs differ in order to highlight the range of values.)

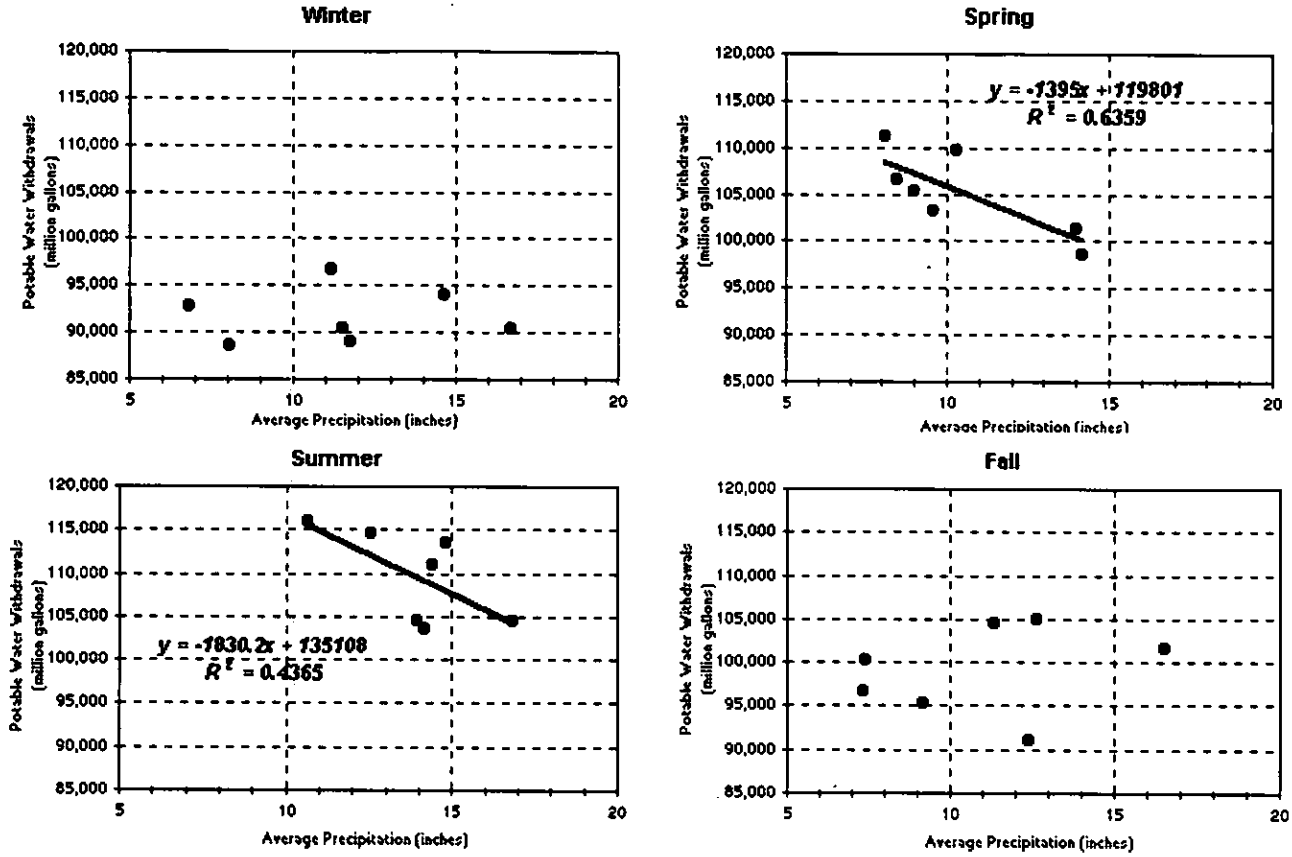

Figure 19. Annual seasonal precipitation and potable water withdrawals. (Note: Precipitation data are from the Office of the New Jersey State Climatologist, Rutgers University; withdrawal data are from this report; data for 1990-1996 are shown.)

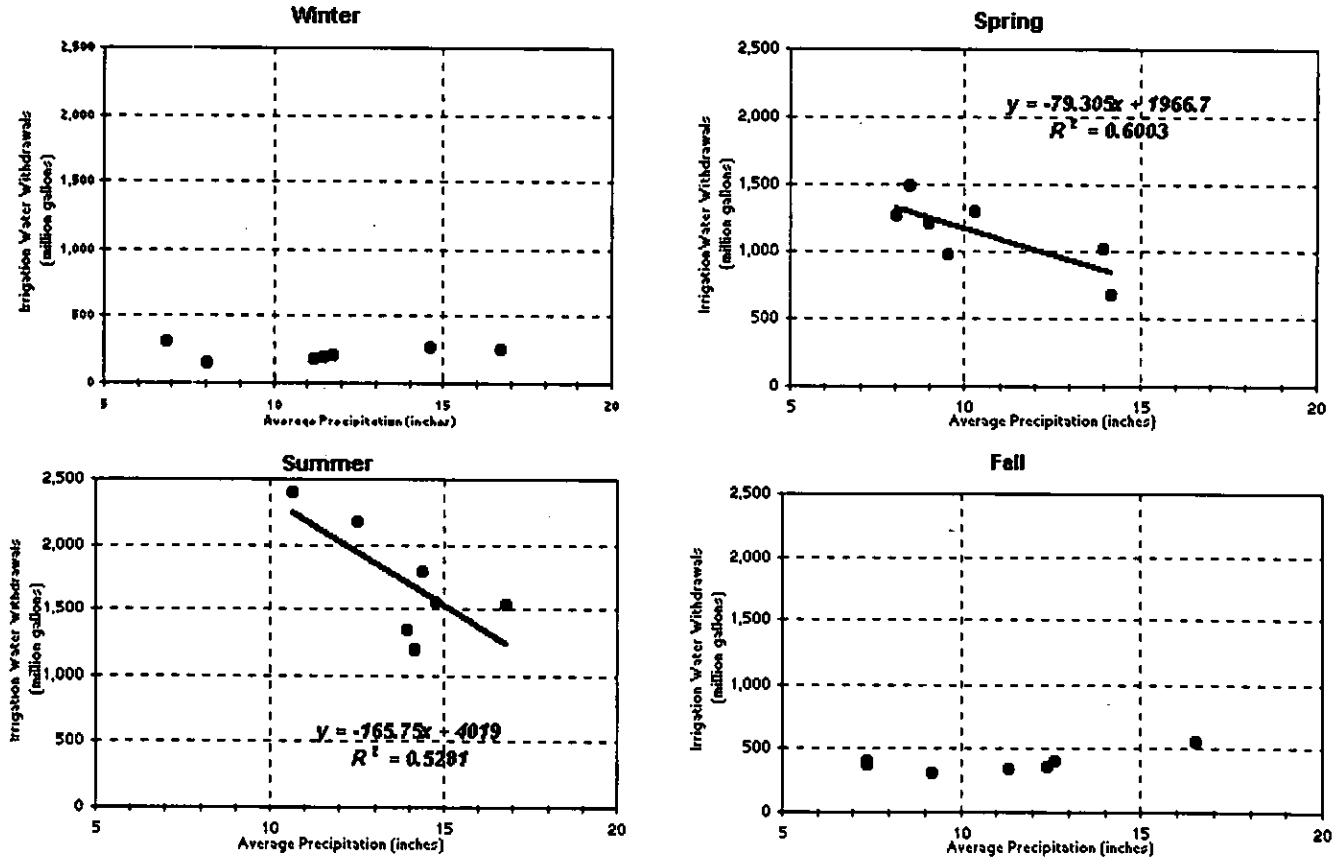

Figure 20. Annual seasonal precipitation and irrigation water withdrawals. (Note: Precipitation data are from the Office of the New Jersey State Climatologist, Rutgers University; withdrawal data are from this report; data for 1990-1996 are shown.)

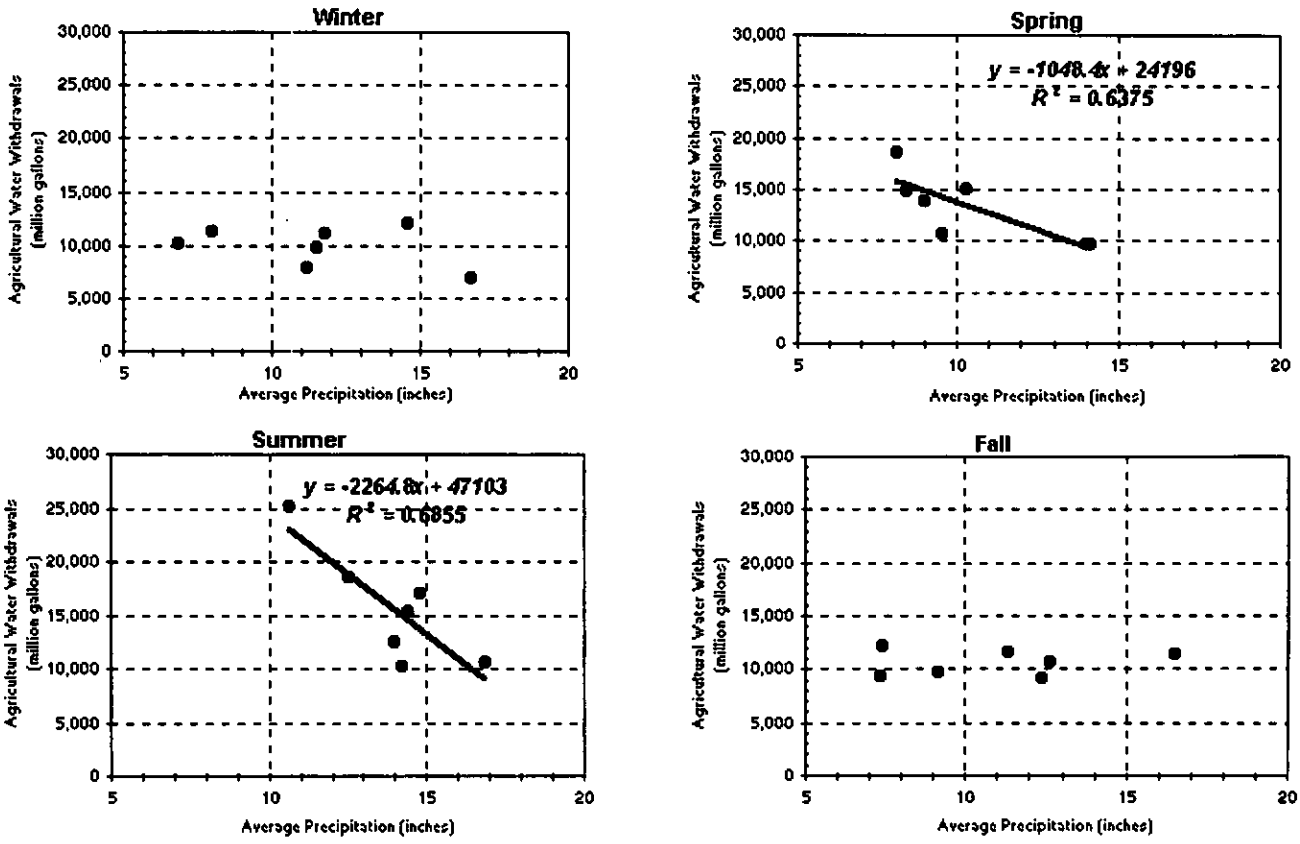

Figure 21. Annual seasonal precipitation and agricultural water withdrawals. (Note: Precipitation data are from the Office of the New Jersey State Climatologist, Rutgers University; withdrawal data are from this report; data for 1990-1996 are shown.)

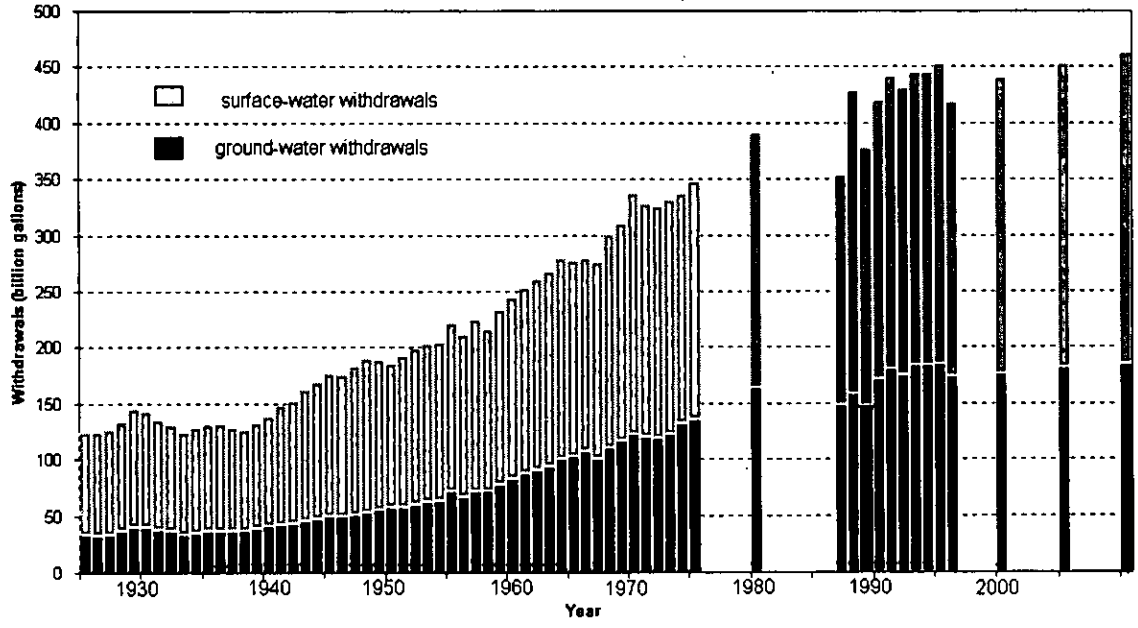

Figure 22. Historical and projected potable water withdrawals and source, 1925-2010. Note: Data sources in table 25. Gaps in graph indicate missing data.

decreased by 79 mg. During the summer, irrigation withdrawals ranged between 1.3 and 2.4 bg with a decline of 166 mg for every inch of rain exceeding 11 inches. Fall and winter withdrawals ranged between 0.15 and 0.56 bg and are not correlated to state-wide average precipitation.

Agricultural withdrawals during the spring ranged between 9.7 and 15.0 bg during the period 1990-96. For each inch of rain received exceeding 8 inches withdrawals decreased by 1.0 bg. During the summer, agricultural demands ranged between 10.1 and 25.1 bg, with a decline of 2.3 bg for every inch of rain exceeding 11 inches. Fall and winter withdrawals ranged between 6.9 and 12.1 bg and are not correlated with rainfall.

This analysis might be improved by looking at monthly instead of seasonal values of water demand and precipitation. It could also be improved by using county-specific monthly rainfall and withdrawals instead of statewide values.

Table 25 shows average precipitation in New Jersey for the period 1990-96. It also shows total and potable water withdrawals expressed as inches of rain. The withdrawals figure is based on dividing reported withdrawals by the area of New Jersey. In general total withdrawals are equivalent to approximately 7 inches of rain, and potable water withdrawals a little over 3 inches.

Table 24. Average precipitation and total and potable water withdrawals (expressed as inches over New Jersey)

Year	Avg ppt (in)[1]	Total withdrawals		Potable withdrawals	
		Volume (inches)	Percent of rain	Volume (inches)	Percent of rain
1990	49.07	7.65	15.6	3.10	6.3
1991	43.16	7.25	16.8	3.26	7.5
1992	42.11	7.04	16.7	3.18	7.6
1993	45.29	7.12	15.7	3.28	7.2
1994	48.07	7.18	14.9	3.28	6.8
1995	40.81	7.15	17.5	3.34	8.2
1996	59.98	6.47	10.8	3.08	5.1

[1] Average precipitation (inches)

HISTORICAL AND PROJECTED WATER DEMAND

Table 25. Seasonal precipitation and potable, irrigation and agricultural water withdrawals, 1990-1996

Season	Year	Precipitation[1] (in)	Withdrawals (millions of gallons) for:		
			Potable water supply[2]	Irrigation[3]	Agriculture[4]
Winter January, February, March	1990	11.50	90,507	186	9,689
	1991	8.03	88,624	147	11,288
	1992	11.20	96,699	169	7,883
	1993	11.77	88,994	197	11,050
	1994	6.84	92,741	299	10,223
	1995	14.63	94,097	262	12,075
	1996	16.71	90,552	251	6,952
Spring April, May, June	1990	14.17	98,688	682	9,712
	1991	8.99	105,363	1,214	13,842
	1992	9.56	103,328	980	10,714
	1993	8.43	106,526	1,479	14,795
	1994	10.29	109,639	1,292	14,990
	1995	8.09	111,235	1,267	18,646
	1996	14.00	101,250	1,022	9,579
Summer July, August, September	1990	14.20	103,689	1,196	10,097
	1991	14.78	113,399	1,551	16,971
	1992	13.97	104,414	1,346	12,474
	1993	12.53	114,646	2,171	18,476
	1994	14.42	110,950	1,789	15,323
	1995	10.67	115,904	2,401	25,114
	1996	16.84	104,478	1,533	10,648
Autumn October, November, December	1990	9.20	95,421	304	9,704
	1991	11.35	104,560	343	11,662
	1992	7.38	96,734	361	9,363
	1993	12.63	105,019	391	10,684
	1994	16.52	101,602	557	11,325
	1995	7.42	100,315	400	12,112
	1996	12.43	90,959	350	9,128

1 Statewide average, based on monthly precipitation data reported by the NJ State Climatologist.
2 Sum of reported monthly withdrawals for potable supply excluding domestic wells
3 Irrigation use for watering for nonagricultural uses (such as golf courses)
4 agricultural use includes irrigation for crops, stock watering and other agricultural practices

Most previous summations of water withdrawals in New Jersey have been confined to potable water. Some, specifically the series of U.S. Geological Survey reports (for example, Nawyn, 1997a), include nonconsumptive demands. This report includes all water demands. Because of the differing scope of these investigations it is in places difficult to compare estimates of water use by different compilers. It is perhaps easiest to compare estimates of potable water demands.

Table 26. Estimated county demands and nonpower withdrawals, 1990 and 1995 (millions of gallons)

County	Year			
	1990		1995	
	Total demand[1]	With-drawals[2]	Total demand[1]	With-drawals[2]
Atlantic	18,493	15,366	19,218	17,936
Bergen	48,570	62,869	48,724	57,425
Burlington	58,997	48,812	62,947	82,019
Camden	30,412	26,947	30,958	26,949
Cape May	10,119	8,769	10,464	8,582
Cumberland	19,208	26,414	19,801	38,688
Essex	63,823	16,985	60,455	12,756
Gloucester	16,726	33,949	17,422	28,894
Hudson	29,834	370	30,694	97
Hunterdon	7,107	64,300	7,590	59,425
Mercer	17,597	16,843	18,072	184,902
Middlesex	53,037	16,707	54,104	20,892
Monmouth	30,759	30,350	31,345	28,465
Morris	20,976	38,805	21,389	39,708
Ocean	24,672	24,198	26,641	23,938
Passaic	23,046	70,943	23,557	153,459
Salem	9,922	8,888	10,135	12,135
Somerset	10,777	39,767	11,234	45,599
Sussex	7,484	6,536	8,049	6,999
Union	36,779	7,394	36,725	10,149
Warren	8,832	41,841	8,976	81,979
sum	547,170	607,054	558,500	940,997

1. From CH2M Hill and others, 1993, task 3.
2. Total withdrawals from this report, excluding power generation.

Table 27. Source of potable water withdrawn in New Jersey, 1925-2010 (billions of gallons)

Year	Water Source		Total	Data source
	surface	ground		
1925	91	33	124	A
1926	93	32	124	A
1927	93	33	126	A
1928	99	36	135	A
1929	106	39	145	A
1930	104	39	143	A
1931	97	38	135	A
1932	94	36	131	A
1933	91	33	124	A
1934	94	34	129	A
1935	96	37	133	A
1936	96	36	132	A
1937	93	36	129	A
1938	91	36	127	A
1939	95	38	133	A
1940	98	41	139	A
1941	106	42	148	A
1942	110	43	152	A
1943	117	45	163	A
1944	123	47	170	A
1945	127	49	177	A
1946	127	49	176	A
1947	136	51	184	A
1948	137	53	190	A
1949	134	55	189	A
1950	129	58	186	A
1951	136	57	193	A
1952	140	59	199	A
1953	142	62	204	A
1954	142	63	204	A
1955	150	71	221	A
1956	146	66	212	A
1957	152	72	224	A
1958	144	72	216	A
1959	157	77	234	A
1960	162	82	244	A
1961	167	87	254	A
1962	171	90	261	A
1963	174	94	267	A
1964	179	101	279	A
1965	176	102	277	A
1966	173	107	280	A
1967	176	100	267	A
1968	191	110	310	A
1969	194	116	310	A
1970	215	123	338	A
1971	208	120	328	A
1972	207	119	326	A
1973	209	123	332	A
1974	205	132	337	A
1975	212	135	347	A
1976	--	--	--	--
1977	--	--	--	--
1978	--		--	--
1979	--	--	--	--
1980	226	164	391	B
1981	--	--	--	--
1982	--	--	--	--
1983	--	--	--	--
1984	--	--	--	--
1985	--	--	--	--
1986	--	--	--	--
1987	205	149	354	C
1988	270	158	428	D
1989	231	147	378	E
1990	249	171	420	F
1991	260	181	441	F
1992	256	175	431	F
1993	261	184	445	F
1994	261	184	445	F
1995	268	185	452	F
1996	244	174	418	F
1997	--	--	--	--
1998	--	--	--	--
1999	--	--	--	--
2000	265	176	441	G
2001	--	--	--	--
2002	--	--	--	--
2003	--	--	--	--
2004	--	--	--	--
2005	272	181	453	G
2006	--	--	--	--
2007	--	--	--	--
2008	--	--	--	--
2009	--	--	--	--
2010	278	185	463	G

Data sources-- A: Havens and Emerson, Inc. and others, 1980; B: Solley, Chanse and Mann, 1983; C: Merend, 1989; D: Sarella, 1992; E: Nawyn and Clawges, 1995; F: this report; G: CH2M Hill and others, 1993.

Figure 22 and table 27 show how the demand for potable water has increased in New Jersey since 1925 and how it is projected to increase in the future. The demand is also broken down into ground-water and surface water sources. Overall demand has increased from 124 bgd in 1925 to 418 bg in 1996. It is projected to increase to 463 bg by 2010 (CH2M Hill and others, 1993).

COUNTY DEMANDS

The data reported here are based on site of withdrawal, not use. Water in New Jersey is commonly exported from one county and used in another. This results in some counties showing water withdrawals not in proportion to their population. For example, Hudson County shows extremely few withdrawals. Most of its water is imported from Passaic County. Table 26 lists water demands by county, along with reported withdrawals in that county.

The water demand estimates are from the task 3 report of the New Jersey Statewide Water Supply Plan (CH2M HILL and others, 1993). That report primarily examines consumptive use of water. It does not consider nonconsumptive uses as power generation. In order to be more consistent with this approach, the withdrawals column in table 26 does not include withdrawals for power generation.

For some counties where little or no water is transferred across state lines (such as Cumberland County) the difference between demand and withdrawals in table 26 may be due to agricultural nonconsumptive use of water (primarily for cranberry cultivation). The state has also begun a more exact recording of agricultural water use in the last few years that has uncovered more use for this purpose than previously thought (Diane Zalaskus, Bureau of Water Allocation, NJDEP, oral communication, 1998).

The counties that export the most water are Hunterdon, Morris, Passaic, Somerset and Warren. The counties that import the most water are Bergen, Essex, Hudson, Middlesex, and Union. This pattern is explained by noting that the exporting counties contain large surface-water reservoirs that supply water to the importing counties. Nawyn and Clawges (1995) discuss the transfers of surface water throughout the state.

CONCLUSIONS

Water withdrawals in New Jersey have averaged 966 billion gallons (bg) annually during the period 1990-96. Potable water use accounts for the greatest demand, between 400 and 450 bg a year. Power generation is the next greatest use, between 300 and 430 bg annually. Water used for power generation may or may not be nonconsumptive, depending on the cooling methodology.

On average, 75 percent of total water withdrawals and 59 percent of potable water withdrawals are from surface water. The relative importance of ground and surface water as a source of potable water withdrawals in each county varies. During the period 1990-96, ground water supplied 100 percent of potable water actually *withdrawn in* Camden, Cape May, Cumberland, Gloucester, Hudson and Warren Counties, but only 4 percent of potable water withdrawn in Passaic County. These numbers are not always indicative of the source of water actually *consumed in* each county. For example, much of the surface water withdrawn in Passaic County is exported to Hudson and Bergen Counties.

The greatest 1-year reported total withdrawal was in Passaic County where 235 bg was withdrawn in 1990. Of this, 231 bg was surface water, making it the largest 1-year withdrawal of surface water. Burlington County reported the greatest 1-year ground-water withdrawal, 32 bg in 1994. Hudson County reported the lowest one-year withdrawal, 88 mg in 1995, all from ground water and mostly for industrial use.

The Central Delaware watershed management area reported the greatest 1-year withdrawal, 256 bg in 1990. The Upper Delaware water region reported the greatest 1-year withdrawal, 377 bg in 1990. These figures include both surface and ground water.

The Potomac-Raritan-Magothy (PRM) aquifer system supplied the most ground water as reported by water purveyors, an average of 72 bg annually during the period 1990-96. Undoubtedly the PRM additionally supplied much water to domestic wells. However, it is not possible to determine what percentage of the statewide volume of water withdrawn for domestic purposes (about 30 bg annually) comes from the PRM.

In terms of total annual withdrawals, the Coastal Plain province supplies the most surface and ground water, on average 293 and 145 bg annually respectively. However, if only withdrawals for potable use are considered, then the Piedmont province supplies the most surface water (157 bg annually on average) whereas the Coastal Plain supplies the most ground water (100 bg annually).

Total withdrawals in New Jersey correspond to approximately 15 percent of precipitation, on a statewide average. Withdrawals for potable use are between 5 percent and 8 percent of precipitation. Withdrawals for potable water, irrigation and agricultural use show a strong inverse correlation with precipitation during the growing season. During the period 1990-96 summer agricultural withdrawals declined about 2.3 bg for every inch of rainfall exceeding 10 inches.

In water-supply critical area 1 in southern New Jersey withdrawals in the central depleted zone have declined from 9 bg in 1990 to 6.5 bg in 1996. The declines have been most pronounced in the middle PRM aquifer which has shown a 53 percent reduction in withdrawals in the area. Significant withdrawal reductions in water supply critical area 2 had not yet been significantly implemented in 1996.

The data reported here have five important qualifications: (1) Withdrawals are reported on the basis of water source, not the site of water use. (2) Water withdrawn is not equivalent to water consumed - the reported volume of surface-water withdrawals do not imply an equivalent volume in streamflows. (3) Only fresh-water withdrawals are summarized here, saline-water withdrawals are not included. (4) All nondomestic withdrawals are summarized from reports filed by the water purveyors with the New Jersey Department of Environmental Protection. Inaccuracies in these reports were corrected where possible but some may carry over to the data in this report. (5) This report does treat the destination of the water after it is used, such as discharge to the ocean or to a stream. Thus there is no analysis of consumptive or depletive water use in this report.

The Bureau of Water Allocation (BWA) in the New Jersey Department of Environmental Protection (NJDEP) regulates fresh-water withdrawals by users who have the capacity to divert 100,000 gallons per day or more. All nondomestic withdrawals are based on data from reports submitted by the regulated community.

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APPENDIXES A — F

Details of withdrawals and list of aquifer groups and assigned aquifers.

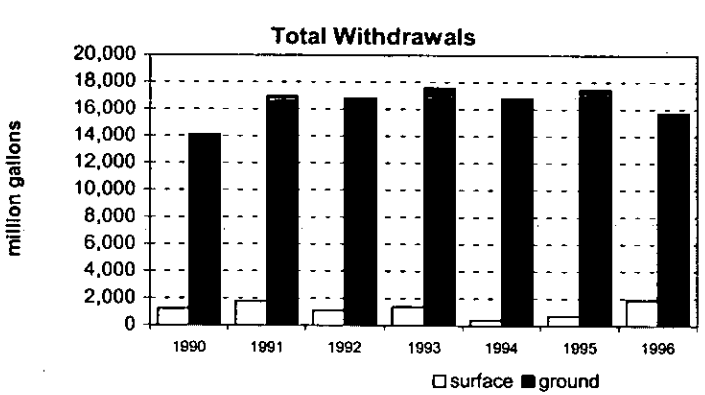
Appendix A.
Details of withdrawals by county

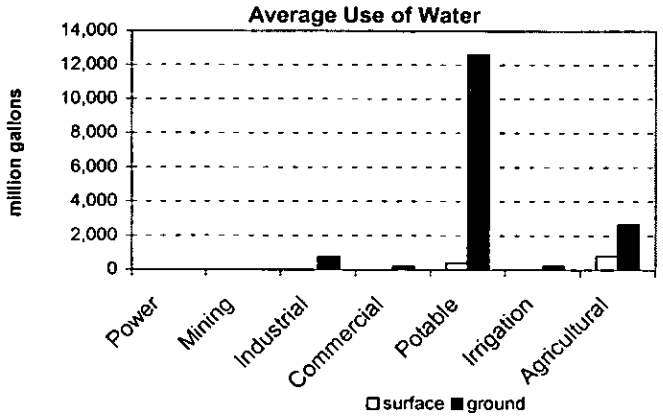
Appendix A. Details of county withdrawals.

Table A1. Atlantic County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	1,240	14,126	15,366
1991	1,787	16,972	18,759
1992	1,099	16,817	17,916
1993	1,384	17,616	18,999
1994	414	16,854	17,268
1995	725	17,478	18,203
1996	1,888	15,742	17,630
average	1,220	16,515	17,735





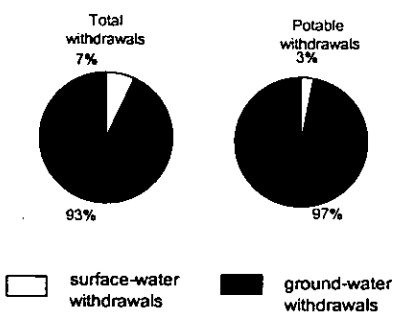
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	0	0	0	556	556	0	180	180	916	11,755	12,671	0	150	150	324	1,485	1,809
1991	0	0	0	0	0	0	0	475	475	0	201	201	0	12,671	12,671	0	153	153	1,787	3,473	5,259
1992	0	0	0	0	0	0	0	779	779	0	180	180	294	12,523	12,817	0	177	177	805	3,158	3,963
1993	0	0	0	0	0	0	0	1,088	1,088	0	227	227	428	12,581	13,009	0	335	335	956	3,384	4,340
1994	0	0	0	0	0	0	0	1,005	1,005	0	217	217	147	13,322	13,469	0	205	205	267	2,105	2,372
1995	0	0	0	0	0	0	0	732	732	0	233	233	5	13,086	13,091	0	316	316	720	3,111	3,831
1996	0	0	0	0	0	0	0	836	836	0	213	213	913	12,521	13,434	16	221	237	958	1,952	2,910
average	0	0	0	0	0	0	0	781	781	0	207	207	386	12,637	13,023	2	223	225	831	2,667	3,498

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	9,000	2,597	292	0	0	0	0	0	0	0	0	0	15	2,222	14,126
1991	0	14	11,656	2,706	319	0	0	0	0	0	0	0	0	0	25	2,253	16,972
1992	0	124	11,393	2,676	341	0	0	0	0	0	0	0	0	0	11	2,271	16,817
1993	0	467	11,646	2,852	337	0	0	0	0	0	0	0	0	0	26	2,287	17,616
1994	0	393	10,806	3,183	161	0	0	0	0	0	0	0	0	0	11	2,299	16,854
1995	0	238	11,544	3,183	192	0	0	0	0	0	0	0	0	0	7	2,314	17,478
1996	0	297	9,896	3,020	169	0	0	0	0	0	0	0	0	0	28	2,332	15,742
average	0	219	10,849	2,888	259	0	0	0	0	0	0	0	0	0	18	2,282	16,515

Average Source of Withdrawals



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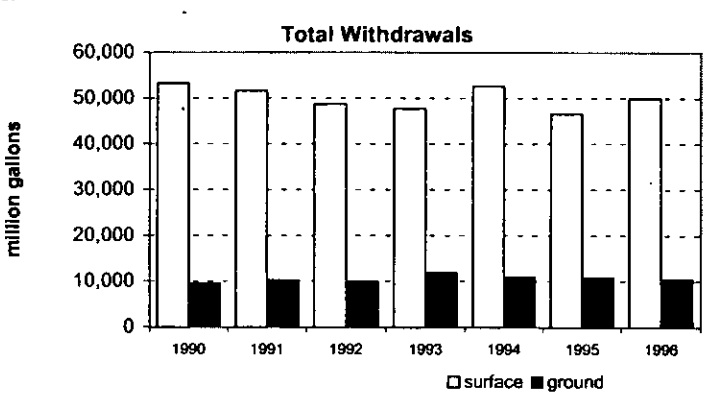
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

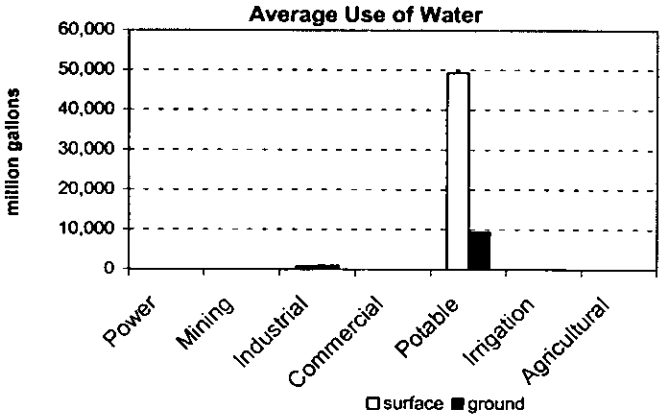
Appendix A. Details of county withdrawals.

Table A2. Bergen County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	53,294	9,575	62,869
1991	51,637	10,313	61,950
1992	48,743	10,021	58,764
1993	47,726	11,946	59,672
1994	52,632	10,931	63,563
1995	46,638	10,787	57,425
1996	49,994	10,539	60,533
average	50,095	10,587	60,682





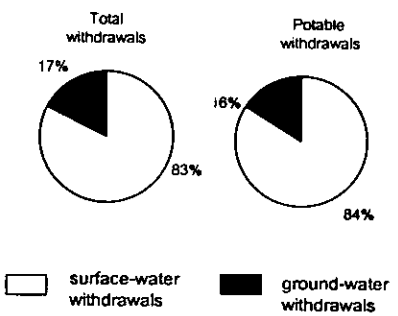
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	0	0	839	992	1,830	0	38	38	52,455	8,450	60,905	0	95	95	0	0	0
1991	0	0	0	0	0	0	872	935	1,807	0	40	40	50,765	9,166	59,932	0	162	162	0	10	10
1992	0	0	0	0	0	0	981	912	1,892	0	35	35	47,763	8,963	56,725	0	111	111	0	0	0
1993	0	0	0	0	0	0	728	1,273	2,001	0	43	43	46,917	10,371	57,289	80	238	318	0	21	21
1994	0	0	0	0	0	0	543	978	1,521	0	40	40	51,982	9,661	61,643	108	245	353	0	7	7
1995	0	0	0	0	0	0	529	937	1,466	0	31	31	46,023	9,517	55,540	86	300	386	0	1	1
1996	0	0	0	0	0	0	434	616	1,050	0	18	18	49,482	9,671	59,153	78	229	307	0	6	6
average	0	0	0	0	0	0	704	949	1,652	0	35	35	49,341	9,400	58,741	50	197	247	0	7	7

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	2,730	0	0	0	0	0	0	0	0	0	6,034	0	0	0	38	773	9,575
1991	3,017	0	0	0	0	0	0	0	0	0	6,472	0	0	0	51	774	10,313
1992	2,650	0	0	0	0	0	0	0	0	0	6,576	0	0	0	16	779	10,021
1993	3,081	0	0	0	0	0	0	0	0	0	8,071	0	0	0	11	783	11,946
1994	2,740	0	0	0	0	0	0	0	0	0	7,399	0	0	0	6	786	10,931
1995	2,635	0	0	0	0	0	0	0	0	0	7,356	0	0	0	6	790	10,787
1996	2,711	0	0	0	0	0	0	0	0	0	7,036	0	0	0	0	792	10,539
average	2,795	0	0	0	0	0	0	0	0	0	6,992	0	0	0	18	782	10,587

Average Source of Withdrawals



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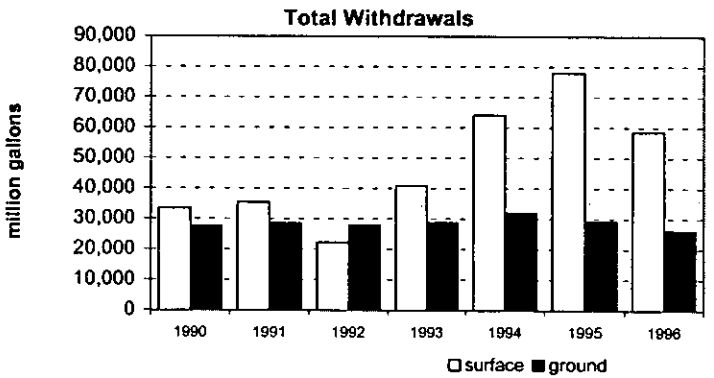
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

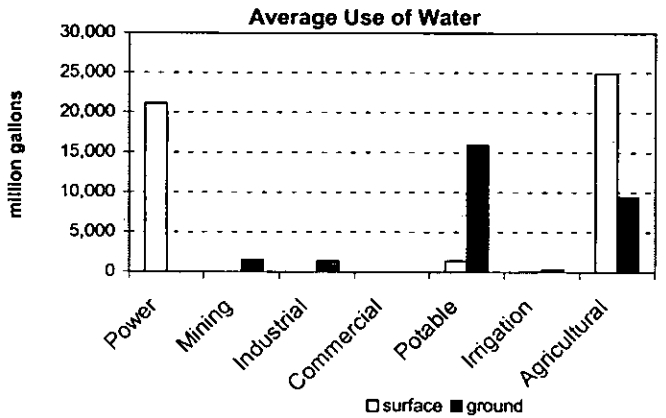
Appendix A. Details of county withdrawals.

Table A3. Burlington County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	33,602	27,713	61,315
1991	35,429	28,619	64,049
1992	22,307	27,970	50,277
1993	40,975	28,855	69,829
1994	64,146	32,069	96,215
1995	77,902	29,216	107,118
1996	58,629	26,231	84,860
average	47,570	28,668	76,238





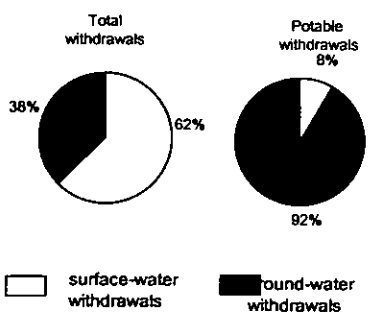
Withdrawals by use group (million gallons)

Year	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	12,503	0	12,503	0	1,661	1,661	0	1,655	1,655	0	5	5	1,268	15,481	16,749	86	315	401	19,745	8,597	28,342
1991	9,489	0	9,489	0	1,286	1,286	0	1,449	1,449	0	8	8	1,075	16,365	17,441	99	286	385	24,766	9,225	33,991
1992	2,974	0	2,974	0	1,365	1,365	0	1,420	1,420	0	12	12	850	15,574	16,424	68	307	375	18,415	9,291	27,706
1993	13,781	0	13,781	0	1,653	1,653	0	1,284	1,284	0	15	15	728	16,035	16,763	60	363	424	26,405	9,505	35,910
1994	38,027	0	38,027	0	1,456	1,456	0	1,324	1,324	0	18	18	972	16,254	17,226	47	417	464	25,099	12,600	37,700
1995	36,513	0	36,513	0	1,521	1,521	27	1,191	1,217	0	19	19	831	16,720	17,551	114	434	547	40,418	9,332	49,750
1996	34,719	0	34,719	0	1,719	1,719	0	1,405	1,405	0	16	16	4,251	15,127	19,378	67	376	443	19,592	7,589	27,181
average	21,144	0	21,144	0	1,523	1,523	4	1,390	1,393	0	13	13	1,425	15,937	17,362	77	357	434	24,920	9,448	34,368

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	8,967	0	552	1,588	1,505	4,334	2,685	5,675	0	0	0	0	37	2,371	27,713
1991	0	0	9,229	0	555	1,642	2,207	5,670	3,352	3,533	0	0	0	0	38	2,393	28,619
1992	0	0	9,597	0	552	1,404	1,910	5,941	3,538	2,597	0	0	0	0	39	2,393	27,970
1993	0	0	9,764	0	556	1,775	2,218	6,415	3,060	2,609	0	0	0	0	58	2,399	28,855
1994	0	0	9,409	0	445	5,261	2,312	6,881	3,965	1,354	0	0	0	0	23	2,419	32,069
1995	0	0	8,195	0	878	2,855	2,295	7,178	4,069	1,285	0	0	0	0	14	2,448	29,216
1996	0	1	8,122	0	534	1,341	2,149	6,203	2,965	2,163	0	0	0	0	286	2,466	26,231
average	0	0	9,040	0	582	2,267	2,085	6,089	3,376	2,745	0	0	0	0	71	2,413	28,668

Average Source of Withdrawals



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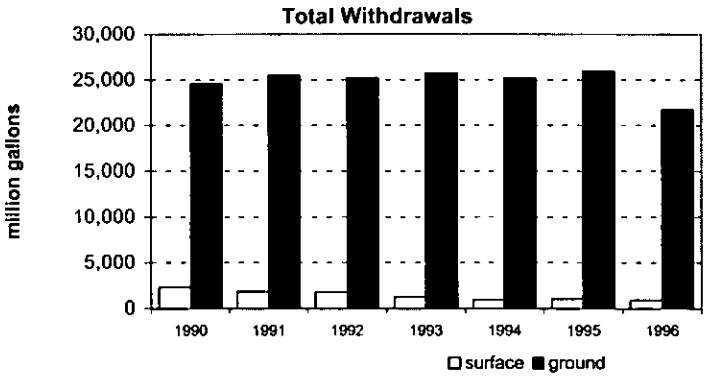
The Irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

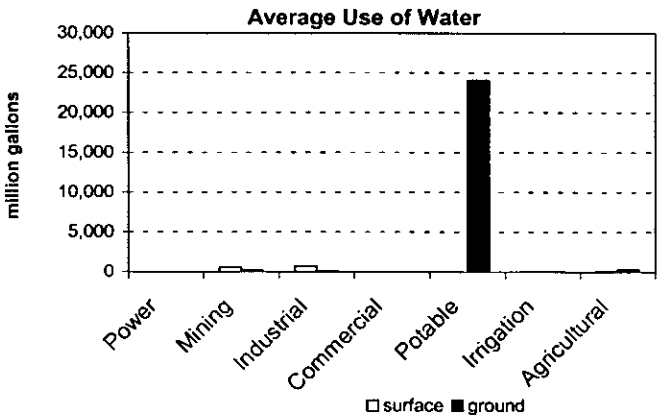
Appendix A. Details of county withdrawals.

Table A4. Camden County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	2,356	24,591	26,947
1991	1,847	25,523	27,369
1992	1,791	25,226	27,017
1993	1,255	25,752	27,007
1994	948	25,212	26,160
1995	1,045	25,979	27,024
1996	906	21,793	22,699
average	1,450	24,868	26,318





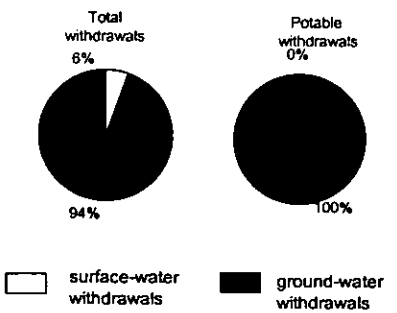
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	488	188	675	1,775	111	1,886	0	0	0	0	23,511	23,511	18	91	109	75	691	766
1991	0	0	0	214	212	425	1,527	132	1,659	0	0	0	0	24,798	24,798	34	65	98	73	316	389
1992	0	0	0	570	156	727	1,131	113	1,243	0	25	25	0	24,692	24,692	44	52	97	45	188	233
1993	0	0	0	734	256	991	407	90	496	1	17	18	0	24,985	24,985	53	70	123	60	335	395
1994	0	0	0	734	243	977	44	87	132	3	22	24	0	24,524	24,524	91	73	163	76	264	340
1995	0	0	0	806	251	1,057	51	78	129	13	21	34	0	25,273	25,273	88	57	145	88	298	386
1996	0	0	0	739	345	1,084	55	89	144	1	15	16	0	21,165	21,165	87	57	144	24	121	145
average	0	0	0	612	236	848	713	100	813	3	14	17	0	24,135	24,135	59	66	126	63	316	379

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	1,759	0	4	1,061	3,853	1,554	7,327	7,844	0	0	0	0	4	1,184	24,591
1991	0	0	1,478	0	11	1,011	4,229	4,002	12,329	1,269	0	0	0	0	5	1,190	25,523
1992	0	0	1,244	0	5	992	4,298	2,786	13,760	949	0	0	0	0	0	1,192	25,226
1993	0	0	1,558	0	21	1,283	4,231	2,470	13,674	1,323	0	0	0	0	1	1,193	25,752
1994	0	0	1,516	0	15	1,162	4,445	2,548	13,076	1,255	0	0	0	0	2	1,193	25,212
1995	0	0	1,522	0	11	1,015	4,226	2,739	14,089	1,183	0	0	0	0	2	1,194	25,979
1996	0	0	1,556	0	4	1,273	3,008	1,830	11,785	1,142	0	0	0	0	2	1,193	21,793
average	0	0	1,519	0	10	1,114	4,041	2,561	12,291	2,138	0	0	0	0	2	1,191	24,868

Average Source of Withdrawals



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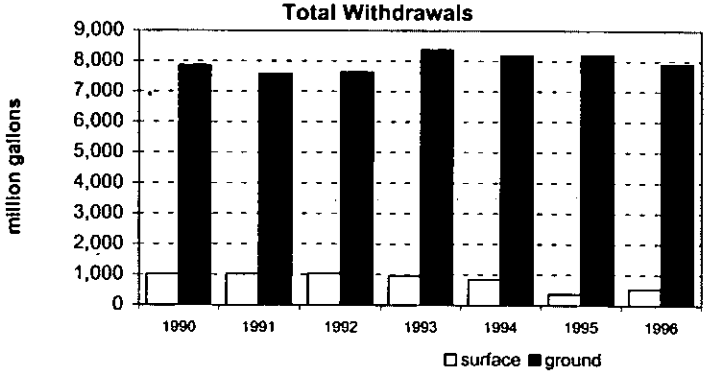
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

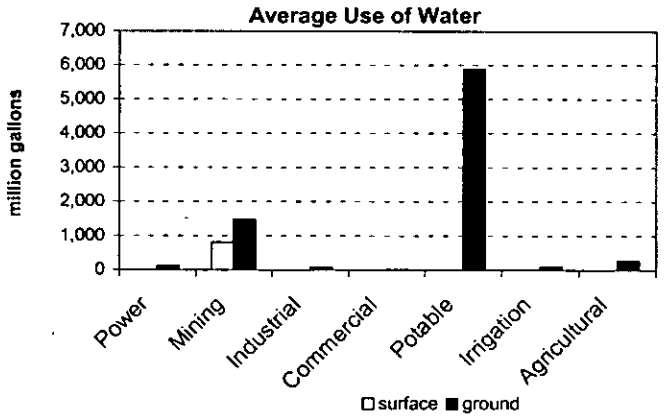
Appendix A. Details of county withdrawals.

Table A5. Cape May County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	1,020	7,873	8,893
1991	1,020	7,595	8,615
1992	1,037	7,658	8,695
1993	958	8,375	9,333
1994	837	8,189	9,026
1995	372	8,211	8,582
1996	531	7,906	8,437
average	825	7,972	8,797





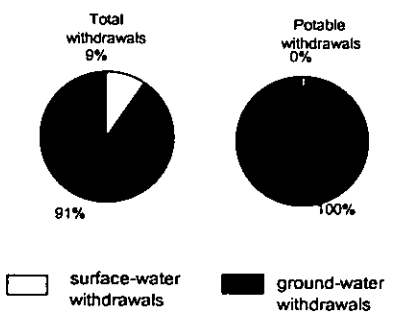
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	123	123	1,016	1,519	2,535	0	76	76	0	32	32	0	5,809	5,809	0	80	80	4	235	238
1991	0	114	114	1,016	1,157	2,172	0	69	69	0	5	5	0	5,869	5,869	0	88	88	4	293	297
1992	0	103	103	1,008	1,364	2,372	0	55	55	0	8	8	0	5,726	5,726	25	109	134	4	293	297
1993	0	119	119	924	1,452	2,376	0	104	104	0	6	6	0	6,181	6,181	34	167	201	0	347	347
1994	0	120	120	824	1,761	2,585	0	71	71	0	21	21	0	5,882	5,882	13	111	124	0	222	222
1995	0	153	153	343	1,690	2,032	0	100	100	0	5	5	0	5,778	5,778	22	142	165	6	342	349
1996	0	179	179	518	1,373	1,891	0	111	111	0	5	5	0	5,941	5,941	12	96	108	1	201	202
average	0	130	130	807	1,474	2,281	0	84	84	0	12	12	0	5,884	5,884	15	113	128	3	276	279

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	1,746	2,404	2,416	0	0	0	0	0	0	0	0	0	0	0	1,307	7,873
1991	0	1,379	2,673	2,216	0	0	0	0	0	0	0	0	0	0	0	1,326	7,595
1992	0	394	3,833	2,096	0	0	0	0	0	0	0	0	0	0	0	1,336	7,658
1993	0	1,847	2,691	2,501	0	0	0	0	0	0	0	0	0	0	0	1,335	8,375
1994	0	2,075	2,501	2,270	0	0	0	0	0	0	0	0	0	0	0	1,344	8,189
1995	0	2,027	2,374	2,460	0	0	0	0	0	0	0	0	0	0	0	1,349	8,211
1996	0	1,710	2,318	2,495	0	0	0	0	0	0	0	0	0	0	33	1,351	7,906
average	0	1,597	2,685	2,351	0	0	0	0	0	0	0	0	0	0	5	1,335	7,972

Average Source of Withdrawals



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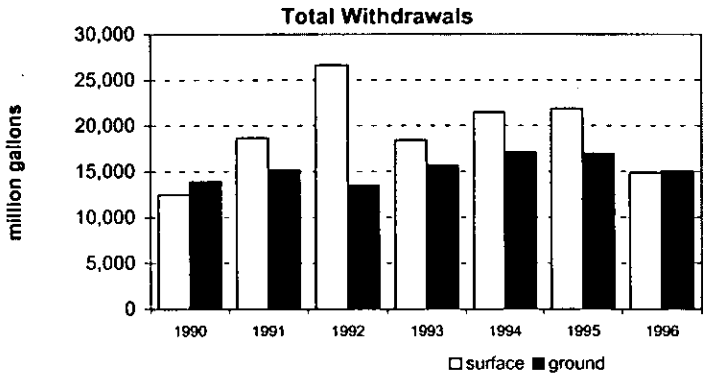
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

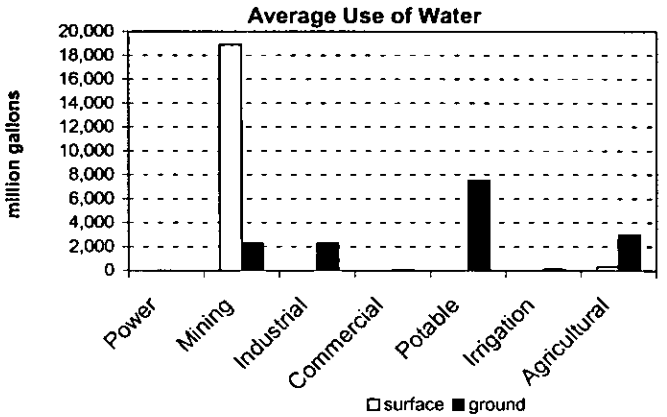
Appendix A. Details of county withdrawals.

Table A6. Cumberland County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	12,487	13,927	26,414
1991	18,671	15,190	33,861
1992	26,646	13,510	40,155
1993	18,439	15,698	34,137
1994	21,482	17,124	38,606
1995	21,863	16,990	38,853
1996	14,886	15,069	29,954
average	19,210	15,358	34,569





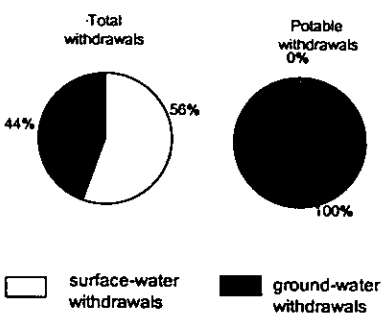
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	12,342	1,553	13,895	0	2,804	2,804	0	18	18	0	7,044	7,044	0	70	70	145	2,437	2,582
1991	0	0	0	18,139	1,279	19,418	0	2,602	2,602	0	23	23	0	7,660	7,660	0	40	40	531	3,586	4,117
1992	0	0	0	26,365	1,373	27,738	0	2,167	2,167	0	20	20	0	7,363	7,363	0	70	70	280	2,517	2,797
1993	0	0	0	18,046	2,342	20,388	0	2,211	2,211	0	43	43	0	7,874	7,874	0	166	166	393	3,062	3,455
1994	0	0	0	21,317	3,050	24,368	0	2,315	2,315	0	4	4	0	8,033	8,033	0	225	225	165	3,497	3,662
1995	0	0	0	21,430	3,182	24,612	0	1,924	1,924	0	8	8	0	7,793	7,793	0	208	208	433	3,875	4,308
1996	0	0	0	14,665	3,463	18,128	0	2,089	2,089	0	4	4	0	7,030	7,030	0	171	171	220	2,313	2,533
average	0	0	0	18,901	2,320	21,221	0	2,302	2,302	0	17	17	0	7,542	7,542	0	136	136	310	3,041	3,351

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	19	12,426	0	0	0	0	0	0	0	0	0	0	0	32	1,450	13,927
1991	0	0	13,423	0	0	0	0	0	0	0	0	0	0	0	308	1,459	15,190
1992	0	0	11,990	0	0	0	0	0	0	0	0	0	0	0	60	1,460	13,510
1993	0	543	13,625	0	0	0	0	0	0	0	0	0	0	0	70	1,460	15,698
1994	0	703	14,952	0	0	0	0	0	0	0	0	0	0	0	11	1,458	17,124
1995	0	850	14,680	0	0	0	0	0	0	0	0	0	0	0	14	1,447	16,990
1996	0	1,710	2,318	2,495	0	0	0	0	0	0	0	0	0	0	7,119	1,428	15,069
average	0	546	11,916	356	0	0	0	0	0	0	0	0	0	0	1,088	1,452	15,358

Average Source of Withdrawals



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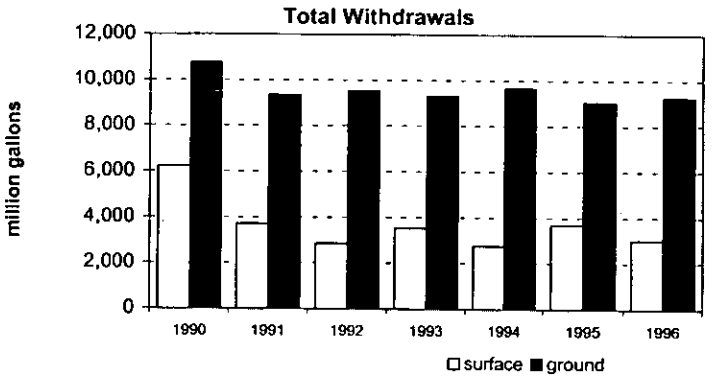
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

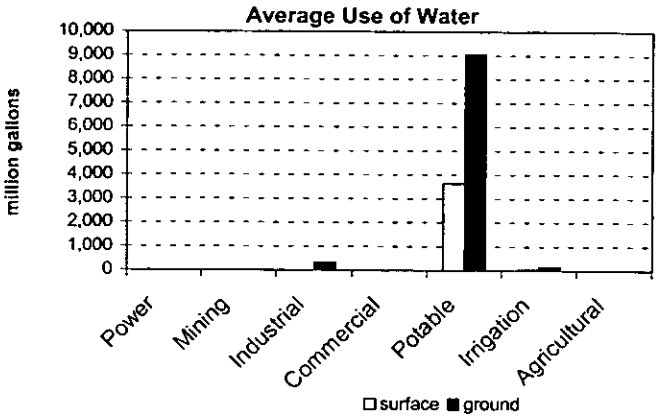
Appendix A. Details of county withdrawals.

Table A7. Essex County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	6,225	10,760	16,985
1991	3,717	9,344	13,061
1992	2,861	9,550	12,411
1993	3,538	9,302	12,840
1994	2,764	9,657	12,422
1995	3,698	9,058	12,756
1996	3,014	9,260	12,274
average	3,688	9,562	13,250





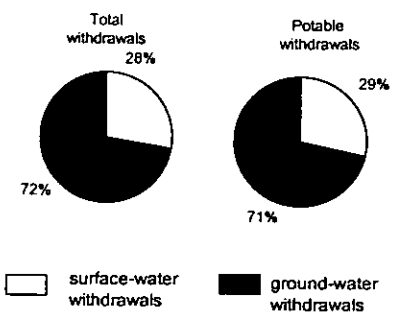
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	0	0	0	302	302	0	36	36	6,207	10,328	16,535	18	94	112	0	0	0
1991	0	0	0	0	0	0	0	294	294	0	51	51	3,682	8,840	12,521	35	160	195	0	0	0
1992	0	0	0	0	0	0	0	334	334	0	37	37	2,832	9,061	11,893	28	119	147	0	0	0
1993	0	0	0	0	0	0	0	361	361	0	0	0	3,467	8,750	12,217	71	190	262	0	0	0
1994	0	0	0	0	0	0	0	293	293	0	0	0	2,703	9,160	11,863	61	204	265	0	0	0
1995	0	0	0	0	0	0	0	402	402	0	0	0	3,630	8,478	12,108	68	177	245	0	0	0
1996	0	0	0	0	0	0	0	343	343	0	5	5	2,975	8,784	11,759	39	129	168	0	0	0
average	0	0	0	0	0	0	0	333	333	0	18	18	3,642	9,057	12,700	46	153	199	0	0	0

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	6,968	0	0	0	0	0	0	0	0	0	3,651	0	0	0	0	141	10,760
1991	5,599	0	0	0	0	0	0	0	0	0	3,605	0	0	0	0	140	9,344
1992	5,399	0	0	0	0	0	0	0	0	0	4,010	0	0	0	0	140	9,550
1993	5,174	0	0	0	0	0	0	0	0	0	3,988	0	0	0	0	140	9,302
1994	5,449	0	0	0	0	0	0	0	0	0	4,069	0	0	0	0	139	9,657
1995	5,335	0	0	0	0	0	0	0	0	0	3,585	0	0	0	0	138	9,058
1996	5,489	0	0	0	0	0	0	0	0	0	3,634	0	0	0	0	137	9,260
average	5,630	0	0	0	0	0	0	0	0	0	3,792	0	0	0	0	140	9,562

Average Source of Withdrawals



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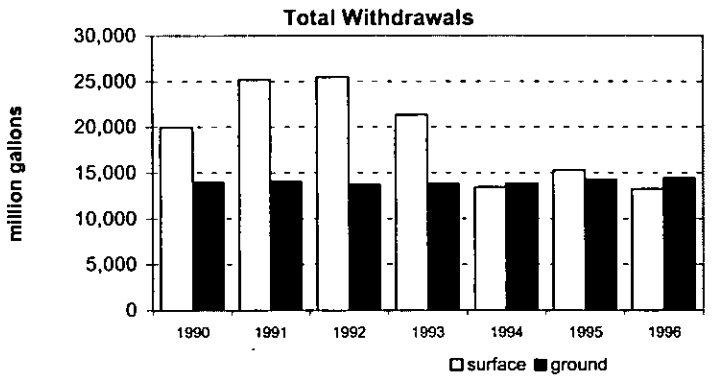
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

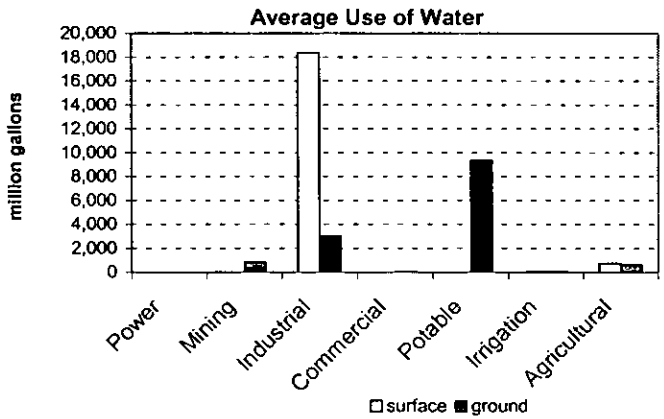
Appendix A. Details of county withdrawals.

Table A8. Gloucester County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	19,968	13,981	33,949
1991	25,187	14,057	39,243
1992	25,489	13,729	39,218
1993	21,330	13,838	35,168
1994	13,455	13,880	27,335
1995	15,265	14,312	29,576
1996	13,251	14,446	27,697
average	19,135	14,035	33,170





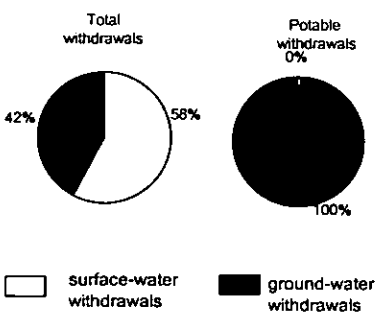
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	706	706	19,443	3,930	23,373	0	3	3	0	8,827	8,827	12	23	35	513	491	1,005
1991	0	0	0	0	774	774	24,178	3,215	27,393	0	8	8	0	9,437	9,437	32	38	70	977	584	1,561
1992	0	0	0	0	766	766	24,830	3,241	28,071	0	24	24	0	9,118	9,118	12	67	79	646	513	1,160
1993	0	0	0	0	640	640	20,527	2,823	23,350	0	48	48	0	9,541	9,541	22	90	112	781	696	1,477
1994	0	0	0	0	771	771	12,746	2,908	15,654	0	22	22	0	9,566	9,566	26	85	111	683	529	1,211
1995	0	0	0	0	876	876	13,948	2,484	16,433	0	25	25	0	9,983	9,983	25	63	88	1,291	880	2,171
1996	0	0	0	0	1,492	1,492	12,807	2,670	15,477	0	24	24	0	9,370	9,370	11	73	85	432	818	1,250
average	0	0	0	0	861	861	18,354	3,039	21,393	0	22	22	0	9,406	9,406	20	63	83	761	645	1,405

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	65	1,578	0	0	20	1,817	1,510	2,359	5,035	0	0	0	0	27	1,570	13,981
1991	0	513	1,802	0	0	25	4,203	2,374	2,070	1,460	0	0	0	0	10	1,598	14,057
1992	0	425	1,618	0	0	133	3,939	2,229	2,181	1,592	0	0	0	0	0	1,612	13,729
1993	0	242	1,840	0	0	226	3,701	1,837	1,921	2,406	0	0	0	0	39	1,626	13,838
1994	0	285	1,836	0	0	400	4,168	2,125	2,056	1,358	0	0	0	0	3	1,649	13,880
1995	0	171	2,355	0	0	444	4,117	2,294	1,957	1,305	0	0	0	0	12	1,657	14,312
1996	0	209	2,874	0	0	671	3,800	2,151	1,845	996	0	0	0	0	234	1,666	14,446
average	0	273	1,986	0	0	274	3,678	2,074	2,056	2,022	0	0	0	0	47	1,625	14,035

Average Source of Withdrawals



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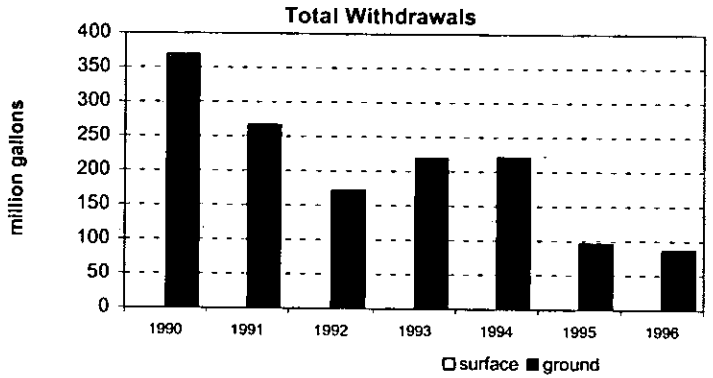
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

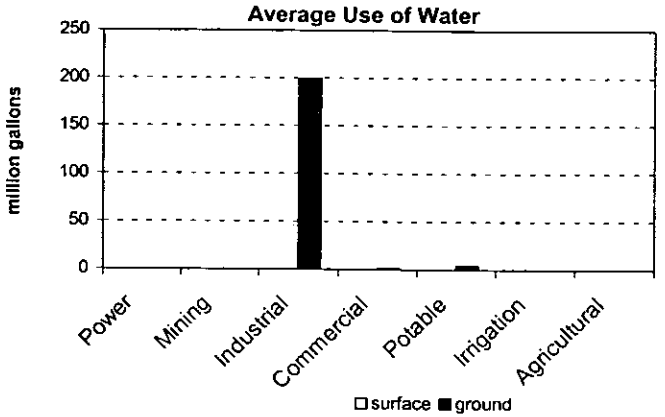
Appendix A. Details of county withdrawals.

Table A9. Hudson County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	0	370	370
1991	0	267	267
1992	0	172	172
1993	0	220	220
1994	0	222	222
1995	0	97	97
1996	0	88	88
average	0	205	205





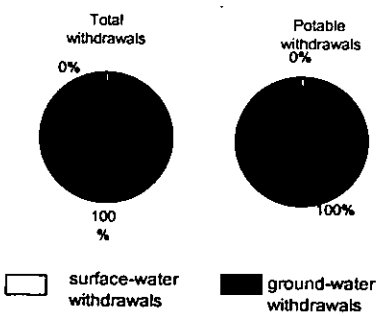
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	0	0	0	363	363	0	2	2	0	4	4	0	0	0	0	0	0
1991	0	0	0	0	0	0	0	260	260	0	3	3	0	4	4	0	0	0	0	0	0
1992	0	0	0	0	0	0	0	168	168	0	0	0	0	4	4	0	0	0	0	0	0
1993	0	0	0	0	0	0	0	215	215	0	0	0	0	4	4	0	0	0	0	0	0
1994	0	0	0	0	0	0	0	215	215	0	2	2	0	4	4	0	0	0	0	0	0
1995	0	0	0	0	0	0	0	92	92	0	0	0	0	4	4	0	0	0	0	0	0
1996	0	0	0	0	0	0	0	83	83	0	0	0	0	4	4	0	0	0	0	0	0
average	0	0	0	0	0	0	0	200	200	0	1	1	0	4	4	0	0	0	0	0	0

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	0	0	0	0	0	0	0	0	365	0	0	0	0	4	370
1991	0	0	0	0	0	0	0	0	0	0	263	0	0	0	0	4	267
1992	0	0	0	0	0	0	0	0	0	0	168	0	0	0	0	4	172
1993	0	0	0	0	0	0	0	0	0	0	215	0	0	0	0	4	220
1994	0	0	0	0	0	0	0	0	0	0	217	0	0	0	0	4	222
1995	0	0	0	0	0	0	0	0	0	0	92	0	0	0	0	4	97
1996	11	0	0	0	0	0	0	0	0	0	72	0	0	0	0	4	88
average	2	0	0	0	0	0	0	0	0	0	199	0	0	0	0	4	205

Average Source of Withdrawals



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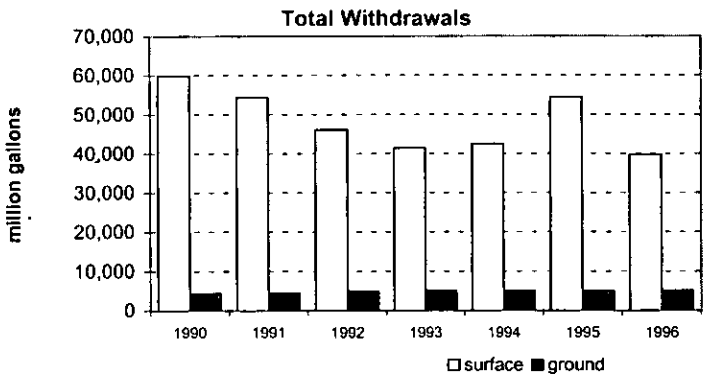
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

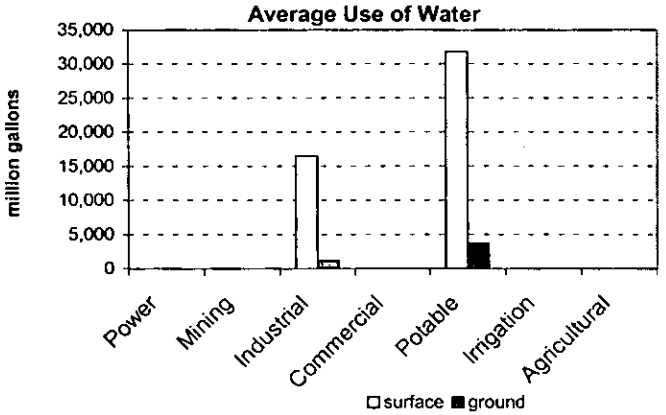
Appendix A. Details of county withdrawals.

Table A10. Hunterdon County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	59.912	4.388	64.300
1991	54.364	4.521	58.885
1992	46.110	4.875	50.985
1993	41.446	5.112	46.557
1994	42.528	5.172	47.701
1995	54.440	4.989	59.428
1996	39.729	5.153	44.881
average	48.361	4.887	53.248





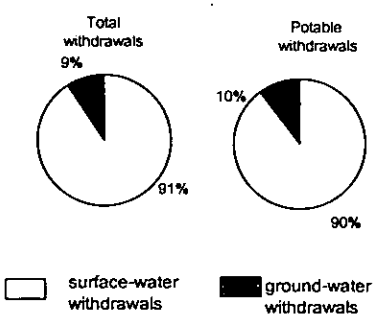
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	0	0	25,928	889	26,817	0	0	0	33,984	3,474	37,458	0	16	16	0	9	9
1991	0	0	0	0	0	0	22,748	959	23,708	0	0	0	31,600	3,524	35,124	0	25	25	16	12	28
1992	0	0	0	0	0	0	15,211	1,275	16,486	0	0	0	30,897	3,567	34,465	0	21	21	1	12	13
1993	0	0	0	0	0	0	8,497	1,351	9,847	0	0	0	32,928	3,699	36,627	0	48	48	21	13	34
1994	0	0	0	0	0	0	11,232	1,319	12,551	0	0	0	31,287	3,819	35,106	6	35	41	3	0	3
1995	0	0	0	0	0	0	21,565	1,124	22,688	0	0	0	32,837	3,802	36,640	14	48	63	23	14	37
1996	0	0	0	0	0	0	10,705	1,164	11,869	0	3	3	29,020	3,942	32,962	3	18	21	1	25	26
average	0	0	0	0	0	0	16,555	1,154	17,709	0	0	0	31,793	3,690	35,483	3	30	34	9	12	22

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	138	0	0	0	0	0	0	0	0	0	1,140	72	170	373	436	2,059	4,388
1991	141	0	0	0	0	0	0	0	0	0	1,326	90	456	422	3	2,084	4,521
1992	131	0	0	0	0	0	0	0	0	0	1,643	106	315	548	0	2,132	4,875
1993	120	0	0	0	0	0	0	0	0	0	1,773	118	313	616	0	2,172	5,112
1994	122	0	0	0	0	0	0	0	0	0	1,737	122	360	629	0	2,203	5,172
1995	131	0	0	0	0	0	0	0	0	0	1,504	90	372	671	0	2,220	4,989
1996	135	0	0	0	0	0	0	0	0	0	1,587	115	425	620	3	2,268	5,153
average	131	0	0	0	0	0	0	0	0	0	1,530	102	344	554	63	2,162	4,887

Average Source of Withdrawals



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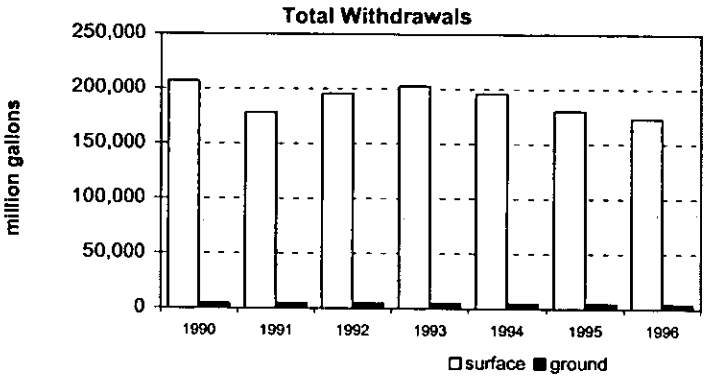
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

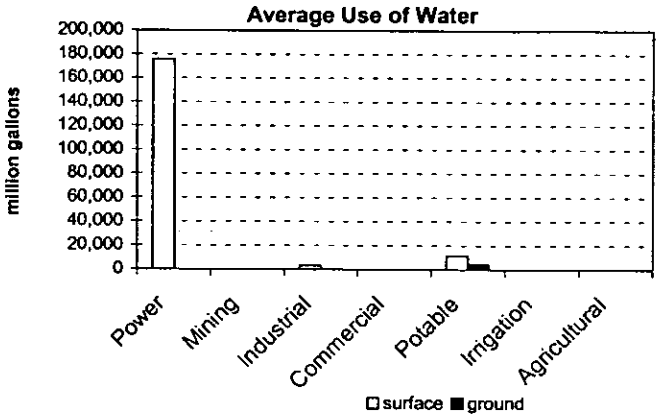
Appendix A. Details of county withdrawals.

Table A11. Mercer County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	207,104	4,339	211,444
1991	178,390	4,782	183,172
1992	195,647	4,619	200,266
1993	202,713	4,797	207,510
1994	195,779	4,707	200,486
1995	180,148	4,773	184,921
1996	172,960	4,245	177,205
average	190,392	4,609	195,001





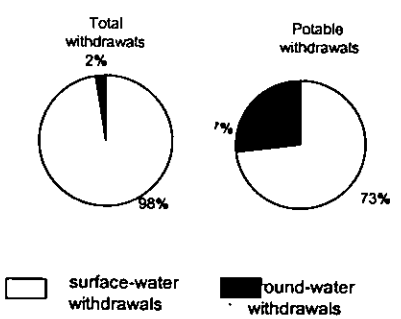
Withdrawals by use group (million gallons)

Year	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	194,601	0	194,601	0	0	0	1,217	256	1,473	0	4	4	11,246	4,034	15,280	28	15	43	12	31	43
1991	164,306	0	164,306	0	0	0	1,438	255	1,693	0	15	15	12,557	4,322	16,879	75	115	190	14	75	90
1992	179,864	0	179,864	0	0	0	4,616	233	4,849	0	16	16	11,091	4,282	15,374	56	48	104	21	40	60
1993	182,407	0	182,407	0	0	0	8,359	245	8,604	0	17	17	11,826	4,396	16,223	87	50	137	33	90	123
1994	177,185	0	177,185	0	0	0	6,787	235	7,023	0	22	22	11,757	4,384	16,141	31	27	58	18	39	57
1995	168,422	0	168,422	0	0	0	4	226	230	0	16	16	11,625	4,404	16,029	67	85	152	30	42	71
1996	161,790	0	161,790	0	0	0	5	210	215	0	15	15	11,133	3,987	15,120	26	18	44	6	15	21
average	175,511	0	175,511	0	0	0	3,204	237	3,441	0	15	15	11,605	4,259	15,863	53	51	104	19	47	67

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	Total
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	0	0	0	8	395	1,098	0	1,222	227	455	0	0	66	868	4,339
1991	1	0	0	0	0	29	402	2,116	0	439	197	726	0	0	0	871	4,782
1992	0	0	0	0	0	11	379	2,012	0	402	220	723	0	0	1	872	4,619
1993	0	0	0	0	0	41	406	1,684	0	784	242	753	0	0	13	876	4,797
1994	0	0	0	0	0	7	357	2,014	0	430	252	758	0	0	11	877	4,707
1995	0	0	0	0	0	14	348	2,110	0	539	252	615	0	0	16	880	4,773
1996	0	0	0	0	0	2	332	2,104	0	191	203	520	0	0	13	880	4,245
average	0	0	0	0	0	16	374	1,877	0	572	228	650	0	0	17	875	4,609

Average Source of Withdrawals



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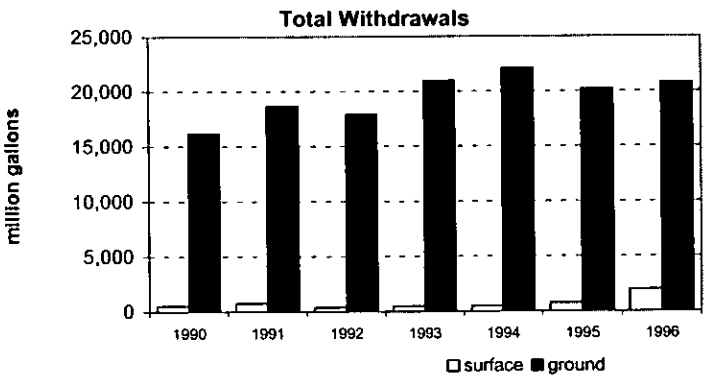
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

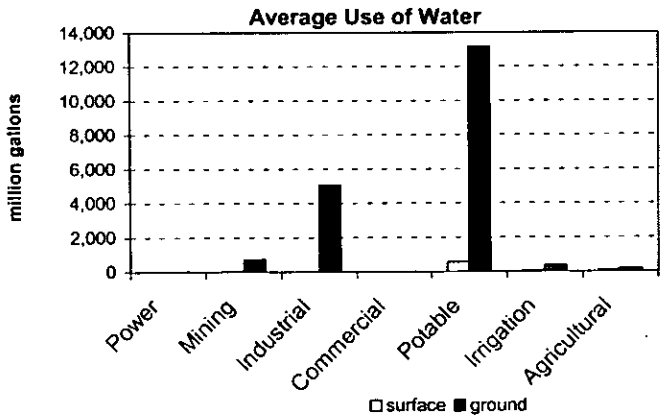
Appendix A. Details of county withdrawals.

Table A12. Middlesex County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	511	16,200	16,711
1991	768	18,677	19,445
1992	388	17,924	18,312
1993	477	21,009	21,486
1994	456	22,152	22,608
1995	745	20,213	20,958
1996	1,986	20,838	22,824
average	762	19,573	20,335





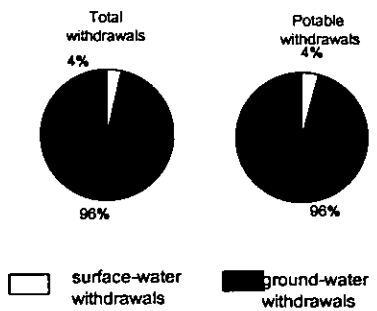
Withdrawals by use group (million gallons)

Year	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	4	4	0	721	721	43	4,794	4,838	0	11	11	303	10,144	10,447	24	368	392	141	159	300
1991	0	36	36	0	745	745	29	4,733	4,762	0	5	5	590	12,479	13,070	45	459	504	104	220	324
1992	0	29	29	0	83	83	23	4,970	4,992	0	6	6	219	12,347	12,566	78	368	446	68	121	189
1993	0	26	26	0	961	961	0	5,249	5,249	0	4	4	318	14,025	14,343	32	481	514	127	264	391
1994	0	28	28	83	1,149	1,232	0	5,350	5,350	0	6	6	202	15,078	15,280	105	327	432	66	215	281
1995	0	30	30	79	439	518	0	4,543	4,543	0	7	7	446	14,672	15,119	81	259	340	139	263	402
1996	0	22	22	32	1,019	1,051	0	5,912	5,912	0	8	8	1,880	13,614	15,494	50	186	236	24	77	102
average	0	25	25	28	731	758	14	5,079	5,092	0	7	7	566	13,194	13,760	59	350	409	96	188	284

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	2	0	0	0	0	79	6,306	2,952	0	2,802	1,347	172	0	0	1,861	679	16,200
1991	785	0	0	0	0	126	7,851	3,934	0	797	4,310	176	0	0	15	684	18,677
1992	562	0	0	0	0	17	7,805	4,138	0	94	4,473	145	0	0	1	689	17,924
1993	1,702	0	0	0	0	34	7,510	4,890	0	1,451	4,549	180	0	0	1	694	21,009
1994	2,173	0	0	0	0	5	7,324	5,161	0	1,237	5,265	185	0	0	102	700	22,152
1995	2,246	0	0	0	0	1	7,681	4,073	0	572	4,762	172	0	0	2	706	20,213
1996	2,078	0	0	0	0	2	8,757	3,574	0	1,111	4,444	161	0	0	1	710	20,838
average	1,364	0	0	0	0	38	7,605	4,103	0	1,152	4,164	170	0	0	283	695	19,573

Average Source of Withdrawals



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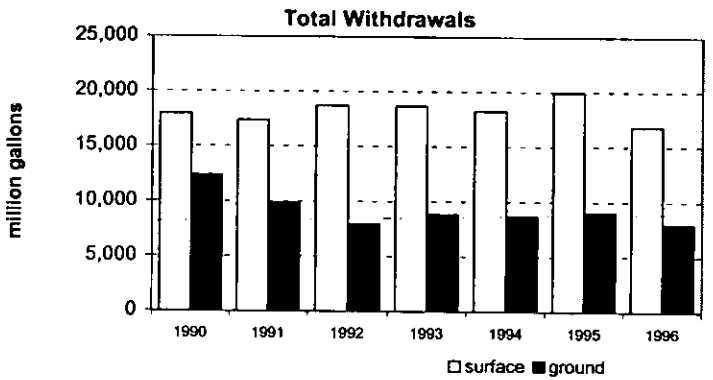
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

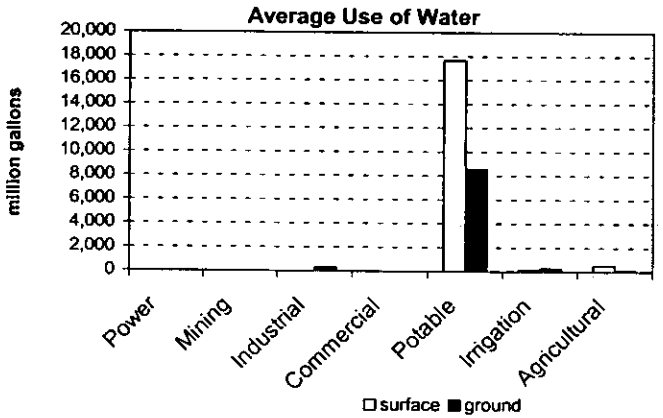
Appendix A. Details of county withdrawals.

Table A13. Monmouth County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	17,964	12,386	30,350
1991	17,385	9,878	27,263
1992	18,735	7,946	26,681
1993	18,702	8,854	27,556
1994	18,266	8,702	26,969
1995	19,989	9,055	29,044
1996	16,825	7,984	24,809
average	18,267	9,258	27,525





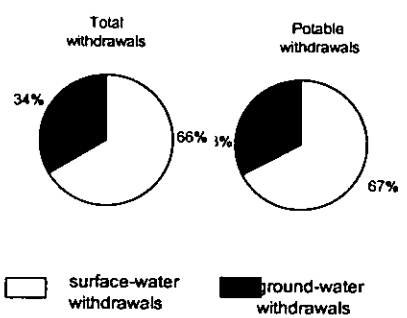
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	1	1	0	308	308	0	4	4	17,660	11,828	29,488	46	223	269	258	22	279
1991	0	0	0	0	11	11	0	290	290	0	0	0	16,846	9,294	26,140	107	249	356	431	34	466
1992	0	5	5	0	9	9	0	348	348	0	20	20	18,235	7,304	25,538	59	237	296	442	23	465
1993	0	6	6	0	0	0	0	366	367	0	6	6	17,926	8,070	25,996	131	315	446	645	91	736
1994	0	8	8	0	0	0	0	321	321	0	5	5	17,546	7,936	25,481	141	280	421	580	153	733
1995	0	7	7	0	1	1	0	329	329	0	18	18	19,006	8,192	27,197	123	352	476	860	156	1,016
1996	0	16	16	0	0	0	0	341	341	0	14	14	16,467	7,362	23,830	71	172	244	287	78	365
average	0	6	6	0	3	3	0	329	329	0	9	9	17,669	8,569	26,239	97	261	358	500	80	580

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	Total
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	605	0	10	1,980	3,269	3,011	0	1,346	0	0	0	0	659	1,506	12,386
1991	0	0	618	0	323	1,047	3,528	2,636	0	204	0	0	0	0	0	1,521	9,878
1992	0	5	534	0	280	1,357	2,595	1,590	0	43	0	0	0	0	0	1,541	7,946
1993	0	6	580	0	304	1,497	3,097	1,750	0	46	0	0	0	0	17	1,558	8,854
1994	0	8	708	0	300	1,437	2,987	1,622	0	41	0	0	0	0	24	1,575	8,702
1995	0	7	606	0	324	1,498	3,279	1,693	0	40	0	0	0	0	14	1,594	9,055
1996	0	19	530	0	327	1,365	2,697	1,377	0	37	0	0	0	0	23	1,610	7,984
average	0	6	597	0	267	1,454	3,064	1,954	0	251	0	0	0	0	105	1,558	9,258

Average Source of Withdrawals



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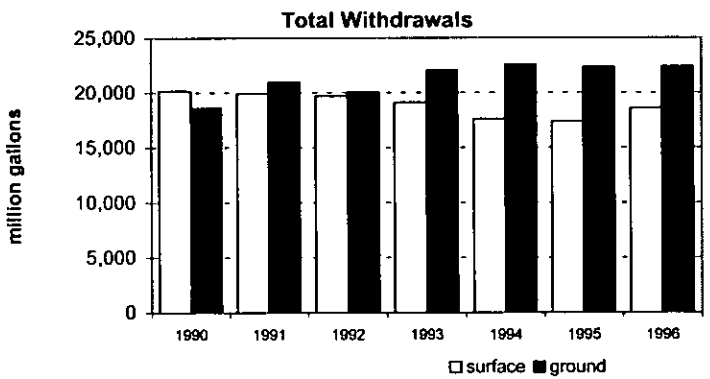
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

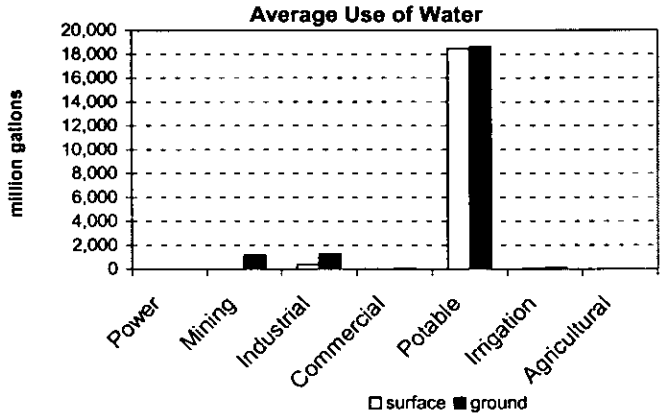
Appendix A. Details of county withdrawals.

Table A14. Morris County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	20,186	18,619	38,805
1991	19,957	20,990	40,947
1992	19,700	20,105	39,804
1993	19,124	22,038	41,161
1994	17,617	22,608	40,225
1995	17,392	22,333	39,725
1996	18,597	22,397	40,994
average	18,939	21,299	40,238





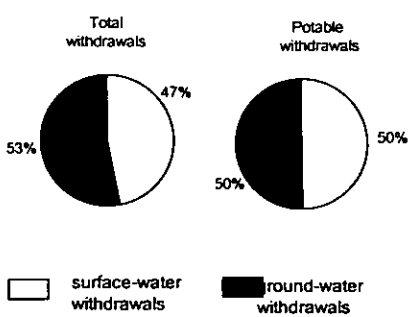
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	548	548	270	1,482	1,752	0	34	34	19,804	16,501	36,305	95	51	146	18	2	20
1991	0	0	0	0	401	401	348	1,417	1,765	0	16	16	19,526	19,023	38,548	76	112	188	7	22	29
1992	0	0	0	0	501	501	407	1,443	1,849	0	43	43	19,253	18,043	37,296	28	70	99	12	4	16
1993	0	0	0	0	926	926	432	1,340	1,772	0	36	36	18,586	19,550	38,136	90	147	237	16	39	55
1994	0	0	0	0	1,907	1,907	440	1,238	1,678	0	44	44	17,120	19,249	36,369	40	163	203	17	6	24
1995	0	0	0	0	1,870	1,870	440	1,168	1,608	0	39	39	16,851	19,027	35,878	74	154	228	28	75	102
1996	0	0	0	0	2,042	2,042	406	1,147	1,553	0	40	40	18,124	19,057	37,181	49	106	155	18	6	23
average	0	0	0	0	1,171	1,171	392	1,319	1,711	0	36	36	18,466	18,636	37,102	65	115	179	16	22	38

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	12,717	0	0	0	0	0	0	0	0	0	686	0	1,246	639	727	2,604	18,619
1991	15,623	0	0	0	0	0	0	0	0	0	802	0	1,002	933	15	2,614	20,990
1992	14,430	0	0	0	0	0	0	0	0	0	670	0	1,385	953	30	2,637	20,105
1993	15,669	0	0	0	0	0	0	0	0	0	743	0	1,714	1,016	224	2,671	22,038
1994	16,131	0	0	0	0	0	0	0	0	0	780	0	1,838	1,126	21	2,712	22,608
1995	15,700	0	0	0	0	0	0	0	0	0	679	0	1,987	1,181	40	2,745	22,333
1996	15,938	0	0	0	0	0	0	0	0	0	670	0	1,820	1,165	29	2,776	22,397
average	15,173	0	0	0	0	0	0	0	0	0	718	0	1,570	1,002	155	2,680	21,299

Average Source of Withdrawals



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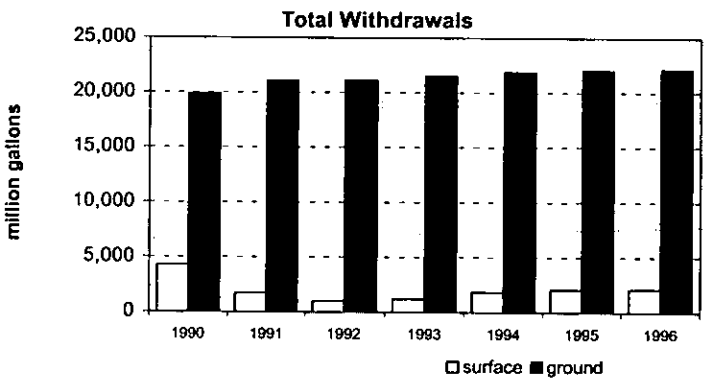
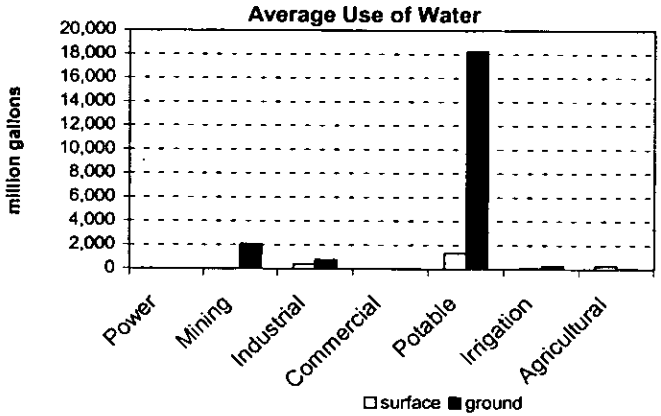
Appendix A. Details of county withdrawals.

Table A15. Ocean County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	4,285	19,913	24,198
1991	1,737	21,080	22,817
1992	986	21,142	22,128
1993	1,206	21,555	22,761
1994	1,854	21,916	23,770
1995	2,064	22,043	24,107
1996	2,113	22,160	24,273
average	2,035	21,401	23,436





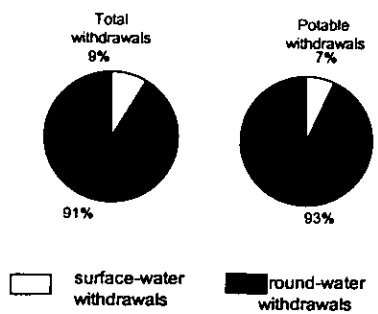
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	3,076	3,076	2,148	720	2,868	0	6	6	1,766	15,973	17,739	38	121	159	333	17	350
1991	0	0	0	0	1,898	1,898	400	604	1,003	0	7	7	906	18,314	19,219	75	186	262	357	72	429
1992	0	0	0	0	2,460	2,460	0	518	518	0	6	6	681	17,908	18,590	58	224	282	248	25	273
1993	0	0	0	0	1,744	1,744	0	611	611	0	6	6	867	18,876	19,743	83	277	360	257	40	297
1994	0	0	0	0	1,947	1,947	0	749	749	0	7	7	1,628	18,854	20,482	58	309	367	168	50	219
1995	0	0	0	0	1,601	1,601	0	780	780	0	6	6	1,811	19,213	21,024	58	391	449	195	52	248
1996	0	0	0	0	1,953	1,953	0	1,418	1,418	0	6	6	1,726	18,403	20,129	40	357	397	348	22	370
average	0	0	0	0	2,097	2,097	364	771	1,135	0	6	6	1,340	18,220	19,561	58	267	325	272	40	312

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	9,481	1,782	451	1,486	1,018	0	763	60	0	0	0	0	1,665	3,209	19,913
1991	0	0	10,306	1,588	824	1,451	794	43	2,730	72	0	0	0	0	24	3,247	21,080
1992	0	0	10,489	1,570	771	1,185	883	61	2,769	108	0	0	0	0	27	3,278	21,142
1993	0	24	10,836	1,802	768	859	957	35	2,840	89	0	0	0	0	11	3,333	21,555
1994	0	0	12,004	1,878	792	764	1,123	41	1,859	56	0	0	0	0	10	3,387	21,916
1995	0	27	11,704	1,799	824	811	1,244	48	2,053	51	0	0	0	0	29	3,453	22,043
1996	0	37	12,128	1,825	731	717	1,040	50	2,026	60	0	0	0	0	34	3,512	22,160
average	0	13	10,993	1,749	737	1,039	1,009	40	2,148	71	0	0	0	0	257	3,346	21,401

Average Source of Withdrawals



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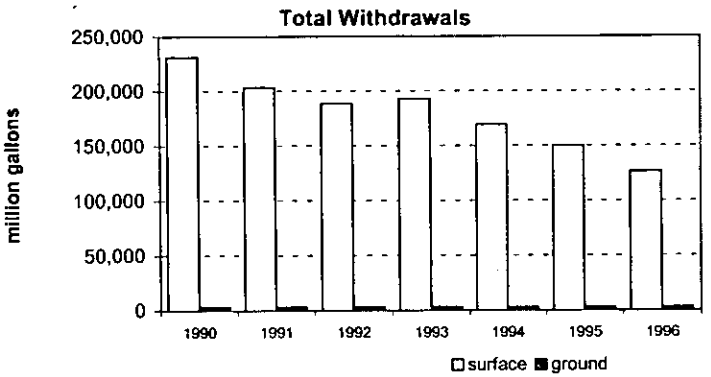
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

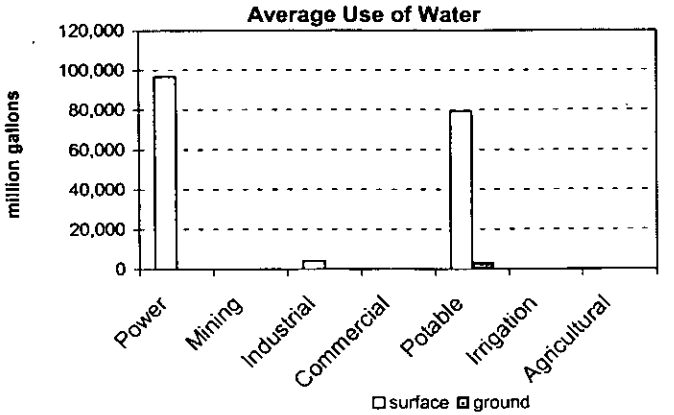
Appendix A. Details of county withdrawals.

Table A16. Passaic County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	231,211	3,420	234,631
1991	203,372	3,341	206,713
1992	188,519	3,134	191,653
1993	192,871	3,234	196,104
1994	169,523	3,031	172,554
1995	150,328	3,141	153,469
1996	126,517	3,012	129,529
average	180,334	3,187	183,522





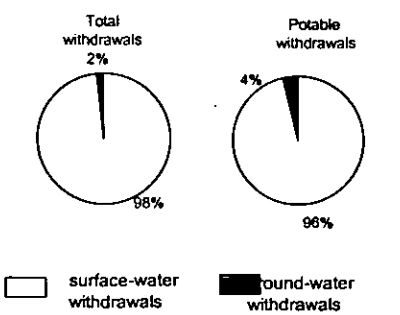
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	163,688	0	163,688	0	0	0	4,151	178	4,328	0	0	0	63,334	3,164	66,498	23	73	97	15	5	20
1991	114,547	0	114,547	0	0	0	4,203	150	4,353	0	0	0	84,599	3,129	87,728	23	61	85	0	0	0
1992	96,736	0	96,736	0	0	0	4,572	118	4,690	0	0	0	87,192	2,977	90,170	9	37	45	10	2	12
1993	101,610	0	101,610	0	0	0	4,014	107	4,121	0	0	0	87,220	3,074	90,294	28	47	75	0	5	5
1994	85,320	0	85,320	0	0	0	3,962	53	4,016	0	0	0	80,212	2,936	83,148	18	35	52	10	6	17
1995	56,954	0	56,954	0	0	0	4,223	109	4,333	0	0	0	89,121	2,983	92,104	18	43	61	12	6	18
1996	58,568	0	58,568	0	0	0	4,224	128	4,352	0	0	0	63,708	2,861	66,568	11	22	34	6	0	6
average	96,775	0	96,775	0	0	0	4,193	121	4,313	0	0	0	79,341	3,018	82,359	18	46	64	8	3	11

Average Source of Withdrawals

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	994	0	0	0	0	0	0	0	0	0	1,192	0	0	178	16	1,040	3,420
1991	988	0	0	0	0	0	0	0	0	0	1,127	0	0	185	0	1,041	3,341
1992	957	0	0	0	0	0	0	0	0	0	937	0	0	194	0	1,045	3,134
1993	990	0	0	0	0	0	0	0	0	0	986	0	0	204	0	1,054	3,234
1994	866	0	0	0	0	0	0	0	0	0	892	0	0	213	0	1,060	3,031
1995	858	0	0	0	0	0	0	0	0	0	1,007	0	0	213	0	1,063	3,141
1996	761	0	0	0	0	0	0	0	0	0	986	0	0	193	5	1,066	3,012
average	916	0	0	0	0	0	0	0	0	0	1,018	0	0	197	3	1,053	3,187



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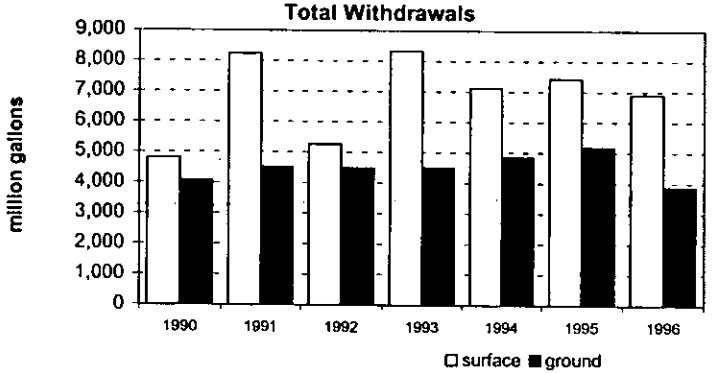
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

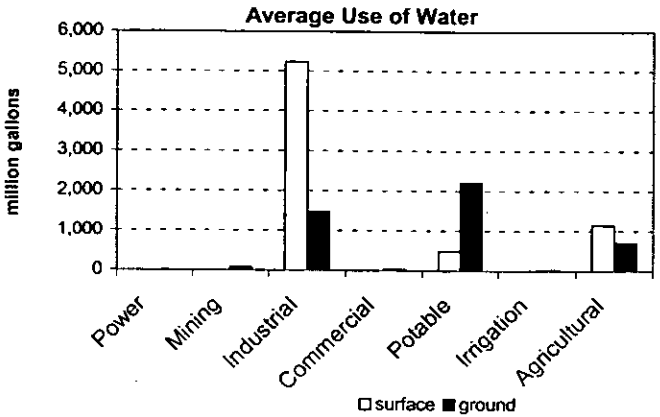
Appendix A. Details of county withdrawals.

Table A17. Salem County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	4,814	4,074	8,888
1991	8,239	4,526	12,765
1992	5,266	4,491	9,757
1993	8,337	4,514	12,850
1994	7,131	4,860	11,991
1995	7,430	5,187	12,617
1996	6,905	3,880	10,785
average	6,874	4,505	11,379





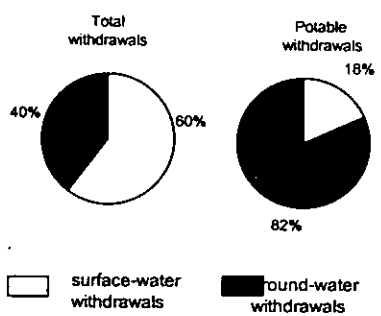
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	0	0	3,896	1,490	5,386	0	8	8	479	2,233	2,712	0	12	12	439	332	770
1991	0	0	0	0	0	0	5,026	1,350	6,376	0	32	32	469	2,409	2,878	0	13	13	2,744	722	3,465
1992	0	0	0	0	0	0	4,275	1,402	5,677	0	37	37	567	2,225	2,792	0	15	15	423	812	1,235
1993	0	0	0	0	0	0	5,040	1,484	6,524	0	40	40	549	2,181	2,731	0	49	49	2,748	760	3,508
1994	0	0	0	0	13	13	6,154	1,549	7,703	0	40	40	494	2,154	2,648	0	25	25	482	1,080	1,563
1995	0	0	0	0	486	486	6,099	1,618	7,717	0	32	32	492	2,223	2,715	11	30	41	828	798	1,626
1996	0	0	0	0	33	33	6,137	1,363	7,500	0	25	25	412	2,015	2,427	12	7	19	344	437	781
average	0	0	0	0	76	76	5,232	1,465	6,698	0	31	31	495	2,206	2,700	3	21	25	1,144	706	1,850

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	220	397	0	0	211	154	919	379	1,031	0	0	0	0	9	754	4,074
1991	0	237	769	0	0	360	545	846	416	588	0	0	0	0	13	753	4,526
1992	0	243	833	0	0	297	643	847	457	417	0	0	0	0	2	752	4,491
1993	0	219	819	0	0	184	632	1,086	334	470	0	0	0	0	18	752	4,514
1994	0	271	1,140	0	0	186	572	1,155	255	515	0	0	0	0	19	748	4,860
1995	0	187	831	0	0	206	579	1,350	244	543	0	0	0	0	494	753	5,187
1996	0	276	378	0	0	297	415	987	231	440	0	0	0	0	77	780	3,880
average	0	236	738	0	0	249	506	1,027	331	572	0	0	0	0	90	756	4,505

Average Source of Withdrawals



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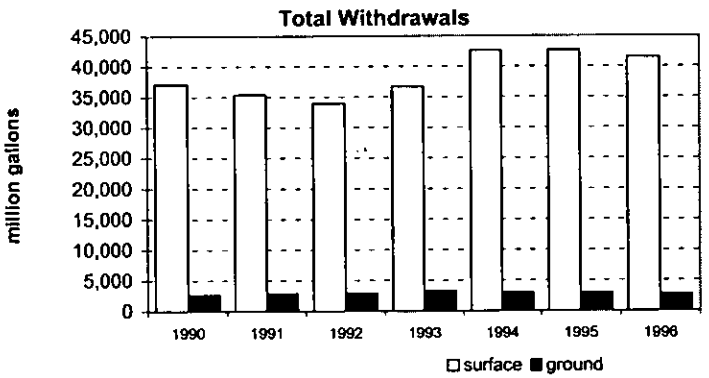
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

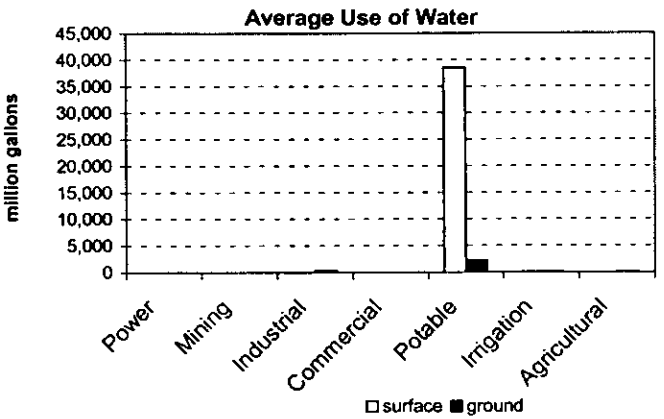
Appendix A. Details of county withdrawals.

Table A18. Somerset County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	37,090	2,677	39,767
1991	35,456	2,902	38,359
1992	33,944	2,935	36,879
1993	36,772	3,275	40,047
1994	42,649	3,020	45,669
1995	42,712	2,899	45,611
1996	41,546	2,808	44,354
average	38,596	2,931	41,527





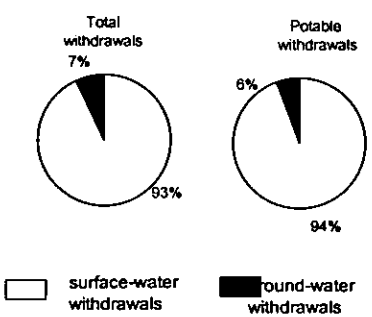
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	0	0	0	0	0	0	396	396	0	4	4	37,048	2,222	39,271	23	47	70	19	8	26
1991	0	0	0	0	0	0	0	427	427	0	0	0	35,357	2,283	37,640	81	180	261	19	11	30
1992	0	0	0	0	0	0	0	493	493	0	6	6	33,895	2,244	36,139	35	172	206	14	20	34
1993	0	0	0	0	0	0	0	456	456	0	6	6	36,694	2,344	39,037	64	162	226	14	308	323
1994	0	0	0	0	0	0	0	439	439	0	6	6	42,534	2,406	44,940	103	155	258	12	15	27
1995	0	0	0	0	0	0	0	387	387	0	6	6	42,626	2,327	44,953	66	166	232	21	12	33
1996	0	0	0	0	0	0	0	400	400	0	8	8	41,466	2,300	43,766	71	86	157	9	14	23
average	0	0	0	0	0	0	0	428	428	0	5	5	38,517	2,304	40,821	63	138	202	15	55	71

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	0	0	0	0	0	0	0	0	860	0	0	5	4	1,807	2,677
1991	0	0	0	0	0	0	0	0	0	0	1,042	0	0	12	2	1,845	2,902
1992	0	0	0	0	0	0	0	0	0	0	1,047	0	0	3	6	1,879	2,935
1993	0	0	0	0	0	0	0	0	0	0	1,328	0	0	15	9	1,923	3,275
1994	0	0	0	0	0	0	0	0	0	0	1,034	0	0	10	15	1,962	3,020
1995	0	0	0	0	0	0	0	0	0	0	876	0	0	23	5	1,995	2,899
1996	0	0	0	0	0	0	0	0	0	0	753	0	0	13	11	2,031	2,808
average	0	0	0	0	0	0	0	0	0	0	992	0	0	12	8	1,920	2,931

Average Source of Withdrawals



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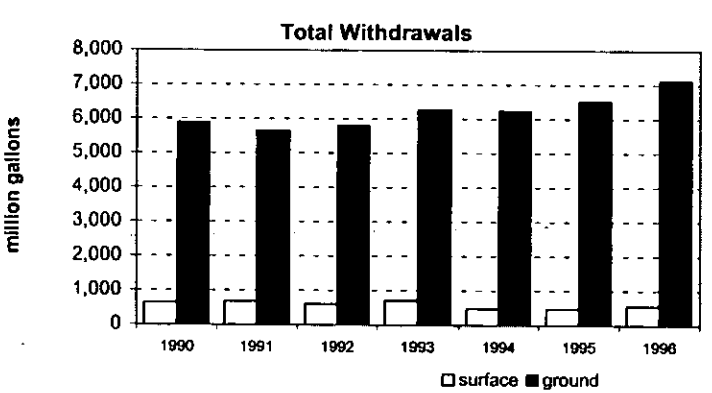
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

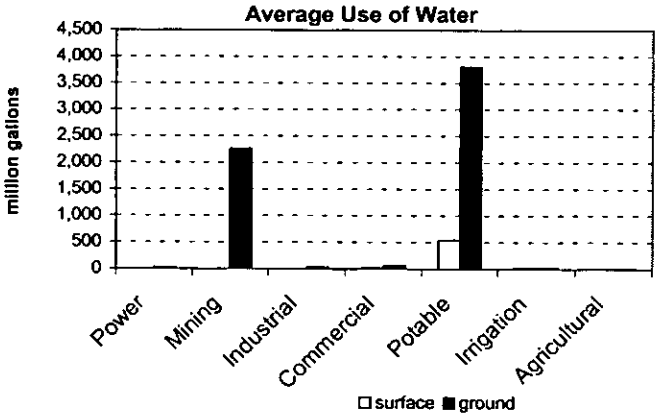
Appendix A. Details of county withdrawals.

Table A19. Sussex County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	641	5,898	6,538
1991	683	5,664	6,346
1992	609	5,805	6,414
1993	706	6,279	6,986
1994	472	6,241	6,714
1995	479	6,520	6,999
1996	561	7,131	7,692
average	593	6,220	6,813





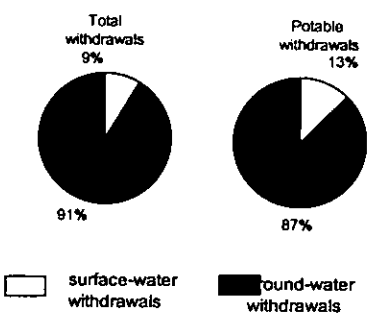
Withdrawals by use group (million gallons)

Year	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	0	2	2	0	2,497	2,497	0	0	0	0	15	15	607	3,368	3,975	10	3	13	24	12	35
1991	0	2	2	0	2,070	2,070	0	0	0	0	32	32	624	3,531	4,155	32	17	49	27	11	37
1992	0	11	11	0	2,079	2,079	0	14	14	0	49	49	589	3,629	4,218	19	14	33	1	8	10
1993	0	30	30	0	2,225	2,225	0	54	54	0	135	135	669	3,805	4,475	34	19	53	3	11	14
1994	0	58	58	0	1,924	1,924	0	51	51	0	70	70	441	4,113	4,554	32	15	47	0	11	11
1995	0	57	57	0	2,231	2,231	0	64	64	0	72	72	457	4,084	4,541	20	1	21	2	11	13
1996	0	39	39	0	2,810	2,810	0	25	25	114	57	171	437	4,138	4,575	10	61	71	0	1	1
average	0	29	29	0	2,262	2,262	0	30	30	16	62	78	546	3,810	4,356	23	19	41	8	9	17

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	239	0	0	0	0	0	0	0	0	0	0	0	2,701	473	142	2,343	5,898
1991	270	0	0	0	0	0	0	0	0	0	0	0	2,504	515	1	2,374	5,664
1992	372	0	0	0	0	0	0	0	0	0	0	0	2,500	491	35	2,407	5,805
1993	490	0	0	0	0	0	0	0	0	0	0	0	2,763	517	69	2,442	6,279
1994	414	0	0	0	0	0	0	0	0	0	0	0	2,661	612	82	2,472	6,241
1995	396	0	0	0	0	0	0	0	0	0	0	0	2,971	586	66	2,503	6,520
1996	374	0	0	0	0	0	0	0	0	0	0	0	3,586	618	25	2,529	7,131
average	365	0	0	0	0	0	0	0	0	0	0	0	2,812	544	60	2,438	6,220

Average Source of Withdrawals



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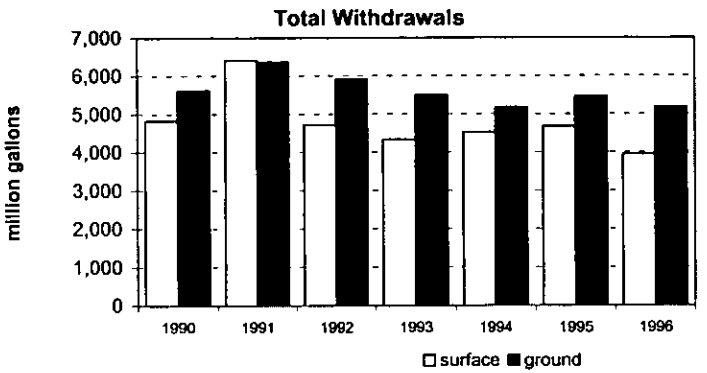
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

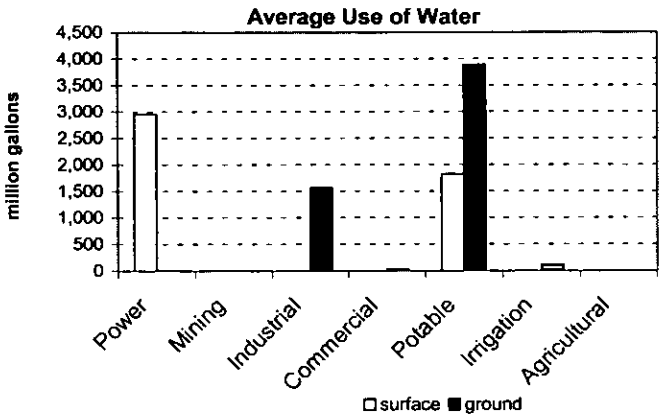
Appendix A. Details of county withdrawals.

Table A20. Union County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	4,833	5,626	10,459
1991	6,414	6,374	12,788
1992	4,722	5,923	10,645
1993	4,340	5,509	9,849
1994	4,531	5,183	9,714
1995	4,681	5,468	10,149
1996	3,951	5,186	9,137
average	4,782	5,610	10,391





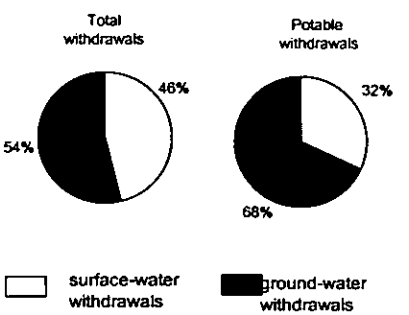
Withdrawals by use group (million gallons)

Year	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	3,065	0	3,065	0	0	0	0	1,788	1,788	0	20	20	1,768	3,734	5,502	0	83	83	0	0	0
1991	4,666	0	4,666	0	0	0	0	1,717	1,717	0	26	26	1,748	4,509	6,258	0	122	122	0	0	0
1992	2,984	1	2,985	0	0	0	0	1,629	1,629	0	18	18	1,738	4,166	5,904	0	109	109	0	0	0
1993	2,535	0	2,535	0	0	0	0	1,458	1,458	0	28	28	1,805	3,880	5,685	0	143	143	0	0	0
1994	2,577	8	2,585	0	0	0	0	1,490	1,490	0	39	39	1,954	3,529	5,483	0	116	116	0	0	0
1995	2,794	8	2,803	0	0	0	0	1,465	1,465	0	40	40	1,887	3,808	5,695	0	147	147	0	0	0
1996	2,078	6	2,083	0	0	0	0	1,437	1,437	0	29	29	1,873	3,608	5,481	0	106	106	0	0	0
average	2,957	3	2,960	0	0	0	0	1,569	1,569	0	29	29	1,825	3,891	5,715	0	118	118	0	0	0

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	1,435	0	0	0	0	0	0	0	0	0	4,136	0	0	0	13	42	5,626
1991	2,088	0	0	0	0	0	0	0	0	0	4,232	0	0	0	13	42	6,374
1992	1,887	0	0	0	0	0	0	0	0	0	3,960	0	0	0	34	42	5,923
1993	1,791	0	0	0	0	0	0	0	0	0	3,650	0	0	0	26	42	5,509
1994	973	0	0	0	0	0	0	0	0	0	4,149	0	0	0	18	42	5,183
1995	1,082	0	0	0	0	0	0	0	0	0	4,313	0	0	0	31	42	5,468
1996	862	0	0	0	0	0	0	0	0	0	4,256	0	0	0	25	42	5,186
average	1,445	0	0	0	0	0	0	0	0	0	4,099	0	0	0	23	42	5,610

Average Source of Withdrawals



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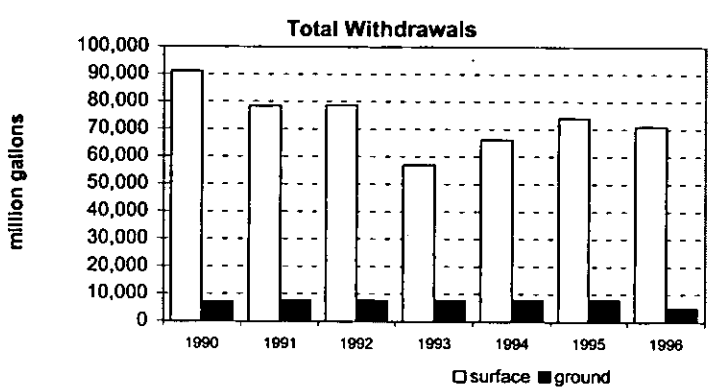
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

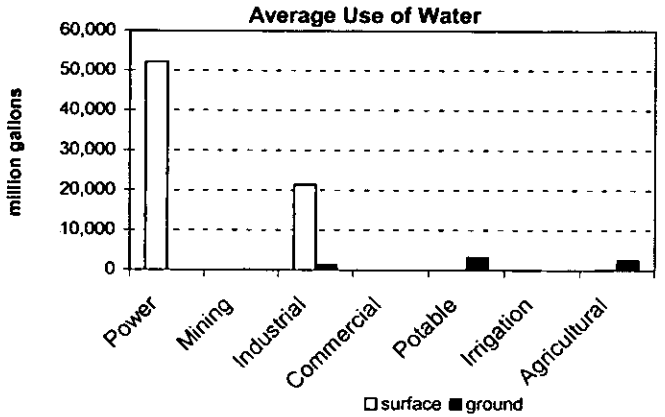
Appendix A. Details of county withdrawals.

Table A21. Warren County

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	91,074	7,217	98,291
1991	78,552	7,751	86,303
1992	78,686	7,735	86,422
1993	57,062	7,727	64,789
1994	66,279	7,852	74,131
1995	74,039	7,976	82,015
1996	71,033	4,892	75,925
average	73,818	7,307	81,125





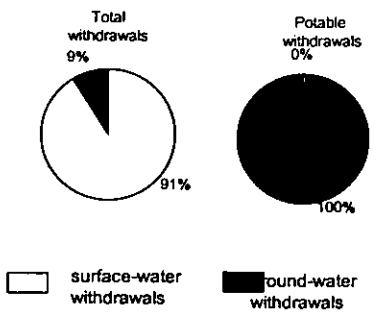
Withdrawals by use group (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
1990	56,450	0	56,450	0	10	10	34,490	1,450	35,940	0	0	0	17	3,245	3,262	15	2	17	102	2,510	2,612
1991	54,531	0	54,531	0	4	4	23,899	1,519	25,418	0	0	0	14	3,320	3,334	7	2	9	102	2,906	3,008
1992	54,917	0	54,917	0	11	11	23,728	1,382	25,110	0	0	0	6	3,320	3,327	7	3	9	28	3,019	3,047
1993	55,279	0	55,279	0	56	56	1,417	1,263	2,680	0	0	0	28	3,448	3,476	8	3	11	330	2,958	3,288
1994	44,380	0	44,380	0	63	63	21,822	1,314	23,136	0	0	0	37	3,265	3,302	4	3	7	36	3,207	3,243
1995	55,717	0	55,717	0	76	76	18,082	1,319	19,401	0	0	0	0	3,194	3,194	19	2	21	221	3,385	3,607
1996	44,233	0	44,233	0	172	172	26,648	1,254	27,901	0	0	0	0	3,247	3,247	9	2	11	143	217	361
average	52,215	0	52,215	0	56	56	21,441	1,357	22,798	0	0	0	15	3,292	3,306	10	2	12	138	2,600	2,738

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	3,578	0	0	0	0	0	0	0	0	0	0	0	2,250	252	2	1,136	7,217
1991	4,378	0	0	0	0	0	0	0	0	0	0	0	2,130	68	26	1,149	7,751
1992	4,523	0	0	0	0	0	0	0	0	0	0	0	1,940	102	10	1,160	7,735
1993	4,597	0	0	0	0	0	0	0	0	0	0	0	1,859	56	46	1,170	7,727
1994	3,366	0	0	0	0	0	0	0	0	0	0	0	3,082	181	40	1,183	7,852
1995	3,401	0	0	0	0	0	0	0	0	0	0	0	3,073	259	46	1,196	7,976
1996	1,312	0	0	0	0	0	0	0	0	0	0	0	2,157	162	51	1,209	4,892
average	3,593	0	0	0	0	0	0	0	0	0	0	0	2,356	154	32	1,172	7,307

Average Source of Withdrawals



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Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

Appendix B.
Details of withdrawals by water region.

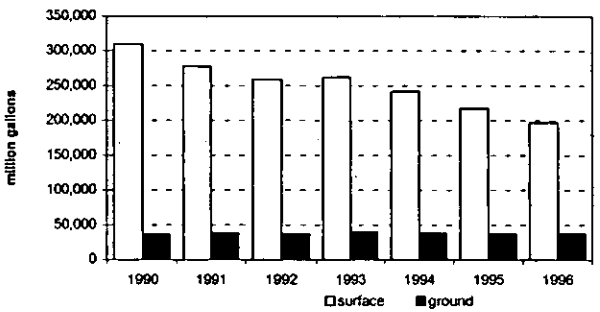
Appendix B. Detailed analysis of use of water withdrawn in each Water Region, 1990-1996.

Table B1. Passaic (Water Region #1)

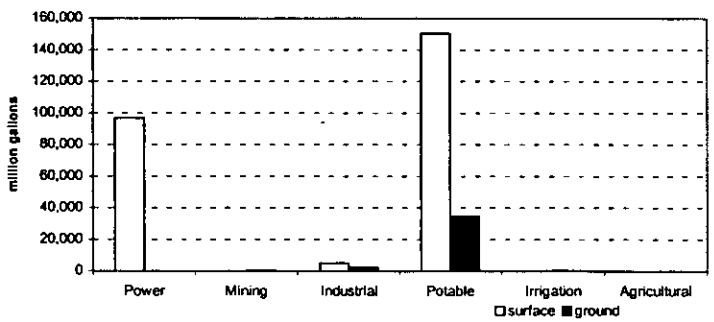
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	310,090	36,990	347,080
1991	278,171	38,428	316,599
1992	259,171	37,031	296,201
1993	262,589	39,995	302,584
1994	241,917	38,474	280,391
1995	217,453	37,558	255,012
1996	197,564	37,852	235,416
average	252,422	38,047	290,469

Total withdrawals in the water region



Average use of water withdrawn in the water region



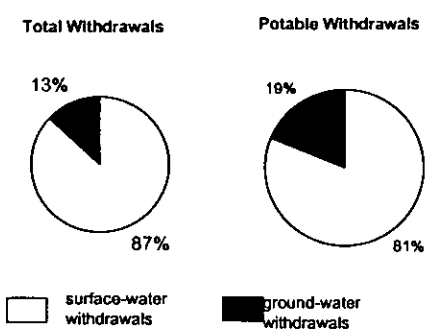
Total withdrawals by use (million gallons)

YEAR	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	163,688	0	163,688	0	136	136	4,989	2,976	7,965	0	111	111	141,343	33,445	174,788	45	318	363	25	5	30
1991	114,547	0	114,547	0	129	129	5,183	2,832	8,015	0	109	109	158,363	34,857	193,220	72	490	563	7	10	17
1992	96,736	0	96,736	0	65	65	5,634	2,695	8,328	0	115	115	156,756	33,823	190,579	33	331	364	12	2	14
1993	101,610	0	101,610	0	153	153	4,854	2,922	7,776	0	80	80	155,915	36,216	192,131	204	599	803	6	25	32
1994	85,320	0	85,320	0	167	167	4,631	2,352	6,983	0	86	86	151,749	35,238	186,987	203	618	822	13	13	26
1995	56,954	0	56,954	0	69	69	4,878	2,338	7,216	0	70	70	155,396	34,428	189,823	202	647	849	23	7	31
1996	58,568	0	58,568	0	67	67	4,754	1,982	6,736	0	62	62	134,082	35,273	169,356	149	461	610	10	6	16
average	96,775	0	96,775	0	112	112	4,989	2,585	7,574	0	91	91	150,515	34,754	185,269	130	495	625	14	10	24

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	21,193	0	0	0	0	0	0	0	0	0	11,416	0	1	414	59	3,908	*36,990*
1991	22,172	0	0	0	0	0	0	0	0	0	11,954	0	1	317	62	3,921	*38,428*
1992	20,819	0	0	0	0	0	0	0	0	0	11,876	0	1	320	63	3,952	*37,031*
1993	22,246	0	0	0	0	0	0	0	0	0	13,359	0	1	352	45	3,992	*39,995*
1994	21,292	0	0	0	0	0	0	0	0	0	12,724	0	1	380	44	4,034	*38,474*
1995	20,611	0	0	0	0	0	0	0	0	0	12,428	0	1	418	33	4,067	*37,558*
1996	21,001	0	0	0	0	0	0	0	0	0	12,311	0	2	399	41	4,098	*37,852*
average	21,333	0	0	0	0	0	0	0	0	0	12,295	0	1	371	50	3,996	*38,047*

Average source of withdrawals



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The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

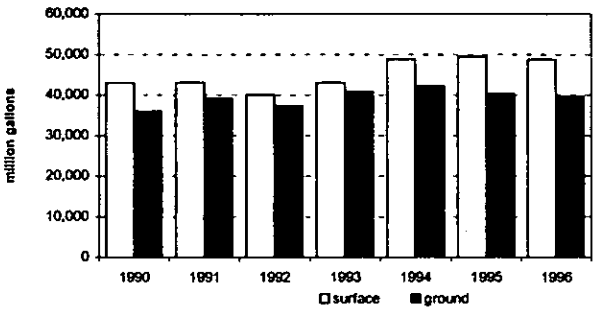
Appendix B. Detailed analysis of use of water withdrawn in each Water Region, 1990-1996.

Table B2. Raritan (Water Region #2)

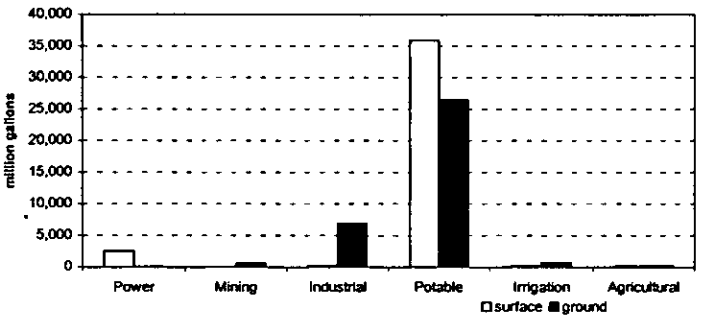
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	42,992	36,083	79,075
1991	43,081	39,312	82,394
1992	40,058	37,362	77,421
1993	43,060	40,883	83,943
1994	48,822	42,271	91,094
1995	49,488	40,337	89,826
1996	48,776	39,693	88,469
average	45,183	39,420	84,603

Total withdrawals in the water region



Average use of water withdrawn in the water region



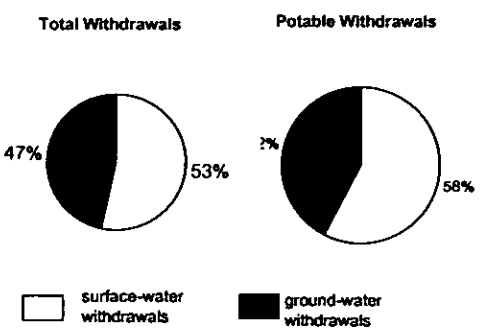
Total withdrawals by use (million gallons)

YEAR	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	1	1	0	390	390	0	7	7	0	4,810	4,810	12	308	319	160	141	302
1991	4,666	36	4,702	0	755	755	269	7,688	7,957	0	46	46	37,700	29,567	67,266	265	938	1,203	182	281	464
1992	2,984	30	3,014	0	93	93	349	7,994	8,343	0	46	46	36,392	28,239	64,630	201	798	999	133	163	296
1993	2,535	26	2,561	0	961	961	320	8,115	8,435	0	54	54	39,757	30,120	69,877	242	967	1,209	206	639	846
1994	2,577	36	2,613	83	1,149	1,232	314	8,243	8,556	0	71	71	45,450	31,742	77,191	277	751	1,028	122	280	402
1995	2,794	39	2,833	79	440	519	316	7,157	7,473	0	70	70	45,780	31,450	77,230	256	803	1,059	263	379	643
1996	2,078	28	2,106	32	1,019	1,051	310	8,447	8,757	0	63	63	46,117	29,556	75,674	175	457	632	63	123	186
average	2,519	28	2,547	28	631	659	268	6,862	7,130	0	51	51	35,885	26,498	62,383	204	717	921	162	287	448

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	2,648	0	0	0	0	261	6,437	4,666	0	4,433	7,786	543	995	569	2,940	4,805	*36,083*
1991	4,879	0	0	0	0	404	7,987	6,785	0	889	10,929	804	932	807	33	4,863	*39,312*
1992	3,889	0	0	0	0	488	8,050	5,840	0	138	11,065	801	1,199	910	47	4,937	*37,362*
1993	4,922	0	0	0	0	518	7,497	6,708	0	1,465	11,260	858	1,512	1,081	46	5,017	*40,883*
1994	4,950	0	0	0	0	504	7,711	6,788	0	1,249	12,124	894	1,666	1,150	146	5,089	*42,271*
1995	5,059	0	0	0	0	464	7,949	6,108	0	632	11,123	754	1,799	1,235	69	5,146	*40,337*
1996	4,588	0	0	0	0	460	8,908	5,367	0	1,113	10,441	655	1,630	1,257	53	5,221	*39,693*
average	4,419	0	0	0	0	443	7,791	6,037	0	1,417	10,675	759	1,390	1,001	476	5,011	*39,420*

Average source of withdrawals



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The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

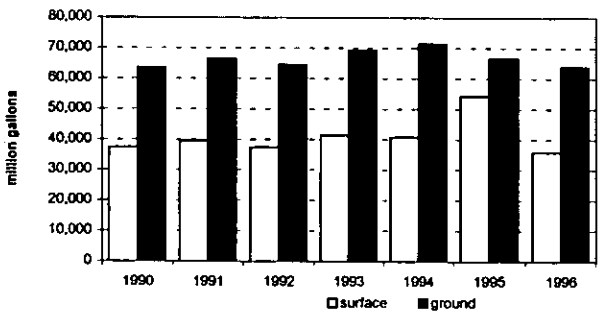
Appendix B. Detailed analysis of use of water withdrawn in each Water Region, 1990-1996.

Table B3. Atlantic Coastal (Water Region #3)

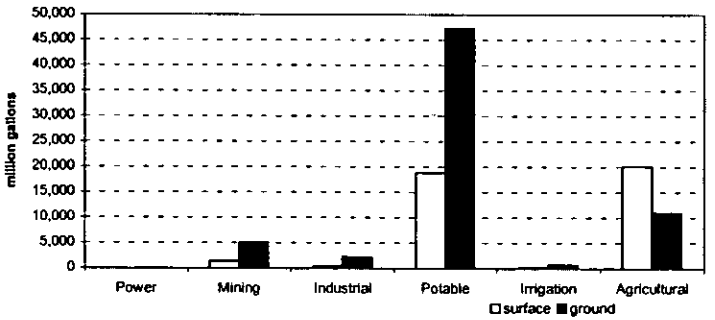
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	37,400	63,642	101,042
1991	39,568	66,634	106,202
1992	37,370	64,637	102,007
1993	41,474	69,360	110,835
1994	40,804	71,424	112,228
1995	54,240	66,707	120,947
1996	35,906	63,904	99,810
average	40,966	66,616	107,582

Total withdrawals in the water region



Average use of water withdrawn in the water region



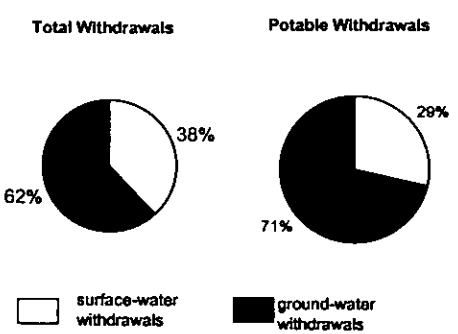
Total withdrawals by use (million gallons)

YEAR	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	123	123	1,504	6,181	7,685	2,148	1,710	3,858	0	227	227	20,342	45,211	65,553	84	490	573	13,323	9,699	23,022
1991	0	114	114	1,229	4,334	5,563	400	1,489	1,889	0	221	221	17,752	47,904	65,656	162	613	774	20,026	11,958	31,984
1992	0	109	109	1,579	5,245	6,824	0	1,752	1,752	0	222	222	18,785	45,908	64,693	163	645	807	16,844	10,756	27,600
1993	0	124	124	1,658	4,844	6,502	0	2,206	2,206	0	280	280	18,382	48,646	67,028	266	992	1,259	21,168	12,267	33,435
1994	0	128	128	1,558	5,145	6,703	0	2,255	2,255	0	265	265	18,575	48,593	67,168	270	843	1,113	20,400	14,196	34,597
1995	0	161	161	1,149	4,788	5,937	0	1,977	1,977	0	276	276	20,034	48,460	68,495	267	1,087	1,354	32,789	9,959	42,748
1996	0	195	195	1,257	5,119	6,376	0	2,742	2,742	0	245	245	18,286	46,669	64,955	222	860	1,082	16,142	8,075	24,216
average	0	136	136	1,419	5,094	6,513	364	2,019	2,383	0	248	248	18,879	47,342	66,221	205	790	995	20,099	10,987	31,086

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	1,746	31,379	6,341	650	4,183	4,937	1,375	763	596	0	0	0	0	2,332	9,340	*63,642*
1991	0	1,393	35,810	6,511	1,364	3,221	5,059	847	2,730	194	0	0	0	0	55	9,451	*66,634*
1992	0	558	36,239	6,342	1,403	2,802	4,008	954	2,769	0	0	0	0	0	37	9,524	*64,637*
1993	0	2,389	36,940	7,155	1,438	3,035	4,924	946	2,840	27	0	0	0	0	60	9,606	*69,360*
1994	0	2,476	36,826	7,331	1,279	6,432	4,431	1,041	1,859	0	0	0	0	0	48	9,701	*71,424*
1995	0	2,299	34,590	7,442	1,361	3,443	4,955	707	2,053	0	0	0	0	0	52	9,804	*66,707*
1996	0	2,078	33,778	7,340	1,239	2,596	4,235	597	2,026	0	0	0	0	0	120	9,895	*63,904*
average	0	1,849	35,080	6,923	1,248	3,673	4,650	924	2,148	117	0	0	0	0	386	9,617	*66,616*

Average source of withdrawals



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Analysis based on location of water withdrawals, not location of water use.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

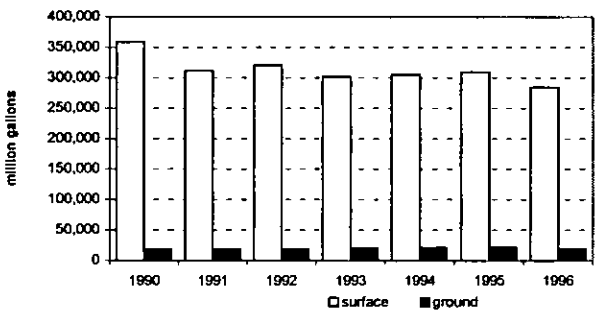
Appendix B. Detailed analysis of use of water withdrawn in each Water Region, 1990-1996.

Table B4. Upper Delaware (Water Region #4)

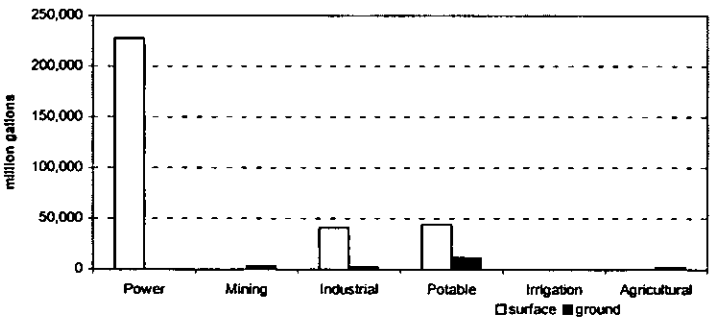
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	359,020	18,463	377,483
1991	312,127	19,195	331,322
1992	321,172	19,617	340,789
1993	302,023	20,630	322,652
1994	305,285	21,347	326,632
1995	309,219	21,952	331,171
1996	284,399	19,303	303,702
average	313,321	20,072	333,393

Total withdrawals in the water region



Average use of water withdrawn in the water region



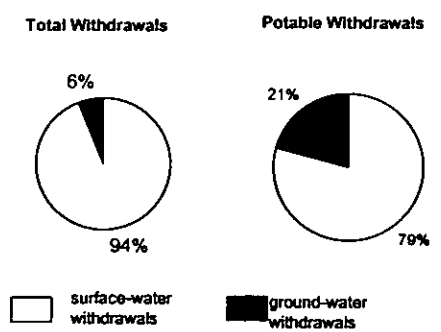
Total withdrawals by use (million gallons)

YEAR	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	251,051	2	251,053	0	2,920	2,920	61,636	2,053	63,689	0	15	15	46,159	10,932	57,091	41	18	58	133	2,524	2,657
1991	218,837	2	218,839	0	2,347	2,347	48,086	2,146	50,231	0	32	32	44,998	11,687	56,685	59	47	107	147	2,934	3,081
1992	234,781	11	234,792	0	2,526	2,526	43,555	2,281	45,837	0	49	49	42,754	11,686	54,439	39	27	67	43	3,037	3,080
1993	237,686	30	237,717	0	3,054	3,054	18,274	2,332	20,606	0	135	135	45,625	12,018	57,644	71	51	122	367	3,009	3,376
1994	221,565	58	221,623	0	3,727	3,727	39,841	2,381	42,222	0	72	72	43,777	11,855	55,631	44	36	80	58	3,218	3,276
1995	224,139	57	224,196	0	4,108	4,108	39,649	2,343	41,991	0	72	72	45,114	11,939	57,054	65	29	95	252	3,403	3,655
1996	206,023	39	206,062	0	4,957	4,957	37,357	2,289	39,647	114	57	171	40,718	11,661	52,379	29	75	104	158	224	382
average	227,726	29	227,755	0	3,377	3,377	41,200	2,261	43,460	16	62	78	44,164	11,683	55,846	50	41	90	165	2,621	2,786

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	4,960	0	0	0	0	0	0	1,001	0	364	438	156	5,371	936	306	4,932	*18,463*
1991	5,838	0	0	0	0	14	33	1,057	0	384	493	188	5,159	1,012	32	4,987	*19,195*
1992	6,204	0	0	0	0	8	9	982	0	402	764	173	4,940	1,061	23	5,052	*19,617*
1993	6,445	0	0	0	0	27	0	672	0	816	926	192	5,136	992	307	5,117	*20,630*
1994	5,993	0	0	0	0	0	0	982	0	459	947	170	6,273	1,241	105	5,177	*21,347*
1995	6,114	0	0	0	0	6	2	1,089	0	519	875	123	6,604	1,279	109	5,231	*21,952*
1996	4,081	0	0	0	0	0	1	1,134	0	225	888	141	6,356	1,115	69	5,292	*19,303*
average	5,662	0	0	0	0	8	6	988	0	453	761	163	5,691	1,091	136	5,112	*20,072*

Average source of withdrawals



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Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

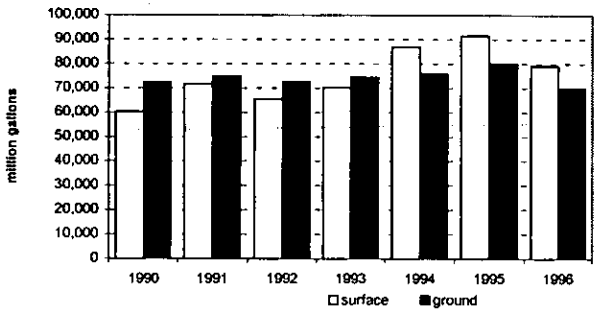
Appendix B. Detailed analysis of use of water withdrawn in each Water Region, 1990-1996.

Table B5. Lower Delaware (Water Region #5)

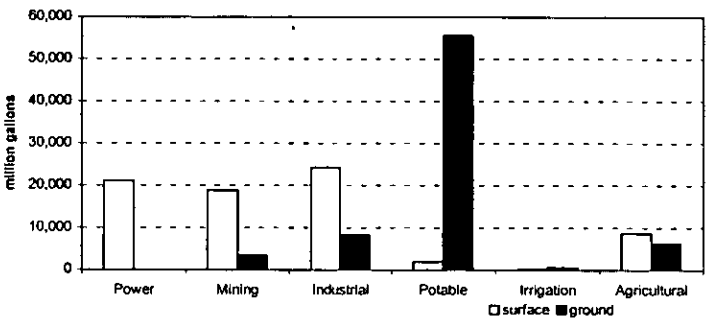
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	60,315	72,495	132,810
1991	71,663	74,798	146,461
1992	65,514	72,639	138,153
1993	70,214	74,636	144,850
1994	86,936	76,067	163,003
1995	91,555	80,170	171,725
1996	79,179	70,006	149,185
average	75,054	74,402	149,455

Total withdrawals in the water region



Average use of water withdrawn in the water region



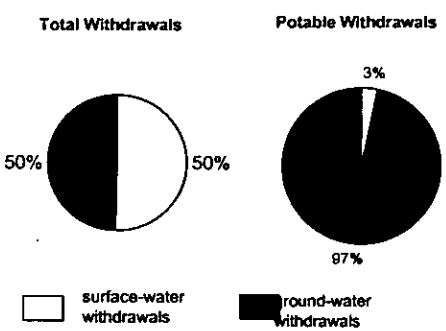
Total withdrawals by use (million gallons)

YEAR	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	12,503	0	12,503	12,342	2,521	14,864	25,114	9,940	35,054	0	30	30	1,747	54,857	56,603	107	516	623	8,501	4,631	13,132
1991	9,489	0	9,489	18,139	2,271	20,411	30,730	8,696	39,426	0	62	62	1,544	56,937	58,481	164	444	608	11,596	6,389	17,985
1992	2,974	0	2,974	26,365	2,238	28,603	30,236	8,291	38,527	0	108	108	1,417	55,383	56,801	90	529	619	4,432	6,089	10,521
1993	13,781	0	13,781	18,046	3,242	21,288	25,973	7,856	33,829	1	128	129	1,278	56,671	57,949	95	750	845	11,041	5,989	17,030
1994	38,027	0	38,027	21,317	4,096	25,413	18,945	8,074	27,018	3	91	94	1,466	56,701	58,167	88	806	894	7,090	6,299	13,389
1995	36,513	0	36,513	21,430	4,819	26,248	20,124	7,260	27,385	13	92	105	1,323	58,286	59,609	164	809	973	11,987	8,905	20,892
1996	34,719	0	34,719	14,665	5,259	19,924	19,000	7,579	26,579	1	76	77	4,663	50,989	55,652	90	639	728	6,041	5,466	11,507
average	21,144	0	21,144	18,901	3,492	22,393	24,303	8,242	32,545	3	84	86	1,920	55,689	57,609	114	642	756	8,670	6,253	14,922

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	304	15,237	454	660	1,988	6,943	8,337	12,751	19,622	0	0	0	0	115	6,085	*72,495*
1991	0	751	16,144	0	668	2,053	10,679	12,933	18,167	6,894	0	0	0	0	369	6,139	*74,798*
1992	0	634	15,291	0	546	2,097	10,385	11,828	19,936	5,663	0	0	0	0	102	6,157	*72,639*
1993	0	960	16,418	0	548	2,319	10,332	11,840	18,988	6,869	0	0	0	0	181	6,180	*74,636*
1994	0	1,259	18,046	0	435	2,287	11,146	12,735	19,351	4,538	0	0	0	0	55	6,213	*76,067*
1995	0	1,208	19,221	0	868	2,931	10,861	13,580	20,359	4,366	0	0	0	0	534	6,242	*80,170*
1996	0	1,383	16,654	0	526	2,611	9,054	11,179	16,827	4,801	0	0	0	0	695	6,276	*70,006*
average	0	928	16,716	65	607	2,327	9,914	11,776	18,054	7,536	0	0	0	0	293	6,185	*74,402*

Average source of withdrawals



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Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

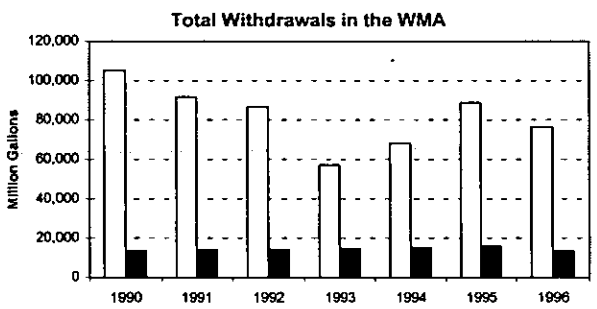
Appendix C.
Details of withdrawals by watershed management area.

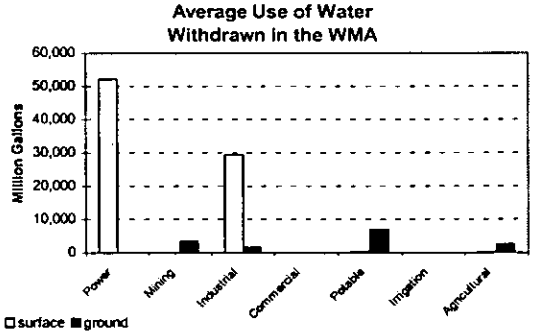
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C1. Upper Delaware (Watershed Management Area #1)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	105,323	13,722	119,045
1991	91,807	14,191	105,998
1992	86,799	14,298	101,097
1993	57,309	14,767	72,077
1994	68,092	15,388	83,479
1995	88,868	16,009	104,877
1996	76,432	13,551	89,982
average	82,090	14,561	96,651



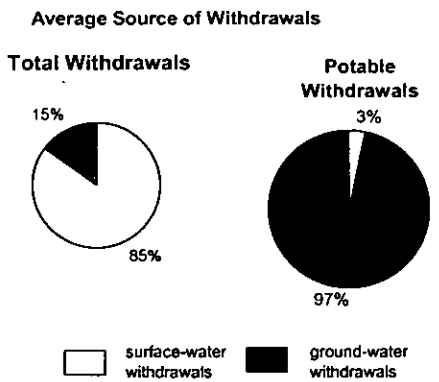


Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	56,450	0	56,450	0	2,914	2,914	48,383	1,778	50,162	0	0	0	357	6,516	6,873	24	3	27	109	2,510	2,619
1991	54,531	0	54,531	0	2,346	2,346	36,908	1,853	38,762	0	0	0	242	7,083	7,325	24	3	27	102	2,906	3,008
1992	54,917	0	54,917	0	2,510	2,510	31,630	1,697	33,327	0	1	1	201	7,068	7,269	13	3	16	38	3,019	3,057
1993	55,279	0	55,279	0	3,039	3,039	1,418	1,547	2,965	0	10	10	247	7,208	7,455	26	3	30	339	2,958	3,297
1994	44,380	0	44,380	0	3,717	3,717	23,319	1,605	24,925	0	3	3	317	6,851	7,168	25	3	28	51	3,207	3,258
1995	55,717	0	55,717	0	4,088	4,088	32,652	1,632	34,284	0	0	0	222	6,901	7,123	39	4	43	238	3,385	3,623
1996	44,233	0	44,233	0	4,906	4,906	31,880	1,577	33,456	0	0	0	144	6,845	6,989	18	6	23	157	217	375
average	52,215	0	52,215	0	3,360	3,360	29,456	1,670	31,126	0	2	2	247	6,925	7,172	24	4	28	148	2,600	2,748

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	4,820	0	0	0	0	0	0	0	0	0	0	0	5,127	740	174	2,861	13,722
1991	5,672	0	0	0	0	0	0	0	0	0	0	0	4,743	850	32	2,894	14,191
1992	5,931	0	0	0	0	0	0	0	0	0	0	0	4,537	887	15	2,930	14,298
1993	6,072	0	0	0	0	0	0	0	0	0	0	0	4,664	813	253	2,966	14,767
1994	5,681	0	0	0	0	0	0	0	0	0	0	0	5,647	1,013	44	3,002	15,388
1995	5,819	0	0	0	0	0	0	0	0	0	0	0	6,006	1,096	51	3,037	16,009
1996	3,807	0	0	0	0	0	0	0	0	0	0	0	5,701	917	55	3,071	13,551
average	5,400	0	0	0	0	0	0	0	0	0	0	0	5,204	902	89	2,966	14,561



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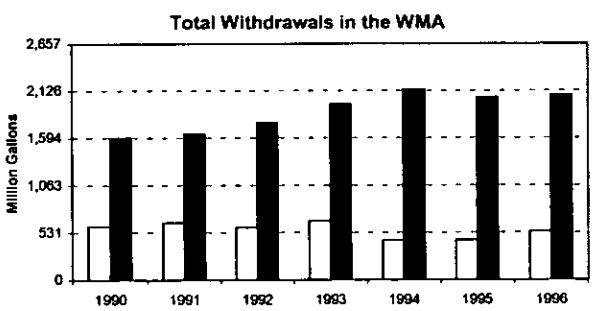
Analysis based on location of water withdrawals, not location of water use.
The industrial category on the graphs includes both industrial and commercial & recreation withdrawals.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

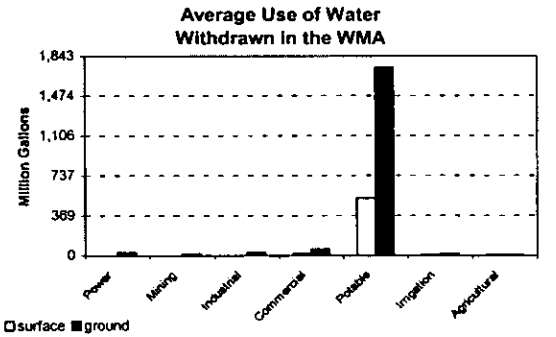
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C2. Walkill, Pohuck and Papakating (Watershed Management Area #2)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	605	1,600	2,205
1991	646	1,644	2,290
1992	591	1,774	2,365
1993	663	1,982	2,646
1994	445	2,144	2,589
1995	448	2,056	2,504
1996	547	2,079	2,625
average	564	1,897	2,461





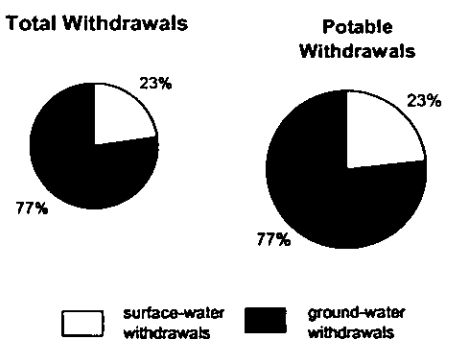
Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	2	2	0	6	6	0	0	0	0	15	15	580	1,563	2,144	1	3	3	24	12	35
1991	0	2	2	0	0	0	0	0	0	0	32	32	604	1,583	2,187	15	16	31	27	11	37
1992	0	11	11	0	16	16	0	14	14	0	48	48	576	1,663	2,239	13	14	27	1	8	10
1993	0	30	30	0	14	14	0	54	54	0	124	124	644	1,731	2,375	16	18	34	3	11	14
1994	0	58	58	0	10	10	0	51	51	0	67	67	434	1,933	2,367	11	14	26	0	11	11
1995	0	57	57	0	20	20	0	64	64	0	72	72	447	1,831	2,277	0	0	0	2	11	13
1996	0	39	39	0	51	51	0	25	25	114	57	171	431	1,844	2,276	1	61	62	0	1	1
average	0	29	29	0	17	17	0	30	30	16	59	76	531	1,735	2,266	8	18	26	8	9	17

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	140	0	0	0	0	0	0	0	0	0	0	0	240	172	131	917	1,600
1991	165	0	0	0	0	0	0	0	0	0	0	0	397	153	0	929	1,644
1992	273	0	0	0	0	0	0	0	0	0	0	0	389	163	8	941	1,774
1993	373	0	0	0	0	0	0	0	0	0	0	0	447	167	41	954	1,982
1994	312	0	0	0	0	0	0	0	0	0	0	0	598	215	52	966	2,144
1995	295	0	0	0	0	0	0	0	0	0	0	0	558	177	48	978	2,056
1996	274	0	0	0	0	0	0	0	0	0	0	0	620	190	6	988	2,079
average	262	0	0	0	0	0	0	0	0	0	0	0	464	177	41	953	1,897

Average Source of Withdrawals



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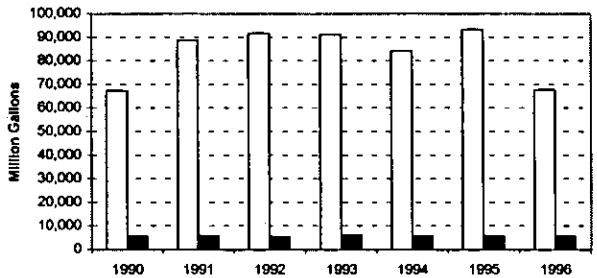
The industrial category on the graphs includes both industrial and commercial & recreation withdrawals.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

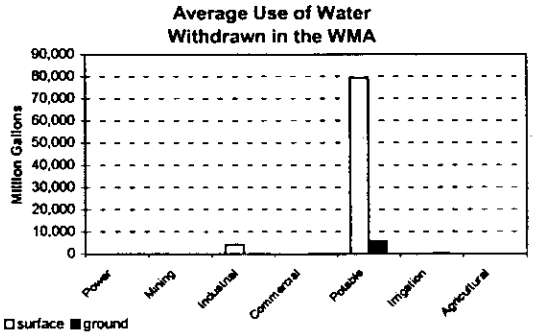
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C3. Pompton, Pequannock, Wanaque and Ramapo (Watershed Management Area #3)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	67,437	5,745	73,181
1991	88,776	5,945	94,721
1992	91,755	5,513	97,268
1993	91,191	6,270	97,461
1994	84,195	5,780	89,976
1995	93,339	5,872	99,211
1996	67,845	5,679	73,524
average	83,506	5,829	89,335



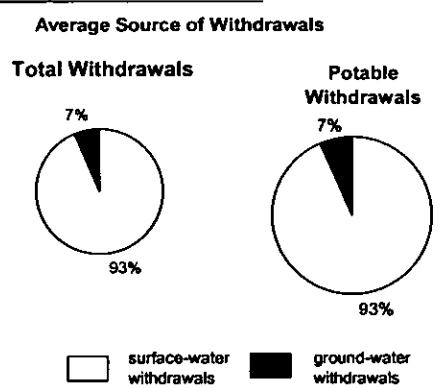


Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	0	0	4,151	79	4,230	0	17	17	63,248	5,562	68,810	23	82	105	15	5	20
1991	0	0	0	0	0	0	4,203	39	4,242	0	20	20	84,550	5,767	90,317	23	119	142	0	0	0
1992	0	0	0	0	0	0	4,572	36	4,608	0	20	20	87,164	5,401	92,566	9	54	62	10	2	12
1993	0	0	0	0	0	0	4,014	46	4,060	0	27	27	87,150	6,054	93,204	28	138	165	0	5	5
1994	0	0	0	0	0	0	3,962	12	3,974	0	30	30	80,205	5,621	85,826	18	112	130	10	6	17
1995	0	0	0	0	0	0	4,223	20	4,243	0	24	24	89,086	5,763	94,849	18	60	77	12	6	18
1996	0	0	0	0	0	0	4,224	6	4,230	0	15	15	63,604	5,592	69,195	11	67	78	6	0	6
average	0	0	0	0	0	0	4,193	34	4,227	0	22	22	79,287	5,680	84,967	18	90	108	8	3	11

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	3,582	0	0	0	0	0	0	0	0	0	534	0	0	390	34	1,205	5,745
1991	3,932	0	0	0	0	0	0	0	0	0	565	0	0	200	41	1,208	5,945
1992	3,620	0	0	0	0	0	0	0	0	0	442	0	0	208	28	1,215	5,513
1993	4,280	0	0	0	0	0	0	0	0	0	509	0	0	227	28	1,226	6,270
1994	3,833	0	0	0	0	0	0	0	0	0	452	0	0	234	26	1,236	5,780
1995	3,883	0	0	0	0	0	0	0	0	0	494	0	0	238	14	1,243	5,872
1996	3,704	0	0	0	0	0	0	0	0	0	453	0	0	251	21	1,250	5,679
average	3,833	0	0	0	0	0	0	0	0	0	493	0	0	250	27	1,226	5,829



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Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

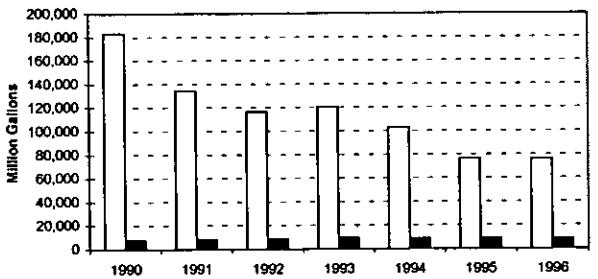
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C4. Lower Passaic and Saddle (Watershed Management Area #4)

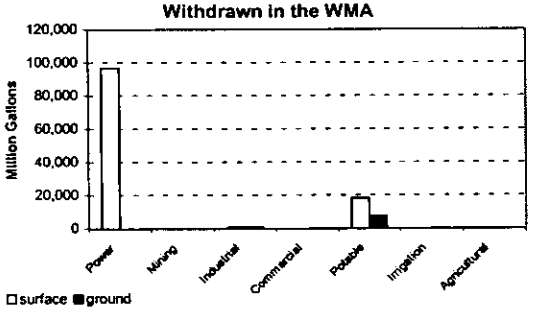
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	183,218	7,972	191,191
1991	134,628	8,414	143,042
1992	116,556	8,401	124,957
1993	120,781	9,616	130,397
1994	103,377	8,876	112,253
1995	76,701	8,565	85,266
1996	76,118	8,815	84,933
average	115,911	8,666	124,577

Total Withdrawals in the WMA



Average Use of Water Withdrawn in the WMA



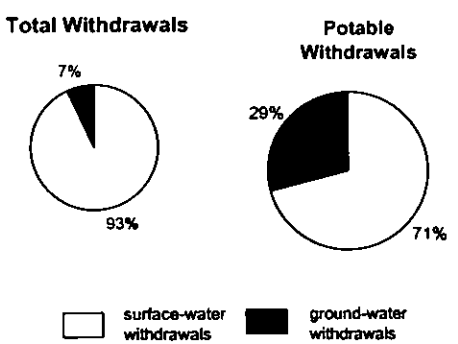
Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	163,688	0	163,688	0	0	0	839	1,127	1,965	0	2	2	18,687	6,734	25,421	4	109	114	0	0	0
1991	114,547	0	114,547	0	0	0	872	920	1,792	0	3	3	19,194	7,298	26,491	16	184	200	0	10	10
1992	96,736	0	96,736	0	0	0	981	821	1,802	0	0	0	18,829	7,452	26,281	11	127	138	0	0	0
1993	101,610	0	101,610	0	0	0	728	1,213	1,941	0	0	0	18,408	8,201	26,609	35	182	217	0	21	21
1994	85,320	0	85,320	0	0	0	543	885	1,428	0	2	2	17,473	7,816	25,289	41	166	207	0	7	7
1995	56,954	0	56,954	0	0	0	529	849	1,378	0	0	0	19,180	7,483	26,663	38	231	269	0	1	1
1996	58,568	0	58,568	0	0	0	434	516	950	0	0	0	17,098	8,139	25,236	17	154	172	0	6	6
average	96,775	0	96,775	0	0	0	704	904	1,608	0	1	1	18,410	7,589	25,999	23	165	188	0	7	7

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	north-ern NJ surficial	south-ern NJ surficial	Cohan-sey, Kirk-wood	Rio Grande, 800 ft-sand	Piney Point, Vincen-town	Weno-nah, Mt. Laurel, English-town	Magothy-Raritan-Potomac				Bruns-wick	Locka-tong, Stock-ton	Paleozoic & Proterzoic		Un-known	Domes-tic wells	
							upper	middle	lower	un-known			carbon-ates	crystal-line			
1990	637	0	0	0	0	0	0	0	0	0	6,753	0	0	0	10	572	7,972
1991	669	0	0	0	0	0	0	0	0	0	7,172	0	0	0	0	573	8,414
1992	565	0	0	0	0	0	0	0	0	0	7,255	0	0	0	6	575	8,401
1993	649	0	0	0	0	0	0	0	0	0	8,388	0	0	0	1	579	9,616
1994	600	0	0	0	0	0	0	0	0	0	7,695	0	0	0	0	581	8,876
1995	504	0	0	0	0	0	0	0	0	0	7,478	0	0	0	0	583	8,565
1996	694	0	0	0	0	0	0	0	0	0	7,537	0	0	0	0	584	8,815
average	617	0	0	0	0	0	0	0	0	0	7,468	0	0	0	2	578	8,666

Average Source of Withdrawals



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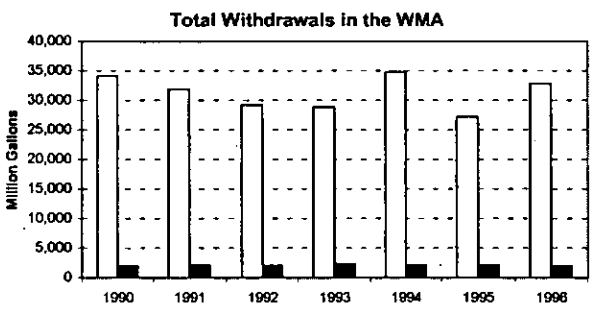
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

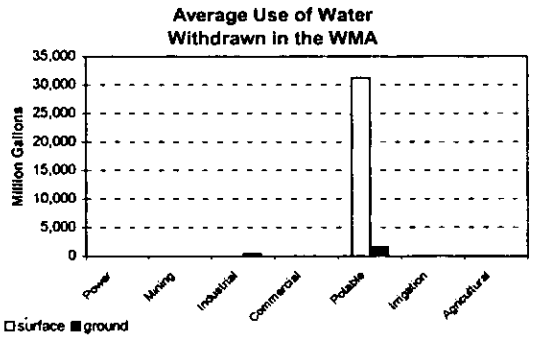
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C5. Hackensack and Pascack (Watershed Management Area #5)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	34,148	2,079	36,227
1991	31,912	2,133	34,046
1992	29,224	2,057	31,281
1993	28,845	2,346	31,191
1994	34,831	2,125	36,957
1995	27,245	2,193	29,438
1996	32,836	1,998	34,835
average	31,292	2,133	33,425





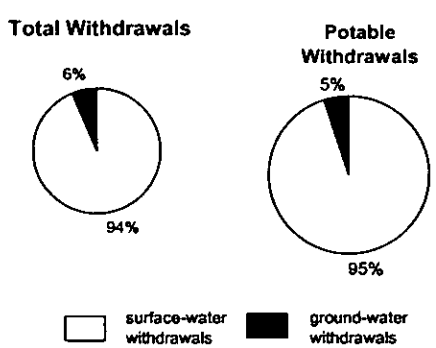
Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	0	0	0	449	449	0	21	21	34,148	1,572	35,720	0	37	37	0	0	0
1991	0	0	0	0	0	0	0	505	505	0	20	20	31,912	1,574	33,486	0	34	34	0	0	0
1992	0	0	0	0	0	0	0	458	458	0	15	15	29,224	1,550	30,774	0	33	33	0	0	0
1993	0	0	0	0	0	0	0	463	463	0	16	16	28,785	1,771	30,556	60	96	156	0	0	0
1994	0	0	0	0	0	0	0	414	414	0	10	10	34,751	1,579	36,329	81	122	203	0	0	0
1995	0	0	0	0	0	0	0	353	353	0	8	8	27,179	1,687	28,866	67	144	211	0	0	0
1996	0	0	0	0	0	0	0	353	353	0	3	3	32,766	1,516	34,281	71	127	198	0	0	0
average	0	0	0	0	0	0	0	428	428	0	13	13	31,252	1,607	32,859	40	85	125	0	0	0

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	608	0	0	0	0	0	0	0	0	0	1,047	0	0	0	10	413	2,079
1991	566	0	0	0	0	0	0	0	0	0	1,144	0	0	0	10	414	2,133
1992	418	0	0	0	0	0	0	0	0	0	1,212	0	0	0	10	416	2,057
1993	448	0	0	0	0	0	0	0	0	0	1,470	0	0	0	10	418	2,346
1994	371	0	0	0	0	0	0	0	0	0	1,329	0	0	0	6	420	2,125
1995	395	0	0	0	0	0	0	0	0	0	1,370	0	0	0	6	422	2,193
1996	343	0	0	0	0	0	0	0	0	0	1,232	0	0	0	0	424	1,998
average	450	0	0	0	0	0	0	0	0	0	1,258	0	0	0	8	418	2,133

Average Source of Withdrawals



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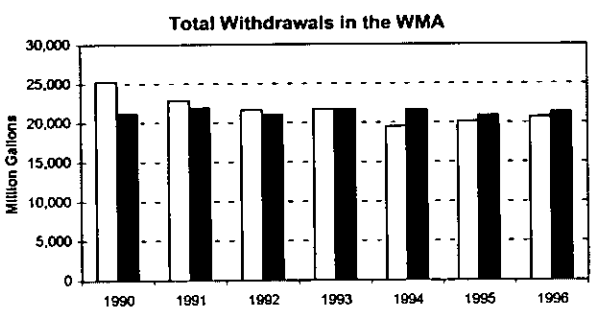
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

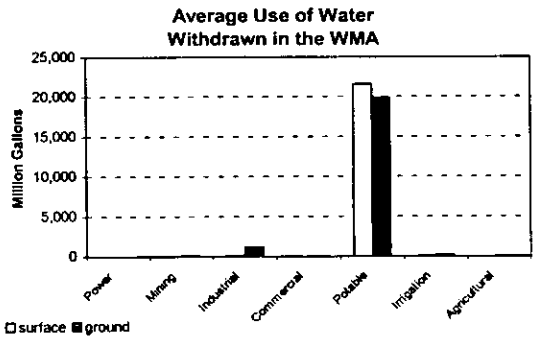
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C6. Upper Passaic, Whippany and Rockaway (Watershed Management Area #6)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	25,287	21,195	46,482
1991	22,855	21,935	44,790
1992	21,636	21,060	42,696
1993	21,772	21,763	43,535
1994	19,513	21,692	41,205
1995	20,168	20,929	41,097
1996	20,765	21,359	42,124
average	21,714	21,419	43,133



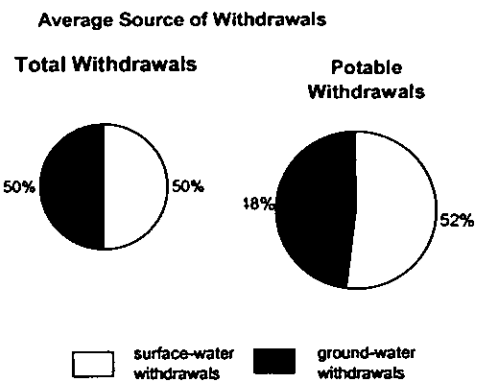


Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	136	136	0	1,321	1,321	0	70	70	25,259	19,577	44,836	17	91	107	11	0	11
1991	0	0	0	0	129	129	108	1,368	1,476	0	66	66	22,707	20,218	42,925	33	154	187	7	0	7
1992	0	0	0	0	65	65	81	1,379	1,460	0	80	80	21,539	19,419	40,958	14	116	130	2	0	2
1993	0	0	0	0	153	153	113	1,200	1,313	0	36	36	21,571	20,190	41,761	81	184	265	6	0	6
1994	0	0	0	0	167	167	126	1,041	1,167	0	44	44	19,320	20,222	39,543	64	218	282	2	0	2
1995	0	0	0	0	69	69	126	1,115	1,241	0	39	39	19,951	19,494	39,445	80	212	292	11	0	11
1996	0	0	0	0	67	67	96	1,108	1,204	0	45	45	20,615	20,027	40,643	50	113	163	4	0	4
average	0	0	0	0	112	112	93	1,219	1,312	0	54	54	21,566	19,878	41,445	48	155	204	6	0	6

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	16,365	0	0	0	0	0	0	0	0	0	3,082	0	1	24	5	1,717	21,195
1991	17,005	0	0	0	0	0	0	0	0	0	3,074	0	1	117	11	1,728	21,935
1992	16,216	0	0	0	0	0	0	0	0	0	2,966	0	1	112	20	1,745	21,060
1993	16,869	0	0	0	0	0	0	0	0	0	2,993	0	1	124	6	1,769	21,763
1994	16,487	0	0	0	0	0	0	0	0	0	3,249	0	1	146	13	1,796	21,692
1995	15,829	0	0	0	0	0	0	0	0	0	3,086	0	1	181	13	1,819	20,929
1996	16,262	0	0	0	0	0	0	0	0	0	3,088	0	2	148	19	1,840	21,359
average	16,433	0	0	0	0	0	0	0	0	0	3,077	0	1	122	12	1,774	21,419



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Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

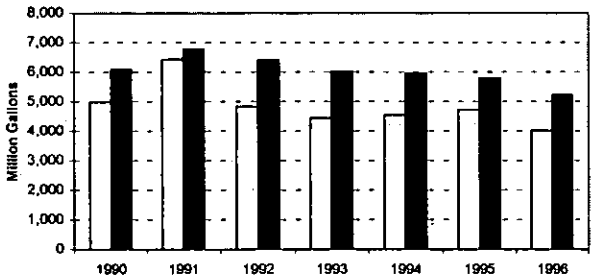
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C7. Elizabeth, Rahway and Woodbridge (Watershed Management Area #7)

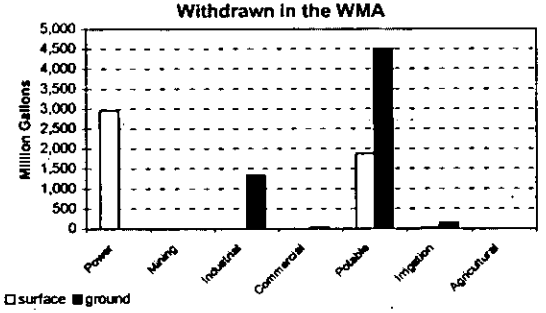
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	4,990	6,093	11,083
1991	6,433	6,781	13,214
1992	4,842	6,408	11,251
1993	4,443	6,030	10,473
1994	4,548	5,954	10,502
1995	4,713	5,803	10,516
1996	4,024	5,228	9,252
average	4,856	6,042	10,899

Total Withdrawals in the WMA



Average Use of Water Withdrawn in the WMA



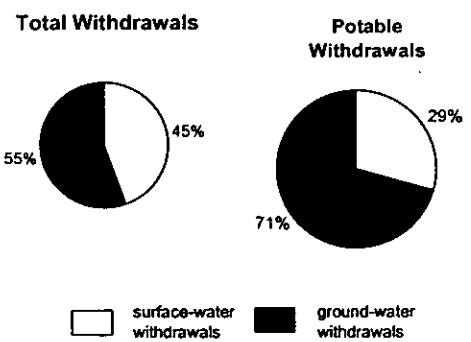
Total withdrawals by use (million gallons)

Year	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	3,065	0	3,065	0	0	0	0	1,607	1,607	0	20	20	1,911	4,377	6,288	14	89	102	0	0	0
1991	4,666	0	4,666	0	0	0	0	1,521	1,521	0	26	26	1,748	5,078	6,826	19	156	175	0	0	0
1992	2,984	0	2,984	0	0	0	0	1,343	1,343	0	18	18	1,840	4,901	6,741	18	147	165	0	0	0
1993	2,535	0	2,535	0	0	0	0	1,230	1,230	0	28	28	1,890	4,551	6,441	19	220	238	0	0	0
1994	2,577	0	2,577	0	0	0	0	1,255	1,255	0	39	39	1,954	4,493	6,447	17	166	184	0	0	0
1995	2,794	0	2,794	0	0	0	0	1,240	1,240	0	40	40	1,906	4,339	6,245	12	184	196	0	0	0
1996	2,078	0	2,078	0	0	0	0	1,203	1,203	0	29	29	1,941	3,865	5,806	6	130	136	0	0	0
average	2,957	0	2,957	0	0	0	0	1,343	1,343	0	29	29	1,884	4,515	6,399	15	156	171	0	0	0

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterozoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	2,243	0	0	0	0	0	0	13	0	0	3,668	0	0	0	13	157	6,093
1991	2,922	0	0	0	0	0	0	13	0	0	3,677	0	0	0	13	157	6,781
1992	2,540	0	0	0	0	0	0	4	0	0	3,673	0	0	0	34	158	6,408
1993	2,511	0	0	0	0	0	0	3	0	0	3,331	0	0	0	26	158	6,030
1994	1,862	0	0	0	0	0	0	5	0	0	3,910	0	0	0	17	159	5,954
1995	2,012	0	0	0	0	0	0	4	0	0	3,597	0	0	0	31	159	5,803
1996	1,936	0	0	0	0	0	0	5	0	0	3,102	0	0	0	25	159	5,228
average	2,289	0	0	0	0	0	0	7	0	0	3,565	0	0	0	23	158	6,042

Average Source of Withdrawals



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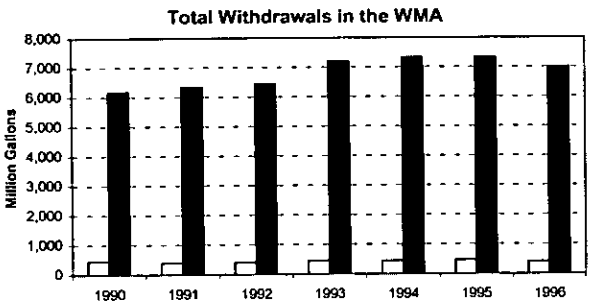
Analysis based on location of water withdrawals, not location of water use.
The industrial category on the graphs includes both industrial and commercial & recreation withdrawals.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

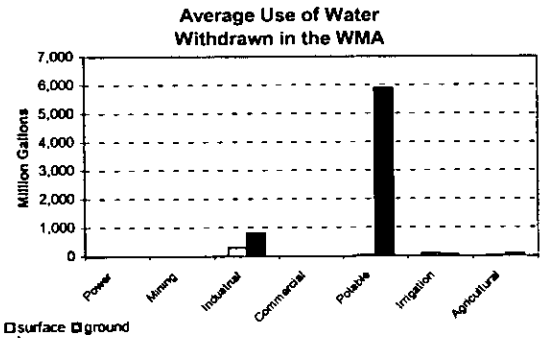
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C8. North and South Branch Raritan (Watershed Management Area #8)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	456	6,184	6,640
1991	386	6,349	6,735
1992	397	6,451	6,847
1993	460	7,204	7,664
1994	441	7,335	7,776
1995	470	7,334	7,804
1996	411	7,012	7,423
average	432	6,838	7,270





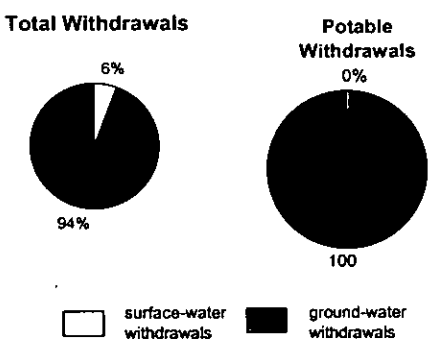
Total withdrawals by use (million gallons)

Year	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	0	0	270	787	1,057	0	4	4	68	5,354	5,422	99	23	122	19	16	35
1991	0	0	0	0	0	0	240	742	983	0	0	0	4	5,532	5,536	120	34	153	22	41	63
1992	0	0	0	0	0	0	326	952	1,278	0	2	2	12	5,439	5,451	44	22	67	15	35	49
1993	0	0	0	0	0	0	320	911	1,231	0	2	2	29	5,866	5,895	97	64	160	15	361	376
1994	0	0	0	0	0	0	314	917	1,231	0	1	1	14	6,349	6,363	101	46	147	13	21	34
1995	0	0	0	0	0	0	314	705	1,019	0	1	1	14	6,463	6,477	105	64	170	36	101	137
1996	0	0	0	0	0	0	310	672	982	0	5	5	10	6,262	6,272	81	35	116	9	39	48
average	0	0	0	0	0	0	299	812	1,111	0	2	2	22	5,895	5,917	93	41	134	18	88	106

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	371	0	0	0	0	0	0	0	0	0	815	37	995	569	997	2,401	6,184
1991	1,136	0	0	0	0	0	0	0	0	0	991	51	932	807	3	2,429	6,349
1992	787	0	0	0	0	0	0	0	0	0	1,018	59	1,199	910	5	2,473	6,451
1993	709	0	0	0	0	0	0	0	0	0	1,301	72	1,512	1,081	10	2,518	7,204
1994	915	0	0	0	0	0	0	0	0	0	970	67	1,666	1,150	9	2,558	7,335
1995	802	0	0	0	0	0	0	0	0	0	807	78	1,799	1,235	26	2,586	7,334
1996	574	0	0	0	0	0	0	0	0	0	833	69	1,630	1,257	15	2,633	7,012
average	756	0	0	0	0	0	0	0	0	0	962	62	1,390	1,001	152	2,514	6,838

Average Source of Withdrawals



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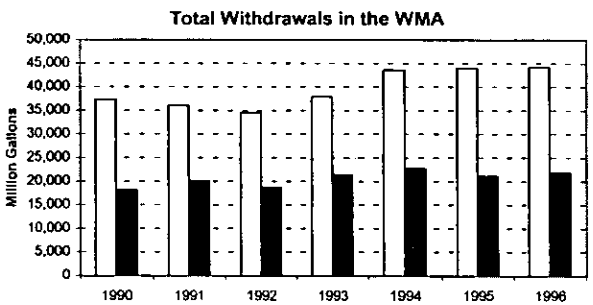
The industrial category on the graphs includes both industrial and commercial & recreation withdrawals.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

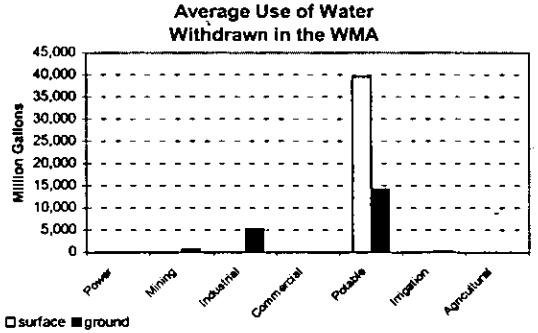
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C9. Lower Raritan, South and Lawrence (Watershed Management Area #9)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	37,374	18,148	55,522
1991	36,054	20,205	56,260
1992	34,611	18,651	53,262
1993	37,913	21,445	59,358
1994	43,625	22,782	66,407
1995	43,994	21,208	65,202
1996	44,245	21,907	66,153
average	39,688	20,621	60,309



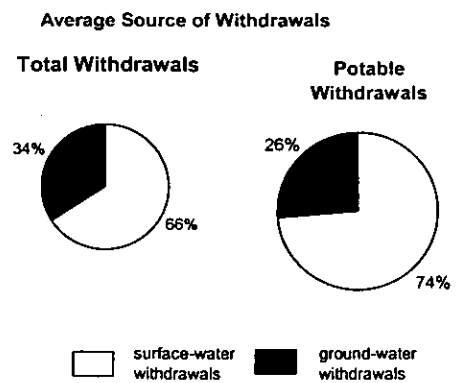


Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	4	4	0	721	721	43	5,077	5,120	0	7	7	37,292	12,144	49,436	36	172	207	4	24	27
1991	0	36	36	0	745	745	29	5,006	5,035	0	2	2	35,947	14,130	50,077	71	264	335	7	23	30
1992	0	30	30	0	83	83	23	5,299	5,322	0	5	5	34,539	12,990	47,530	42	223	264	7	21	28
1993	0	26	26	0	961	961	0	5,545	5,545	0	4	4	37,838	14,590	52,428	68	250	318	7	69	76
1994	0	36	36	83	1,149	1,232	0	5,640	5,640	0	4	4	43,482	15,686	59,168	51	232	283	9	36	45
1995	0	39	39	79	439	518	0	4,796	4,796	0	6	6	43,859	15,661	59,520	47	256	303	9	12	21
1996	0	28	28	32	1,019	1,051	0	6,178	6,178	0	10	10	44,166	14,530	58,696	42	139	181	5	3	9
average	0	28	28	28	731	758	14	5,363	5,377	0	5	5	39,589	14,247	53,836	51	219	270	7	27	34

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	34	0	0	0	0	182	5,479	3,553	0	3,086	2,879	0	0	0	1,862	1,072	18,148
1991	820	0	0	0	0	322	6,992	4,448	0	772	5,752	0	0	0	13	1,086	20,205
1992	562	0	0	0	0	484	7,067	3,521	0	94	5,819	0	0	0	4	1,101	18,651
1993	1,702	0	0	0	0	480	6,474	4,275	0	1,398	5,992	0	0	0	7	1,117	21,445
1994	2,173	0	0	0	0	464	6,834	4,279	0	1,191	6,593	0	0	0	115	1,133	22,782
1995	2,246	0	0	0	0	447	6,971	3,649	0	527	6,217	0	0	0	4	1,147	21,208
1996	2,078	0	0	0	0	458	8,030	2,944	0	1,089	6,142	2	0	0	5	1,161	21,907
average	1,373	0	0	0	0	405	6,835	3,810	0	1,165	5,628	0	0	0	287	1,117	20,621



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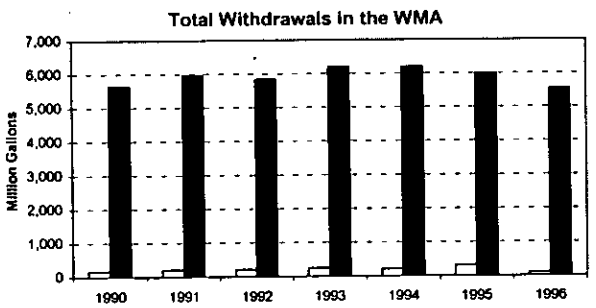
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

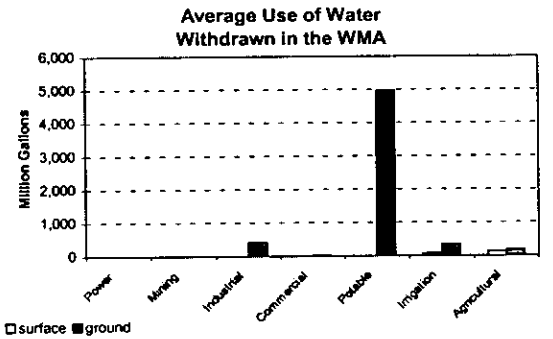
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C10. Millstone (Watershed Management Area #10)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	172	5,658	5,830
1991	208	5,977	6,185
1992	209	5,852	6,061
1993	243	6,205	6,448
1994	208	6,200	6,408
1995	312	5,993	6,304
1996	95	5,546	5,641
average	207	5,919	6,125



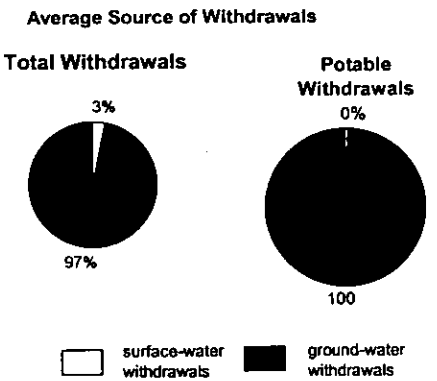


Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	1	1	0	390	390	0	7	7	0	4,810	4,810	12	308	319	160	141	302
1991	0	0	0	0	11	11	0	419	419	0	17	17	0	4,827	4,827	55	486	540	153	217	370
1992	0	0	0	0	9	9	0	400	400	0	21	21	0	4,908	4,908	97	406	504	112	107	219
1993	0	0	0	0	0	0	0	429	429	0	20	20	0	5,113	5,113	58	434	492	185	209	394
1994	0	0	0	0	0	0	0	430	430	0	27	27	0	5,214	5,214	107	306	413	101	223	324
1995	0	0	0	0	1	1	2	416	418	0	23	23	0	4,987	4,987	91	299	391	218	267	485
1996	0	0	0	0	0	0	0	394	394	0	19	19	0	4,900	4,900	46	152	199	49	80	130
average	0	0	0	0	3	3	0	411	411	0	19	19	0	4,966	4,966	67	342	408	140	178	318

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	0	0	0	79	958	1,100	0	1,346	425	506	0	0	69	1,175	5,658
1991	1	0	0	0	0	82	995	2,324	0	117	509	754	0	0	4	1,191	5,977
1992	0	0	0	0	0	3	983	2,315	0	44	556	742	0	0	4	1,205	5,852
1993	0	0	0	0	0	39	1,022	2,430	0	67	636	786	0	0	3	1,223	6,205
1994	0	0	0	0	0	40	877	2,504	0	58	651	827	0	0	5	1,239	6,200
1995	0	0	0	0	0	16	978	2,455	0	105	501	676	0	0	8	1,253	5,993
1996	0	0	0	0	0	2	878	2,418	0	24	365	584	0	0	7	1,267	5,546
average	0	0	0	0	0	37	956	2,221	0	252	520	696	0	0	14	1,222	5,919



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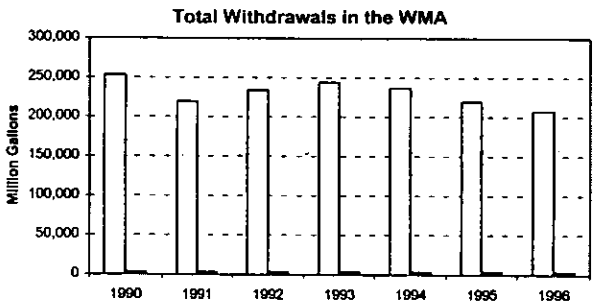
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

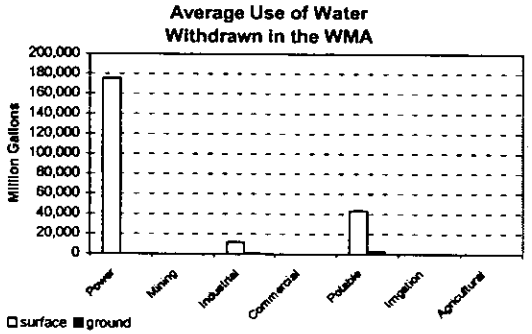
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C11. Central Delaware (Watershed Management Area #11)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	253,092	3,141	256,233
1991	219,674	3,359	223,034
1992	233,783	3,545	237,327
1993	244,050	3,880	247,930
1994	236,748	3,816	240,564
1995	219,903	3,887	223,790
1996	207,421	3,673	211,094
average	230,667	3,614	234,282





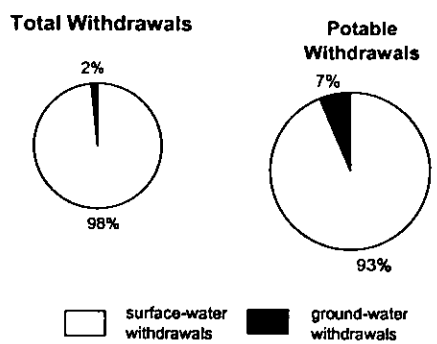
Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	194,601	0	194,601	0	0	0	13,252	275	13,527	0	0	0	45,222	2,852	48,074	16	12	28	1	2	3
1991	164,306	0	164,306	0	0	0	11,177	292	11,470	0	0	0	44,152	3,021	47,173	21	28	49	18	18	36
1992	179,864	0	179,864	0	0	0	11,925	570	12,495	0	0	0	41,977	2,955	44,932	13	10	24	4	9	13
1993	182,407	0	182,407	0	0	0	16,856	731	17,587	0	0	0	44,734	3,079	47,813	28	30	58	25	39	64
1994	177,185	0	177,185	0	0	0	16,522	725	17,247	0	2	2	43,026	3,071	46,097	8	18	27	7	0	7
1995	168,422	0	168,422	0	0	0	6,997	647	7,644	0	0	0	44,446	3,208	47,654	26	26	52	13	6	19
1996	161,790	0	161,790	0	0	0	5,478	687	6,165	0	0	0	40,142	2,971	43,114	10	9	19	1	6	6
average	175,511	0	175,511	0	0	0	11,744	561	12,305	0	0	0	43,386	3,023	46,408	18	19	37	10	11	21

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	Total
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	0	0	0	0	0	1,001	0	364	438	156	4	24	1	1,154	3,141
1991	0	0	0	0	0	14	33	1,057	0	384	493	188	19	9	0	1,164	3,359
1992	0	0	0	0	0	8	9	982	0	402	764	173	15	11	0	1,181	3,545
1993	0	0	0	0	0	27	0	672	0	816	926	192	25	12	13	1,197	3,880
1994	0	0	0	0	0	0	0	982	0	459	947	170	27	13	9	1,208	3,816
1995	0	0	0	0	0	6	2	1,089	0	519	875	123	39	6	11	1,216	3,887
1996	0	0	0	0	0	0	1	1,134	0	225	888	141	35	8	8	1,233	3,673
average	0	0	0	0	0	8	6	988	0	453	761	163	23	12	6	1,193	3,614

Average Source of Withdrawals



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Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

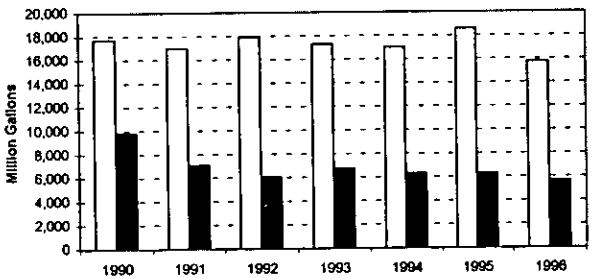
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C12. Monmouth County (Watershed Management Area #12)

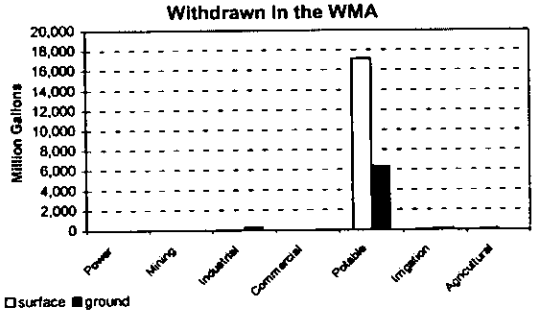
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	17,728	9,827	27,555
1991	17,002	7,091	24,093
1992	17,934	6,072	24,006
1993	17,310	6,771	24,080
1994	17,019	6,321	23,340
1995	18,579	6,290	24,869
1996	15,761	5,667	21,428
average	17,333	6,862	24,196

Total Withdrawals in the WMA



Average Use of Water Withdrawn in the WMA



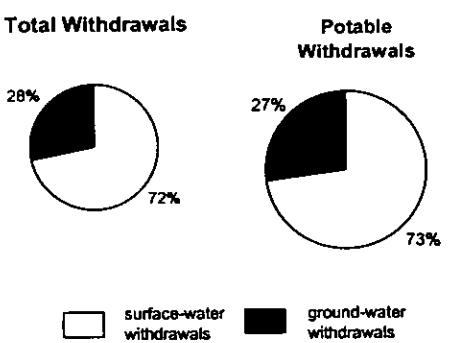
Total withdrawals by use (million gallons)

Year	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	0	0	0	265	265	0	6	6	17,660	9,430	27,090	28	122	150	41	3	44
1991	0	0	0	0	0	0	0	252	252	0	2	2	16,846	6,660	23,506	52	164	217	104	13	117
1992	0	5	5	0	0	0	0	311	311	0	21	21	17,810	5,603	23,413	36	126	161	89	5	94
1993	0	6	6	0	0	0	0	311	311	0	7	7	17,087	6,221	23,308	94	197	291	128	29	157
1994	0	8	8	0	0	0	0	269	269	0	7	7	16,799	5,847	22,647	95	170	264	125	20	145
1995	0	7	7	0	0	0	0	279	279	0	20	20	18,219	5,736	23,955	83	222	305	278	26	303
1996	0	16	16	0	0	0	0	315	315	0	16	16	15,647	5,171	20,817	54	141	195	60	8	68
average	0	6	6	0	0	0	0	286	286	0	11	11	17,153	6,381	23,534	63	163	226	118	15	132

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	757	0	10	1,773	3,429	1,375	0	574	0	0	0	0	883	1,025	9,827
1991	0	0	709	0	14	691	3,670	804	0	168	0	0	0	0	0	1,035	7,091
1992	0	5	645	0	17	835	2,627	893	0	0	0	0	0	0	0	1,048	6,072
1993	0	6	450	0	26	917	3,384	911	0	0	0	0	0	0	17	1,060	6,771
1994	0	8	577	0	17	852	2,771	1,000	0	0	0	0	0	0	24	1,072	6,321
1995	0	7	433	0	45	897	3,150	659	0	0	0	0	0	0	14	1,084	6,290
1996	0	19	426	0	31	816	2,712	547	0	0	0	0	0	0	21	1,096	5,667
average	0	6	571	0	23	969	3,106	884	0	106	0	0	0	0	137	1,060	6,862

Average Source of Withdrawals



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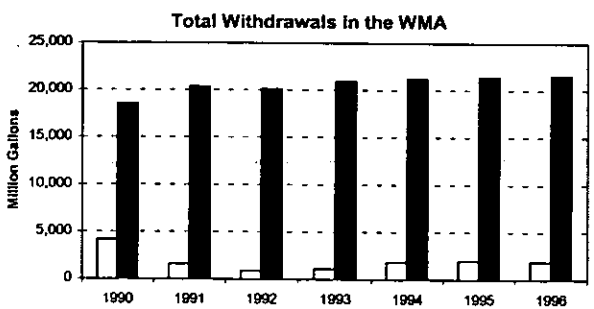
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

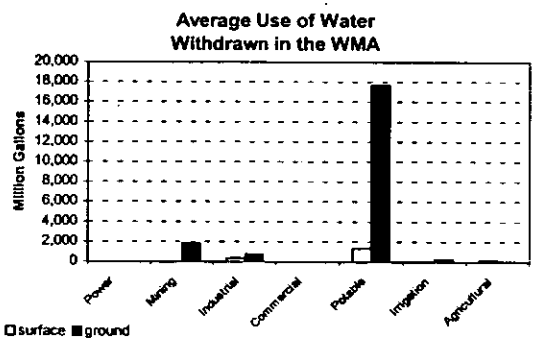
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C13. Barnegat Bay (Watershed Management Area #13)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	4,166	18,557	22,724
1991	1,591	20,379	21,969
1992	863	20,148	21,011
1993	1,103	20,969	22,072
1994	1,817	21,218	23,035
1995	1,984	21,439	23,423
1996	1,893	21,594	23,487
average	1,917	20,615	22,532



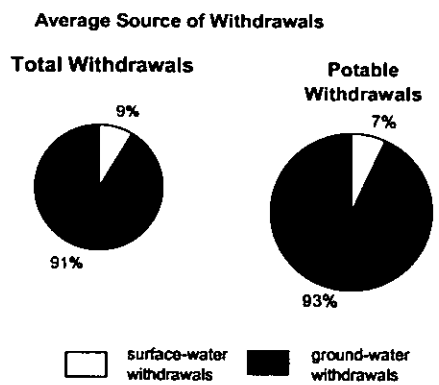


Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	2,939	2,939	2,148	718	2,866	0	4	4	1,766	14,765	16,530	38	121	159	214	10	225
1991	0	0	0	0	1,789	1,789	400	598	997	0	5	5	906	17,794	18,700	75	186	262	210	6	216
1992	0	0	0	0	2,185	2,185	0	516	516	0	4	4	681	17,213	17,894	58	222	279	125	7	132
1993	0	0	0	0	1,473	1,473	0	626	626	0	5	5	867	18,583	19,450	83	274	356	154	8	162
1994	0	0	0	0	1,564	1,564	0	769	769	0	5	5	1,628	18,548	20,176	70	307	377	119	25	144
1995	0	0	0	0	1,199	1,199	0	830	830	0	4	4	1,811	18,979	20,790	73	388	461	101	39	139
1996	0	0	0	0	1,619	1,619	0	1,444	1,444	0	4	4	1,726	18,138	19,863	51	355	407	116	34	151
average	0	0	0	0	1,824	1,824	364	786	1,150	0	4	4	1,340	17,717	19,058	64	265	329	148	19	167

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	9,094	1,601	451	1,447	972	0	763	23	0	0	0	0	1,441	2,767	18,557
1991	0	0	9,942	1,416	1,133	1,467	795	43	2,730	27	0	0	0	0	25	2,800	20,379
1992	0	0	9,995	1,419	1,034	1,176	840	61	2,769	0	0	0	0	0	27	2,827	20,148
1993	0	24	10,564	1,712	1,046	928	909	35	2,840	27	0	0	0	0	11	2,874	20,969
1994	0	0	11,611	1,819	1,075	792	1,090	41	1,859	0	0	0	0	0	10	2,920	21,218
1995	0	27	11,384	1,728	1,103	876	1,217	48	2,053	0	0	0	0	0	29	2,975	21,439
1996	0	37	11,841	1,776	1,027	772	1,005	50	2,026	0	0	0	0	0	34	3,025	21,594
average	0	13	10,633	1,639	981	1,065	975	40	2,148	11	0	0	0	0	225	2,884	20,615



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Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

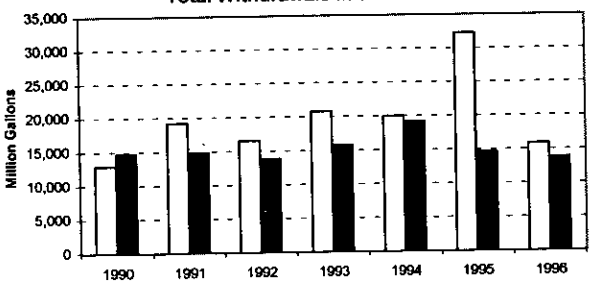
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C14. Mullica and Wading (Watershed Management Area #14)

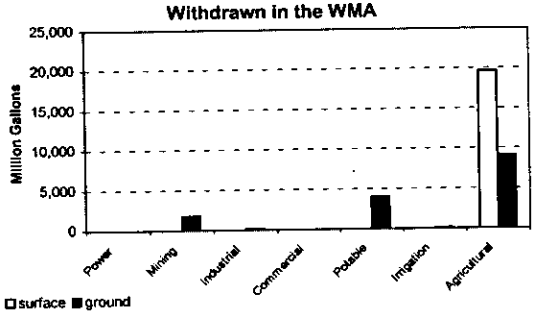
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	12,953	14,719	27,671
1991	19,273	14,815	34,089
1992	16,537	13,865	30,402
1993	20,785	15,850	36,635
1994	20,011	19,249	39,260
1995	32,301	14,696	46,997
1996	15,871	13,840	29,711
average	19,676	15,291	34,966

Total Withdrawals in the WMA



Average Use of Water Withdrawn in the WMA



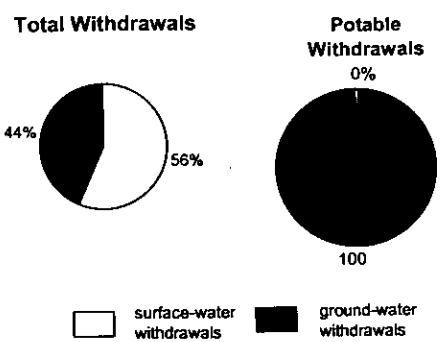
Total withdrawals by use (million gallons)

Year	WATER USE																	
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	1,723	1,723	0	166	166	0	5	5	0	4,173	4,173	0	64	64	12,953	8,588	21,541
1991	0	0	0	0	1,388	1,388	0	99	99	0	7	7	0	3,790	3,790	0	78	78	19,273	9,453	28,726
1992	0	0	0	0	1,692	1,692	0	140	140	0	21	21	0	3,771	3,771	0	80	80	16,537	8,161	24,698
1993	0	0	0	0	1,918	1,918	0	252	252	0	39	39	0	4,027	4,027	0	141	141	20,785	9,473	30,257
1994	0	0	0	0	1,819	1,819	0	320	320	0	26	26	0	4,152	4,152	0	66	66	20,011	12,866	32,877
1995	0	0	0	0	1,899	1,899	0	202	202	0	13	13	0	4,141	4,141	0	172	172	32,301	8,269	40,570
1996	0	0	0	0	2,126	2,126	0	133	133	0	7	7	0	4,132	4,132	16	133	150	15,854	7,308	23,162
average	0	0	0	0	1,795	1,795	0	187	187	0	17	17	0	4,027	4,027	2	105	107	19,673	9,160	28,833

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	10,972	1,056	11	510	0	0	0	0	0	0	0	0	3	2,168	14,719
1991	0	0	11,390	538	18	672	0	0	0	0	0	0	0	0	7	2,190	14,815
1992	0	0	10,688	564	19	387	0	0	0	0	0	0	0	0	8	2,199	13,865
1993	0	43	12,320	542	31	691	0	0	0	0	0	0	0	0	14	2,210	15,850
1994	0	4	12,208	476	28	4,297	0	0	0	0	0	0	0	0	11	2,225	19,249
1995	0	23	10,651	491	22	1,257	0	0	0	0	0	0	0	0	7	2,246	14,696
1996	0	21	10,530	515	12	490	0	0	0	0	0	0	0	0	10	2,262	13,840
average	0	13	11,251	597	20	1,186	0	0	0	0	0	0	0	0	9	2,214	15,291

Average Source of Withdrawals



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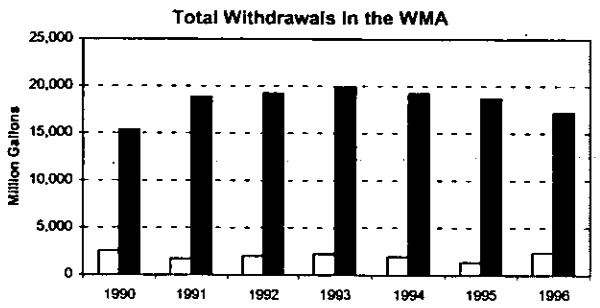
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

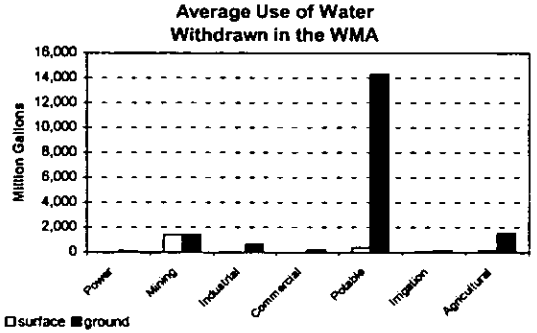
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C15. Great Egg Harbor and Tuckahoe (Watershed Management Area #15)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	2,549	15,415	17,964
1991	1,697	18,902	20,599
1992	2,006	19,243	21,249
1993	2,242	19,924	22,166
1994	1,944	19,261	21,205
1995	1,347	18,745	20,092
1996	2,368	17,222	19,590
average	2,022	18,387	20,409





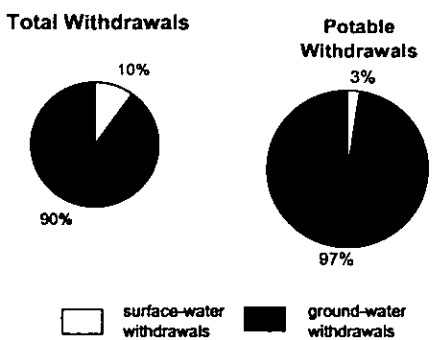
Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	123	123	1,504	1,446	2,950	0	485	485	0	207	207	916	12,188	13,104	18	102	120	111	863	975
1991	0	114	114	1,229	1,091	2,320	0	474	474	0	202	202	0	14,732	14,732	34	96	130	434	2,193	2,627
1992	0	103	103	1,579	1,305	2,884	0	730	730	0	171	171	294	14,534	14,828	44	109	153	89	2,290	2,379
1993	0	119	119	1,658	1,412	3,070	0	916	916	0	223	223	428	14,630	15,058	55	213	269	101	2,412	2,512
1994	0	120	120	1,558	1,700	3,259	0	828	828	0	222	222	147	15,140	15,287	92	189	281	146	1,063	1,209
1995	0	153	153	1,149	1,616	2,765	0	567	567	0	235	235	5	14,729	14,734	89	162	252	104	1,283	1,387
1996	0	179	179	1,257	1,294	2,552	0	741	741	0	213	213	913	14,138	15,051	88	134	223	109	524	633
average	0	130	130	1,419	1,409	2,828	0	677	677	0	210	210	386	14,299	14,685	60	144	204	156	1,518	1,674

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	1,473	8,265	2,182	178	453	535	0	0	0	0	0	0	0	6	2,325	15,415
1991	0	1,104	10,983	3,254	199	391	593	0	0	0	0	0	0	0	23	2,356	18,902
1992	0	162	12,290	3,136	334	404	541	0	0	0	0	0	0	0	2	2,373	19,243
1993	0	1,881	10,818	3,357	335	498	631	0	0	0	0	0	0	0	18	2,386	19,924
1994	0	2,105	9,834	3,700	159	490	570	0	0	0	0	0	0	0	3	2,401	19,261
1995	0	1,831	9,654	3,652	191	414	588	0	0	0	0	0	0	0	2	2,413	18,745
1996	0	1,586	8,538	3,413	169	518	518	0	0	0	0	0	0	0	54	2,426	17,222
average	0	1,449	10,054	3,242	223	453	568	0	0	0	0	0	0	0	15	2,383	18,387

Average Source of Withdrawals



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Analysis based on location of water withdrawals, not location of water use.
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Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

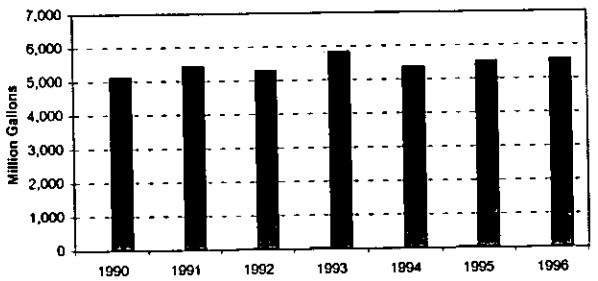
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C16. Cape May County (Watershed Management Area #16)

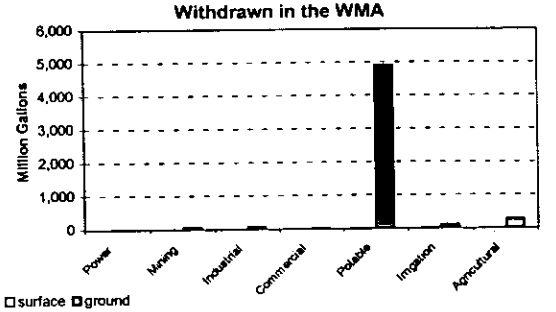
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	4	5,124	5,127
1991	4	5,448	5,452
1992	29	5,310	5,339
1993	34	5,846	5,880
1994	13	5,376	5,388
1995	29	5,537	5,566
1996	13	5,581	5,594
average	18	5,460	5,478

Total Withdrawals in the WMA



Average Use of Water Withdrawn in the WMA



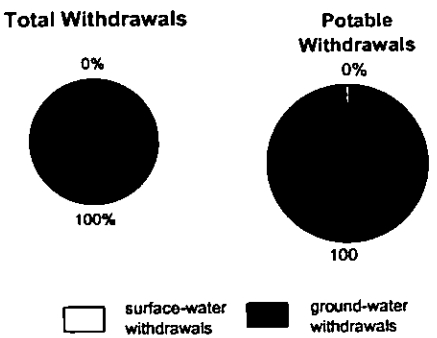
Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	73	73	0	76	76	0	5	5	0	4,656	4,656	0	80	80	4	235	238
1991	0	0	0	0	67	67	0	67	67	0	5	5	0	4,928	4,928	0	88	88	4	293	297
1992	0	0	0	0	63	63	0	54	54	0	5	5	0	4,787	4,787	25	109	134	4	293	297
1993	0	0	0	0	41	41	0	102	102	0	6	6	0	5,184	5,184	34	167	201	0	347	347
1994	0	0	0	0	61	61	0	68	68	0	6	6	0	4,907	4,907	13	111	124	0	222	222
1995	0	0	0	0	74	74	0	98	98	0	5	5	0	4,876	4,876	22	142	165	6	342	349
1996	0	0	0	0	79	79	0	109	109	0	5	5	0	5,091	5,091	12	96	108	1	201	202
average	0	0	0	0	65	65	0	82	82	0	5	5	0	4,918	4,918	15	113	128	3	276	279

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	274	2,292	1,503	0	0	0	0	0	0	0	0	0	0	0	1,055	5,124
1991	0	289	2,786	1,303	0	0	0	0	0	0	0	0	0	0	0	1,070	5,448
1992	0	390	2,621	1,222	0	0	0	0	0	0	0	0	0	0	0	1,077	5,310
1993	0	436	2,789	1,544	0	0	0	0	0	0	0	0	0	0	0	1,076	5,846
1994	0	360	2,597	1,337	0	0	0	0	0	0	0	0	0	0	0	1,083	5,376
1995	0	412	2,468	1,572	0	0	0	0	0	0	0	0	0	0	0	1,086	5,537
1996	0	415	2,444	1,635	0	0	0	0	0	0	0	0	0	0	0	1,086	5,581
average	0	368	2,571	1,445	0	0	0	0	0	0	0	0	0	0	0	1,076	5,460

Average Source of Withdrawals



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Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

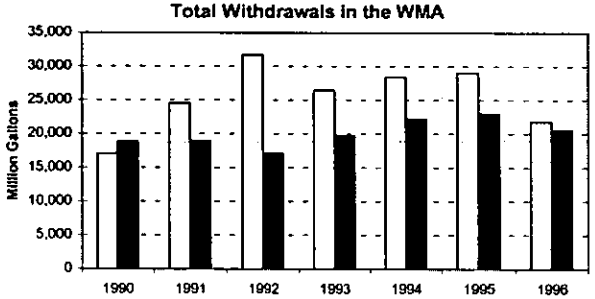
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C17. Maurice, Salem and Cohansey (Watershed Management Area #17)

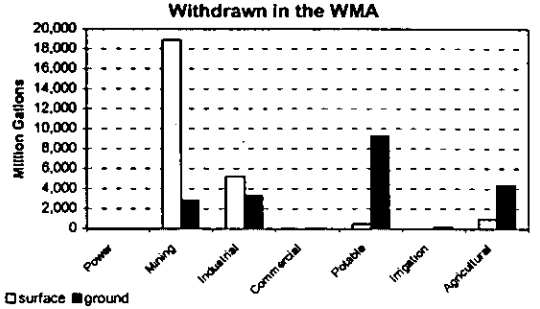
Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	17,076	18,891	35,967
1991	24,555	18,985	43,540
1992	31,708	17,096	48,804
1993	26,486	19,751	46,237
1994	28,456	22,259	50,715
1995	29,098	23,007	52,105
1996	21,842	20,623	42,465
average	25,603	20,087	45,690

Total Withdrawals in the WMA



Average Use of Water Withdrawn in the WMA



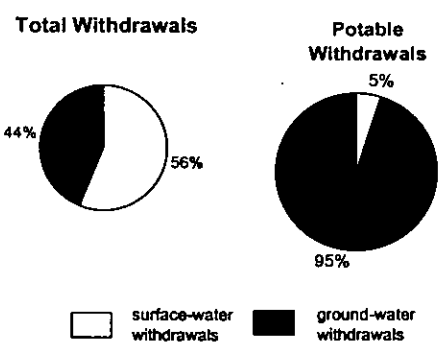
Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	12,342	1,977	14,319	3,896	3,925	7,821	0	27	27	479	9,623	10,102	0	91	91	358	3,248	3,606
1991	0	0	0	18,139	1,654	19,793	5,026	3,590	8,615	0	55	55	469	8,793	9,262	0	63	63	921	4,831	5,752
1992	0	0	0	26,365	1,731	28,096	4,275	3,188	7,463	0	57	57	567	8,278	8,846	0	98	98	500	3,744	4,244
1993	0	0	0	18,046	2,659	20,704	5,040	3,260	8,300	0	83	83	549	9,153	9,702	0	228	228	2,852	4,368	7,220
1994	0	0	0	21,317	3,426	24,743	6,154	3,448	9,602	0	44	44	494	10,002	10,496	0	264	264	490	5,074	5,565
1995	0	0	0	21,430	4,070	25,499	6,099	3,072	9,171	0	41	41	492	10,020	10,512	0	254	254	1,077	5,550	6,627
1996	0	0	0	14,665	4,628	19,293	6,138	2,976	9,114	0	29	29	412	9,009	9,421	0	181	181	628	3,800	4,428
average	0	0	0	18,901	2,878	21,778	5,233	3,351	8,584	0	48	48	495	9,269	9,763	0	168	168	975	4,374	5,349

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	257	14,377	454	114	66	355	466	23	750	0	0	0	0	48	1,983	18,891
1991	0	261	15,167	0	120	112	517	308	19	161	0	0	0	0	322	1,998	18,985
1992	0	259	13,723	0	0	198	343	334	13	160	0	0	0	0	66	2,002	17,096
1993	0	764	15,455	0	0	293	293	352	6	495	0	0	0	0	87	2,005	19,751
1994	0	982	17,237	0	0	443	627	401	1	526	0	0	0	0	33	2,008	22,259
1995	0	1,037	17,313	0	0	450	545	620	8	522	0	0	0	0	512	2,001	23,007
1996	0	1,140	15,474	0	0	457	522	415	0	430	0	0	0	0	189	1,995	20,623
average	0	671	15,535	65	34	288	457	414	10	435	0	0	0	0	180	1,999	20,087

Average Source of Withdrawals



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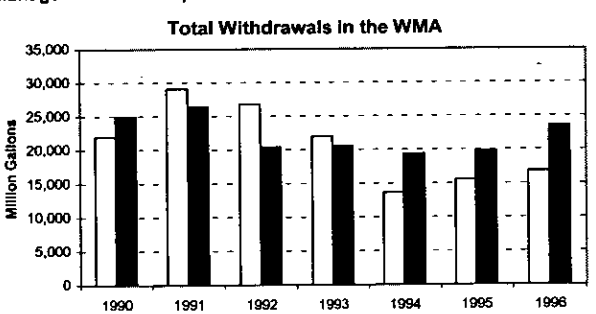
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

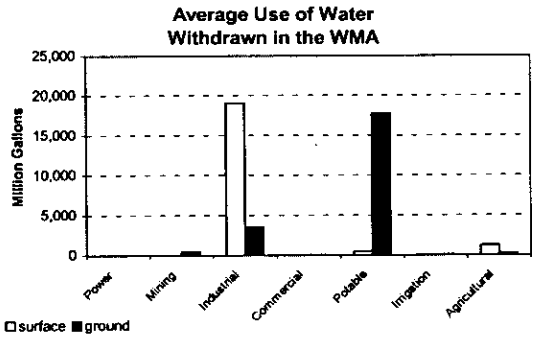
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C18. Lower Delaware (Watershed Management Area #18)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	21,958	25,027	46,985
1991	29,080	26,420	55,499
1992	26,809	20,467	47,276
1993	22,018	20,594	42,612
1994	13,641	19,386	33,027
1995	15,529	19,764	35,294
1996	16,821	23,570	40,391
average	20,837	22,175	43,012



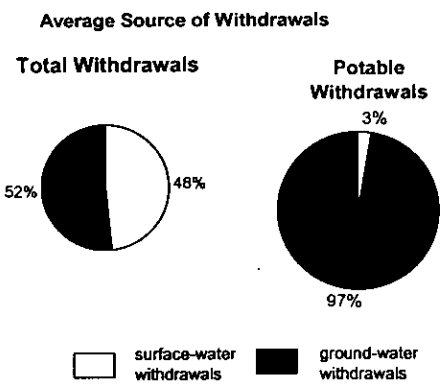


Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	418	418	21,216	4,360	25,576	0	3	3	0	20,009	20,009	12	86	98	730	150	880
1991	0	0	0	0	535	535	25,703	3,657	29,360	0	6	6	0	21,872	21,872	32	71	102	3,345	279	3,623
1992	0	0	0	0	408	408	25,959	3,682	29,641	0	47	47	0	16,005	16,005	12	92	105	838	232	1,070
1993	0	0	0	0	473	473	20,932	3,311	24,242	1	39	40	0	16,418	16,418	20	126	147	1,065	226	1,291
1994	0	0	0	0	546	546	12,789	3,386	16,175	3	42	45	0	15,125	15,125	25	90	115	826	197	1,022
1995	0	0	0	0	610	610	13,997	2,997	16,994	13	45	58	0	15,639	15,639	35	80	115	1,484	394	1,878
1996	0	0	0	0	514	514	12,861	3,198	16,059	1	38	40	3,470	19,412	22,883	23	79	102	466	328	794
average	0	0	0	0	501	501	19,065	3,513	22,578	3	32	34	496	17,783	18,279	23	89	112	1,250	258	1,508

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	47	303	0	0	434	3,972	2,136	5,353	10,997	0	0	0	0	30	1,754	25,027
1991	0	490	360	0	0	513	6,936	4,557	9,442	2,342	0	0	0	0	9	1,772	26,420
1992	0	375	156	0	0	441	6,488	3,576	5,408	2,241	0	0	0	0	0	1,780	20,467
1993	0	196	330	0	0	498	6,388	3,155	5,064	3,132	0	0	0	0	40	1,789	20,594
1994	0	278	261	0	0	445	6,623	3,395	4,482	2,099	0	0	0	0	3	1,800	19,386
1995	0	171	364	0	0	600	6,566	3,809	4,434	1,999	0	0	0	0	12	1,809	19,764
1996	0	242	524	0	0	1,045	5,512	3,410	9,354	1,427	0	0	0	0	224	1,832	23,570
average	0	257	328	0	0	568	6,069	3,434	6,220	3,463	0	0	0	0	46	1,791	22,175



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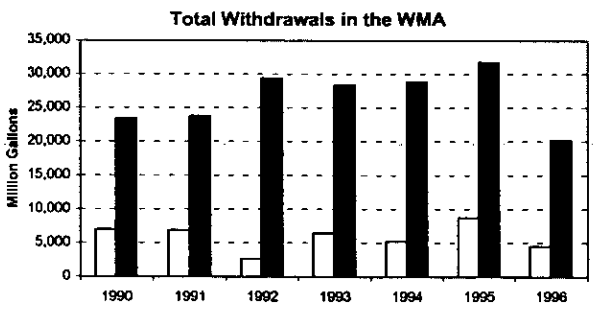
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

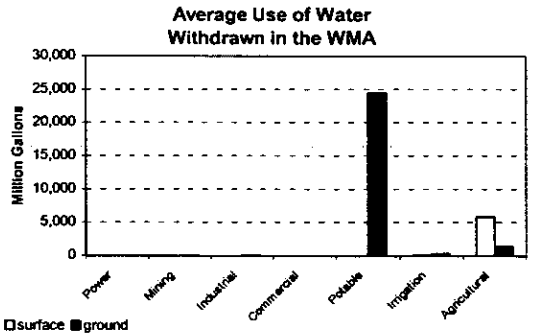
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C19. Rancocas (Watershed Management Area #19)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	6,970	23,486	30,457
1991	6,875	23,839	30,714
1992	2,615	29,437	32,052
1993	6,461	28,398	34,858
1994	5,227	28,886	34,114
1995	8,759	31,802	40,561
1996	4,519	20,205	24,724
average	5,918	26,579	32,497





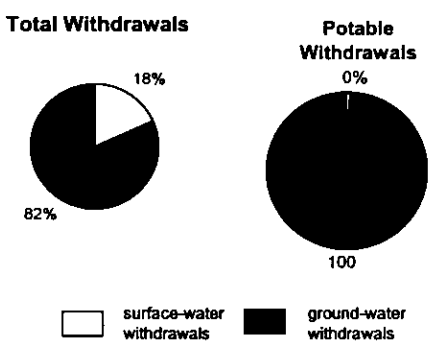
Total withdrawals by use (million gallons)

Year	WATER USE																				
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	0	0	0	0	126	126	2	237	240	0	1	1	23	21,662	21,685	86	316	402	6,858	1,144	8,003
1991	0	0	0	0	82	82	2	158	160	0	1	1	0	22,167	22,167	99	288	387	6,774	1,143	7,918
1992	0	0	0	0	99	99	2	67	69	0	4	4	0	26,946	26,946	68	301	368	2,546	2,020	4,565
1993	0	0	0	0	111	111	2	56	58	0	6	6	0	26,628	26,628	60	358	418	6,399	1,240	7,639
1994	0	0	0	0	124	124	2	94	96	0	4	4	0	27,427	27,427	47	415	462	5,179	822	6,001
1995	0	0	0	0	139	139	28	88	117	0	6	6	0	28,459	28,459	114	427	541	8,617	2,682	11,299
1996	0	0	0	0	117	117	1	184	186	0	9	9	0	18,307	18,307	67	366	433	4,450	1,222	5,672
average	0	0	0	0	114	114	5	126	132	0	4	4	3	24,514	24,517	77	353	430	5,832	1,468	7,299

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP																Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	514	0	545	1,400	2,291	3,626	7,170	6,347	0	0	0	0	37	1,556	23,486
1991	0	0	542	0	548	1,345	2,960	5,236	8,456	3,145	0	0	0	0	38	1,570	23,839
1992	0	0	1,362	0	546	1,377	3,264	4,970	14,188	2,126	0	0	0	0	33	1,572	29,437
1993	0	0	575	0	548	1,463	3,330	5,327	13,581	1,944	0	0	0	0	53	1,578	28,398
1994	0	0	474	0	435	1,265	3,567	5,897	14,551	1,089	0	0	0	0	18	1,590	28,886
1995	0	0	1,499	0	868	1,665	3,391	6,112	15,655	1,001	0	0	0	0	4	1,607	31,802
1996	0	0	638	0	526	1,003	2,651	4,223	7,173	2,092	0	0	0	0	281	1,617	20,205
average	0	0	801	0	574	1,360	3,065	5,056	11,539	2,535	0	0	0	0	66	1,584	26,579

Average Source of Withdrawals



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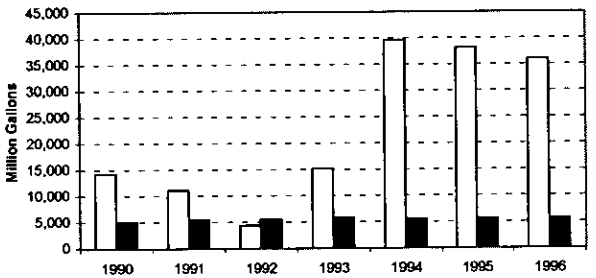
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

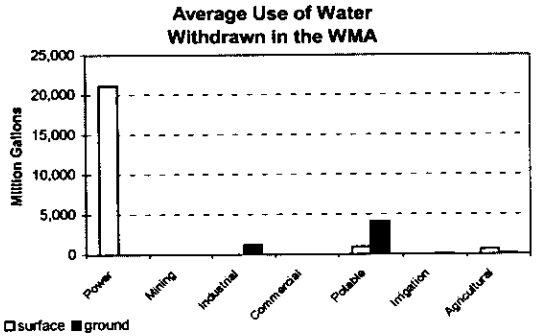
Appendix C. Detailed analysis of use of water withdrawn in each watershed management areas.

Table C20. Crosswicks (Watershed Management Area #20)

Total withdrawals by source (million gallons)

Year	Water source		Total
	surface	ground	
1990	14,311	5,091	19,402
1991	11,153	5,554	16,708
1992	4,382	5,638	10,020
1993	15,249	5,893	21,143
1994	39,612	5,536	45,147
1995	38,169	5,597	43,766
1996	35,997	5,609	41,606
average	22,696	5,560	28,256



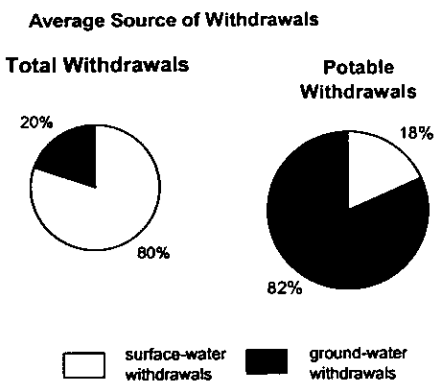


Total withdrawals by use (million gallons)

Year	WATER USE																			
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural		
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground		surface	ground	
1990	12,503	0	12,503	0	0	0	0	1,417	1,417	0	0	0	1,244	3,562	4,807	9	22	31	554	89	643
1991	9,489	0	9,489	0	0	0	0	1,291	1,291	0	0	0	1,075	4,105	5,180	33	23	56	557	136	692
1992	2,974	0	2,974	0	0	0	0	1,354	1,354	0	0	0	850	4,154	5,004	10	38	47	548	93	641
1993	13,781	0	13,781	0	0	0	0	1,228	1,228	0	0	0	728	4,472	5,201	14	38	53	726	155	880
1994	38,027	0	38,027	0	0	0	0	1,146	1,146	0	0	0	972	4,147	5,119	16	37	53	596	206	802
1995	36,513	0	36,513	0	0	0	0	1,102	1,102	0	0	0	831	4,168	4,999	16	48	63	810	279	1,088
1996	34,719	0	34,719	0	0	0	0	1,221	1,221	0	0	0	781	4,259	5,041	0	13	13	497	116	613
average	21,144	0	21,144	0	0	0	0	1,251	1,251	0	0	0	926	4,124	5,050	14	31	45	612	153	766

Ground-water withdrawals by aquifer group (million gallons)

Year	AQUIFER GROUP															Total
	northern NJ surficial	southern NJ surficial	Cohansey, Kirkwood	Rio Grande, 800 ft-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick	Lockatong, Stockton	Paleozoic & Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
1990	0	0	44	0	0	87	325	2,110	204	1,528	0	0	0	0	0	792	5,091
1991	0	0	76	0	0	84	267	2,831	251	1,246	0	0	0	0	0	799	5,554
1992	0	0	49	0	0	81	289	2,948	327	1,137	0	0	0	0	4	802	5,638
1993	0	0	58	0	0	65	321	3,006	337	1,298	0	0	0	0	0	808	5,893
1994	0	0	74	0	0	133	329	3,043	318	824	0	0	0	0	0	815	5,536
1995	0	0	45	0	0	216	360	3,040	261	845	0	0	0	0	6	825	5,597
1996	0	1	17	0	0	106	369	3,130	299	852	0	0	0	0	1	832	5,609
average	0	0	52	0	0	110	323	2,873	285	1,104	0	0	0	0	2	811	5,560



All data, except estimates of domestic well pumpage, are from purveyor-generated reports submitted to the Bureau of Water Allocation, NJDEP
Analysis based on location of water withdrawals, not location of water use.
The industrial category on the graphs includes both industrial and commercial & recreation withdrawals.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

Appendix D.
Details of withdrawals by year, use, and watershed management areas.

Appendix D. Details of withdrawals by year, watershed management area and use.

Table D1. Use of water by watershed management area for 1990 (millions of gallons)

Watershed Management Area	WATER USE																					Yearly Total		
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural					
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
Passaic (Water Region 1)																								
Pompton, Pequannock, Wanaque and Ramapo	0	0	0	0	0	0	4,151	79	4,230	0	17	17	63,248	5,562	68,810	23	82	105	15	5	20	67,437	5,745	73,181
Lower Passaic and Saddle	163,688	0	163,688	0	0	0	839	1,127	1,965	0	2	2	18,687	6,734	25,421	4	109	114	0	0	0	183,218	7,972	191,191
Hackensack and Pascack	0	0	0	0	0	0	0	449	449	0	21	21	34,148	1,572	35,720	0	37	37	0	0	0	34,148	2,079	36,227
Upper Passaic, Whippany and Rockaway	0	0	0	0	136	136	0	1,321	1,321	0	70	70	25,259	19,577	44,836	17	91	107	11	0	11	25,287	21,195	46,482
sum	163,688	0	163,688	0	136	136	4,989	2,976	7,965	0	111	111	141,343	33,445	174,788	45	318	363	25	5	30	310,090	36,990	347,080
Raritan (Water Region 2)																								
Elizabeth, Rahway and Woodbridge	3,065	0	3,065	0	0	0	0	1,607	1,607	0	20	20	1,911	4,377	6,288	14	89	102	0	0	0	4,990	6,093	11,083
North and South Branch Raritan	0	0	0	0	0	0	270	787	1,057	0	4	4	68	5,354	5,422	99	23	122	19	16	35	456	6,184	6,640
Lower Raritan, South and Lawrence	0	4	4	0	721	721	43	5,077	5,120	0	7	7	37,292	12,144	49,436	36	172	207	4	24	27	37,374	18,148	55,522
Millstone	0	0	0	0	1	1	0	390	390	0	7	7	0	4,810	4,810	12	308	319	160	141	302	172	5,658	5,830
sum	3,065	4	3,068	0	722	722	314	7,861	8,175	0	38	38	39,271	26,688	65,956	160	591	751	183	181	364	42,992	36,083	79,075
Atlantic Coastal (Water Region 3)																								
Monmouth County	0	0	0	0	0	0	0	265	265	0	6	6	17,660	9,430	27,090	28	122	150	41	3	44	17,728	9,827	27,555
Barnegat Bay	0	0	0	0	2,939	2,939	2,148	718	2,866	0	4	4	1,766	14,765	16,530	38	121	159	214	10	225	4,166	18,557	22,724
Mullica and Wading	0	0	0	0	1,723	1,723	0	166	166	0	5	5	0	4,173	4,173	0	64	64	12,953	8,588	21,541	12,953	14,719	27,671
Great Egg Harbor and Tuckahoe	0	123	123	1,504	1,446	2,950	0	485	485	0	207	207	916	12,188	13,104	18	102	120	111	863	975	2,549	15,415	17,964
Cape May County	0	0	0	0	73	73	0	76	76	0	5	5	0	4,656	4,656	0	80	80	4	235	238	4	5,124	5,127
sum	0	123	123	1,504	6,181	7,685	2,148	1,710	3,858	0	227	227	20,342	45,211	65,553	84	490	573	13,323	9,699	23,022	37,400	63,642	101,042
Upper Delaware (Water Region 4)																								
Upper Delaware	56,450	0	56,450	0	2,914	2,914	48,383	1,778	50,162	0	0	0	357	6,516	6,873	24	3	27	109	2,510	2,619	105,323	13,722	119,045
Walkill, Pohuck and Papakating	0	2	2	0	6	6	0	0	0	0	15	15	580	1,563	2,144	1	3	3	24	12	35	605	1,600	2,205
Central Delaware	194,601	0	194,601	0	0	0	13,252	275	13,527	0	0	0	45,222	2,852	48,074	16	12	28	1	2	3	253,092	3,141	256,233
sum	251,051	2	251,053	0	2,920	2,920	61,636	2,053	63,689	0	15	15	46,159	10,932	57,091	41	18	58	133	2,524	2,657	359,020	18,463	377,483
Lower Delaware (Water Region 5)																								
Maurice, Salem and Cohansey	0	0	0	12,342	1,977	14,319	3,896	3,925	7,821	0	27	27	479	9,623	10,102	0	91	91	358	3,248	3,606	17,076	18,891	35,967
Lower Delaware	0	0	0	0	418	418	21,216	4,360	25,576	0	3	3	0	20,009	20,009	12	86	98	730	150	880	21,958	25,027	46,985
Rancocas	0	0	0	0	126	126	2	237	240	0	1	1	23	21,662	21,685	86	316	402	6,858	1,144	8,003	6,970	23,486	30,457
Crosswicks	12,503	0	12,503	0	0	0	0	1,417	1,417	0	0	0	1,244	3,562	4,807	9	22	31	554	89	643	14,311	5,091	19,402
sum	12,503	0	12,503	12,342	2,521	14,864	25,114	9,940	35,054	0	30	30	1,747	54,857	56,603	107	516	623	8,501	4,631	13,132	60,315	72,495	132,810
Source total withdrawals	430,307	129	430,436	13,846	12,480	26,326	94,201	24,540	118,741	0	422	422	248,861	171,130	419,991	436	1,932	2,368	22,165	17,041	39,206	809,816	227,674	1,037,490

All data, except estimates of domestic well pumpage, are from purveyor-generated reports submitted to the Bureau of Water Allocation, NJDEP
Analysis based on location of water withdrawals, not location of water use.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

Appendix D. Details of withdrawals by year, watershed management area and use.

Table D2. Use of water by watershed management area for 1991 (millions of gallons)

Watershed Management Area	WATER USE																					Yearly Total		
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural					
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
Passaic (Water Region 1)																								
Pompton, Pequannock, Wanaque and Ramapo	0	0	0	0	0	0	4,203	39	4,242	0	20	20	84,550	5,767	90,317	23	119	142	0	0	0	88,776	5,945	94,721
Lower Passaic and Saddle	114,547	0	114,547	0	0	0	872	920	1,792	0	3	3	19,194	7,298	26,491	16	184	200	0	10	10	134,628	8,414	143,042
Hackensack and Pascack	0	0	0	0	0	0	0	505	505	0	20	20	31,912	1,574	33,486	0	34	34	0	0	0	31,912	2,133	34,046
Upper Passaic, Whippany and Rockaway	0	0	0	0	129	129	108	1,368	1,476	0	66	66	22,707	20,218	42,925	33	154	187	7	0	7	22,855	21,935	44,790
sum	114,547	0	114,547	0	129	129	5,183	2,832	8,015	0	109	109	158,363	34,857	193,220	72	490	563	7	10	17	278,171	38,428	316,599
Raritan (Water Region 2)																								
Elizabeth, Rahway and Woodbridge	4,666	0	4,666	0	0	0	0	1,521	1,521	0	26	26	1,748	5,078	6,826	19	156	175	0	0	0	6,433	6,781	13,214
North and South Branch Raritan	0	0	0	0	0	0	240	742	983	0	0	0	4	5,532	5,536	120	34	153	22	41	63	386	6,349	6,735
Lower Raritan, South and Lawrence	0	36	36	0	745	745	29	5,006	5,035	0	2	2	35,947	14,130	50,077	71	264	335	7	23	30	36,054	20,205	56,260
Millstone	0	0	0	0	11	11	0	419	419	0	17	17	0	4,827	4,827	55	486	540	153	217	370	208	5,977	6,185
sum	4,666	36	4,702	0	755	755	269	7,688	7,957	0	46	46	37,700	29,567	67,266	265	938	1,203	182	281	464	43,081	39,312	82,394
Atlantic Coastal (Water Region 3)																								
Monmouth County	0	0	0	0	0	0	0	252	252	0	2	2	16,846	6,660	23,506	52	164	217	104	13	117	17,002	7,091	24,093
Barnegat Bay	0	0	0	0	1,789	1,789	400	598	997	0	5	5	906	17,794	18,700	75	186	262	210	6	216	1,591	20,379	21,969
Mullica and Wading	0	0	0	0	1,388	1,388	0	99	99	0	7	7	0	3,790	3,790	0	78	78	19,273	9,453	28,726	19,273	14,815	34,089
Great Egg Harbor and Tuckahoe	0	114	114	1,229	1,091	2,320	0	474	474	0	202	202	0	14,732	14,732	34	96	130	434	2,193	2,627	1,697	18,902	20,599
Cape May County	0	0	0	0	67	67	0	67	67	0	5	5	0	4,928	4,928	0	88	88	4	293	297	4	5,448	5,452
sum	0	114	114	1,229	4,334	5,563	400	1,489	1,889	0	221	221	17,752	47,904	65,656	162	613	774	20,026	11,958	31,984	39,568	66,634	106,202
Upper Delaware (Water Region 4)																								
Upper Delaware	54,531	0	54,531	0	2,346	2,346	36,908	1,853	38,762	0	0	0	242	7,083	7,325	24	3	27	102	2,906	3,008	91,807	14,191	105,998
Walkill, Pohuck and Papakating	0	2	2	0	0	0	0	0	0	0	32	32	604	1,583	2,187	15	16	31	27	11	37	646	1,644	2,290
Central Delaware	164,306	0	164,306	0	0	0	11,177	292	11,470	0	0	0	44,152	3,021	47,173	21	28	49	18	18	36	219,674	3,359	223,034
sum	218,837	2	218,839	0	2,347	2,347	48,086	2,146	50,231	0	32	32	44,998	11,687	56,685	59	47	107	147	2,934	3,081	312,127	19,195	331,322
Lower Delaware (Water Region 5)																								
Maurice, Salem and Cohansey	0	0	0	18,139	1,654	19,793	5,026	3,590	8,615	0	55	55	469	8,793	9,262	0	63	63	921	4,831	5,752	24,555	18,985	43,540
Lower Delaware	0	0	0	0	535	535	25,703	3,657	29,360	0	6	6	0	21,872	21,872	32	71	102	3,345	279	3,623	29,080	26,420	55,499
Rancocas	0	0	0	0	82	82	2	158	160	0	1	1	0	22,167	22,167	99	288	387	6,774	1,143	7,918	6,875	23,839	30,714
Crosswicks	9,489	0	9,489	0	0	0	0	1,291	1,291	0	0	0	1,075	4,105	5,180	33	23	56	557	136	692	11,153	5,554	16,708
sum	9,489	0	9,489	18,139	2,271	20,411	30,730	8,696	39,426	0	62	62	1,544	56,937	58,481	164	444	608	11,596	6,389	17,985	71,663	74,798	146,461
Source total withdrawals	347,539	153	347,691	19,369	9,836	29,205	84,667	22,851	107,518	0	470	470	260,357	180,951	441,308	721	2,533	3,255	31,958	21,572	53,530	744,611	238,367	982,978

All data, except estimates of domestic well pumpage, are from purveyor-generated reports submitted to the Bureau of Water Allocation, NJDEP
Analysis based on location of water withdrawals, not location of water use.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

Appendix D. Details of withdrawals by year, watershed management area and use.

Table D3. Use of water by watershed management area for 1992 (millions of gallons)

Watershed Management Area	WATER USE																					Yearly Total		
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural					
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
Passaic (Water Region 1)																								
Pompton, Pequannock, Wanaque and Ramapo	0	0	0	0	0	0	4,572	36	4,608	0	20	20	87,164	5,401	92,566	9	54	62	10	2	12	91,755	5,513	97,268
Lower Passaic and Saddle	96,736	0	96,736	0	0	0	981	821	1,802	0	0	0	18,829	7,452	26,281	11	127	138	0	0	0	116,556	8,401	124,957
Hackensack and Pascack	0	0	0	0	0	0	0	458	458	0	15	15	29,224	1,550	30,774	0	33	33	0	0	0	29,224	2,057	31,281
Upper Passaic, Whippany and Rockaway	0	0	0	0	65	65	81	1,379	1,460	0	80	80	21,539	19,419	40,958	14	116	130	2	0	2	21,636	21,060	42,696
sum	96,736	0	96,736	0	65	65	5,634	2,695	8,328	0	115	115	156,756	33,823	190,579	33	331	364	12	2	14	259,171	37,031	296,201
Raritan (Water Region 2)																								
Elizabeth, Rahway and Woodbridge	2,984	0	2,984	0	0	0	0	1,343	1,343	0	18	18	1,840	4,901	6,741	18	147	165	0	0	0	4,842	6,408	11,251
North and South Branch Raritan	0	0	0	0	0	0	326	952	1,278	0	2	2	12	5,439	5,451	44	22	67	15	35	49	397	6,451	6,847
Lower Raritan, South and Lawrence	0	30	30	0	83	83	23	5,299	5,322	0	5	5	34,539	12,990	47,530	42	223	264	7	21	28	34,611	18,651	53,262
Millstone	0	0	0	0	9	9	0	400	400	0	21	21	0	4,908	4,908	97	406	504	112	107	219	209	5,852	6,061
sum	2,984	30	3,014	0	93	93	349	7,994	8,343	0	46	46	36,392	28,239	64,630	201	798	999	133	163	296	40,058	37,362	77,421
Atlantic Coastal (Water Region 3)																								
Monmouth County	0	5	5	0	0	0	0	311	311	0	21	21	17,810	5,603	23,413	36	126	161	89	5	94	17,934	6,072	24,006
Barnegat Bay	0	0	0	0	2,185	2,185	0	516	516	0	4	4	681	17,213	17,894	58	222	279	125	7	132	863	20,148	21,011
Mullica and Wading	0	0	0	0	1,692	1,692	0	140	140	0	21	21	0	3,771	3,771	0	80	80	16,537	8,161	24,698	16,537	13,865	30,402
Great Egg Harbor and Tuckahoe	0	103	103	1,579	1,305	2,884	0	730	730	0	171	171	294	14,534	14,828	44	109	153	89	2,290	2,379	2,006	19,243	21,249
Cape May County	0	0	0	0	63	63	0	54	54	0	5	5	0	4,787	4,787	25	109	134	4	293	297	29	5,310	5,339
sum	0	109	109	1,579	5,245	6,824	0	1,752	1,752	0	222	222	18,785	45,908	64,693	163	645	807	16,844	10,756	27,600	37,370	64,637	102,007
Upper Delaware (Water Region 4)																								
Upper Delaware	54,917	0	54,917	0	2,510	2,510	31,630	1,697	33,327	0	1	1	201	7,068	7,269	13	3	16	38	3,019	3,057	86,799	14,298	101,097
Watkill, Pohuck and Papakating	0	11	11	0	16	16	0	14	14	0	48	48	576	1,663	2,239	13	14	27	1	8	10	591	1,774	2,365
Central Delaware	179,864	0	179,864	0	0	0	11,925	570	12,495	0	0	0	41,977	2,955	44,932	13	10	24	4	9	13	233,783	3,545	237,327
sum	234,781	11	234,792	0	2,526	2,526	43,555	2,281	45,837	0	49	49	42,754	11,686	54,439	39	27	67	43	3,037	3,080	321,172	19,617	340,789
Lower Delaware (Water Region 5)																								
Maurice, Salem and Cohansey	0	0	0	26,365	1,731	28,096	4,275	3,188	7,463	0	57	57	567	8,278	8,846	0	98	98	500	3,744	4,244	31,708	17,096	48,804
Lower Delaware	0	0	0	0	408	408	25,959	3,682	29,641	0	47	47	0	16,005	16,005	12	92	105	838	232	1,070	26,809	20,467	47,276
Rancocas	0	0	0	0	99	99	2	67	69	0	4	4	0	26,946	26,946	68	301	368	2,546	2,020	4,565	2,615	29,437	32,052
Crosswicks	2,974	0	2,974	0	0	0	0	1,354	1,354	0	0	0	850	4,154	5,004	10	38	47	548	93	641	4,382	5,638	10,020
sum	2,974	0	2,974	26,365	2,238	28,603	30,236	8,291	38,527	0	108	108	1,417	55,383	56,801	90	529	619	4,432	6,089	10,521	65,514	72,639	138,153
Source total withdrawals	337,475	149	337,624	27,944	10,168	38,112	79,774	23,013	102,787	0	541	541	256,104	175,038	431,142	525	2,330	2,855	21,464	20,047	41,510	723,285	231,286	954,571

All data, except estimates of domestic well pumpage, are from purveyor-generated reports submitted to the Bureau of Water Allocation, NJDEP
Analysis based on location of water withdrawals, not location of water use.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

Appendix D. Details of withdrawals by year, watershed management area and use.

Table D4. Use of water by watershed management area for 1993 (millions of gallons)

Watershed Management Area	WATER USE																					Yearly Total		
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural					
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
Passaic (Water Region 1)													**Passaic (Water Region 1)**											
Pompton, Pequannock, Wanaque and Ramapo	0	0	0	0	0	0	4,014	46	4,060	0	27	27	87,150	6,054	93,204	28	138	165	0	5	5	91,191	6,270	97,461
Lower Passaic and Saddle	101,610	0	101,610	0	0	0	728	1,213	1,941	0	0	0	18,408	8,201	26,609	35	182	217	0	21	21	120,781	9,616	130,397
Hackensack and Pascack	0	0	0	0	0	0	0	463	463	0	16	16	28,785	1,771	30,556	60	96	156	0	0	0	28,845	2,346	31,191
Upper Passaic, Whippany and Rockaway	0	0	0	0	153	153	113	1,200	1,313	0	36	36	21,571	20,190	41,761	81	184	265	6	0	6	21,772	21,763	43,535
sum	101,610	0	101,610	0	153	153	4,854	2,922	7,776	0	80	80	155,915	36,216	192,131	204	599	803	6	25	32	262,589	39,995	302,584
Raritan (Water Region 2)													**Raritan (Water Region 2)**											
Elizabeth, Rahway and Woodbridge	2,535	0	2,535	0	0	0	0	1,230	1,230	0	28	28	1,890	4,551	6,441	19	220	238	0	0	0	4,443	6,030	10,473
North and South Branch Raritan	0	0	0	0	0	0	320	911	1,231	0	2	2	29	5,866	5,895	97	64	160	15	361	376	460	7,204	7,664
Lower Raritan, South and Lawrence	0	26	26	0	961	961	0	5,545	5,545	0	4	4	37,838	14,590	52,428	68	250	318	7	69	76	37,913	21,445	59,358
Millstone	0	0	0	0	0	0	0	429	429	0	20	20	0	5,113	5,113	58	434	492	185	209	394	243	6,205	6,448
sum	2,535	26	2,561	0	961	961	320	8,115	8,435	0	54	54	39,757	30,120	69,877	242	967	1,209	206	639	846	43,060	40,883	83,943
Atlantic Coastal (Water Region 3)													**Atlantic Coastal (Water Region 3)**											
Monmouth County	0	6	6	0	0	0	0	311	311	0	7	7	17,087	6,221	23,308	94	197	291	128	29	157	17,310	6,771	24,080
Barnegat Bay	0	0	0	0	1,473	1,473	0	626	626	0	5	5	867	18,583	19,450	83	274	356	154	8	162	1,103	20,969	22,072
Mullica and Wading	0	0	0	0	1,918	1,918	0	252	252	0	39	39	0	4,027	4,027	0	141	141	20,785	9,473	30,257	20,785	15,850	36,635
Great Egg Harbor and Tuckahoe	0	119	119	1,658	1,412	3,070	0	916	916	0	223	223	428	14,630	15,058	55	213	269	101	2,412	2,512	2,242	19,924	22,166
Cape May County	0	0	0	0	41	41	0	102	102	0	6	6	0	5,184	5,184	34	167	201	0	347	347	34	5,846	5,880
sum	0	124	124	1,658	4,844	6,502	0	2,206	2,206	0	280	280	18,382	48,646	67,028	266	992	1,259	21,168	12,267	33,435	41,474	69,360	110,835
Upper Delaware (Water Region 4)													**Upper Delaware (Water Region 4)**											
Upper Delaware	55,279	0	55,279	0	3,039	3,039	1,418	1,547	2,965	0	10	10	247	7,208	7,455	26	3	30	339	2,958	3,297	57,309	14,767	72,077
Wallkill, Pohuck and Papakating	0	30	30	0	14	14	0	54	54	0	124	124	644	1,731	2,375	16	18	34	3	11	14	663	1,982	2,646
Central Delaware	182,407	0	182,407	0	0	0	16,856	731	17,587	0	0	0	44,734	3,079	47,813	28	30	58	25	39	64	244,050	3,880	247,930
sum	237,686	30	237,717	0	3,054	3,054	18,274	2,332	20,606	0	135	135	45,625	12,018	57,644	71	51	122	367	3,009	3,376	302,023	20,630	322,652
Lower Delaware (Water Region 5)													**Lower Delaware (Water Region 5)**											
Maurice, Salem and Cohansey	0	0	0	18,046	2,659	20,704	5,040	3,260	8,300	0	83	83	549	9,153	9,702	0	228	228	2,852	4,368	7,220	26,486	19,751	46,237
Lower Delaware	0	0	0	0	473	473	20,932	3,311	24,242	1	39	40	0	16,418	16,418	20	126	147	1,065	226	1,291	22,018	20,594	42,612
Rancocas	0	0	0	0	111	111	2	56	58	0	6	6	0	26,628	26,628	60	358	418	6,399	1,240	7,639	6,461	28,398	34,858
Crosswicks	13,781	0	13,781	0	0	0	0	1,228	1,228	0	0	0	728	4,472	5,201	14	38	53	726	155	880	15,249	5,893	21,143
sum	13,781	0	13,781	18,046	3,242	21,288	25,973	7,856	33,829	1	128	129	1,278	56,671	57,949	95	750	845	11,041	5,989	17,030	70,214	74,636	144,850
Source total withdrawals	355,612	181	355,793	19,704	12,255	31,958	49,420	23,431	72,852	1	677	678	260,956	183,672	444,627	879	3,359	4,238	32,788	21,930	54,718	719,359	245,504	964,864

All data, except estimates of domestic well pumpage, are from purveyor-generated reports submitted to the Bureau of Water Allocation, NJDEP
Analysis based on location of water withdrawals, not location of water use.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

Appendix D. Details of withdrawals by year, watershed management area and use.

Table D5. Use of water by watershed management area for 1994 (millions of gallons)

Watershed Management Area	WATER USE																					Yearly Total		
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural					
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
Passaic (Water Region 1)													**Passaic (Water Region 1)**											
Pompton, Pequannock, Wanaque and Ramapo	0	0	0	0	0	0	3,962	12	3,974	0	30	30	80,205	5,621	85,826	18	112	130	10	6	17	84,195	5,780	89,976
Lower Passaic and Saddle	85,320	0	85,320	0	0	0	543	885	1,428	0	2	2	17,473	7,816	25,289	41	166	207	0	7	7	103,377	8,876	112,253
Hackensack and Pascack	0	0	0	0	0	0	0	414	414	0	10	10	34,751	1,579	36,329	81	122	203	0	0	0	34,831	2,125	36,957
Upper Passaic, Whippany and Rockaway	0	0	0	0	167	167	126	1,041	1,167	0	44	44	19,320	20,222	39,543	64	218	282	2	0	2	19,513	21,692	41,205
sum	85,320	0	85,320	0	167	167	4,631	2,352	6,983	0	86	86	151,749	35,238	186,987	203	618	822	13	13	26	241,917	38,474	280,391
Raritan (Water Region 2)													**Raritan (Water Region 2)**											
Elizabeth, Rahway and Woodbridge	2,577	0	2,577	0	0	0	0	1,255	1,255	0	39	39	1,954	4,493	6,447	17	166	184	0	0	0	4,548	5,954	10,502
North and South Branch Raritan	0	0	0	0	0	0	314	917	1,231	0	1	1	14	6,349	6,363	101	46	147	13	21	34	441	7,335	7,776
Lower Raritan, South and Lawrence	0	36	36	83	1,149	1,232	0	5,640	5,640	0	4	4	43,482	15,686	59,168	51	232	283	9	36	45	43,625	22,782	66,407
Millstone	0	0	0	0	0	0	0	430	430	0	27	27	0	5,214	5,214	107	306	413	101	223	324	208	6,200	6,408
sum	2,577	36	2,613	83	1,149	1,232	314	8,243	8,556	0	71	71	45,450	31,742	77,191	277	751	1,028	122	280	402	48,822	42,271	91,094
Atlantic Coastal (Water Region 3)													**Atlantic Coastal (Water Region 3)**											
Monmouth County	0	8	8	0	0	0	0	269	269	0	7	7	16,799	5,847	22,647	95	170	264	125	20	145	17,019	6,321	23,340
Barnegat Bay	0	0	0	0	1,564	1,564	0	769	769	0	5	5	1,628	18,548	20,176	70	307	377	119	25	144	1,817	21,218	23,035
Mullica and Wading	0	0	0	0	1,819	1,819	0	320	320	0	26	26	0	4,152	4,152	0	66	66	20,011	12,866	32,877	20,011	19,249	39,260
Great Egg Harbor and Tuckahoe	0	120	120	1,558	1,700	3,259	0	828	828	0	222	222	147	15,140	15,287	92	189	281	146	1,063	1,209	1,944	19,261	21,205
Cape May County	0	0	0	0	61	61	0	68	68	0	6	6	0	4,907	4,907	13	111	124	0	222	222	13	5,376	5,388
sum	0	128	128	1,558	5,145	6,703	0	2,255	2,255	0	265	265	18,575	48,593	67,168	270	843	1,113	20,400	14,196	34,597	40,804	71,424	112,228
Upper Delaware (Water Region 4)													**Upper Delaware (Water Region 4)**											
Upper Delaware	44,380	0	44,380	0	3,717	3,717	23,319	1,605	24,925	0	3	3	317	6,851	7,168	25	3	28	51	3,207	3,258	68,092	15,388	83,479
Walkill, Pohuck and Papakating	0	58	58	0	10	10	0	51	51	0	67	67	434	1,933	2,367	11	14	26	0	11	11	445	2,144	2,589
Central Delaware	177,185	0	177,185	0	0	0	16,522	725	17,247	0	2	2	43,026	3,071	46,097	8	18	27	7	0	7	236,748	3,816	240,564
sum	221,565	58	221,623	0	3,727	3,727	39,841	2,381	42,222	0	72	72	43,777	11,855	55,631	44	36	80	58	3,218	3,276	305,285	21,347	326,632
Lower Delaware (Water Region 5)													**Lower Delaware (Water Region 5)**											
Maurice, Salem and Cohansey	0	0	0	21,317	3,426	24,743	6,154	3,448	9,602	0	44	44	494	10,002	10,496	0	264	264	490	5,074	5,565	28,456	22,259	50,715
Lower Delaware	0	0	0	0	546	546	12,789	3,386	16,175	3	42	45	0	15,125	15,125	25	90	115	826	197	1,022	13,641	19,386	33,027
Rancocas	0	0	0	0	124	124	2	94	96	0	4	4	0	27,427	27,427	47	415	462	5,179	822	6,001	5,227	28,886	34,114
Crosswicks	38,027	0	38,027	0	0	0	0	1,146	1,146	0	0	0	972	4,147	5,119	16	37	53	596	206	802	39,612	5,536	45,147
sum	38,027	0	38,027	21,317	4,096	25,413	18,945	8,074	27,018	3	91	94	1,466	56,701	58,167	88	806	894	7,090	6,299	13,389	86,936	76,067	163,003
Source total withdrawals	347,490	222	347,712	22,959	14,283	37,241	63,731	23,304	87,034	3	585	588	261,016	184,128	445,145	883	3,054	3,937	27,684	24,007	51,690	723,764	249,583	973,347

All data, except estimates of domestic well pumpage, are from purveyor-generated reports submitted to the Bureau of Water Allocation, NJDEP
Analysis based on location of water withdrawals, not location of water use.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

Appendix D. Details of withdrawals by year, watershed management area and use.

Table D6. Use of water by watershed management area for 1995 (millions of gallons)

Watershed Management Area	WATER USE																					Yearly Total		
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural					
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
Passaic (Water Region 1)													**Passaic (Water Region 1)**											
Pompton, Pequannock, Wanaque and Ramapo	0	0	0	0	0	0	4,223	20	4,243	0	24	24	89,086	5,763	94,849	18	60	77	12	6	18	93,339	5,872	99,211
Lower Passaic and Saddle	56,954	0	56,954	0	0	0	529	849	1,378	0	0	0	19,180	7,483	26,663	38	231	269	0	1	1	76,701	8,565	85,266
Hackensack and Pascack	0	0	0	0	0	0	0	353	353	0	8	8	27,179	1,687	28,866	67	144	211	0	0	0	27,245	2,193	29,438
Upper Passaic, Whippany and Rockaway	0	0	0	0	69	69	126	1,115	1,241	0	39	39	19,951	19,494	39,445	80	212	292	11	0	11	20,168	20,929	41,097
sum	56,954	0	56,954	0	69	69	4,878	2,338	7,216	0	70	70	155,396	34,428	189,823	202	647	849	23	7	31	217,453	37,558	255,012
Raritan (Water Region 2)													**Raritan (Water Region 2)**											
Elizabeth, Rahway and Woodbridge	2,794	0	2,794	0	0	0	0	1,240	1,240	0	40	40	1,906	4,339	6,245	12	184	196	0	0	0	4,713	5,803	10,516
North and South Branch Raritan	0	0	0	0	0	0	314	705	1,019	0	1	1	14	6,463	6,477	105	64	170	36	101	137	470	7,334	7,804
Lower Raritan, South and Lawrence	0	39	39	79	439	518	0	4,796	4,796	0	6	6	43,859	15,661	59,520	47	256	303	9	12	21	43,994	21,208	65,202
Millstone	0	0	0	0	1	1	2	416	418	0	23	23	0	4,987	4,987	91	299	391	218	267	485	312	5,993	6,304
sum	2,794	39	2,833	79	440	519	316	7,157	7,473	0	70	70	45,780	31,450	77,230	256	803	1,059	263	379	643	49,488	40,337	89,826
Atlantic Coastal (Water Region 3)													**Atlantic Coastal (Water Region 3)**											
Monmouth County	0	7	7	0	0	0	0	279	279	0	20	20	18,219	5,736	23,955	83	222	305	278	26	303	18,579	6,290	24,869
Barnegat Bay	0	0	0	0	1,199	1,199	0	830	830	0	4	4	1,811	18,979	20,790	73	388	461	101	39	139	1,984	21,439	23,423
Mullica and Wading	0	0	0	0	1,899	1,899	0	202	202	0	13	13	0	4,141	4,141	0	172	172	32,301	8,269	40,570	32,301	14,696	46,997
Great Egg Harbor and Tuckahoe	0	153	153	1,149	1,616	2,765	0	567	567	0	235	235	5	14,729	14,734	89	162	252	104	1,283	1,387	1,347	18,745	20,092
Cape May County	0	0	0	0	74	74	0	98	98	0	5	5	0	4,876	4,876	22	142	165	6	342	349	29	5,537	5,566
sum	0	161	161	1,149	4,788	5,937	0	1,977	1,977	0	276	276	20,034	48,460	68,495	267	1,087	1,354	32,789	9,959	42,748	54,240	66,707	120,947
Upper Delaware (Water Region 4)													**Upper Delaware (Water Region 4)**											
Upper Delaware	55,717	0	55,717	0	4,088	4,088	32,652	1,632	34,284	0	0	0	222	6,901	7,123	39	4	43	238	3,385	3,623	88,868	16,009	104,877
Walkill, Pohuck and Papakating	0	57	57	0	20	20	0	64	64	0	72	72	447	1,831	2,277	0	0	0	2	11	13	448	2,056	2,504
Central Delaware	168,422	0	168,422	0	0	0	6,997	647	7,644	0	0	0	44,446	3,208	47,654	26	26	52	13	6	19	219,903	3,887	223,790
sum	224,139	57	224,196	0	4,108	4,108	39,649	2,343	41,991	0	72	72	45,114	11,939	57,054	65	29	95	252	3,403	3,655	309,219	21,952	331,171
Lower Delaware (Water Region 5)													**Lower Delaware (Water Region 5)**											
Maurice, Salem and Cohansey	0	0	0	21,430	4,070	25,499	6,099	3,072	9,171	0	41	41	492	10,020	10,512	0	254	254	1,077	5,550	6,627	29,098	23,007	52,105
Lower Delaware	0	0	0	0	610	610	13,997	2,997	16,994	13	45	58	0	15,639	15,639	35	80	115	1,484	394	1,878	15,529	19,764	35,294
Rancocas	0	0	0	0	139	139	28	88	117	0	6	6	0	28,459	28,459	114	427	541	8,617	2,682	11,299	8,759	31,802	40,561
Crosswicks	36,513	0	36,513	0	0	0	0	1,102	1,102	0	0	0	831	4,168	4,999	16	48	63	810	279	1,088	38,169	5,597	43,766
sum	36,513	0	36,513	21,430	4,819	26,248	20,124	7,260	27,385	13	92	105	1,323	58,286	59,609	164	809	973	11,987	8,905	20,892	91,555	80,170	171,725
Source total withdrawals	320,400	257	320,657	22,657	14,223	36,880	64,968	21,074	86,042	13	580	593	267,647	184,563	452,210	955	3,375	4,330	45,316	22,653	67,969	721,956	246,724	968,680

All data, except estimates of domestic well pumpage, are from purveyor-generated reports submitted to the Bureau of Water Allocation, NJDEP
Analysis based on location of water withdrawals, not location of water use.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

Table D7. Use of water by watershed management area for 1996 (millions of gallons)

Watershed Management Area	WATER USE																					Yearly Total		
	Power Generation			Mining			Industrial			Commercial & recreation			Potable water supply			Irrigation			Agricultural					
	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total	Water source		Total
	Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground		Surface	Ground	
Passaic (Water Region 1)																								
Pompton, Pequannock, Wanaque and Ramapo	0	0	0	0	0	0	4,224	6	4,230	0	15	15	63,604	5,592	69,195	11	67	78	6	0	6	67,845	5,679	73,524
Lower Passaic and Saddle	58,568	0	58,568	0	0	0	434	516	950	0	0	0	17,098	8,139	25,236	17	154	172	0	6	6	76,118	8,815	84,933
Hackensack and Pascack	0	0	0	0	0	0	0	353	353	0	3	3	32,766	1,516	34,281	71	127	198	0	0	0	32,836	1,998	34,835
Upper Passaic, Whippany and Rockaway	0	0	0	0	67	67	96	1,108	1,204	0	45	45	20,615	20,027	40,643	50	113	163	4	0	4	20,765	21,359	42,124
sum	58,568	0	58,568	0	67	67	4,754	1,982	6,736	0	62	62	134,082	35,273	169,356	149	461	610	10	6	16	197,564	37,852	235,416
Raritan (Water Region 2)																								
Elizabeth, Rahway and Woodbridge	2,078	0	2,078	0	0	0	0	1,203	1,203	0	29	29	1,941	3,865	5,806	6	130	136	0	0	0	4,024	5,228	9,252
North and South Branch Raritan	0	0	0	0	0	0	310	672	982	0	5	5	10	6,262	6,272	81	35	116	9	39	48	411	7,012	7,423
Lower Raritan, South and Lawrence	0	28	28	32	1,019	1,051	0	6,178	6,178	0	10	10	44,166	14,530	58,696	42	139	181	5	3	9	44,245	21,907	66,153
Millstone	0	0	0	0	0	0	0	394	394	0	19	19	0	4,900	4,900	46	152	199	49	80	130	95	5,546	5,641
sum	2,078	28	2,106	32	1,019	1,051	310	8,447	8,757	0	63	63	46,117	29,556	75,674	175	457	632	63	123	186	48,776	39,693	88,469
Atlantic Coastal (Water Region 3)																								
Monmouth County	0	16	16	0	0	0	0	315	315	0	16	16	15,647	5,171	20,817	54	141	195	60	8	68	15,761	5,667	21,428
Barnegat Bay	0	0	0	0	1,619	1,619	0	1,444	1,444	0	4	4	1,726	18,138	19,863	51	355	407	116	34	151	1,893	21,594	23,487
Mullica and Wading	0	0	0	0	2,126	2,126	0	133	133	0	7	7	0	4,132	4,132	16	133	150	15,854	7,308	23,162	15,871	13,840	29,711
Great Egg Harbor and Tuckahoe	0	179	179	1,257	1,294	2,552	0	741	741	0	213	213	913	14,138	15,051	88	134	223	109	524	633	2,368	17,222	19,590
Cape May County	0	0	0	0	79	79	0	109	109	0	5	5	0	5,091	5,091	12	96	108	1	201	202	13	5,581	5,594
sum	0	195	195	1,257	5,119	6,376	0	2,742	2,742	0	245	245	18,286	46,669	64,955	222	860	1,082	16,142	8,075	24,216	35,906	63,904	99,810
Upper Delaware (Water Region 4)																								
Upper Delaware	44,233	0	44,233	0	4,906	4,906	31,880	1,577	33,456	0	0	0	144	6,845	6,989	18	6	23	157	217	375	76,432	13,551	89,982
Walkill, Pohuck and Papakating	0	39	39	0	51	51	0	25	25	114	57	171	431	1,844	2,276	1	61	62	0	1	1	547	2,079	2,625
Central Delaware	161,790	0	161,790	0	0	0	5,478	687	6,165	0	0	0	40,142	2,971	43,114	10	9	19	1	6	6	207,421	3,673	211,094
sum	206,023	39	206,062	0	4,957	4,957	37,357	2,289	39,647	114	57	171	40,718	11,661	52,379	29	75	104	158	224	382	284,399	19,303	303,702
Lower Delaware (Water Region 5)																								
Maurice, Salem and Cohansey	0	0	0	14,665	4,628	19,293	6,138	2,976	9,114	0	29	29	412	9,009	9,421	0	181	181	628	3,800	4,428	21,842	20,623	42,465
Lower Delaware	0	0	0	0	514	514	12,861	3,198	16,059	1	38	40	3,470	19,412	22,883	23	79	102	466	328	794	16,821	23,570	40,391
Rancocas	0	0	0	0	117	117	1	184	186	0	9	9	0	18,307	18,307	67	366	433	4,450	1,222	5,672	4,519	20,205	24,724
Crosswicks	34,719	0	34,719	0	0	0	0	1,221	1,221	0	0	0	781	4,259	5,041	0	13	13	497	116	613	35,997	5,609	41,606
sum	34,719	0	34,719	14,665	5,259	19,924	19,000	7,579	26,579	1	76	77	4,663	50,989	55,652	90	639	728	6,041	5,466	11,507	79,179	70,006	149,185
Source total withdrawals	301,388	261	301,650	15,954	16,420	32,374	61,421	23,040	84,461	116	503	619	243,866	174,148	418,014	664	2,492	3,156	22,414	13,893	36,307	645,824	230,759	876,582

All data, except estimates of domestic well pumpage, are from purveyor-generated reports submitted to the Bureau of Water Allocation, NJDEP
Analysis based on location of water withdrawals, not location of water use.
Only fresh-water withdrawals are summarized.
Not all withdrawals are consumptive. Surface-water withdrawals do not imply an equivalent reduction in stream flow.
The irrigation use group includes all non-agricultural irrigation. Irrigation for agricultural use in in the agricultural use group.

Appendix E.
Details of withdrawals by year and aquifer group

Appendix E. Details of withdrawals by year, county and aquifer group.

Table E1. Ground-water withdrawals in 1990 (millions of gallons)

County	AQUIFER GROUP																County totals
	northern New Jersey surficial	southern New Jersey surficial	Cohansey, Kirkwood	Rio Grande, 800-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick supergroup	Lockatong, Stockton	Paleozoic&Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
Atlantic	0	0	9,000	2,597	292	0	0	0	0	0	0	0	0	0	15	2,222	14,126
Bergen	2,730	0	0	0	0	0	0	0	0	0	6,034	0	0	0	38	773	9,575
Burlington	0	0	8,967	0	552	1,588	1,505	4,334	2,685	5,675	0	0	0	0	37	2,371	27,713
Camden	0	0	1,759	0	4	1,061	3,853	1,554	7,327	7,844	0	0	0	0	4	1,184	24,591
Cape May	0	1,746	2,404	2,416	0	0	0	0	0	0	0	0	0	0	0	1,307	7,873
Cumberland	0	19	12,426	0	0	0	0	0	0	0	0	0	0	0	32	1,450	13,927
Essex	6,968	0	0	0	0	0	0	0	0	0	3,651	0	0	0	0	141	10,760
Gloucester	0	65	1,578	0	0	20	1,817	1,510	2,359	5,035	0	0	0	0	27	1,570	13,981
Hudson	0	0	0	0	0	0	0	0	0	0	365	0	0	0	0	4	370
Hunterdon	138	0	0	0	0	0	0	0	0	0	1,140	72	170	373	436	2,059	4,388
Mercer	0	0	0	0	0	8	395	1,098	0	1,222	227	455	0	0	66	868	4,339
Middlesex	2	0	0	0	0	79	6,306	2,952	0	2,802	1,347	172	0	0	1,861	679	16,200
Monmouth	0	0	605	0	10	1,980	3,269	3,011	0	1,346	0	0	0	0	659	1,506	12,386
Morris	12,717	0	0	0	0	0	0	0	0	0	686	0	1,246	639	727	2,604	18,619
Ocean	0	0	9,481	1,782	451	1,486	1,018	0	763	60	0	0	0	0	1,665	3,209	19,913
Passaic	994	0	0	0	0	0	0	0	0	0	1,192	0	0	178	16	1,040	3,420
Salem	0	220	397	0	0	211	154	919	379	1,031	0	0	0	0	9	754	4,074
Somerset	0	0	0	0	0	0	0	0	0	0	860	0	0	5	4	1,807	2,677
Sussex	239	0	0	0	0	0	0	0	0	0	0	0	2,701	473	142	2,343	5,898
Union	1,435	0	0	0	0	0	0	0	0	0	4,136	0	0	0	13	42	5,626
Warren	3,578	0	0	0	0	0	0	0	0	0	0	0	2,250	252	2	1,136	7,217
Aquifer group totals	28,800	2,050	46,616	6,795	1,309	6,432	18,317	15,379	13,514	25,015	19,640	699	6,367	1,919	5,752	29,069	227,674

Appendix E. Details of withdrawals by year, county and aquifer group.

Table E2. Ground-water withdrawals in 1991 (millions of gallons)

County	AQUIFER GROUP																County totals
	northern New Jersey surficial	southern New Jersey surficial	Cohansey, Kirkwood	Rio Grande, 800-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick supergroup	Lockatong, Stockton	Paleozoic&Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
Atlantic	0	14	11,656	2,706	319	0	0	0	0	0	0	0	0	0	25	2,253	16,972
Bergen	3,017	0	0	0	0	0	0	0	0	0	6,472	0	0	0	51	774	10,313
Burlington	0	0	9,229	0	555	1,642	2,207	5,670	3,352	3,533	0	0	0	0	38	2,393	28,619
Camden	0	0	1,478	0	11	1,011	4,229	4,002	12,329	1,269	0	0	0	0	5	1,190	25,523
Cape May	0	1,379	2,673	2,216	0	0	0	0	0	0	0	0	0	0	0	1,326	7,595
Cumberland	0	0	13,423	0	0	0	0	0	0	0	0	0	0	0	308	1,459	15,190
Essex	5,599	0	0	0	0	0	0	0	0	0	3,605	0	0	0	0	140	9,344
Gloucester	0	513	1,802	0	0	25	4,203	2,374	2,070	1,460	0	0	0	0	10	1,598	14,057
Hudson	0	0	0	0	0	0	0	0	0	0	263	0	0	0	0	4	267
Hunterdon	141	0	0	0	0	0	0	0	0	0	1,326	90	456	422	3	2,084	4,521
Mercer	1	0	0	0	0	29	402	2,116	0	439	197	726	0	0	0	871	4,782
Middlesex	785	0	0	0	0	126	7,851	3,934	0	797	4,310	176	0	0	15	684	18,677
Monmouth	0	0	618	0	323	1,047	3,528	2,636	0	204	0	0	0	0	0	1,521	9,878
Morris	15,623	0	0	0	0	0	0	0	0	0	802	0	1,002	933	15	2,614	20,990
Ocean	0	0	10,306	1,588	824	1,451	794	43	2,730	72	0	0	0	0	24	3,247	21,080
Passaic	988	0	0	0	0	0	0	0	0	0	1,127	0	0	185	0	1,041	3,341
Salem	0	237	769	0	0	360	545	846	416	588	0	0	0	0	13	753	4,526
Somerset	0	0	0	0	0	0	0	0	0	0	1,042	0	0	12	2	1,845	2,902
Sussex	270	0	0	0	0	0	0	0	0	0	0	0	2,504	515	1	2,374	5,664
Union	2,088	0	0	0	0	0	0	0	0	0	4,232	0	0	0	13	42	6,374
Warren	4,378	0	0	0	0	0	0	0	0	0	0	0	2,130	68	26	1,149	7,751
Aquifer group totals	32,889	2,144	51,954	6,511	2,032	5,692	23,758	21,621	20,898	8,362	23,375	992	6,092	2,136	551	29,361	238,367

Appendix E. Details of withdrawals by year, county and aquifer group.

Table E3. Ground-water withdrawals in 1992 (millions of gallons)

County	AQUIFER GROUP																County totals
	northern New Jersey surficial	southern New Jersey surficial	Cohansey, Kirkwood	Rio Grande, 800-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick supergroup	Lockatong, Stockton	Paleozoic&Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
Atlantic	0	124	11,393	2,676	341	0	0	0	0	0	0	0	0	0	11	2,271	16,817
Bergen	2,650	0	0	0	0	0	0	0	0	0	6,576	0	0	0	16	779	10,021
Burlington	0	0	9,597	0	552	1,404	1,910	5,941	3,538	2,597	0	0	0	0	39	2,393	27,970
Camden	0	0	1,244	0	5	992	4,298	2,786	13,760	949	0	0	0	0	0	1,192	25,226
Cape May	0	394	3,833	2,096	0	0	0	0	0	0	0	0	0	0	0	1,336	7,658
Cumberland	0	0	11,990	0	0	0	0	0	0	0	0	0	0	0	60	1,460	13,510
Essex	5,399	0	0	0	0	0	0	0	0	0	4,010	0	0	0	0	140	9,550
Gloucester	0	425	1,618	0	0	133	3,939	2,229	2,181	1,592	0	0	0	0	0	1,612	13,729
Hudson	0	0	0	0	0	0	0	0	0	0	168	0	0	0	0	4	172
Hunterdon	131	0	0	0	0	0	0	0	0	0	1,643	106	315	548	0	2,132	4,875
Mercer	0	0	0	0	0	11	379	2,012	0	402	220	723	0	0	1	872	4,619
Middlesex	562	0	0	0	0	17	7,805	4,138	0	94	4,473	145	0	0	1	689	17,924
Monmouth	0	5	534	0	280	1,357	2,595	1,590	0	43	0	0	0	0	0	1,541	7,946
Morris	14,430	0	0	0	0	0	0	0	0	0	670	0	1,385	953	30	2,637	20,105
Ocean	0	0	10,489	1,570	771	1,185	883	61	2,769	108	0	0	0	0	27	3,278	21,142
Passaic	957	0	0	0	0	0	0	0	0	0	937	0	0	194	0	1,045	3,134
Salem	0	243	833	0	0	297	643	847	457	417	0	0	0	0	2	752	4,491
Somerset	0	0	0	0	0	0	0	0	0	0	1,047	0	0	3	6	1,879	2,935
Sussex	372	0	0	0	0	0	0	0	0	0	0	0	2,500	491	35	2,407	5,805
Union	1,887	0	0	0	0	0	0	0	0	0	3,960	0	0	0	34	42	5,923
Warren	4,523	0	0	0	0	0	0	0	0	0	0	0	1,940	102	10	1,160	7,735
Aquifer group totals	30,912	1,192	51,529	6,342	1,949	5,395	22,452	19,604	22,705	6,203	23,704	974	6,140	2,291	273	29,621	231,286

Appendix E. Details of withdrawals by year, county and aquifer group.

Table E4. Ground-water withdrawals in 1993 (millions of gallons)

County	AQUIFER GROUP																County totals
	northern New Jersey surficial	southern New Jersey surficial	Cohansey, Kirkwood	Rio Grande, 800-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick supergroup	Lockatong, Stockton	Paleozoic&Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
Atlantic	0	467	11,646	2,852	337	0	0	0	0	0	0	0	0	0	26	2,287	17,616
Bergen	3,081	0	0	0	0	0	0	0	0	0	8,071	0	0	0	11	783	11,946
Burlington	0	0	9,764	0	556	1,775	2,218	6,415	3,060	2,609	0	0	0	0	58	2,399	28,855
Camden	0	0	1,558	0	21	1,283	4,231	2,470	13,674	1,323	0	0	0	0	1	1,193	25,752
Cape May	0	1,847	2,691	2,501	0	0	0	0	0	0	0	0	0	0	0	1,335	8,375
Cumberland	0	543	13,625	0	0	0	0	0	0	0	0	0	0	0	70	1,460	15,698
Essex	5,174	0	0	0	0	0	0	0	0	0	3,988	0	0	0	0	140	9,302
Gloucester	0	242	1,840	0	0	226	3,701	1,837	1,921	2,406	0	0	0	0	39	1,626	13,838
Hudson	0	0	0	0	0	0	0	0	0	0	215	0	0	0	0	4	220
Hunterdon	120	0	0	0	0	0	0	0	0	0	1,773	118	313	616	0	2,172	5,112
Mercer	0	0	0	0	0	41	406	1,684	0	784	242	753	0	0	13	876	4,797
Middlesex	1,702	0	0	0	0	34	7,510	4,890	0	1,451	4,549	180	0	0	1	694	21,009
Monmouth	0	6	580	0	304	1,497	3,097	1,750	0	46	0	0	0	0	17	1,558	8,854
Morris	15,669	0	0	0	0	0	0	0	0	0	743	0	1,714	1,016	224	2,671	22,038
Ocean	0	24	10,836	1,802	768	859	957	35	2,840	89	0	0	0	0	11	3,333	21,555
Passaic	990	0	0	0	0	0	0	0	0	0	986	0	0	204	0	1,054	3,234
Salem	0	219	819	0	0	184	632	1,086	334	470	0	0	0	0	18	752	4,514
Somerset	0	0	0	0	0	0	0	0	0	0	1,328	0	0	15	9	1,923	3,275
Sussex	490	0	0	0	0	0	0	0	0	0	0	0	2,763	517	69	2,442	6,279
Union	1,791	0	0	0	0	0	0	0	0	0	3,650	0	0	0	26	42	5,509
Warren	4,597	0	0	0	0	0	0	0	0	0	0	0	1,859	56	46	1,170	7,727
Aquifer group totals	33,613	3,349	53,358	7,155	1,987	5,899	22,753	20,166	21,828	9,177	25,544	1,050	6,649	2,424	639	29,913	245,504

Appendix E. Details of withdrawals by year, county and aquifer group.

Table E5. Ground-water withdrawals in 1994 (millions of gallons)

County	AQUIFER GROUP																County totals
	northern New Jersey surficial	southern New Jersey surficial	Cohansey, Kirkwood	Rio Grande, 800-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick supergroup	Lockatong, Stockton	Paleozoic&Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
Atlantic	0	393	10,806	3,183	161	0	0	0	0	0	0	0	0	0	11	2,299	16,854
Bergen	2,740	0	0	0	0	0	0	0	0	0	7,399	0	0	0	6	786	10,931
Burlington	0	0	9,409	0	445	5,261	2,312	6,881	3,965	1,354	0	0	0	0	23	2,419	32,069
Camden	0	0	1,516	0	15	1,162	4,445	2,548	13,076	1,255	0	0	0	0	2	1,193	25,212
Cape May	0	2,075	2,501	2,270	0	0	0	0	0	0	0	0	0	0	0	1,344	8,189
Cumberland	0	703	14,952	0	0	0	0	0	0	0	0	0	0	0	11	1,458	17,124
Essex	5,449	0	0	0	0	0	0	0	0	0	4,069	0	0	0	0	139	9,657
Gloucester	0	285	1,836	0	0	400	4,168	2,125	2,056	1,358	0	0	0	0	3	1,649	13,880
Hudson	0	0	0	0	0	0	0	0	0	0	217	0	0	0	0	4	222
Hunterdon	122	0	0	0	0	0	0	0	0	0	1,737	122	360	629	0	2,203	5,172
Mercer	0	0	0	0	0	7	357	2,014	0	430	252	758	0	0	11	877	4,707
Middlesex	2,173	0	0	0	0	5	7,324	5,161	0	1,237	5,265	185	0	0	102	700	22,152
Monmouth	0	8	708	0	300	1,437	2,987	1,622	0	41	0	0	0	0	24	1,575	8,702
Morris	16,131	0	0	0	0	0	0	0	0	0	780	0	1,838	1,126	21	2,712	22,608
Ocean	0	0	12,004	1,878	792	764	1,123	41	1,859	56	0	0	0	0	10	3,387	21,916
Passaic	866	0	0	0	0	0	0	0	0	0	892	0	0	213	0	1,060	3,031
Salem	0	271	1,140	0	0	186	572	1,155	255	515	0	0	0	0	19	748	4,860
Somerset	0	0	0	0	0	0	0	0	0	0	1,034	0	0	10	15	1,962	3,020
Sussex	414	0	0	0	0	0	0	0	0	0	0	0	2,661	612	82	2,472	6,241
Union	973	0	0	0	0	0	0	0	0	0	4,149	0	0	0	18	42	5,183
Warren	3,366	0	0	0	0	0	0	0	0	0	0	0	3,082	181	40	1,183	7,852
Aquifer group totals	32,235	3,736	54,872	7,331	1,714	9,223	23,288	21,546	21,210	6,246	25,795	1,065	7,940	2,771	398	30,213	249,583

Appendix E. Details of withdrawals by year, county and aquifer group.

Table E6. Ground-water withdrawals in 1995 (millions of gallons)

County	AQUIFER GROUP																County totals
	northern New Jersey surficial	southern New Jersey surficial	Cohansey, Kirkwood	Rio Grande, 800-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick supergroup	Lockatong, Stockton	Paleozoic&Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
Atlantic	0	238	11,544	3,183	192	0	0	0	0	0	0	0	0	0	7	2,314	17,478
Bergen	2,635	0	0	0	0	0	0	0	0	0	7,356	0	0	0	6	790	10,787
Burlington	0	0	8,195	0	878	2,855	2,295	7,178	4,069	1,285	0	0	0	0	14	2,448	29,216
Camden	0	0	1,522	0	11	1,015	4,226	2,739	14,089	1,183	0	0	0	0	2	1,194	25,979
Cape May	0	2,027	2,374	2,460	0	0	0	0	0	0	0	0	0	0	0	1,349	8,211
Cumberland	0	850	14,680	0	0	0	0	0	0	0	0	0	0	0	14	1,447	16,990
Essex	5,335	0	0	0	0	0	0	0	0	0	3,585	0	0	0	0	138	9,058
Gloucester	0	171	2,355	0	0	444	4,117	2,294	1,957	1,305	0	0	0	0	12	1,657	14,312
Hudson	0	0	0	0	0	0	0	0	0	0	92	0	0	0	0	4	97
Hunterdon	131	0	0	0	0	0	0	0	0	0	1,504	90	372	671	0	2,220	4,989
Mercer	0	0	0	0	0	14	348	2,110	0	539	252	615	0	0	16	880	4,773
Middlesex	2,246	0	0	0	0	1	7,681	4,073	0	572	4,762	172	0	0	2	706	20,213
Monmouth	0	7	606	0	324	1,498	3,279	1,693	0	40	0	0	0	0	14	1,594	9,055
Morris	15,700	0	0	0	0	0	0	0	0	0	679	0	1,987	1,181	40	2,745	22,333
Ocean	0	27	11,704	1,799	824	811	1,244	48	2,053	51	0	0	0	0	29	3,453	22,043
Passaic	858	0	0	0	0	0	0	0	0	0	1,007	0	0	213	0	1,063	3,141
Salem	0	187	831	0	0	206	579	1,350	244	543	0	0	0	0	494	753	5,187
Somerset	0	0	0	0	0	0	0	0	0	0	876	0	0	23	5	1,995	2,899
Sussex	396	0	0	0	0	0	0	0	0	0	0	0	2,971	586	66	2,503	6,520
Union	1,082	0	0	0	0	0	0	0	0	0	4,313	0	0	0	31	42	5,468
Warren	3,401	0	0	0	0	0	0	0	0	0	0	0	3,073	259	46	1,196	7,976
Aquifer group totals	31,784	3,507	53,811	7,442	2,229	6,844	23,768	21,484	22,411	5,517	24,426	877	8,403	2,933	797	30,490	246,724

Appendix E. Details of withdrawals by year, county and aquifer group.

Table E7. Ground-water withdrawals in 1996

County	AQUIFER GROUP																County totals
	northern New Jersey surficial	southern New Jersey surficial	Cohansey, Kirkwood	Rio Grande, 800-sand	Piney Point, Vincentown	Wenonah, Mt. Laurel, Englishtown	Magothy-Raritan-Potomac				Brunswick supergroup	Lockatong, Stockton	Paleozoic&Proterzoic		Unknown	Domestic wells	
							upper	middle	lower	unknown			carbonates	crystalline			
Atlantic	0	297	9,896	3,020	169	0	0	0	0	0	0	0	0	0	28	2,332	15,742
Bergen	2,711	0	0	0	0	0	0	0	0	0	7,036	0	0	0	0	792	10,539
Burlington	0	1	8,122	0	534	1,341	2,149	6,203	2,965	2,163	0	0	0	0	286	2,466	26,231
Camden	0	0	1,556	0	4	1,273	3,008	1,830	11,785	1,142	0	0	0	0	2	1,193	21,793
Cape May	0	1,710	2,318	2,495	0	0	0	0	0	0	0	0	0	0	33	1,351	7,906
Cumber- land	0	1,710	2,318	2,495	0	0	0	0	0	0	0	0	0	0	7,119	1,428	15,069
Essex	5,489	0	0	0	0	0	0	0	0	0	3,634	0	0	0	0	137	9,260
Gloucester	0	209	2,874	0	0	671	3,800	2,151	1,845	996	0	0	0	0	234	1,666	14,446
Hudson	11	0	0	0	0	0	0	0	0	0	72	0	0	0	0	4	88
Hunterdon	135	0	0	0	0	0	0	0	0	0	1,587	115	425	620	3	2,268	5,153
Mercer	0	0	0	0	0	2	332	2,104	0	191	203	520	0	0	13	880	4,245
Middlesex	2,078	0	0	0	0	2	8,757	3,574	0	1,111	4,444	161	0	0	1	710	20,838
Monmouth	0	19	530	0	327	1,365	2,697	1,377	0	37	0	0	0	0	23	1,610	7,984
Morris	15,938	0	0	0	0	0	0	0	0	0	670	0	1,820	1,165	29	2,776	22,397
Ocean	0	37	12,128	1,825	731	717	1,040	50	2,026	60	0	0	0	0	34	3,512	22,160
Passaic	761	0	0	0	0	0	0	0	0	0	986	0	0	193	5	1,066	3,012
Salem	0	276	378	0	0	297	415	987	231	440	0	0	0	0	77	780	3,880
Somerset	0	0	0	0	0	0	0	0	0	0	753	0	0	13	11	2,031	2,808
Sussex	374	0	0	0	0	0	0	0	0	0	0	0	3,586	618	25	2,529	7,131
Union	862	0	0	0	0	0	0	0	0	0	4,256	0	0	0	25	42	5,186
Warren	1,312	0	0	0	0	0	0	0	0	0	0	0	2,157	162	51	1,209	4,892
Aquifer group totals	29,670	4,258	40,120	9,835	1,765	5,667	22,197	18,277	18,853	6,140	23,641	796	7,989	2,771	7,997	30,782	230,759

Appendix F.
Detailed list of aquifer groups and assigned aquifers.

Appendix F. Detailed list of aquifer groups and assigned aquifers

abbreviation	geologic unit

A - glacial sediments of northern New Jersey

ct	continuous till
dt	discontinous till
m	morainic deposits
im	morainic deposits (Illinoian age)
d	deltaic sediment
l	lake-bottom sediment
f	fluvial sediment
fl	fluvial over lacustrine sediment
if	fluvial sediment (Illinoian age)
ic	ice-contact sediment
it	till of Illinoian age
jt	till of Jerseyan age
js	sand and gravel of Jerseyan age
x	non-glacial material
Qs	Swamp and Marsh Deposits
Qal	Alluvium
Qalb	Alluvium and Boulder Lag
Qalfp	Floodplain Deposits
Qalc	Channel Deposits
Qcal	Colluvium and Alluvium, Undivided
Qmm	Estuarine Deposits
Qaf	Alluvial Fan Deposits
Qst	Stream Terrace Deposits
Qta	Talus
Qe	Eolian Deposits
Qgu*	glacial undifferentiated
Qt	Till
Qtt	Discontinuous Till (generally < 10 feet)
Qtw	Late Wisconsian Till
Qtwr	Rahway Till
Qtwn	Netcong Till
Qtwk	Kittatinny Mountain Till
Qtwqc	derived from quartzite and conglomerate
Qtwc	derived from carbonate rock
Qtwg	derived from gneiss
Qtwss	derived from gray slate, mudstone and sand
Qtwrs	derived from red shale, mudstone and sand
Qtwb	derived from basalt and diabase
Qif*	Illinoian fluvial deposits
Qti	Illinoian Till
Qid*	Illinoian deltaic deposits
Qtif	Flanders Till
Qtib	Bergen Till
Qtj	Pre-Illinoian (Jerseyan) Till
Qtl	Tillstone Lag
Qsd	Stratified Drift
Qtm*	terminal moraine
Qsdw	Late Wisconsinan Stratified Drift
Qsdwd	Glaciolacustrine Sand and Gravel
Qsdwde	Deltaic Deposits
Qsdwlf	Lacustrine Fan Deposits
Qsdwlb	Glaciolacustrine Lake Bottom Deposits
Qsdwf	Glaciofluvial Sand and Gravel
Qsdwfv	Valley Outwash Deposits
Qsdwft	Meltwater Terrace Deposits
Qsdi	Illinoian Stratified Drift
Qsdid	Glaciolacustrine Sand and Gravel
Qsdide	Deltaic Deposits
Qsdilf	Lacustrine Fan Deposits
Qsdilb	Glaciolacustrine Lake Bottom Deposits
Qsdif	Glaciofluvial Sand and Gravel
Qsdifv	Valley Outwash Deposits
Qsdift	Meltwater Terrace deposits
Qsdj	Pre-Illinoian (Jerseyan) Stratified Drift
Qsdjd	Glaciolacustrine Sand and Gravel
Qsdjde	Deltaic Deposits
Qsdjlf	Lacustrine Fan Deposits
Qsdjlb	Glaciolacustrine Lake Bottom Deposits
Qsdjf	Glaciofluvial Sand and Gravel
Qsdjfv	Valley Outwash Deposits
Qsdjft	Meltwater Terrace Deposits
Qic	Ice Contact Deposits
Qm	Morainic Deposits
Qmw	Late Wisconsinan Moraines
Qmi	Illinoian Moraines
Qc	Colluvium
Qcg	Gneiss Colluvium
Qcb	Basalt Colluvium
Qcd	Diabase Colluvium
Qcs	Slate, Shale, Sandstone, Mudstone Colluvium
Qcc	Conglomerate Colluvium
Qcq	Quartzite Colluvium
Qcsg	Sand and Gravel Colluvium
Qcsl	Sand and Silt Colluvium
Qccb	Carbonate Colluvium
Qct	Till Colluvium

* These unit abbreviations are used by the Bureau of Water Allocation to assign pumpage but are not currently used by the New Jersey Geological Survey.

Appendix F. Detailed list of aquifer groups and assigned aquifers (cont.)

abbreviation & geologic unit		abbreviation & geologic unit	

A - glacial sediments of northern New Jersey (cont.)

Qw	Weathered Bedrock	Qwc	Weathered Conglomerate
Qwg	Weathered Gneiss	Qwcb	Weathered Carbonate
Qwb	Weathered Basalt	Qwq	Weathered Quartzite
Qwd	Weathered Diabase	Qwsc	Weathered Schist
Qws	Weathered Slate, Shale, Sandstone, Mudstone		

B - surficial deposits in southern New Jersey

Cz	Cenozic Era	Tb	Bridgeton Formation
Q	Quaternary System	Qes*	Pleistocene estuarine sand facies
Qbs	Beach Sand	Qvsl*	Van Sciver Lake beds
Qcm	Cape May Formation	Qsl*	Spring Lake beds
Qchb	Holly Beach water-bearing unit	Tg	Upland Gravel
T	Tertiary System	Tbh	Beacon Hill Formation
Tp	Pensauken Formation	Tht	Hornerstown Formation

C - Kirkwood and Cohansey

Tch	Cohansey Formation	Tkw	Kirkwood Formation
Tck	Cohansey & Kirkwood Formations	Tkuc	Upper Kirkwood confining unit

D - Rio Grande and Atlantic City 800-foot sand

Tkrg	Rio Grande water-bearing unit (upper sand)	Tklc	Lower Kirkwood confining unit
Tac	Atlantic City 800-foot sand (lower sand)		

E - Piney Point and Vincentown

Tkpp	Piney Point aquifer	Tmqvt*	Manasquan-Vincentown Formations
Tkocpp*	Old Church-Piney Point	Tvt	Vincentown Formation
Tcc	Composite confining unit	M	Mesozoic Era
Tsr	Shark River Formation	K	Cretaceous System
Tsrpp*	Shark River Marl-Piney Point	Krb	Redbank Formation
Tmq	Manasquan Formation	Kt	Tinton Formation

F - Wenonah, Mount Laurel and Englishtown

Kns	Navesink Formation	Ket	Englishtown Formation
Kml	Mt. Laurel Formation	Ketu	Englishtown upper sand
Kmw	Mt. Laurel & Wenonah Formations	Ketl	Englishtown lower sand
Kwe	Wenonah Formation	Kwb	Woodbury Formation
Kmt	Marshalltown Formation	Kwbmc	Merchantville-Woodbury confining unit
Kmtwc	Marshalltown-Wenonah confining unit	Kmv	Merchantville Formation

Appendix F. Detailed list of aquifer groups and assigned aquifers (cont.)

abbreviation & geologic unit		abbreviation & geologic unit	
G - upper Magothy, Raritan and Potomac			
Kmrpu	Upper Magothy, Raritan & Potomac aquifer	Kmas	Amboy Stoneware Clay Member
Km	Magothy Formation	Kmob	Old Bridge Sand Member
H - middle Magothy, Raritan and Potomac			
Kmrpm	Middle Magothy, Raritan & Potomac aquifer	Krc	Raritan confining unit
Kmsa	South Amboy Fire Clay Member	Krwc	Woodbridge Clay Member
Kmss	Sayerville Sand Member	Krfs	Farrington Sand Member
Kr	Raritan Formation	Krfc	Raritan Fire Clay Member
I - lower Magothy, Raritan and Potomac			
Kp	Potomac Formation	Kmrpl	Lower Magothy, Raritan & Potomac aquifer
Kpc	Potomac confining unit		
J - undifferentiated Magothy, Raritan and Potomac			
Kmr*	Magothy & Raritan Formations	Kmrp	Magothy, Raritan, & Potomac Formations
K - Brunswick Supergroup			
JTr	Jurassic & Triassic Systems	JTrc	Jurassic-Triassic Conglomerate
JTrb	Brunswick aquifer	JTrcq	Jurassic-Triassic Quartzite-clast Conglomerate
JTrbsed*	Brunswick aquifer sedimentary units	JTrcsh	Jurassic-Triassic Shale-clast Conglomerate
J	Jurassic System	JTrcl	Jurassic-Triassic Limestone-clast Conglomerate
Jb	Boonton Formation	JTrp	Passaic Formation
Jbcb	Basalt-clast Conglomerate	JTrpg	Gray bed
Jbcg	Gneiss-clast Conglomerate	JTrpgh	Gray-bed hornfels
Jbcq	Quartzite-clast Conglomerate	JTrph	Red-bed Hornfels
Jbs	Jurassic Basalt	JTrpcq	Quartzite-clast Conglomerate facies
Jh	Hook Mt. Basalt	JTrpcl	Limestone-clast Conglomerate facies
Jt	Towaco Formation	JTrpcsh	Shale-clast Conglomerate facies
Jp	Preakness Basalt	JTrpcs	Conglomerate and Sandstone facies
Jf	Feltville Formation	JTrpsp	Conglomerate and Pebbly Sandstone facies
Jo	Orange Mountain Basalt	JTrps	Sandstone and Siltstone facies
Jd	Jurassic Diabase	Tr	Triassic System
L - Lockatong and Stockton			
Trl	Lockatong Formation	Trla	Arkosic Sandstone facies
Trlr	Red bed	Trls	Sandstone and Conglomerate Sandstone facies
Trlh	Hornfel	Trs	Stockton Formation

Appendix F. Detailed list of aquifer groups and assigned aquifers (cont.)

M - limestone, dolomite and marble of the Valley & Ridge and Highlands provinces

abbreviation	geologic unit
Db	Buttermilk Falls Limestone
Dmn	Minisink Limestone & New Scotland Formation
Dmi	Minisink Limestone
Dkl	Kalkberg Limestone
Dcl	Coeymans Limestone
Dml	Manlius Limestone
Sbv	Bossardville Limestone
Oj	Jacksonburg Limestone
Ojr	Cement Rock Facies
Ojl	Cement Limestone Facies
OCu	Ordovician & Cambrian Systems
OCjk	Jacksonburg Limestone and Kittatinny Supergroup
OCjwb	Jacksonburg Limestone, Wantage Sequence, & Beekmantown
OCk	Kittantinny Supergroup
Oe	Epler Formation
Oel	Lafayette Member
Oebs	Big Springs Member
Oebr	Branchville Member
Or	Rickenback Dolomite
Orh	Hope Member
Orl	Lower Member
Cok*	Kittatinny Formation
OCa	Allentown Dolomite
OCau	Upper Member
OCal	Limeport Member
Cl	Leithsville Formation
Clha	Hamburg Member
Ymr	Marble
Yfl	Franklin Limestone
Yfm*	Franklin Marble
?wcm*	Wildcat Marble

N - Noncarbonate consolidated rocks of the Valley & Ridge and Highlands provinces

abbreviation	geologic unit
Trssc	Cobble Conglomerate and Sandstone facies
Pz	Paleozoic Era
Wgn*	Wissahickon Gneiss
D	Devonian System
Dgpu*	Green Pond Mountain undifferentiated
Dsk	Skunnemunk Conglomerate
Dbv	Bellvale Sandstone
Dcw	Cornwall Shale
Dm	Marcellus Shale
Dkec	Kanouse & Esopus Formations, & Connelly Conglomerate
Dkn	Kanouse Sandstone
Ds	Schoharie Formation
De	Esopus Formation
Dcc	Connelly Conglomerate
Do	Oriskany Group
Drs	Ridgely Sandstone
Dsc	Shriver Chert
Dg	Glenarie Formation
Dh	Helderberg Group
Dp	Port Ewen Shale
Dn	New Scotland Formation
Dc	Coeymans Formation Undivided
DS	Devonian & Silurian Systems
S	Silurian System
DSr	Rondout Formation
DSrd	Rondout & Decker Formations
Svru*	Silurian Valley & Ridge undifferentiated
Sd	Decker Formation
Sbvy	Berkshire Valley Formation
Sp	Poxono Island Formation
Sgpu*	Silurian Green Pond Mountain undifferentiated
Sbrk*	Berkshire Valey Formation
Spi*	Poxono Island Formation
Spbv	Berkshire Valley & Poxono Island Formations
Sb	Bloomsburg Red Beds
Sl	Longwood Shale
Sqp	Green Pond Conglomerate
Shf*	High Falls Formation
Ss	Shawangunk Formation
O	Ordovician System
Obsu	Beemerville Intrusive Suite
Ons	Nepheline Syenite
Ol	Lamprophyre and Related Rocks
Oub	Ouachitite Breccia - Volcanic Breccia
Om	Martinsburg Formation
Omhp	High Point Member
Omhph	High Point Member Hornfel
Omr	Ramseyburg Member
Omrh	Ramseyburg Member Hornfel
Omb	Bushkill Member
Ombh	Bushkill Member Hornfel
Ojt	Jutland Klippe Sequence
Ojtb	Unit B
Ojta	Unit A
Ow	Wantage Sequence
Ob	Beekmantown Group

Appendix F. Detailed list of aquifer groups and assigned aquifers (cont.)

abbreviation & geologic unit		abbreviation & geologic unit	
N - Noncarbonate consolidated rocks of the Valley & Ridge and Highlands provinces (cont.)			
Obu	Upper Part	Ylh	Lake Hopatcong Intrusive Suite
Obl	Lower Part	Ypg	Pyroxene Granite
Oo	Ontelaunee Formation	Yps	Pyroxene Syenite
Ooh	Harmonyvale Member	Ypa	Pyroxene Alaskite
Oobr	Beaver Run Member	Ys	Syenite Gneiss
Os	Stonehenge Formation	Yms	Metasedimentary Rocks
C	Cambrian System	Yk	Potassic Feldspar Gneiss
Clw	Walkill Member	Ym	Microcline Gneiss
Clc	Califon Member	Yb	Biotite-Quartz-Feldspar Gneiss
Clh	Leithsville Formation & Hardyston Quartzite	Ymh	Hornblende-Quartz-Feldspar Gneiss
Ch	Hardyston Quartzite	Ymp	Clinopyroxene-Quartz-Feldspar Gneiss
Pc	Precambrian	Yp	Pyroxene Gneiss
Pz	Proterozoic Era	Ype	Pyroxene-Epidote Gneiss
Zu	Late Proterozoic Era	Yq	Quartzite
Ygr*	granite	Ye	Epidote Gneiss
Ygn*	gneiss	Yl	Losee Metamorphic Suite
CZm	Manhattan Schist	Ylo	Quartz-Oligoclase Gneiss
CZs	Serpentinite	Yla	Albite Oligoclase Granite
Zch	Chestnut Hill Formation	Ylb	Biotite-Quartz-Oligoclase Gneiss
Zd	Late Proterozoic Diabase	Yh	Hypersthene-Quartz-Oligoclase Gneiss
Yu	Middle Proterozoic Era	Yd	Diorite
Ybgn*	Baltimore Gneiss	Ya	Amphibolite
Ygm	Mt. Eve Granite	Yam	Migmatite
Ybi	Byram Intrusive Suite	Ymg	Monazite Gneiss
Ybh	Hornblende Granite	Yhp	Hornblende-Plagioclase Gneiss
Ybs	Hornblende Syenite	Ybp	Biotite-Plagioclase Gneiss
Ybb	Biotite Granite	Yma	Microantiperthite Alaskite
Yba	Microperthite Alaskite	?cq*	Chickies Quartzite
P - unknown			
sd*	surficial deposit	h?	Holocene Series
af	artificial fill	?	unknown
ebo	extensive bedrock outcrop (surficial sediment generally absent)	Mult	multiple aquifers
Q - domestic wells			
?	all domestic wells		

GLOSSARY

Consumptive withdrawals - The volume of water which is withdrawn from a defined source that is lost to the atmosphere by evaporation or transpiration. In general agricultural activities, irrigation and industrial cooling are the primary generators of consumptive withdrawals.

Depletive withdrawals - The volume of water withdrawn from a defined source that is exported to a different area. Water that is returned to the source, either in its original form or in an altered state, does not count as a depletive use.

Evapotranspiration - The net loss of water to the atmosphere by both evaporation and transpiration.

Potable water withdrawals -The volume of water withdrawn from a defined water source and intended for potable water supply.

Purveyor - As defined by the N.J. Department of Environmental Protection a purveyor is a withdrawer of water that comes under the regulatory scope of the department.

Total withdrawals - The volume of water withdrawn from a defined source for any use. It does not consider the eventual destination of the water. This term includes water withdrawn and then exported from a defined area (such as interbasin potable water transfers), water returned to the source but altered chemically or thermally (such as sewage-treatment-plant discharges), and water returned to the source unaltered in any way (such as water used by instream hydroelectric power plants).

Transpiration - The release of water vapor by plants. This water is taken up by plant roots and then released to the atmosphere as a byproduct of the plant's respiration and photosynthesis activities.

NEW JERSEY WATER WITHDRAWALS

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