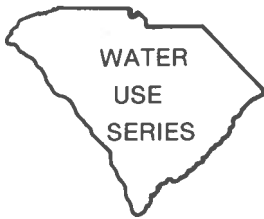


SCWRC REPORT NO. 138



WATER USE IN SOUTH CAROLINA, 1980



STATE OF SOUTH CAROLINA
WATER RESOURCES COMMISSION



IN COOPERATION WITH
THE U.S. GEOLOGICAL SURVEY

MAY 1983

Honorable Richard W. Riley, Governor

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WATER USE IN SOUTH CAROLINA, 1980

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Report No. 138

**South Carolina Water Resources Commission
1001 Harden Street
Columbia, South Carolina 29250**

May, 1983

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in cooperation with
the South Carolina Water Resources Commission**



Map of South Carolina showing counties and major rivers.

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A special note of gratitude is extended to the U.S. Geological Survey, Water Resources Division, for financial support through the National Water-Use Information Program, and specifically to Rodney N. Cherry and Donald I. Cahal of the South Carolina District Office for their guidance and support.

SUMMARY

Approximately 5.8 billion gallons of water were withdrawn daily in South Carolina in 1980 by public suppliers, rural users (domestic, livestock, and irrigation), industry, and thermoelectric power plants. Of this amount, 96 percent was taken from surface-water sources and four percent from ground-water sources. Approximately 94 percent was returned without being consumed. Thermoelectric plants used 76 percent of the total withdrawal; industry, 17 percent; public supplies, five percent; and rural users, two percent. Of the total withdrawal, 64 percent was used at four locations.

Nonwithdrawal use of water for hydroelectric power production was eleven times greater than all withdrawal uses, averaging 63.9 billion gallons per day. Other nonwithdrawal uses — recreation, navigation, fish and wildlife habitat, and waste disposal — are difficult to quantify and are not addressed in this report.

Withdrawals by thermoelectric plants grew by almost 800 percent since 1955, the greatest increase of all uses. Rural use increased by 85 percent, while industrial use increased by 240 percent. Total withdrawals increased by 70 percent during the past decade, and by more than 500 percent since 1955.

INTRODUCTION

The South Carolina Water Resources Planning and Coordination Act, by which the Water Resources Commission was created, states, in part:

. . . That plans and programs for the development and enlargement of the water resources of the State be devised and promoted and that other activities designed to encourage, promote, and secure the maximum beneficial use and control of such water resources be coordinated by a committee which, in carrying out its functions, shall give proper and adequate consideration to the multiple aspects of the beneficial use and control of such water resources with an impartiality of interest except that which is designed to best protect and promote the public welfare generally (Section (2)(b), Act No. 61, Acts and Joint Resolutions of South Carolina, 1967).

The information presented in this report partially satisfies the legislated responsibility of the agency to "give proper and adequate consideration . . . of the beneficial use" of the State's water resources. This water-use information also complements water availability data and is a basic and necessary component of wise water resources plans and programs. The periodic assessment of water use in South Carolina helps to identify real and potential problems and helps in planning for their resolve. The purpose of this report is to evaluate the uses of water in South Carolina in 1980, with comparisons to the past and projections for the future, and to present these data in a useful form.

TERMINOLOGY

Terms commonly used in this report are defined as follows:

Consumptive Use — That portion of water withdrawn that is no longer available because it has been either evaporated, transpired, incorporated into products or crops, consumed by man or livestock, or otherwise removed from the water environment (Murray and Reeves, 1977).

Domestic Use — Any household use of water.

Ground Water — Water in the ground that is in the zone of saturation (Langbein and Iseri, 1960).

Hydroelectric Plant — A facility at which water is passed through turbines to generate electricity.

Industrial Use — Any use of water for the manufacture of goods.

Irrigation Use — The use of water for irrigation of agricultural crops. Water used on golf courses or lawns is excluded.

Nonwithdrawal Use — Any use of water which does not require removal from a source, including hydroelectric power, navigation, waste assimilation, fish and wildlife habitat, and recreation.

Public Supply — Municipal suppliers and water districts which serve the general public.

Pumped Storage — The pumping of water at a hydroelectric plant from a lower reservoir to an upper reservoir for reuse.

Rural Use — The combination of rural domestic, livestock and irrigation uses.

Surface Water — Water on the surface of the earth (Langbein and Iseri, 1960).

Thermoelectric Plants — Power plants which produce electricity by the passage of steam through turbines.

Withdrawal Use — Any use of water which requires removal from the source. Withdrawal uses are divided into four major categories — public supply, rural, industrial, and thermoelectric power.

PREVIOUS INVESTIGATIONS

Similar reports have been published previously by the S.C. Water Resources Commission (1971) (Duke, 1977), with data for the years 1970 and 1976, respectively. National assessments have been made by the U.S. Geological Survey every fifth year since 1950 (MacKichan, 1951, 1957; MacKichan and Kammerer, 1961; Murray, 1968; Murray and Reeves, 1972, 1977).

Numerous other reports on the subject of water use in the State are available. Many of these reports are specific to a region or to a particular use, and are not comprehensive. Information from such reports is incorporated herein, as applicable.

PRESENT INVESTIGATION

The S.C. Water Resources Commission entered into a cooperative agreement with the U.S. Geological Survey in 1979 for the collection, storage, and dissemination of statewide water-use data. The Commission was to serve as the lead agency in the acquisition and storage of data, with funding from the Geological Survey. The data thus collected and presented in this report are the result of the inventory of water use in 1980, and supersede any data previously published for the year. Compilations of data are presented by county and river sub-basin (Figure 1) for five categories of use: (1) public supply (excluding industrial purchases), (2) rural (domestic, livestock, and irrigation), (3) industrial (purchased and self-supplied), (4) thermoelectric power, and (5) hydroelectric power. Data tabulations for each of these uses are also divided by source, either surface water or ground water.

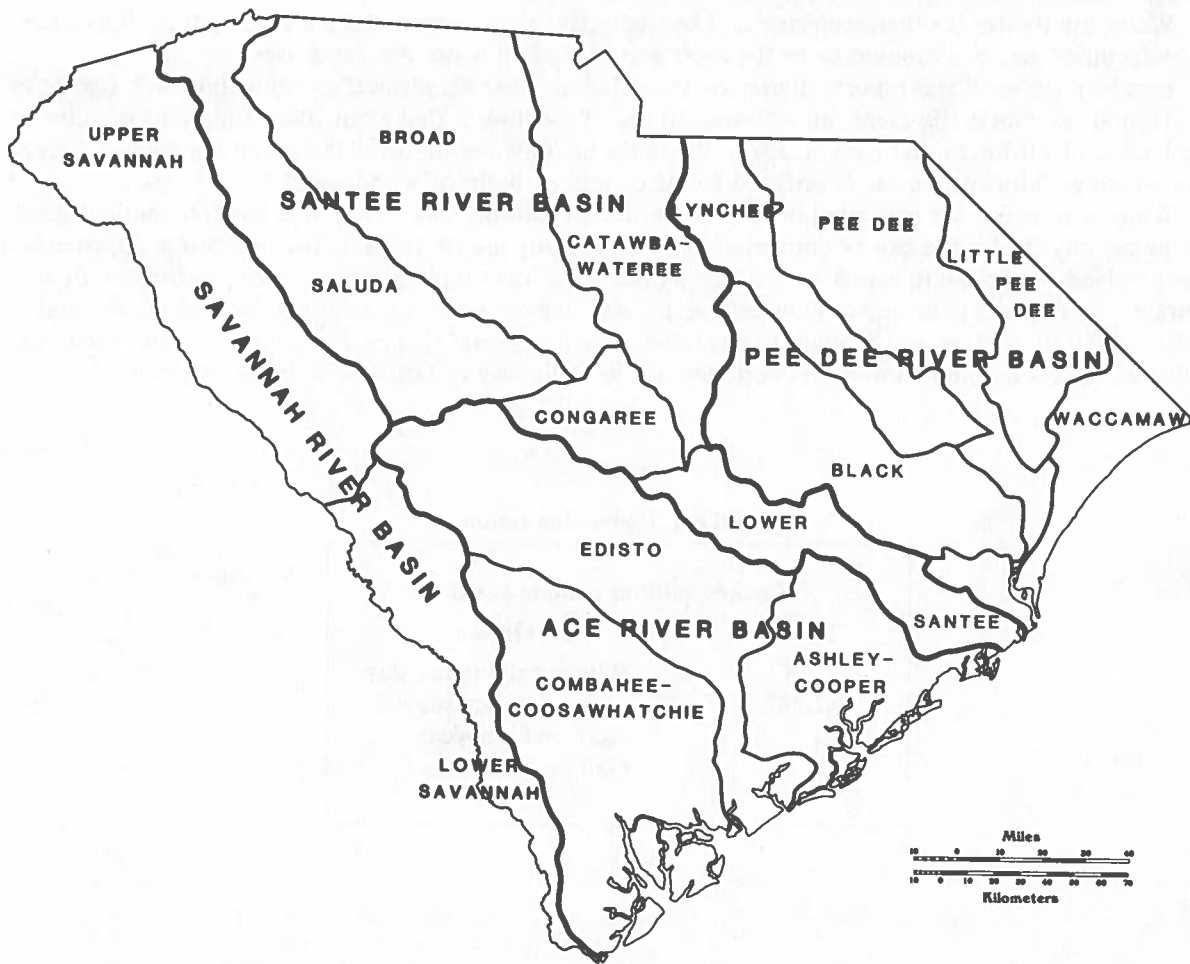


FIGURE 1. Major river basins and sub-basins in South Carolina.

METHODS OF COLLECTION AND ACCURACY OF PUBLISHED FIGURES

Water-use data in this report are compiled from various sources and vary in accuracy, but are thought to be the best available estimates of the actual use in 1980. Reporting was generally voluntary, although some users were required to report use or related information in conjunction with regulatory programs.

Water-use figures for public supply are based on monthly reports submitted to the South Carolina Department of Health and Environmental Control as required under the State Safe Drinking Water Act of 1976. Only those public suppliers which applied some type of treatment to the water before use were required to report. Those public suppliers not applying treatment were contacted, or their use was estimated. Only municipalities and water districts were included as a part of public supply. Small water utilities such as mobile home and subdivision suppliers are included in rural domestic use. Published figures for public supply represent the total withdrawal less the estimate of industrial purchases.

Rural water-use figures are the least accurate of all categories of use. Rural domestic use was calculated by estimating the population not served by a municipality or water district and applying a use of 80 gallons per day per person, although per capita use may be somewhat less (Feth, 1973). Livestock use was based on the reported numbers of farm animals (S.C. Crop and Livestock Reporting Service, 1982) and estimates of water needs of each type (MacKichan and Kammerer, 1961). Irrigation use was based on estimated acreage and an assumed application of 10 inches of water per acre during the growing season (Interagency Task Force on Irrigation Efficiencies, 1979).

Industrial use was compiled from voluntary reports of industry to the State Labor Department. Total reported use was not adjusted for non-reporting industries, since a comparison to wastewater discharge volumes revealed a difference approximately equal to estimated consumptive losses. Thus, the water use of non-reporting industries was considered insignificant.

Water use figures for thermoelectric and hydroelectric plants were obtained directly from the owners of the facilities, and are thought to be the most accurate of all water use categories.

For the purpose of this report, all uses are classified as either withdrawal or nonwithdrawal. Except at the Hagood thermoelectric plant, all withdrawals are of freshwater (less than 1000 milligrams per liter of dissolved solids) (Murray and Reeves, 1977). When the use of water occurred in a county or basin different from where withdrawn, the use is assigned to the county or basin of withdrawal.

Water use figures are presented in units of million gallons per day (mgd), and less frequently, billion gallons per day (bgd), and can be converted to other units by use of Table 1. Because of the approximations involved, water-use figures are rounded to three significant figures, or two, where estimates are less accurate. Uses of less than one million gallons per day are presented to only two decimal places, and if smaller than 0.01 mgd, as <0.01 mgd. In any table, a dash indicates that no known use of water occurred. Published figures are annual averages and may not be indicative of seasonal or daily variation.

TABLE 1. Conversion factors

Multiply million gallons per day	
By	To Obtain
.001	Billion gallons per day
1.547	Cubic feet per second
1,123	Acre-feet per year
694	Gallons per minute

WITHDRAWAL USES

Approximately 5.8 billion gallons of water were withdrawn daily in South Carolina in 1980. Thermoelectric plants used 76 percent of this total for the production of electricity. More than 17 percent went to industry, with public suppliers using five percent and two percent withdrawn for rural uses. Surface-water sources provided 96 percent of the total demand, and ground water the remainder. Sixty-four percent of the total withdrawal was made at four facilities: The Oconee, Robinson and Wateree thermoelectric plants, and the Savannah River Plant. Approximately 370 mgd, or 6 percent of the total withdrawal, was consumed.

Withdrawal uses are depicted in Figure 2 and tabulated by county and sub-basin in Tables 2 and 3, respectively.

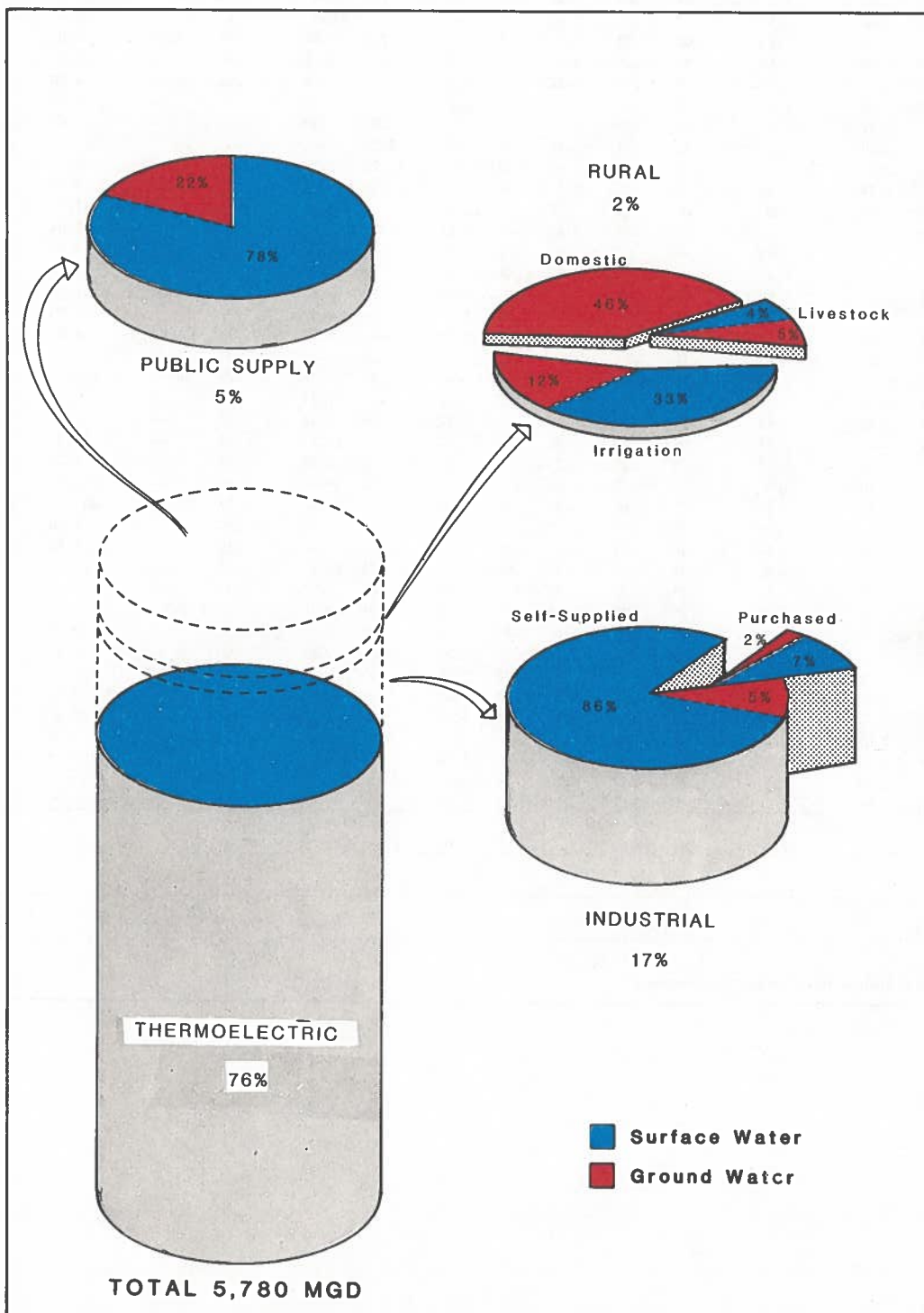


FIGURE 2. Withdrawal uses of water in South Carolina by category and source, 1980.

TABLE 2. Withdrawal uses of water in South Carolina in million gallons per day by county, 1980.

COUNTY	PUBLIC SUPPLY		RURAL				INDUSTRIAL				THERMO-ELECTRIC		TOTAL		TOTAL WATER USE	
	SURFACE	GROUND	DOMESTIC GROUND	LIVESTOCK		IRRIGATION		PURCHASED		SELF-SUPPLIED		SURFACE	GROUND	SURFACE		GROUND
				SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND					
Abbeville	.54	--	.89	.11	.10	.11	--	1.40	--	.50	.03	--	2.66	1.02	3.69	
Aiken	4.73	3.11	.92	.12	.42	.45	.16	.44	.36	514	9.49	166	686	14.5	701	
Allendale	--	.48	.22	.08	.08	3.0	4.0	--	.04	--	1.59	--	3.06	6.39	9.45	
Anderson	9.14	--	1.3	.25	.26	.07	--	4.62	--	2.46	.55	207	224	2.07	226	
Bamberg	--	.95	.49	.10	.10	1.1	.99	--	.35	.02	.03	--	1.18	2.91	4.09	
Barnwell	--	1.73	.39	.08	.08	1.1	.36	--	1.40	--	2.50	--	1.16	6.47	7.62	
Beaufort	--	4.47	2.0	.05	.05	.03	.21	--	--	--	.13	--	.08	6.82	6.90	
Berkeley	--	.82	5.6	.04	.04	.16	.13	--	.01	10.2	2.24	356	366	8.82	375	
Calhoun	--	.46	.57	.07	.08	1.9	.99	--	--	66.5	.47	--	68.4	2.57	71.0	
Charleston	--	1.66	1.2	.02	.03	--	.22	--	.46	.02	.84	16	16.0	4.45	20.5	
Cherokee	5.19	.15	.64	.07	.06	1.9	--	1.50	--	3.08	.30	--	11.8	1.15	12.9	
Chester	2.09	--	.74	.08	.09	.12	--	1.13	--	.66	.01	--	4.08	.84	4.92	
Chesterfield	2.56	.26	1.1	.07	.08	.61	.12	1.25	--	4.50	.06	--	8.99	1.64	10.6	
Clarendon	--	1.39	1.4	.10	.17	.45	--	--	.01	.09	<.01	--	.64	2.94	3.58	
Colleton	--	1.40	1.1	.11	.12	.12	.07	--	1.03	--	<.01	157	157	3.72	161	
Darlington	--	2.90	2.2	.08	.10	.66	.40	--	.28	8.72	1.50	730	739	7.40	747	
Dillon	--	1.37	.99	.05	.06	2.1	.04	--	.08	--	.84	--	2.15	3.39	5.54	
Dorchester	43.4	1.68	1.8	.06	.06	.06	--	22.3	.04	1.71	2.24	--	67.5	5.78	73.3	
Edgefield	1.18	--	.25	.07	.07	7.4	--	.22	--	--	.04	--	8.89	.36	9.25	
Fairfield	.87	.22	.83	.06	.07	--	.01	.15	--	<.01	.01	3.9	5.09	1.13	6.22	
Florence	--	8.58	3.4	.05	.14	.07	<.01	--	.92	24.4	1.22	--	24.6	14.3	38.8	
Georgetown	1.23	.72	.95	.02	.03	--	--	1.54	.95	30.4	1.02	11.1	705	3.68	48.0	
Greenville	33.8	.19	.06	.11	.12	.75	.02	13.9	--	4.47	.39	--	53.0	.78	53.8	
Greenwood	5.65	.02	.85	.12	.11	<.01	--	2.27	--	4.25	.31	0.3	12.6	1.29	13.9	
Hampton	--	.71	.50	.11	.11	--	.26	--	.09	--	2.31	--	.11	3.98	4.09	
Horry	--	13.9	3.5	.11	.12	.21	.02	--	.57	.04	.24	104	104	18.3	123	
Jasper	6.11	.47	.69	.04	.05	--	.02	.06	--	1.87	--	--	8.08	1.23	9.31	
Kershaw	2.06	1.12	.43	.05	.14	.67	--	.12	.06	8.67	3.09	--	11.6	4.84	16.4	
Laconster	3.59	--	.67	.06	.07	.05	--	.41	--	11.2	.03	--	15.3	.77	16.1	
Laurens	3.21	.42	.55	.23	.13	.22	--	1.19	.01	4.88	.05	--	9.73	1.16	10.9	
Lee	--	.50	1.0	.03	.12	.19	.55	--	.24	--	1.97	--	.22	4.38	4.60	
Lexington	5.66	.26	2.5	.09	.16	1.3	.61	.76	.32	31.4	2.81	164	203	6.69	210	
McCormick	.62	--	.31	.03	.03	<.01	--	.53	--	--	.01	--	1.18	.35	1.53	
Marion	--	.61	.55	.06	.05	5.3	.85	--	1.31	--	.12	--	5.41	3.49	8.90	
Marlboro	--	2.32	.92	.04	.04	.13	.06	--	.75	12.8	.42	--	13.0	4.51	17.5	
Newberry	3.28	.06	.88	.29	.22	.19	--	.81	.21	.03	.15	--	4.60	1.52	6.11	
Oconee	3.81	.02	.45	.15	.08	.08	--	1.19	.01	3.12	.06	2,040	2050	.61	2,050	
Orangeburg	3.99	1.54	2.4	.27	.48	2.4	1.8	.64	.07	1.50	4.21	--	8.77	10.5	19.3	
Pickens	8.27	--	.97	.06	.08	.01	.01	2.53	--	.31	.50	--	11.2	1.56	12.7	
Richland	46.4	.14	.87	.06	.06	.83	.58	1.09	--	.75	.69	417	466	2.34	468	
Saluda	--	.08	.82	.30	.23	1.4	.22	--	--	--	.17	--	1.73	1.52	3.25	
Spartanburg	20.2	.74	1.4	.17	.12	4.9	.01	9.15	.40	4.95	.39	--	39.4	3.09	42.5	
Sumter	--	7.09	2.4	.12	.44	.87	2.0	--	7.23	3.60	.15	--	4.59	19.2	23.8	
Union	3.08	.06	.15	.05	.06	--	--	1.08	.02	4.08	--	--	8.29	.30	8.59	
Williamsburg	--	1.15	2.1	.10	.17	.03	.06	--	.46	--	2.53	--	.13	6.45	6.58	
York	6.01	.54	3.3	.17	.12	.20	.01	.67	.09	92.6	.69	--	99.7	4.76	104	
TOTAL BY SOURCE	227	64.3	57	4.6	5.6	41	15	71.0	17.8	858	46.4	4,370	5,570	206		
TOTAL BY SUBCATEGORY			57	10		56		88.7		905						
TOTAL BY CATEGORY	291		123							993		4,370			5,780	

(Partial figures may not sum to totals because of independent rounding.)

TABLE 3. Withdrawal uses of water in South Carolina in million gallons per day by sub-basin, 1980.

SUB-BASIN	PUBLIC SUPPLY		RURAL				INDUSTRIAL				THERMO-ELECTRIC	TOTAL		TOTAL WATER USE	
			DOMESTIC	LIVESTOCK		IRRIGATION		PURCHASED		SELF-SUPPLIED					
	SURFACE	GROUND	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND	SURFACE	GROUND		SURFACE
Ashley-Cooper	----	3.98	8.7	.10	.10	.14	.19	----	.18	10.3	2.87	372	383	16.1	399
Black	----	8.99	6.6	.28	.70	.54	1.6	----	8.64	.09	2.68	----	.90	29.2	30.1
Broad	76.0	1.30	1.9	.62	.52	7.4	.04	15.2	.42	20.0	1.63	3.9	123	5.84	129
Catawba-Wateree	13.8	1.30	4.7	.32	.39	1.2	1.2	1.00	.14	116	1.99	417	550	9.76	560
Combahee-Coosawatchie	----	9.87	6.4	.41	.42	3.0	3.5	----	1.30	1.90	2.50	----	5.26	24.0	29.2
Congaree	6.27	----	2.6	.11	.14	.29	.58	.22	----	77.0	2.73	----	83.9	6.27	90.2
Edisto	49.8	2.00	2.6	.46	.71	11	3.7	24.2	2.28	3.00	7.00	157	246	18.3	264
Little Pee Dee	----	2.30	3.5	.11	.12	2.2	.16	----	1.06	----	.90	----	2.35	8.03	10.4
Lynches	.91	1.82	4.2	.08	.18	1.2	.23	1.23	.64	1.52	4.89	----	4.96	12.0	16.9
Pee Dee	5.27	13.6	4.1	.22	.30	6.4	1.2	.58	1.86	79.3	2.17	730	822	23.2	845
Saluda	49.7	.96	.67	.90	.74	2.4	.10	20.0	.07	27.4	.99	371	472	3.53	475
Lower Santee	----	1.30	2.1	.10	.15	1.8	.40	----	.04	.14	1.26	11.1	13.2	5.28	18.4
Upper Savannah	16.8	.01	4.2	.62	.55	2.3	.01	8.32	.01	6.58	.96	2,040	2,070	5.71	2,080
Lower Savannah	8.11	2.68	1.7	.14	.40	1.3	1.8	.29	.45	514	13.3	166	690	20.2	711
Waccamaw	----	14.0	3.2	1.0	.11	.10	----	----	.66	.04	.56	104	104	18.5	123
TOTAL BY SOURCE	227	64.3	57	4.6	5.5	41	15	71.0	17.8	858	46.4	4,370	5,570	206	
TOTAL BY SUBCATEGORY			57	10		56		88.8		905					
TOTAL BY CATEGORY		291		123					993			4,370			5,780

(Partial figures may not sum to totals because of independent rounding.)

PUBLIC SUPPLY

Public suppliers withdrew an average of 291 mgd in 1980 for domestic, commercial, and institutional use. An additional 88.8 mgd was supplied to industry. A total of 2.4 million persons, 75 percent of the total population, was served by a public supplier. Almost eighty percent of the withdrawals were taken from surface-water sources, primarily in the Piedmont and more populated areas of the Coastal Plain (Figure 3). Larger withdrawals were generally from surface water (Table 4), but ground water was relied on more commonly for smaller supplies (Figure 4).

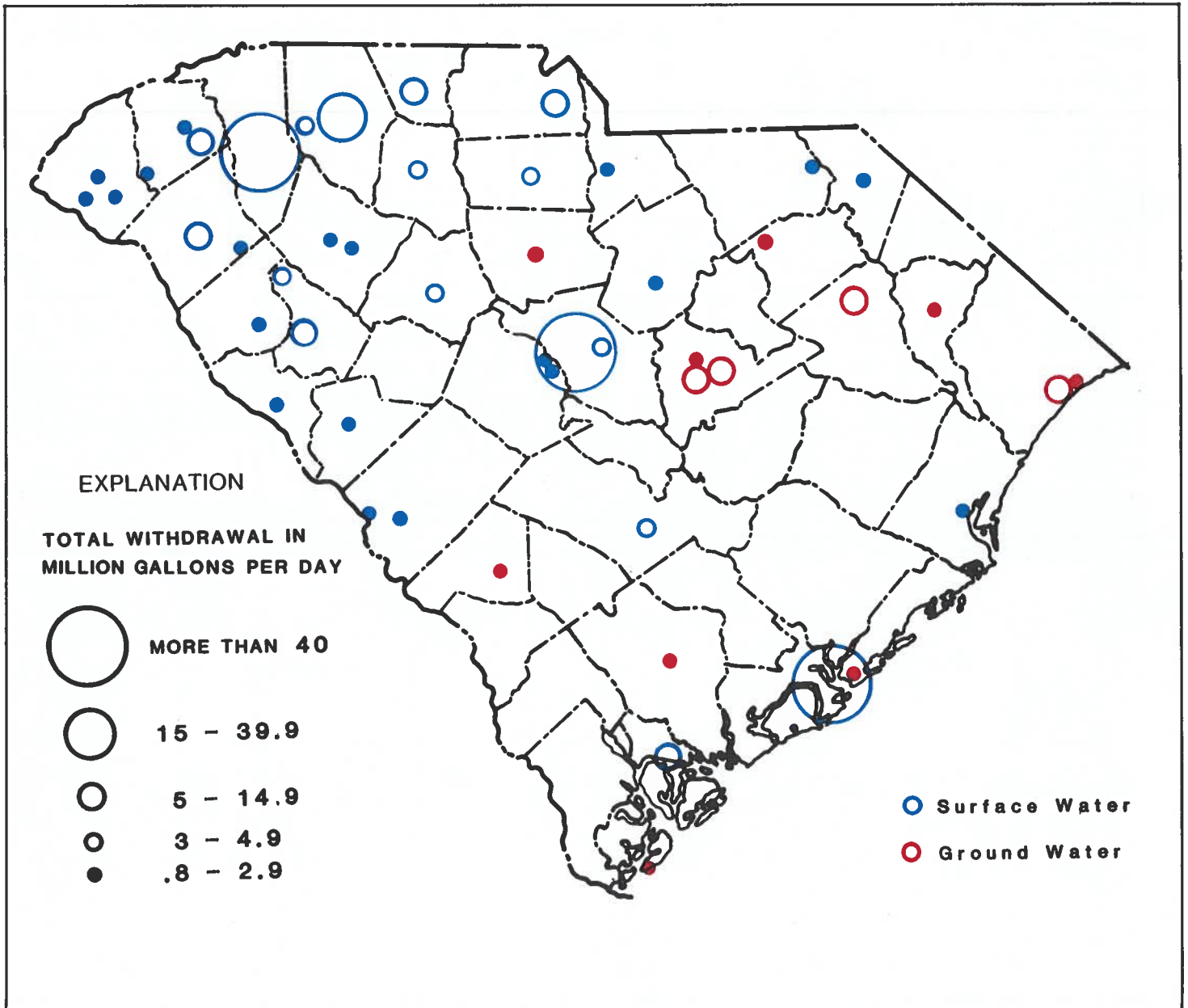


FIGURE 3. Location of fifty largest withdrawals of water for public supply in South Carolina, 1980.

TABLE 4. List of largest public suppliers in South Carolina, 1980.

PUBLIC SUPPLIER	SOURCE	POPULATION SERVED	AVERAGE DAILY WITHDRAWALS, IN MGD
Charleston	Edisto River		
	Foster Creek		
	Goose Creek Reservoir	240,000	64.9
Greenville	N. Saluda Reservoir		
	Table Rock Reservoir	269,000	43.6
Columbia	Broad River	234,000	43.3
Spartanburg	S. Pacolet River	93,900	28.5
Anderson	Hartwell Lake ¹	45,800	10.5
Greenwood	Lake Greenwood	38,700	7.36
Florence	7 wells	44,100	7.22
Sumter	7 wells	48,200	6.86
Gaffney	Lake Wheeler	24,900	6.21
Beaufort	Savannah River ²	14,000	6.17
Myrtle Beach	16 wells	20,000	5.74
Easley	Burdine Creek		
	Saluda River	24,400	5.40
Rock Hill	Catawba River	42,500	5.29
Sumter #3	4 wells	235	5.20
Orangeburg	N. Fork Edisto River	36,000	4.63
Ware Shoals	Saluda River ³	3,680	4.52
Fort Jackson	Gills Creek		
	Broad River ⁴	28,000	4.29
Greer	S. Tyger River	25,000	4.02
Union	Broad River	15,000	3.70
Newberry	Saluda River	12,400	3.40
Chester	Catawba River	18,200	3.14
West Columbia	Saluda River	22,000	2.95
Aiken	Shaw Creek	33,900	2.95
Georgetown	Pee Dee River ⁵		
	5 wells	13,200	2.73
Belton-Honea Path	Saluda River	200	2.64
Pickens	Twelvemile Creek		
	Hagood Branch	7,560	2.45
Seneca	Lake Keowee	20,000	2.41
Laurens	Rabon Creek		
	Reedy fork	20,000	2.25
Cayce	Congaree Creek	15,500	2.20
Camden	Pine Tree Creek	18,600	2.18
Sea Pines PSD	12 wells	2,922	2.13
Cheraw	Pee Dee River	8,800	2.10
Clinton	Enoree River		
	Duncan Creek	10,800	2.04
Barnwell	11 wells	7,000	2.00
North Myrtle Beach	8 wells	4,040	1.92
Shaw Air Force Base	3 wells	7,020	1.89
North Augusta	Savannah River	15,000	1.74
Bennettville	9 wells	12,000	1.53
Abbeville	Rocky River	7,890	1.51
Westminster	Chauga River	7,000	1.49
	Ramsey Creek		
Hartsville	4 wells	11,000	1.41
Edgefield	Savannah River	13,600	1.40
Mt Pleasant	3 wells	14,500	1.33
Clemson University	Hartwell Lake	5,250	1.29
Walterboro	2 wells	12,000	1.20
McCormick	Clarks Hill Lake		
	Rocky Creek	3,400	1.15
Lancaster	Catawba River ⁶	21,000	1.10
Walhalla	Coneross Creek		
	Cane Creek	9,000	1.09
Marion	8 wells	10,500	1.09
Winnsboro	Campbell Creek	7,150	1.02
	Mill Creek		

¹ Purchased from Duke Power Company

² Purchased from Beaufort-Jasper Water Authority

³ Purchased from Riegel Textile Corporation

⁴ Purchased from City of Columbia

⁵ Purchased from International Paper Company

⁶ Purchased from Springs Mills

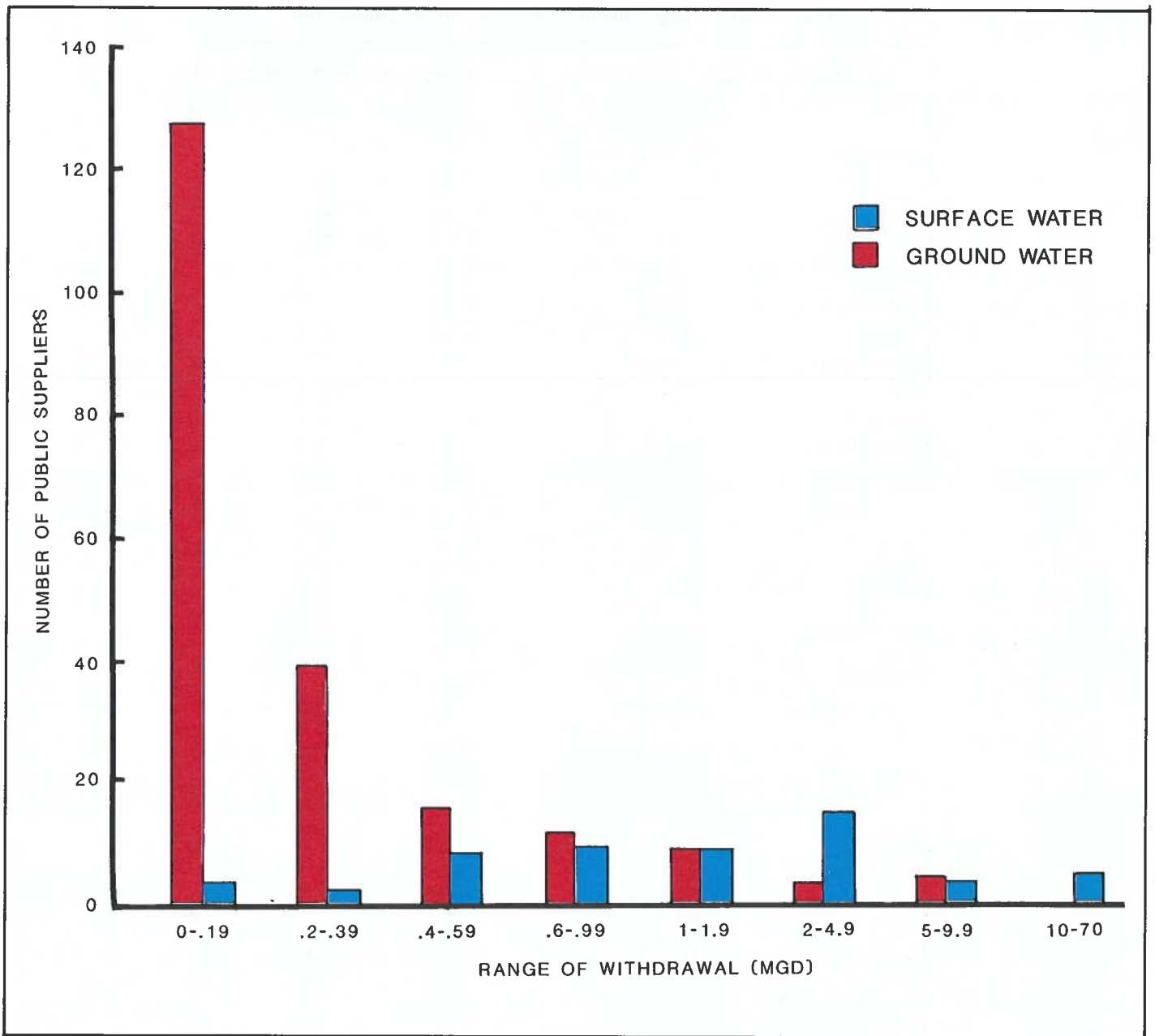


FIGURE 4. Variation in source of water with magnitude of withdrawal by public suppliers, 1980.

RURAL

Withdrawals of water for rural use were approximately 123 mgd in 1980. Ground-water sources provided 63 percent of the demand.

Virtually all water for rural domestic use was withdrawn from ground water, an average daily use of 57 mgd. Approximately one-quarter of the total State population relies on a private well or small utility for domestic needs.

Approximately 10 mgd was withdrawn daily for livestock in 1980, with ground water providing 54 percent of the demand.

Irrigation of crops required an average daily withdrawal of 56 million gallons, of which more than 70 percent was taken from surface water. Irrigated acreage was generally concentrated in a northeast-southwest trending belt of counties in the Upper and Middle Coastal Plain (Figure 5). Sixty percent of all irrigated acreage was in corn and peaches (Figure 6). Irrigation demand, unlike most other uses, does not continue throughout the year but occurs primarily during the months of April through August. For this reason, the actual impact may be greater than indicated by annual figures. The estimated uses in Table 5 are for a five-month period, but elsewhere in this report are published as yearly averages.

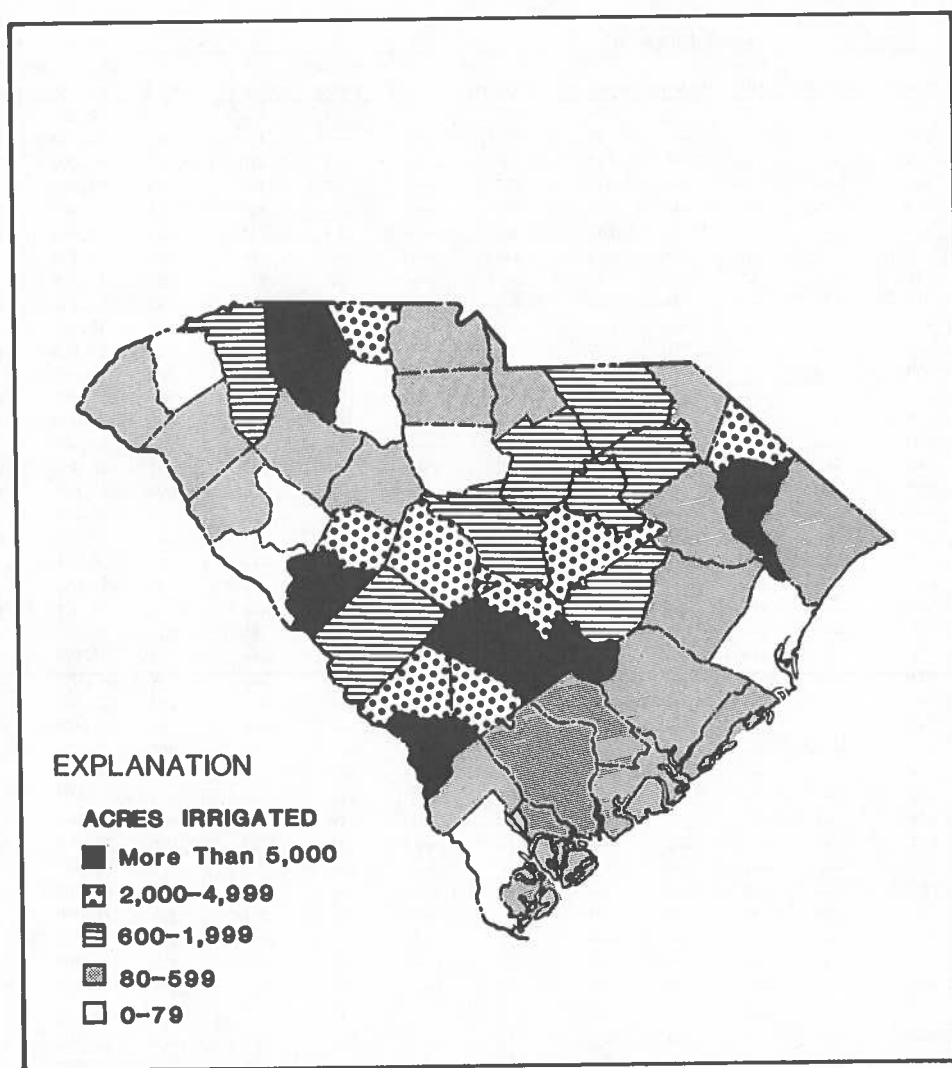


FIGURE 5. Irrigated crop acreage in South Carolina by county, 1980.

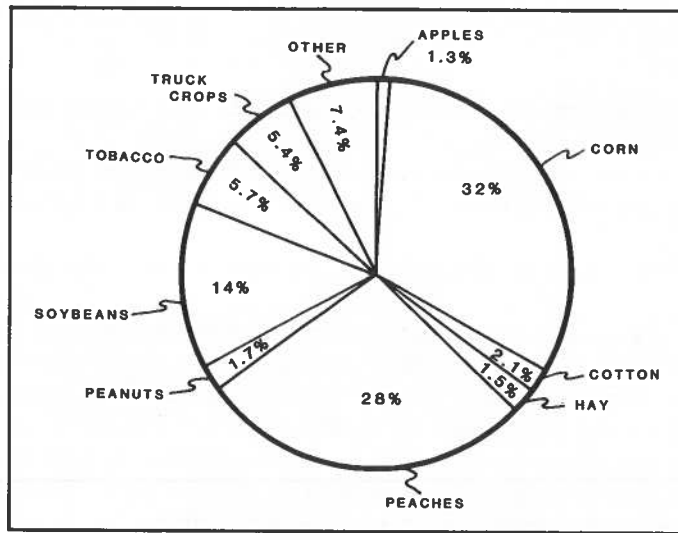


FIGURE 6. Irrigated acreage in South Carolina by crop, 1980.

TABLE 5. Irrigated acreage and water used during the growing season in South Carolina by crop and county, 1980.

COUNTY	ACRES IRRIGATED											TOTAL ACRES IN CROPS	AVERAGE DAILY WATER USED DURING GROWING SEASON (MGD)		
	APPLES	CORN	COTTON	HAY	PEACHES	PEANUTS	SOYBEANS	TOBACCO	TRUCK CROPS	OTHER	TOTAL		SURFACE	GROUND	TOTAL
Abbeville	---	21	---	112	---	---	---	---	17	---	150	22,200	.3	---	.3
Aiken	---	253	---	---	---	70	253	---	---	244	820	94,300	1.1	.4	1.5
Allendale	---	4,480	---	---	---	163	3,340	---	163	1,210	9,360	97,600	7.2	9.7	17
Anderson	---	---	---	70	---	---	225	---	30	---	325	93,900	.6	---	.6
Bamberg	---	1,450	---	231	---	30	725	---	234	109	2,780	95,400	2.6	2.4	5.0
Barnwell	---	924	---	---	---	185	462	---	369	735	2,680	83,700	2.6	2.2	4.8
Beaufort	---	---	260	---	---	---	---	---	---	56	316	19,100	.07	.5	.6
Berkeley	---	75	---	25	---	---	---	---	75	210	385	36,600	.4	.3	.7
Calhoun	---	2,210	775	---	34	---	---	---	145	700	3,860	91,500	4.5	2.4	6.9
Charleston	---	---	---	---	---	---	---	---	175	125	300	38,400	---	.5	.5
Cherokee	---	---	---	---	2,570	---	---	---	50	---	2,620	29,900	4.7	---	4.7
Chester	---	50	100	---	---	---	---	---	10	---	160	22,800	.3	---	.3
Chesterfield	---	---	---	---	910	---	---	25	50	---	985	93,100	1.5	.3	1.8
Clarendon	---	610	---	---	---	---	---	---	---	---	610	137,000	1.1	---	1.1
Colleton	---	180	---	---	---	---	---	---	---	80	260	67,400	.3	.2	.5
Darlington	---	180	---	20	---	---	487	258	43	437	1,420	166,000	1.6	1.0	2.6
Dillon	---	800	---	---	---	---	1,700	390	---	---	2,890	100,000	5.1	.1	5.2
Dorchester	---	---	---	---	---	---	---	---	---	80	80	40,700	.1	---	.1
Edgefield	150	70	---	---	9,680	---	---	---	230	175	10,300	37,900	19	---	19
Fairfield	---	5	---	---	---	---	---	---	20	2	27	6,650	.04	.01	.05
Florence	---	---	---	---	---	---	---	---	90	5	95	161,000	.2	.01	.2
Georgetown	---	---	---	---	---	---	---	---	---	---	0	19,400	0	0	0
Greenville	50	360	---	---	330	---	---	---	230	90	1,060	38,600	1.9	---	1.9
Greenwood	---	6	---	---	---	---	---	---	---	---	6	13,800	.01	---	.01
Hampton	---	356	---	---	---	---	---	---	---	---	356	107,000	---	.6	.6
Horry	---	---	---	---	---	---	---	250	40	---	290	125,000	.5	.04	.5
Jasper	---	---	---	---	---	---	25	---	---	---	25	25,100	---	.04	.04
Kershaw	---	---	---	---	---	---	900	---	---	---	900	35,200	1.6	---	1.6
Lancaster	---	---	---	63	---	---	---	---	17	---	80	20,100	.1	---	.1
Laurens	---	300	---	---	---	---	---	---	---	---	300	51,600	.5	---	.5
Lee	---	569	60	---	---	20	258	20	---	60	987	147,000	.5	1.3	1.8
Lexington	---	825	50	---	730	---	---	---	744	165	2,510	64,800	3.0	1.5	4.5
McCormick	---	---	---	---	---	---	---	---	---	5	5	3,990	.01	---	.01
Marion	---	4,020	---	300	---	---	560	3,280	---	175	8,340	68,000	13	2.1	15
Marlboro	---	20	120	---	20	---	---	---	---	105	265	111,000	.3	.2	.5
Newberry	---	250	---	---	---	---	---	---	---	---	250	56,300	.4	---	.4
Oconee	---	10	---	---	---	---	---	---	95	---	105	16,500	.2	---	.2
Orangeburg	---	2,960	---	282	34	---	1,130	---	1,130	113	5,650	198,000	5.8	4.4	10
Pickens	---	---	---	---	20	---	---	---	10	---	30	13,000	.02	.03	.05
Richland	---	1,400	---	---	50	---	150	---	150	145	1,900	41,300	2.0	1.4	3.4
Saluda	---	375	200	---	1,400	---	210	---	---	38	2,220	51,600	3.5	.5	4.0
Spartanburg	775	---	---	---	5,450	---	---	---	76	312	6,610	76,200	12	.03	12
Sumter	---	1,990	80	82	---	860	586	---	6	206	3,810	147,000	2.1	4.8	6.9
Union	---	---	---	---	---	---	---	---	---	---	0	9,600	0	0	0
Williamsburg	---	---	---	---	---	---	---	---	50	70	120	137,000	.07	.1	.2
York	---	---	---	---	285	---	---	---	---	---	285	43,900	.5	.02	.5
STATE TOTALS:	985	24,700	1,640	1,120	21,600	1,330	11,000	4,330	4,150	5,640	76,500	3,160,000	101	37	138

(Partial figures may not sum to totals because of independent rounding.)

INDUSTRIAL

Withdrawals of water for industrial use averaged 993 mgd in 1980. More than half of this amount was withdrawn at one location, the Savannah River Plant. Ninety-six percent of all withdrawals were made by four types of industry (Figure 7) and surface water supplied 94 percent of industrial needs. Industrial water use by type of industry is summarized in Table 6.

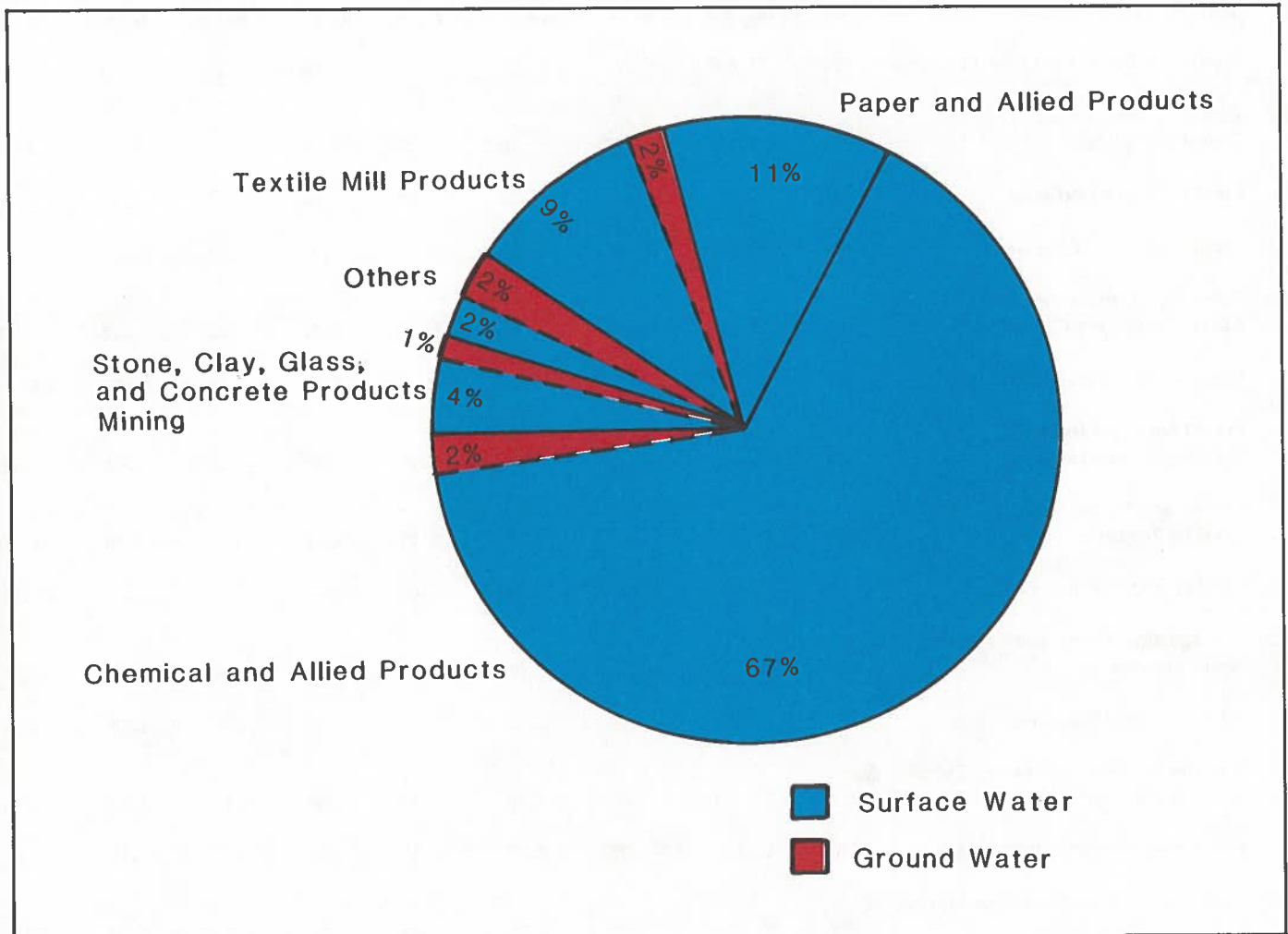


FIGURE 7. Industrial water use in South Carolina by type of industry and source, 1980.

TABLE 6. Industrial water use in South Carolina by Standard Industrial Classification code, 1980.

SIC CODE	PRODUCT DESCRIPTION	No. of Users	No. Employed	WITHDRAWALS IN MILLION GALLONS PER DAY						TOTAL
				SURFACE WATER			GROUND WATER			
				Self- Supplied	Purchased	Total	Self- Supplied	Purchased	Total	
20	Food and Kindred Products	334	22,000	---	3.17	3.17	1.07	4.33	5.40	8.57
21	Tobacco Leaf Manufacturing	2	350	---	---	---	---	.01	.01	.01
22	Textile Mill Products	359	183,000	65.3	25.1	90.4	11.6	6.35	17.9	108
23	Apparel & Other Finished Products	237	73,800	.06	.22	.28	.04	.27	.31	.59
24	Lumber & Wood Products, Except Furniture	191	19,300	.13	.10	.23	3.07	.79	3.86	4.09
25	Furniture and fixtures	64	6,140	---	.02	.02	.04	.13	.17	.19
26	Paper and Allied Products	66	25,700	87.4	21.7	109	.32	.03	.35	109
27	Printing, Publishing and Allied Industries	185	8,780	---	.01	.01	<.01	.12	.12	.13
28	Chemical and Allied Products	169	58,000	665	5.81	671	14.7	.28	15.0	686
29	Petroleum Refining and Related Industries	16	1,640	.16	.08	.24	.25	.16	.41	.65
30	Rubber and Miscellaneous Plastic Products	100	21,400	---	1.25	1.25	2.62	.93	3.55	4.80
31	Leather and Leather Products	7	355	---	<.01	<.01	---	---	---	<.01
, 14	Stone, Clay, Glass and Concrete Products; Mining	153	18,200	40.7	1.02	41.8	8.61	.34	8.95	50.7
33	Primary Metal Products	83	15,300	---	2.12	2.12	.59	.50	1.09	3.21
34	Fabricated Metal Products, Except Machinery & Transportation Equip.	282	27,900	---	2.70	2.70	.08	1.17	1.25	3.95
35	Machinery, Except Electrical	333	41,900	.09	3.77	3.86	.23	.31	.54	4.40
36	Electrical & Electronic Machinery, Equipment and Supplies	99	31,000	1.98	1.85	3.83	.26	1.25	1.51	5.34
37	Transportation Equipment	42	6,640	.01	.13	.14	.16	.01	.17	.31
38	Measuring, Analyzing and Controlling Instruments; Photo, Medic; Watches and Clocks	31	10,400	---	.74	.74	.25	.51	.76	1.50
39	Miscellaneous Manufacturing Industries	57	6,890	<.01	.78	.78	.04	.37	.41	1.19
73	Industrial Research	9	1,580	---	.36	.36	2.51	<.01	2.51	2.87
STATE TOTALS		2,819	580,000	858	71.0	929	46.4	17.8	64.2	993

(Partial figures may not sum to totals because of independent rounding.)

THERMOELECTRIC POWER

In 1980, more than three-fourths of all withdrawals in South Carolina were made for the production of electricity. Fourteen thermoelectric plants (Table 7) generated a total of 39 million megawatt-hours of energy, 87 percent of the electricity produced in the State.

Large quantities of water were needed for cooling and most plants are located where water is available in adequate quantities (Figure 8). Surface water was utilized totally as the source of cooling water. Slightly more than one percent of the total withdrawal was consumed, although consumptive use varied with each plant.

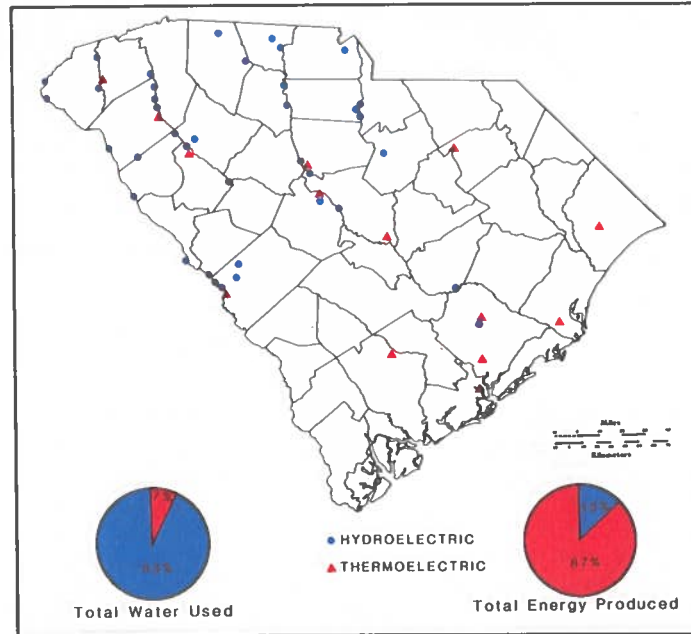


FIGURE 8. Location of thermoelectric and hydroelectric plants in South Carolina, 1980.

TABLE 7. Water use and energy data for thermoelectric plants in South Carolina, 1980.

SUB-BASIN	NAME OF PLANT	COUNTY	OWNER ¹	SOURCE OF WATER	TYPE ²	CAPACITY (MW)	ENERGY GENERATED (1000 MWH)	WATER WITHDRAWN (MGD)	WATER CONSUMED (MGD)
Ashley-Cooper	Jefferies	Berkeley	SCPSA	Lake Moultrie	C	324	1,882	175	.07
	Hagood	Charleston	SCE&G	Ashley River ³		F	94	59	
	Williams	Berkeley	SCE&G	Back River Res.	F	580	1,252	137	
Broad	Parr	Fairfield	SCE&G	Broad River	W	28	8	3.9	.02
Catawba-Watersee	Watersee	Richland	SCE&G	Watersee River	C	720	4,014	417	.97
Edisto	Canadys	Colleton	SCE&G	Edisto River	C	430	2,424	157	7.75
Pee Dee	Robinson	Darlington	CP&L	Lake Robinson	C	665	3,191	548	4.0
						N	174	1,006	182
Saluda	Lee	Anderson	Duke	Saluda River	C	323	1,678	207	1.80
	Ware Shoals	Greenwood	Riegel	Saluda River	C	4	8	.3	---
	McMeekin	Lexington	SCE&G	Lake Murray	C	252	1,934	164	.72
Lower Santee	Winyah	Georgetown	SCPSA	N. Santee River	C	1,040	4,891	11.1	9.0
Upper Savannah	Oconee	Oconee	Duke	Lake Keowee	N	2,580	14,213	2,040	17.6
Lower Savannah	Urquhart	Aiken	SCE&G	Savannah River	C	250	1,617	166	1.62
Waccamaw	Granger	Horry	SCPSA	Waccamaw River	C	178	960	104	3.52
STATE TOTALS						7,740	39,200	4,370	51.4

¹SCE&G- South Carolina Electric and Gas Company.
 CP&L- Carolina Power and Light Company.
 Duke- Duke Power Company.
 Riegel-Riegel Textile Corporation.
 SCPSA- South Carolina Public Service Authority.
²F- Fuel Oil, C-Coal, N-Nuclear, W-Waste Heat.
³Uses Saline Water.

(Partial figures may not sum to totals because of independent rounding.)

NONWITHDRAWAL USES

Nonwithdrawal uses include those for hydroelectric power generation, navigation, recreation, assimilation and transport of wastes, fish and wildlife habitat, and other uses which are not dependent on the removal of water from a source. Estimates of nonwithdrawal uses, other than hydroelectric power, are beyond the scope of this report because of the difficulty in quantifying the amounts used. These uses are important, however, and cannot be ignored in any comprehensive water resources planning and management program.

HYDROELECTRIC POWER

In 1980, hydroelectric plants used 63.9 billion gallons of water daily to produce 5.7 million megawatt-hours of energy. This gross use, eleven times greater than all withdrawals combined, includes reuse of water as much as nine times. Thirty-eight major hydroelectric plants (Table 8), located primarily in the Piedmont (Figure 8), utilized a portion, if not all, of the available streamflow to generate electrical energy.

TABLE 8. Water use and energy data for hydroelectric plants in South Carolina, 1980.

SUB-BASIN	NAME OF PLANT	OWNER ¹	SOURCE OF WATER	MAXIMUM RESERVOIR STORAGE (BILLION GALLONS)	CAPACITY (MW)	ENERGY GENERATED (1000 MWH)	AVERAGE ⁵ ANNUAL INFLOW (MGD)	WATER USED (MGD)
Ashley	Cooper							
	Jeffries	SCPSA	Lake Moultrie	360	130	669	10,100	10,000
Broad								
	Gaston Shoals	Duke	Broad River	.65	9.1	33.8	1,310	720
	99 Islands	Duke	Broad River	.75	19.7	69.6	1,550	1,110
	R. B. Simms (Rainbow Lake)	Spartanburg Waterworks	S. Pacolet River	1.5	1.0	3.6	100	77
	Pacolet	Lockhart Power Co.	Pacolet River	.03	.8	3.8	400	175
	Lockhart	Lockhart Power Co.	Broad River	.49	12.3	85.2	2,350	1,680
	Neal Shoals	SCE&G	Broad River	2.0	5.2	30.5	2,570	1,360
	Fairfield ² (Monticello Res.)	SCE&G	Broad River, Free Creek	140	511	600	3,620	4,160
	Parr Shoals	SCE&G	Broad River	17	14.9	91.1	3,930	2,880
	Columbia	SCE&G	Broad River	.36	10.6	50.9	4,320	1,660
Catawba-Watersee								
	Wylie	Duke	Catawba River	92	55.0	165	2,650	2,630
	Fishing Creek	Duke	Catawba River	20	42.2	179	3,140	3,370
	Great Falls- Dearborn	Duke	Catawba River	.65	60.4	206	3,330	3,160
	Rocky Creek- Cedar Creek	Duke	Catawba River	3.1	66.5	183	3,500	3,450
	Watersee	Duke	Watersee River	99	71.5	267	3,760	3,780
Saluda								
	Saluda	Duke	Saluda River	2.4	2.4	7.2	440	190
	Piedmont ³	J.P. Stevens Co.	Saluda River	.20	1.0	2.5	480	175
	Upper Pelzer	Kendall Co.	Saluda River	.33	2.0	7.0	510	290
	Lower Pelzer	Kendall Co.	Saluda River	.10	3.3	11.8	515	345
	Holidays Bridge	Duke	Saluda River	2.4	3.5	13.9	570	430
	Ware Shoals	Riegel	Saluda River	.03	5.0	17.0	650	340
	Boyd's Mill	Duke	Reedy River	1.0	1.0	2.3	200	52
	Buzzards Roost (Lake Greenwood)	Greenwood County ⁴	Saluda River	88	13.2	52.9	1,060	1,070
	Saluda (Lake Murray)	SCE&G	Saluda River	680	198	254	1,740	1,430
Lower Santee								
	Spillway (Lake Marion)	SCPSA	Santee River	490	2.0	10.0	11,600	370
Upper Savannah								
	Tugaloo	Ga. Power Co.	Tugaloo River	14	45	119	745	850
	Yonah	Ga. Power Co.	Tugaloo River	3.8	22.5	60.4	750	925
	Jocassee ²	Duke	Keowee River	380	610	748	195	2,660
	Keowee	Duke	Keowee River	310	140	95.8	420	840
	Hartwell	Corps of Engineers	Savannah River	930	264	606	3,170	3,350
	Rocky River (Secession Lake)	City of Abbeville	Rocky River	10	2.8	9.5	290	125
	Clarks Hill	Corps of Engineers	Savannah River	940	280	914	6,270	6,360
	Stevens Creek	SCE&G	Savannah River	5.8	18.9	87.1	6,400	3,190
	Sibley	Graniteville Co. }			2.1	12.3		340
	King	Spartan Mills }	Savannah River	3.0	2.2	9.4	6,400	300
	Enterprise	Graniteville Co. }	(Augusta Canal)		1.2	3.7		100
Lower Savannah								
	Vaulume	Graniteville Co.	Horse Creek	.33	.24	.4	30	8
	Graniteville	Graniteville Co.	Horse Creek	.33	.45	.4	45	10
STATE TOTALS				4,600	2,630	5,680		63,900

¹Duke- Duke Power Company.
²SCE&G- South Carolina Electric and Gas Company.
³Riegel- Riegel Textile Corporation.
⁴SCPSA- South Carolina Public Service Authority.
⁵Pumped Storage.
⁶Operation Ended in August, 1980.
⁷Operated by Duke Power Company.
⁸Long-Term Average

(Partial figures may not sum to totals because of independent rounding.)

CONSUMPTIVE USE

Of the average withdrawal of 5,780 mgd in 1980, approximately 370 mgd was consumed. Consumptive use data are based on estimates for each category of use, as shown in Table 9. Fifteen percent of all public supply withdrawals were thought to be consumed, consistent with earlier reports (Murray and Reeves, 1977), although estimates vary from ten percent (Jordan, 1955) to 23 percent (Carter and Johnson, 1974). All rural uses are considered totally consumptive. Estimates for industry and thermoelectric plants are based on reported consumptive use.

TABLE 9. Consumptive uses of water in South Carolina, 1980.

Category	Percent Consumed	Total (mgd)
Public supply	15	44
Rural	100	123
Industrial	15.6	155
Thermoelectric	1.2	<u>51.4</u>
		370

TRENDS AND PROJECTIONS 1950 - 2000

Since 1955, withdrawals of water in South Carolina have increased by more than 500 percent, while the total population grew by a modest 40 percent (S.C. Division of Research and Statistical Services, 1982). For the period 1955 to 1970, the rate of growth was nearly five times the national average and second only to Florida among the states. The rapid increase in demand during the past 25 years can be largely attributed to a 775 percent increase in withdrawals by thermoelectric plants. Withdrawals for public supply, rural, and industrial use increased by 190, 85, and 240 percent, respectively. Surface-water use increased by 570 percent, and ground-water use by 75 percent.

In the future, based on projections for the southeastern states (U.S. Water Resources Council, 1978), withdrawal uses are expected to increase less rapidly. By the year 2000, approximately 6.3 billion gallons a day will be withdrawn, an increase of less than ten percent. This anticipated decline in growth rate will be the result of conservation and reuse rather than a decline in demand. Consumptive use, which increased by more than 200 percent since 1960, is expected to increase by 50 percent by the year 2000. Trends and projections are plotted in Figures 9 and 10.

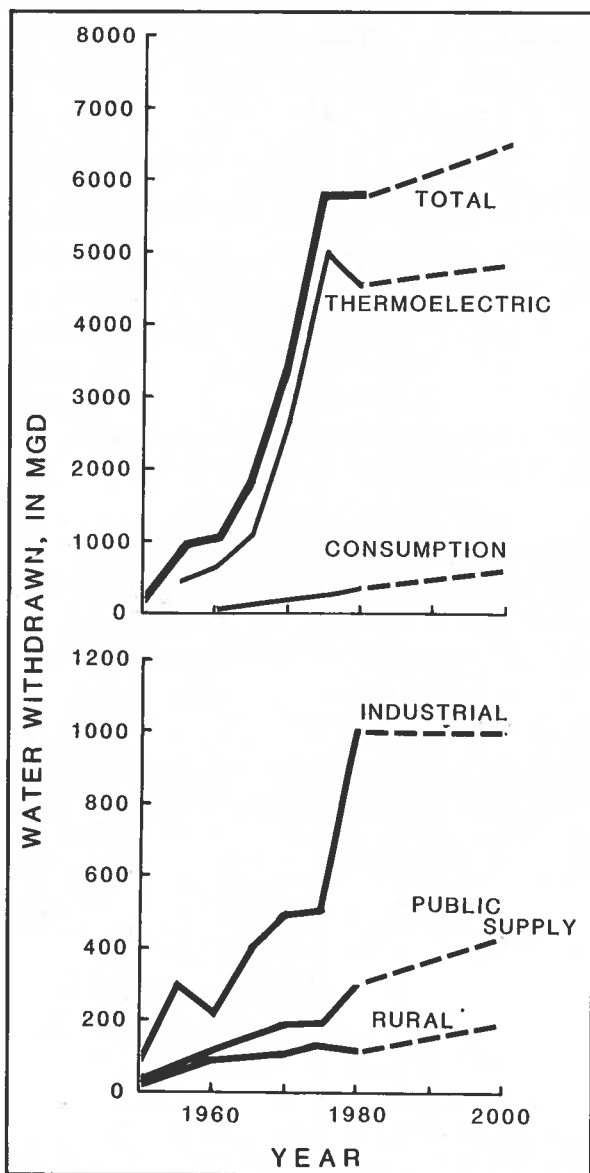


FIGURE 9. Trends and projections for withdrawal and consumptive uses of water in South Carolina, 1950-2000.

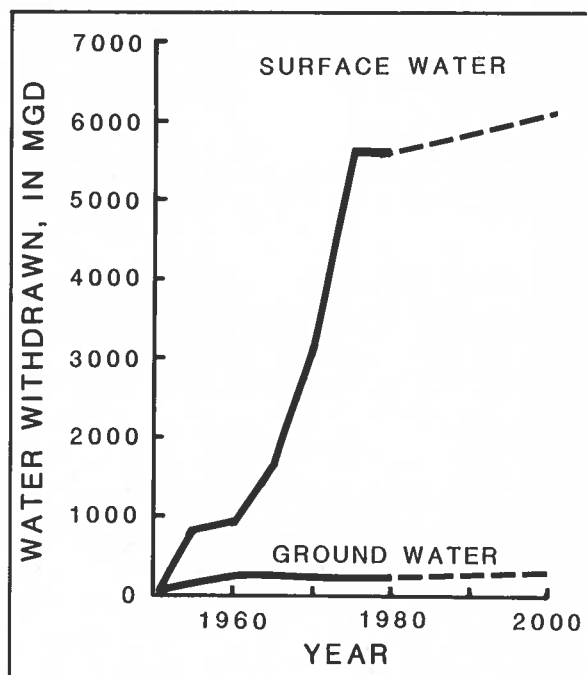


FIGURE 10. Trends and projections for surface- and ground- water withdrawals in South Carolina, 1950-2000.

FUTURE INVESTIGATIONS

Because of the importance of water to the State, use of this resource has demanded much attention in recent years. The Water-Use Reporting and Coordination Act (Act No. 282, Acts and Joint Resolutions of South Carolina, 1982) became law in 1982, and will require that any withdrawal of 100,000 gallons per day or more be reported to the S.C. Water Resources Commission. This reported use will provide much greater accuracy, and aid in assessing all aspects of water use. Reporting is expected to begin by late 1983. Summaries of water use will then be made annually, with detailed reports being published every four years.

A detailed analysis of water supply versus demand will be included in the State Water Assessment, Phase I of the State Water Plan. This document is currently being prepared by the S.C. Water Resources Commission and is scheduled for publication in mid-1983.

SELECTED REFERENCES

- Carter, R.F., and A.M.F. Johnson, 1974, Use of water in Georgia, 1970, with projections to 1990: Georgia Department of Natural Resources Hydrologic Report No. 2, 74 p.
- Duke, J.W., 1977, Municipal and industrial water use in South Carolina: South Carolina Water Resources Commission Report No. 127, Columbia, South Carolina, 180 p.
- Feth, J.H., 1973, Water facts and figures for planners and managers: U.S. Geological Survey Circular 601-I, 30 p.
- Interagency Task Force on Irrigation Efficiencies, 1979, Irrigation water use and management: U.S. Department of the Interior, U.S. Department of Agriculture, U.S. Environmental Protection Agency, 133 p.
- Jordan, H.E., 1955, The problems that face our cities, In: Water, the yearbook of agriculture, 1955: U.S. Department of Agriculture, p. 649-653
- Langbein, W.B. and K.T. Iseri, 1960, General introduction and hydrologic definitions: U.S. Geological Survey Water Supply Paper 1541-A, 29 p.
- MacKichan, K.A., 1951, Estimated use of water in the United States, 1950: U.S. Geological Survey Circular 115, 13 p.
- 1957, Estimated use of water in the United States, 1955: U.S. Geological Survey Circular 398, 18 p.
- MacKichan, K.A. and J.C. Kammerer, 1961, Estimated use of water in the United States, 1960: U.S. Geological Survey Circular 456, 26 p.
- Murray, C.R., 1968, Estimated use of water in the United States, 1965: U.S. Geological Survey Circular 556, 53 p.
- Murray, C.R. and E.B. Reeves, 1972, Estimated use of water in the United States in 1970: U.S. Geological Survey Circular 676, 37 p.
- 1977, Estimated use of water in the United States in 1975: U.S. Geological Survey Circular 765, 39 p.
- Public Service Commission of South Carolina, 1979-1980 Annual Report of the Public Service Commission of South Carolina: Columbia, South Carolina, 85 p.
- S.C. Crop and Livestock Reporting Service, 1981, South Carolina Crop Statistics - AE-417: S.C. Crop and Livestock Reporting Service, Columbia, South Carolina, 42 p.
- S.C. Division of Research and Statistical Service, 1982, 1981 Statistical Abstract: South Carolina Division of Research and Statistical Service, 282 p.
- S.C. Governor's Office of Energy Resources, 1981, South Carolina energy use profile: Columbia, South Carolina, 38 p.
- S.C. State Development Board, 1981, South Carolina Industrial Directory, South Carolina State Development Board, Columbia, South Carolina, 502 p.
- S.C. Water Resources Commission, 1971, Water use in South Carolina, 1970: South Carolina Water Resources Commission, Report No. 103, 114 p.
- U.S. Army Corps of Engineers, 1981, National hydroelectric power resources study, U.S. Army Corps of Engineers, regional report, v. XVI, 321 p.
- U.S. Water Resources Council, 1978, The nation's water resources, 1975-2000: v 4, South Atlantic Gulf Region, 80 p.