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ESTIMATED USE OF WATER IN FLORIDA, 1970

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ESTIMATED USE OF WATER IN FLORIDA, 1970

By R. W. Pride

ABSTRACT

Estimates of water use in Florida for 1970 indicate that about 15,300 mgd (million gallons per day) was withdrawn for all purposes, including public supply, rural domestic and livestock, irrigation, and industrial (including thermoelectric power). About 9,500 mgd of the total use was saline water withdrawn from bays and estuaries. The remainder, or 5,800 mgd, was fresh water, withdrawn in nearly equal quantities from surface and ground sources. Most of the saline water was used for thermoelectric power generation. The average per capita use of all water in 1970 was 2,250 gpd (gallons per day) an increase from 332 gpd in 1950. Considering fresh water only, the average per capita use was 849 gpd in 1970. The quantity of water consumed—that is, water made unavailable for further possible withdrawal because of evaporation, incorporation into products and crops, and other causes—was estimated to be 1,930 mgd in 1970, most of which was fresh water. The quantity consumed was about one third of the total fresh water withdrawn from the source.

The largest use of fresh water in Florida in 1970 was for irrigation, 2,070 mgd. The counties in southern Florida, comprising Water Resources Council subregion 0309, used 75 percent of all water used for irrigation. The second largest use of fresh water was by industry, other than thermoelectric power plants, which required 926 mgd of self-supplied water and 166 mgd from public supply systems. The third largest use was for public supplies, 884 mgd.

INTRODUCTION

The basic amounts of water in Florida remain relatively unchanged while population growth and urban and industrial development continue to put increased demands on the available supply. For this reason it is important to gather basic data showing quantitatively the present water requirements of the various major users.

Periodic assessments of withdrawal from available water sources not only show the changes in volume of water used but also indicate trends in use. Planning for the future necessitates that estimates be made of future water requirements based on assessments of past usage.

Water-use data include both the purpose for which the water is used and the quantities used for each purpose; each type of use has a different effect on the

available supply and on the remaining supply. Water used for irrigation, for example, is subject to pollution by pesticides and fertilizers, and a large part of the water withdrawn is evaporated and transpired. Water used by industry commonly picks up pollutants of various types depending on the product produced, but, in general, only a small amount of water is consumed—that is, removed more or less permanently from the local supply.

Water-use data for this report are presented by principal use and by source for each of the 67 counties in Florida and by Water Resources Council subregions or parts of subregions in Florida. See figure 1 for subregion delineation. The major categories of water use for which data are given are for public supply, rural domestic and livestock supply, irrigation, and self-supplied industry, including thermoelectric power generation.

Nonwithdrawal uses, which include hydroelectric power generation, navigation, water-based recreation, propagation of fish and wildlife, and dilution and conveyance of sewage and other liquid and solid wastes are not tabulated in this report.

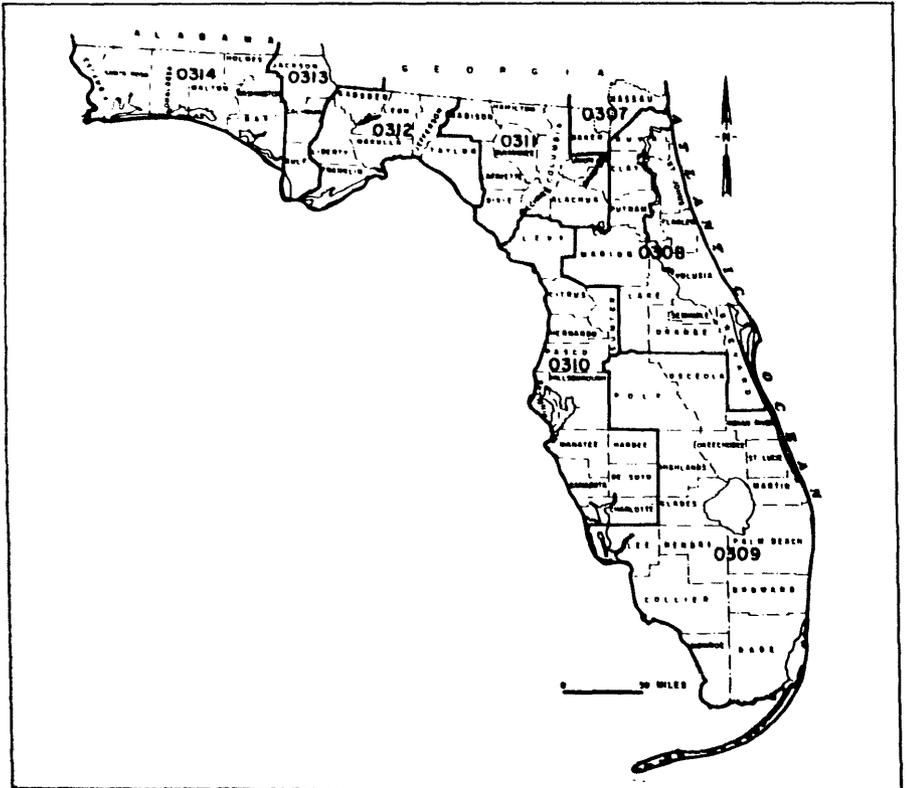


Figure 1. Approximate Water Resources Council subareas in Florida delineated along county boundaries

PREVIOUS INVESTIGATIONS

Compilations of water-use data from readily available sources were started on a nationwide basis in 1950 by the U. S. Geological Survey. These compilations have been continued at 5-year intervals, and the results for 1950, 1955, 1960, 1965, and 1970 are contained in reports by MacKichan (1951, 1957); MacKichan and Kammerer (1961); Murray (1968); and Murray and Reeves (1972). These reports contain estimates of water use by categories for each state but contain no information for smaller subareas, such as counties.

In 1956 the Florida Water Resources Study Commission compiled water-use data by counties and by categories of use as part of their report to the Governor of Florida and the 1957 Legislature. That report represents the earliest documentation of water use on a county-by-county basis in Florida.

A water-use inventory of southwest Florida was made in 1962 by the Florida Division of Water Resources and published in their report on land and water resources (1966). Water-use data for northeast Florida for 1965 were compiled by Snell and Anderson (1970) and were given also in the water and related land resources report of the St. Johns River basin by the Florida Department of Natural Resources (1970).

The 1965 water-use data for Florida were published in a map report, (Pride, 1970).

Additional water-use data on public supplies of selected municipalities for 1970 are given in a report by Healy (1972).

PRESENT INVESTIGATION

This report was prepared to document the results of the 1970 water-use survey made by the U. S. Geological Survey as part of the Statewide cooperative program with the Bureau of Geology, Florida Department of Natural Resources, and as part of programs with the Central and Southern Florida Flood Control District, the Southwest Florida Water Management District, and with other state, local, and federal agencies.

The report presents estimates, based on data from many sources, of the amount of water diverted and consumed in Florida, by categories of water use. Water use is reported by counties and by Water Resources Council subregions for the following categories: public supplies, rural domestic and livestock, irrigation, and self-supplied industrial (including thermoelectric power production). (Thermoelectric power is electrical energy generated in steam-electric plants including those that use nuclear fuel.) Source of the water (ground and surface) is given as determined by the Geological Survey.

BUREAU OF GEOLOGY

ACKNOWLEDGMENTS

The assistance of municipal water department officials; county agricultural agents; plant, institutional, and utility managers; and officials of county, state, and federal agencies in furnishing data pertinent to this report is gratefully acknowledged. Sincere appreciation is expressed to George Baragona of the Florida Department of Natural Resources for assistance in coordinating the data obtained from many sources. The assistance of Professor Dalton S. Harrison of the Institute of Food and Agricultural Sciences at the University of Florida in furnishing information on irrigated crop acreage during 1970 is also acknowledged with thanks.

Many individuals in the field offices of the U. S. Geological Survey in Florida participated in the county-by-county inventories to obtain the information on which to base these estimates of water use. Special thanks are given C. A. Pascale of the Tallahassee Subdistrict, A. F. Robertson of the Tampa Subdistrict, J. E. Hull of the Miami Subdistrict, and the late L. J. Crain of the Ocala Subdistrict for their assistance in directing the data collection and coordinating the results obtained in their areas of operation.

The investigation was made and the report prepared under the general supervision of C. S. Conover, District Chief, Florida District.

TERMINOLOGY

When the term "water use" appears in this report, withdrawal use (the amount of water withdrawn from its source) is implied; this is equivalent to "intake" or "water diversion," as used in industry and agriculture, respectively. Water diverted from a source for agriculture is generally more than delivered or conveyed to the crop because of "conveyance losses" and may be more or less than the optimum amount required by a crop. If the water is reused it will do the work of a greater quantity of water; the amount of this greater quantity, which is commonly called the "gross water use," is not evaluated in this report. If, however, the water is returned to a stream, lake, aquifer, or other source and then withdrawn anew, the summation of successive withdrawals gives the total withdrawal use.

The terms "water consumed," "consumptive use," or "consumption," as used in this report, refer to that part of the water withdrawn that is no longer available because it has evaporated, has been incorporated into products and crops, consumed by man or livestock, or otherwise removed from the water environment. Water that is discharged into salt water bodies after being used and is not recoverable from a practical standpoint is not classed as consumed. Water with more than one thousand parts per million dissolved solids is classed as "saline" irrespective of the nature of the minerals present.

Water obtained from a water utility that serves the public is classed as a "public supply"; if a public supply is either not available or not used, the water is "self-supplied." Water used by individual families and by small communities not served by a water utility is classed as "rural." The term "nonwithdrawal uses" refers to water used within recognized stream channels. Some non-withdrawal uses are navigation, sport fishing, fresh-water discharge into estuaries to maintain proper salinity, and the disposition and dilution of waste water.

Water-use data are reported as the average quantities used daily as derived from the annual use. The average use is generally expressed in million gallons per day; for irrigation, the amount is also given in units of 1,000 acre-feet per year. An acre-foot of water is the amount required to cover an acre (43,560 square feet) to a depth of 1 foot (43,560 square feet or 325,851 gallons). One million gallons per day is 3.07 acre-feet per day. One thousand acre-feet per year is nearly equal to a flow of a million gallons per day for a year (1,000 acre-feet per year equals 0.89 mgd). Common equivalents of these units are given in table 1.

Table 1. Hydraulic equivalents. (Equivalent values, to three significant figures, are on the same horizontal line)

Million gallons per day (mgd)	Billion gallons per day (bgd)	Thousand acre-feet per year	Thousand cubic feet per second	Thousand gallons per minute	Million cubic meters per day
1.0	0.001	1.12	0.00155	0.694	0.00379
1,000	1.0	1,120	1.55	694	3.79
.893	.000893	1.0	.00138	.620	.00338
646	.646	724	1.0	449	2.45
1.44	.00144	1.61	.00223	1.0	.00545
264	.264	296	.409	184	1.0

PUBLIC SUPPLY

SOURCE AND RELIABILITY OF DATA

Estimates of water used for public supply in 1970 were obtained from information furnished by the Bureau of Sanitary Engineering, Florida Department of Health and Rehabilitative Services, and by personal communication with water department officials of most municipalities served by public water supply systems.

Most municipalities maintain a record of water pumped from the source or delivered to customers. For such systems the data used in this report are considered to be reliable. A few utility companies keep no pumpage records. For these systems the amount of water used during 1970 was estimated on the basis of the number of customers served.

WATER WITHDRAWN

Water withdrawals in Florida for public supplies in 1970 were estimated to be 884 mgd. of which 759 mgd was from ground-water sources and 125 mgd was from surface-water sources. Population served by public water supplies was estimated to be 5,420,000. Estimates indicate that 166 mgd of water from public supplies was used by industrial and commercial establishments, of which 46 mgd was for air conditioning. See table 2 and figure 2 for county-by-county withdrawals for public supply in 1970.

The average per capita use was 163 gpd, considering the total water withdrawn by public supply systems including that used for industry and commerce. Considering only the public supply water for domestic use, the average per capita use was 132 gpd. In Bay County, where the gross per capita use was 982 gpd, about 33 mgd of water from public supply systems was used for industry and commerce. The average per capita use of public supply water for only domestic use in Bay County was 134 gpd.

CONSUMPTIVE USE

Water consumed is approximately the difference between intake at the waterworks and effluent from the sewage plant, if there are no large leaks into or out of the sewers, no industries discharging self-supplied water to the sewers, nor extensive use of septic tanks in areas served from the public water supply. Only a few cities measure the effluent from the sewage plant. Thus estimates of consumption were based mostly on knowledge of the local situation.

Public supply water consumed in Florida during 1970 was estimated at 235 mgd, about 27 percent of the total amount withdrawn.

Table 2. Water used for public supplies, by counties in WRC Subregions in Florida, 1970

County	Population served			Water withdrawn				Water delivered			Water consumed (mgd)	
	Ground water (thou-sands)	Surface water (thou-sands)	All water (thou-sands)	Ground water (mgd)	Surface water (mgd)	All water (mgd)	Per capita (gpd)	Indust. and Air condi-tioning (mgd)	commer. uses Except air cond. (mgd)	All uses (mgd)		Domestic use and losses (mgd)
WRC Subreg. 0307												
Baker	2.6	--	2.6	0.5	--	0.5	192	--	0.1	0.1	0.4	0.2
Nassau	8.9	--	8.9	2.0	--	2.0	225	0.1	.5	.6	1.4	.5
Subreg. Total	11.5	--	11.5	2.5	--	2.5	217	.1	.6	.7	1.8	.7
WRC Subreg. 0308												
Brevard	204.0	--	204.0	a/11.2	--	a/11.2	b/130	--	--	--	26.5	5.3
Clay	12.7	--	12.7	1.6	--	1.6	126	--	.2	.2	1.4	.5
Duval	345.3	--	345.3	67.8	--	67.8	197	5.0	10.0	15.0	52.8	13.6
Flagler	2.8	--	2.8	.3	--	.3	107	--	--	--	.3	.1
Lake	42.2	--	42.2	10.0	--	10.0	237	.1	1.9	2.0	8.0	5.0
Marion	28.4	--	28.4	3.9	--	3.9	137	--	1.2	1.2	2.7	.4
Orange	290.0	--	290.0	c/65.8	--	c/65.8	b/140	--	5.0	5.0	45.5	12.0
Putnam	14.0	--	14.0	2.7	--	2.7	193	--	--	--	2.7	1.4
St. Johns	10.0	7.0	17.0	1.4	1.1	2.5	147	--	.1	.1	2.4	.1
Seminole	58.9	--	58.9	6.3	--	6.3	107	.1	.6	.7	5.6	1.9
Volusia	142.3	--	142.3	19.2	--	19.2	135	.1	3.7	3.8	15.4	4.5
Subreg. Total	1,150.6	7.0	1,157.6	190.2	1.1	191.3	166	5.3	22.7	28.0	163.3	44.8
WRC Subreg. 0309												
Broward	550.0	--	550.0	102.0	1.0	103.0	188	5.0	5.3	10.3	92.7	20.0
Collier	26.0	3.5	29.5	5.0	.9	5.9	200	.3	.3	.6	5.3	1.4
Dade	1,384.0	--	1,384.0	d/212.1	--	d/212.1	b/149	10.0	11.2	21.2	185.7	42.0
Glades	1.5	2.9	4.4	.1	e/	e/1	b/63	--	--	--	.2	.1
Hendry	1.8	4.7	6.5	.2	1.2	1.4	215	--	.7	.7	.7	.4
Highlands	20.8	2.6	23.4	4.1	.6	4.7	201	--	.9	.9	3.8	4.4
Indian River	21.0	--	21.0	3.1	--	3.1	148	--	.3	.3	2.8	.8
Lee	65.5	26.0	91.5	6.7	1.6	8.3	91	--	1.6	1.6	6.7	2.5
Martin	12.0	--	12.0	1.6	--	1.6	133	--	.1	.1	1.5	.4
Monroe	f/48.9	f/15.0	63.9	g/	1.6	h/1.6	b/106	.3	.4	.7	6.1	1.4
Okeechobee	--	7.6	7.6	--	i/6	i/6	b/66	--	.1	.1	.4	.2
Osceola	14.5	--	14.5	2.7	--	2.7	186	--	.1	.1	2.6	.6
Palm Beach	165.5	94.5	260.0	34.9	20.4	55.3	213	4.0	12.0	16.0	39.3	28.0
Polk	170.0	--	170.0	27.7	--	27.7	163	--	4.2	4.2	23.5	11.0
St. Lucie	34.0	--	34.0	4.3	--	4.3	127	--	.2	.2	4.1	1.0
Subreg. Total	2,515.5	156.8	2,672.3	404.5	27.9	432.4	162	19.6	37.4	57.0	375.4	114.2
WRC Subreg. 0310												
Charlotte	2.0	14.0	16.0	j/0.4	2.2	j/2.6	b/169	--	0.1	0.1	2.6	0.1
Citrus	2.5	--	2.5	.2	--	.2	80	--	.05	.05	.2	.1
DeSoto	6.0	--	6.0	.5	--	.5	83	--	--	--	.5	.2
Hardee	6.5	--	6.5	.7	--	.7	108	--	--	--	.7	.3
Hernando	5.0	--	5.0	.6	--	.6	120	--	.1	.1	.5	.1
Hillsborough	65.0	305.0	370.0	k/35.2	44.6	k/79.8	b/140	0.2	3.9	4.1	47.7	11.8
Levy	7.4	--	7.4	.9	--	.9	122	--	--	--	.9	.3
Manatee	3.5	61.3	64.8	.3	9.6	9.9	153	.6	1.4	2.0	7.9	.3
Pasco	24.3	--	24.3	2.0	--	2.0	82	--	.4	.4	1.6	1.2
Pinellas	413.0	--	413.0	l/32.0	--	l/32.0	b/145	6.0	6.0	12.0	48.0	24.0
Sarasota	101.2	3.1	104.3	m/11.0	.3	m/11.3	b/107	1.0	1.1	2.1	9.1	.5
Sumter	4.8	--	4.8	.8	--	.8	166	--	--	--	.8	.2
Subreg. Total	641.2	383.4	1,024.6	84.6	56.7	141.3	138	7.8	13.0	20.8	120.5	39.1
WRC Subreg. 0311												
Alachua	79.1	--	79.1	22.3	--	22.3	282	10.5	--	10.5	11.8	12.2
Bradford	5.8	--	5.8	.7	--	.7	121	--	.1	.1	.6	.4
Columbia	16.6	--	16.6	1.7	--	1.7	102	.1	.3	.4	1.3	.4
Dixie	2.0	--	2.0	.4	--	.4	200	--	--	--	.4	.1
Gilchrist	1.2	--	1.2	.1	--	.1	117	--	--	--	.1	.1
Hamilton	4.3	--	4.3	.5	--	.5	116	--	.2	.2	.3	.2
Lafayette	.9	--	.9	.1	--	.1	111	--	--	--	.1	.1
Madison	6.4	--	6.4	.6	--	.6	94	--	.1	.1	.5	.1
Suwannee	7.8	--	7.8	.6	--	.6	77	--	.1	.1	.5	.2
Union	1.6	--	1.6	.1	--	.1	62	--	--	--	.1	.1
Subreg. Total	125.7	--	125.7	27.1	--	27.1	216	10.6	.8	11.4	15.7	13.9

continued

Table 2. Water used for public supplies, by counties in WRC subregions in Florida, 1970

County	Population served			Water withdrawn				Water delivered				Water consumed (mgd)
	Ground water (thousands)	Surface water (thousands)	All water (thousands)	Ground water (mgd)	Surface water (mgd)	All water (mgd)	Per capita (gpd)	Indust. and commer. uses (mgd)	Except air cond. (mgd)	All uses (mgd)	Domestic use and losses (mgd)	
WRC Subreg. 0312												
Franklin	4.0	—	4.0	0.5	—	0.5	125	—	0.1	0.1	0.4	0.1
Gadsden	7.9	9.1	17.0	.8	1.2	2.0	118	—	.6	.6	1.4	.6
Jefferson	2.7	—	2.7	.4	—	.4	148	—	.1	.1	.3	.2
Leon	77.7	—	77.7	12.0	—	12.0	154	1.2	3.8	5.0	7.0	4.0
Liberty	1.6	—	1.6	.2	—	.2	125	—	—	—	.2	.1
Taylor	10.4	—	10.4	1.2	—	1.2	114	—	.6	.6	.6	.3
Wakulla	2.4	—	2.4	.2	—	.2	83	—	—	—	.2	.1
Subreg. Total	106.7	9.1	115.8	15.3	1.2	16.5	142	1.2	5.2	6.4	10.1	5.4
WRC Subreg. 0313												
Calhoun	3.2	—	3.2	.2	—	.2	62	—	—	—	.2	.1
Gulf	1.5	4.5	6.0	.1	.4	.5	83	.02	.03	.05	.4	.2
Jackson	15.0	—	15.0	1.6	—	1.6	107	—	.2	.2	1.4	.4
Subreg. Total	19.7	4.5	24.2	1.9	.4	2.3	95	.02	.23	.3	2.0	.7
WRC Subreg. 0314												
Bay	7.9	30.9	38.8	.7	37.4	38.1	982	.6	32.3	32.9	5.2	4.8
Escambia	158.4	—	158.4	20.3	—	20.3	128	.9	4.7	5.6	14.7	8.1
Holmes	3.0	—	3.0	.3	—	.3	100	—	—	—	.3	.1
Okaloosa	60.8	—	60.8	7.9	—	7.9	130	.1	2.3	2.4	5.5	2.0
Santa Rosa	14.8	—	14.8	2.4	—	2.4	162	—	.6	.6	1.8	.6
Walton	9.2	—	9.2	.7	—	.7	76	—	.1	.1	.6	.3
Washington	3.8	—	3.8	.4	—	.4	105	—	—	—	.4	.1
Subreg. Total	257.9	30.9	288.8	32.7	37.4	70.1	243	1.6	40.0	41.6	28.5	16.0
State Total	4,828.8	591.7	5,420.5	758.8	124.7	883.5	163	46.2	120.0	166.2	717.3	234.8

a/ Does not include 15.3 mgd imported from Orange County.

b/ Net use in County.

c/ Includes 15.3 mgd exported to Brevard County.

d/ Includes 5.2 mgd exported to Monroe County.

e/ Does not include 0.1 mgd imported from City of Okeechobee in Okeechobee County.

f/ Prorated using average per capita for each source.

g/ 5.2 mgd imported from Dade County.

h/ Does not include 5.2 mgd of ground water imported from Dade County.

i/ Includes 0.1 mgd exported to Glades County.

j/ Does not include 0.1 mgd imported from Sarasota County.

k/ Includes 28.0 mgd exported to Pinellas County.

l/ Does not include 28.0 mgd imported from Hillsborough County.

m/ Includes 0.1 mgd exported to Charlotte County.

IRRIGATION

SOURCE AND RELIABILITY OF DATA

Estimates of water used for crop irrigation during 1970 were made by Survey hydrologists from information obtained by personal communication with local (county) and State representatives of agricultural agencies, and from some grove owners and/or farmers. The county agricultural agent, the county SCS (Soil Conservation Service) director, or the county ASCS (Agricultural Stabilization and Conservation Service) director was usually interviewed to obtain estimates of irrigated acreage and depth of water applied for each crop irrigated in a county.

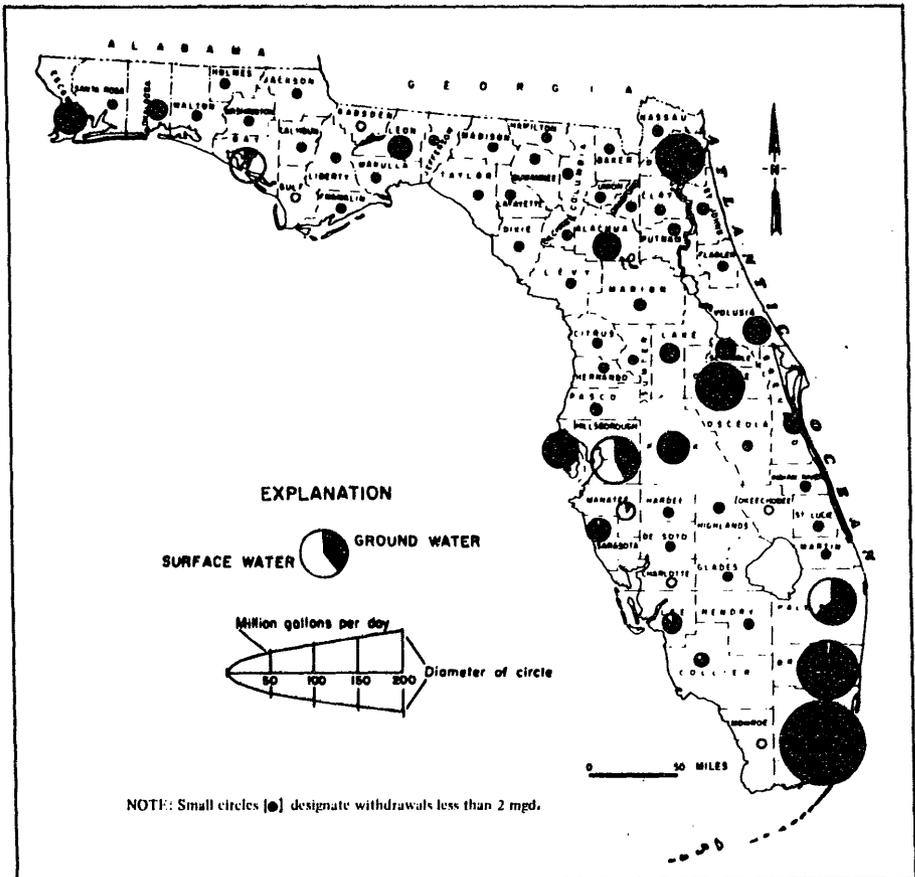


Figure 2. Water withdrawn for public supplies by counties in Florida, 1970

Total crop acreage in each county, as taken from the 1970 annual report by Florida ASCS and the 1970 Florida Agricultural Statistics summary reports by the Florida Department of Agriculture, was used as a guideline for estimating the irrigated crop acreage. The percentage of the total crop acreage that was irrigated in 1970 varied by crop and by locale. As an example, sugar cane in four counties adjacent to Lake Okeechobee was 100 percent irrigated. On the other hand, only a small percentage of field crops, such as corn grown in northern Florida, was irrigated.

Estimates of irrigated crop acreage, as determined for this report, were coordinated with estimates by other Federal and State agencies. Representatives of the following agencies participated in the review and verification of estimates of irrigated crop acreage: U.S. Soil Conservation Service, U.S. Corps of Engineers, Florida Department of Natural Resources, Institute of

Food and Agricultural Sciences at the University of Florida, Central and Southern Florida Flood Control District, and Southwest Florida Water Management District. The Division of Interior Resources, Florida Department of Natural Resources, was the principal coordinating agency and gave significant assistance in reviewing and verifying the irrigation acreage on the basis of independent estimates made as part of their water and related land-resource assessments of river basins.

Although precise records of water use for irrigation were not available for most of the State, the estimates given herein are probably valid because information from all reliable sources was coordinated.

WATER WITHDRAWN

Estimates of water used for irrigation are reported as the amounts diverted from the source and include that applied to the crop plus conveyance loss, if any. Depth of water applied to each crop was estimated by determining the number of applications during 1970 and the average depth per application. Depth of application was estimated in inches and then converted to feet in order to compute acre-feet of water applied during the year. In some areas where irrigation water was conveyed by open ditch from the source to the point of application, the conveyance loss due to seepage was added to the water applied to estimate the total water withdrawn. Most of the reported conveyance loss was in southern Florida.

Water use for irrigation, as reported by the U. S. Geological Survey, is estimated as the amount withdrawn from the source during a specific year or other period. The SCS and other agricultural agencies usually report water use for irrigation based on optimum use for crop requirements from the Blaney-Criddle method. On a long-term average the results obtained by the different approaches should be reasonably consistent, though water withdrawn usually exceeds optimum use, especially in Florida where water is generally plentiful.

County estimates of the quantities of water used for irrigation were much higher in the southern part of the State than elsewhere, both for acres irrigated and for the depth of water applied. The total irrigated crop acreage, tabulated by counties and Water Resources Council subregions, is given in table 3. Of the total acres irrigated in 1970, about 1,134,000, or 71 percent were in WRC subregion 0309, which includes the southernmost counties. Citrus was the major irrigated crop, accounting for 40 percent of the total irrigated acreage.

The rate of water use (water applied in feet per year) was also greater in southern Florida than elsewhere. The range in application rates for the major irrigated crops in those counties where irrigation was practiced in 1970 is shown in table 4.

Table 3. Irrigated crop acreage in Florida, 1970

WRC Subregion and County	Crop (irrigated acres)					Total (all crops)
	Citrus	Truck (vegetables)	Pasture	Sugar cane	Other	
Subreg. 0307						
Baker	0	0	0	0	0	0
Nassau	0	0	0	0	0	0
Subreg. total	0	0	0	0	0	0
Subreg. 0308						
Brevard	8,000	200	16,400	0	0	24,600
Clay	0	400	3,000	0	0	3,400
Duval	0	0	0	0	a/1,400	1,400
Flagler	230	5,600	2,400	0	0	8,230
Lake	36,000	8,000	2,500	0	0	46,500
Marion	8,400	4,000	600	0	a/700	13,700
Orange	32,000	6,000	1,000	0	0	39,000
Putnam	5,000	5,500	0	0	b/700	11,200
St. Johns	0	17,000	2,000	0	0	19,000
Seminole	6,000	4,000	200	0	400	10,600
Volusia	2,000	1,000	0	0	c/1,700	4,700
Subreg. total	97,630	51,700	28,100	0	4,900	182,330
Subreg. 0309						
Broward	5,000	10,000	0	0	a/14,000	29,000
Collier	5,000	12,000	5,000	0	a/2,000	24,000
Dade	5,500	29,300	4,100	0	d/8,800	47,700
Glades	2,000	1,500	35,000	12,000	0	50,500
Hendry	27,000	11,000	30,000	48,500	0	116,500
Highlands	37,000	1,400	35,000	0	a/600	74,000
Indian River	50,000	2,100	20,000	0	0	72,100
Lee	7,000	7,000	6,000	0	a/3,000	23,000
Martin	41,000	1,900	10,000	2,000	0	54,900
Monroe	0	0	0	0	0	0
Okeechobee	2,500	3,500	40,000	0	0	46,000
Osceola	15,000	0	5,000	0	0	20,000
Palm Beach	20,000	88,000	127,000	116,500	0	351,500
Polk	128,000	1,000	500	0	0	129,500
St. Lucie	77,000	350	17,500	0	0	94,850
Subreg. total	422,000	169,050	335,100	179,000	28,400	1,133,550
Subreg. 0310						
Charlotte	6,000	3,000	7,000	0	a/1,200	17,200
Citrus	3,000	900	0	0	0	3,900
DeSoto	16,000	3,200	30,000	0	0	49,200
Hardee	25,500	4,500	14,000	0	0	44,000
Hernando	1,050	270	0	0	0	1,320
Hillsborough	37,500	7,700	1,000	0	a/800	47,000
Levy	0	500	400	0	a/300	1,200
Manatee	10,000	5,000	13,000	0	a/900	28,900
Pasco	10,800	1,000	2,600	0	0	14,400
Pinellas	3,000	0	0	0	0	3,000
Sarasota	1,800	2,100	12,000	0	a/1,200	17,100
Sumter	0	4,650	1,000	0	0	5,650
Subreg. total	114,650	32,820	81,000	0	4,400	232,870
Subreg. 0311						
Alachua	0	6,000	500	0	e/1,000	7,500
Bradford	0	230	0	0	c/70	300
Columbia	0	0	320	0	e/120	440
Dixie	0	0	0	0	f/180	180
Gilchrist	0	430	160	0	a/50	640
Hamilton	0	50	50	0	g/1,780	1,880
Lafayette	0	100	0	0	h/1,400	1,500
Madison	0	0	0	0	i/3,380	3,380
Suwannee	0	0	140	0	j/7,730	7,870
Union	0	0	0	0	e/250	250
Subreg. total	0	6,810	1,170	0	15,960	23,940

continued

Table 3. Irrigated crop acreage in Florida, 1970

WRC Subregion and County	Crop (irrigated acres)					Total (all crops)
	Citrus	Truck (vegetables)	Pasture	Sugar cane	Other	
Subreg. 0312						
Franklin	0	0	0	0	0	0
Gadsden	0	700	0	0	k/2,720	3,420
Jefferson	0	0	0	0	l/1,240	1,240
Leon	0	10	0	0	m/70	80
Liberty	0	0	0	0	0	0
Taylor	0	0	0	0	n/240	240
Wakulla	0	0	0	0	o/20	20
Subreg. total	0	710	0	0	4,290	5,000
Subreg. 0313						
Calhoun	0	0	0	0	p/240	240
Gulf	0	0	0	0	0	0
Jackson	0	0	0	0	q/1,750	1,750
Subreg. total	0	0	0	0	1,990	1,990
Subreg. 0314						
Bay	0	0	0	0	r/700	700
Escambia	0	160	0	0	0	160
Holmes	0	0	0	0	s/100	100
Okaloosa	0	0	0	0	0	0
Santa Rosa	0	0	0	0	t/780	780
Walton	0	0	0	0	u/13,560	13,560
Washington	0	0	0	0	v/100	100
Subreg. total	0	160	0	0	15,240	15,400
Florida total	634,280	261,250	445,370	179,000	75,180	1,595,080

a/ Not identified.

b/ 500 acres of flowers; 200 acres of ferns.

c/ 1,400 acres of ferns; 300 acres not identified.

d/ Fruit other than citrus.

e/ Tobacco.

f/ 130 acres of tobacco; 50 acres of watermelons.

g/ 1,380 acres of tobacco; 300 acres of corn; 100 acres of watermelons.

h/ 800 acres of tobacco; 600 acres of watermelons.

i/ 1,500 acres of corn; 1,050 acres of tobacco; 830 acres of peaches.

j/ 4,620 acres of corn; 2,480 acres of tobacco; 590 acres of soybeans; 40 acres of watermelons.

k/ 2,560 acres of tobacco; 160 acres of corn.

l/ 500 acres of watermelons; 450 acres of nurseries; 230 acres of corn; 60 acres of tobacco.

mi/ 50 acres of nurseries; 20 acres of tobacco.

n/ 170 acres of tobacco; 50 acres of corn; 20 acres of pine seedlings.

o/ Watermelons.

pi/ 160 acres of gladiolus; 80 acres of corn.

q/ 1,550 acres of corn; 200 acres of gladiolus.

r/ 460 acres of corn; 120 acres of soybeans; 80 acres of rye; 40 acres of wheat.

s/ 60 acres of tobacco; 40 acres of corn.

t/ 780 acres of corn and beans.

u/ 7,870 acres of corn; 5,690 acres of soybeans.

Water-use for irrigation in Florida in 1970 was nearly 2,319,000 acre-feet or 2,070 million gallons per day (table 5 and figure 3). Subregion 0309 used 75 percent of the total irrigation water in 1970. Palm Beach County, which irrigated 351,500 acres of citrus, truckfarms, pasture, and sugar cane, used 459,000 acre feet of irrigation water and was the largest county user of irrigation water.

CONSUMPTIVE USE

No measurements of consumptive use of irrigation water were made by the Geological Survey. Estimates given in this report were computed by

Table 4. Annual rate of water application for selected crops, 1970.

Crop	North and Central Florida (feet)	South Florida (feet)
Citrus	0.4 - 1.3	0.7 - 2.0
Truck (vegetables)	.2 - 1.7	1.0 - 2.4
Pasture	.2 - 1.3	.7 - 2.6
Sugar Cane	-	1.1 - 2.3
Corn	.3 - .9	-
Soybeans	.3 - .7	-
Tobacco	.4 - 1.0	-

Table 5. Water used for irrigation, by counties in WRC subregions in Florida, 1970.

County	Acres irrigated	Total water withdrawn (million gallons per day)				Conveyance loss (Ac-ft per yr)	Consumptive use (Ac-ft per yr)	Total water withdrawn (MGD)				Conveyance loss (mgd)	Consumptive use (mgd)
		Acre/Feet						MGD					
		Surface water	Ground water	Other water	All water			Surface water	Ground water	Other water	All water		
WRC Subreg. 0307													
Baker	0	-	-	-	-	-	-	-	-	-	-	-	-
Nassau	0	-	-	-	-	-	-	-	-	-	-	-	-
Subreg. total	0	-	-	-	-	-	-	-	-	-	-	-	-
WRC Subreg. 0308													
Brevard	24,600	-	53,600 a/31,500	b/53,600	-	38,000	-	47.9 a/28.1	b/47.9	-	33.9	-	33.9
Clay	3,400	-	4,590	-	4,590	3,400	-	4.1	-	4.1	-	3.0	3.0
Duval	1,400	-	4,100	-	4,100	3,100	-	3.7	-	3.7	-	2.8	2.8
Flagler	8,230	200	10,100	-	10,300	7,200	0.2	9.0	-	9.2	-	6.4	6.4
Lake	46,500	8,600	15,000	-	23,600	400	18,000	7.7	13.4	-	21.1	0.4	16.1
Marion	13,700	1,230	6,440	-	7,670	-	5,800	1.1	5.7	-	6.8	-	5.2
Orange	39,000	10,000	12,500	-	22,500	-	17,000	8.9	11.2	-	20.1	-	15.2
Putnam	11,200	2,300	8,550	-	10,850	-	8,100	2.1	7.6	-	9.7	-	7.2
St. Johns	19,000	-	24,800	-	24,800	-	17,000	-	22.1	-	22.1	-	15.2
Seminole	10,600	2,970	3,850	-	6,820	820	4,500	2.7	3.4	-	6.1	.7	4.0
Volusia	4,700	320	7,780	-	8,100	-	5,700	.3	6.9	-	7.2	-	5.1
Subreg. total	182,330	25,620	151,310 a/31,500	b/176,930	1,220	127,800	23.0	135.0 a/28.1	b/158.0	1.1	114.1	-	114.1
WRC Subreg. 0309													
Broward	29,000	44,600	33,600	-	78,200	20,000	35,000	39.8	30.0	-	69.8	17.9	31.3
Collier	24,000	500	52,700	-	53,200	13,200	32,000	.4	47.1	-	47.5	11.8	28.6
Dade	47,700	-	50,200	-	50,200	-	30,000	-	44.8	-	44.8	-	26.8
Glades	50,500	5,800	46,000	-	51,800	4,700	30,000	5.2	41.1	-	46.3	4.2	26.8
Hendry	116,500	248,000	28,000	-	276,000	25,100	150,000	221.4	25.0	-	246.4	22.4	133.9
Highlands	74,000	39,700	25,100	-	64,800	5,900	41,000	35.4	22.4	-	57.8	5.3	36.6
Indian River	72,100	38,000	109,100	-	147,100	-	96,000	33.9	97.4	-	131.3	-	85.7
Lee	23,000	9,000	30,600	-	39,600	500	23,000	8.0	27.3	-	35.3	.4	20.5
Martin	54,900	83,900	17,300	-	101,200	9,200	55,000	74.9	15.4	-	90.3	8.2	49.1
Montroe	0	-	-	-	-	-	-	-	-	-	-	-	-
Okeechobee	46,000	6,600	32,400	-	39,000	3,600	23,000	5.9	28.9	-	34.8	3.2	20.5
Osceola	20,000	6,000	9,000	-	15,000	1,500	11,200	5.4	8.0	-	13.4	1.3	10.0
Palm Beach	351,500	321,900	138,000	-	459,900	41,700	250,000	286.6	123.2	-	409.8	37.2	223.2
Polk	129,500	19,400	174,800	10	194,210	-	145,000	17.3	156.1	.01	173.4	-	129.5
St. Lucie	94,850	145,000	29,000	-	174,000	15,800	95,000	129.5	25.9	-	155.4	14.1	84.8
Subreg. total	1,133,550	967,500	775,800	10	1,743,310	141,200	1,016,200	863.7	692.6	.01	1,556.3	126.0	907.3

continued

Table 5. Water used for irrigation, by counties in WRC subregions in Florida, 1970.

County	Total water withdrawn (million gallons per day)					Total water withdrawn (Ac-ft per year)					Con- vey- ance loss (mgd)	Con- sump- tive use (mgd)	
	Acres irrigated	Surface water	Ground water	Other water	All water	Convey- ance (Ac-ft per yr)	Con- sump- tive use (Ac-ft per yr)	Surface water	Ground water	Other water			All water
WRC Subreg. 0310													
Charlotte	17,200	800	31,600	-	32,400	-	21,000	0.7	28.2	-	28.9	-	18.8
Citrus	3,900	50	5,450	-	5,500	-	4,100	.04	4.9	-	4.94	-	3.7
DeSoto	49,200	-	72,400	-	72,400	-	50,000	-	64.7	-	64.7	-	44.6
Hardee	44,000	-	70,000	-	70,000	-	50,000	-	62.5	-	62.5	-	44.6
Herrando	1,320	20	1,850	-	1,870	-	1,400	.02	1.7	-	1.72	-	1.2
Hillsborough	47,000	5,700	71,900	-	77,600	-	54,000	5.1	64.2	-	69.3	-	48.2
Levy	1,300	-	440	-	440	-	330	-	4	-	4	-	3
Manatee	28,900	-	55,400	-	55,400	-	38,800	-	49.5	-	49.5	-	34.6
Pasco	14,400	-	10,700	-	10,700	-	8,000	-	9.6	-	9.6	-	7.1
Pinellas	3,000	50	4,450	-	4,500	-	3,200	.04	4.0	-	4.04	-	2.9
Sarasota	17,100	2,600	30,600	-	33,200	-	22,000	2.3	27.3	-	29.6	-	19.6
Sumter	5,650	-	5,160	-	5,160	-	3,900	-	4.6	-	4.6	-	3.5
Subreg. total	232,870	9,220	359,950	-	369,170	-	256,730	8.20	321.6	-	329.8	-	229.1
WRC Subreg. 0311													
Alachua	7,500	750	3,000	-	3,750	-	2,800	.7	2.7	-	3.4	-	2.5
Bradford	300	75	75	-	150	-	100	.07	.07	-	.14	-	.1
Columbia	440	-	250	-	250	-	190	-	2	-	2	-	1
Dixie	180	40	60	-	100	-	70	.04	.05	-	.09	-	.1
Gilchrist	640	-	200	-	200	-	150	-	2	-	2	-	1
Hamilton	1,880	180	540	-	720	-	540	.2	.5	-	.7	-	.5
Lafayette	1,500	260	1,020	-	1,280	-	960	.2	.9	-	1.1	-	.9
Madison	3,380	110	1,770	-	1,880	-	1,440	.1	1.6	-	1.7	-	1.3
Suwannee	7,870	-	4,560	-	4,560	-	3,400	-	4.1	-	4.1	-	3.0
Union	250	25	100	-	125	-	90	.02	.09	-	.11	-	.1
Subreg. total	23,940	1,440	11,575	-	13,015	-	9,740	1.33	10.41	-	11.7	-	8.8
WRC Subreg. 0312													
Franklin	0	-	-	-	-	-	-	-	-	-	-	-	-
Gadsden	3,420	2,300	600	-	2,900	-	2,200	2.1	0.5	-	2.6	-	2.0
Jefferson	1,240	50	470	-	520	-	400	.04	.4	-	.44	-	.4
Leon	80	10	50	-	60	-	40	.01	.04	-	.05	-	.0
Liberty	0	-	-	-	-	-	-	-	-	-	-	-	-
Taylor	240	-	110	-	110	-	80	-	.1	-	.1	-	.1
Wakulla	20	5	-	-	5	-	5	-	-	-	-	-	.0
Subreg. total	5,000	2,365	1,230	-	3,595	-	2,725	2.15	1.04	-	3.2	-	2.5
WRC Subreg. 0313													
Calhoun	240	30	150	-	180	-	140	.03	.13	-	.16	-	.1
Gulf	0	-	-	-	-	-	-	-	-	-	-	-	.0
Jackson	1,750	20	730	-	750	-	560	.02	.7	-	.72	-	.5
Subreg. total	1,990	50	880	-	930	-	700	.05	.83	-	.9	-	.6
WRC Subreg. 0314													
Bay	700	-	300	-	300	-	220	-	.3	-	.3	-	.2
Escambia	160	-	110	-	110	-	80	-	.1	-	.1	-	.1
Holmes	100	-	50	-	50	-	40	-	.04	-	.04	-	0
Okaloosa	0	-	-	-	-	-	-	-	-	-	-	-	-
Santa Rosa	780	-	200	-	200	-	150	-	.2	-	.2	-	.1
Walton	13,560	-	11,300	-	11,300	-	8,500	-	10.1	-	10.1	-	7.6
Washington	100	-	25	-	25	-	20	-	.02	-	.02	-	0
Subreg. total	15,400	-	11,985	-	11,985	-	9,010	-	10.76	-	10.76	-	8.0
State Total	1,595,080	1,006,195	1,312,730	a/31,510	b/2,318,933	142,420	1,422,905	898.43	1,172.24	28.11	2,070.66	127.1	1,270.4

a/ 27,000 ac-ft of saline ground water and 4,500 ac-ft of saline surface water for marsh flooding for mosquito control.

b/ Fresh water only.

multiplying the amount of water applied to the crop by a consumptive-use coefficient developed by the U. S. Soil Conservation Service. Table 2 of Technical Release No. 21 "Irrigation Water Requirements" by the Soil Conservation Service, shows consumptive-use crop coefficients for the normal growing season for several crops. Consumptive-use coefficients, as applied in this report, ranged from 0.60 to 0.75. The total consumptive use of irrigation water in Florida was estimated to be 1,423,000 acre-feet in 1970. The difference between the total water withdrawn, 2,319,000 acre-feet, and the amount consumed, 1,423,000 acre-feet, is 896,000 acre-feet, which returned to the source and was available for reuse.

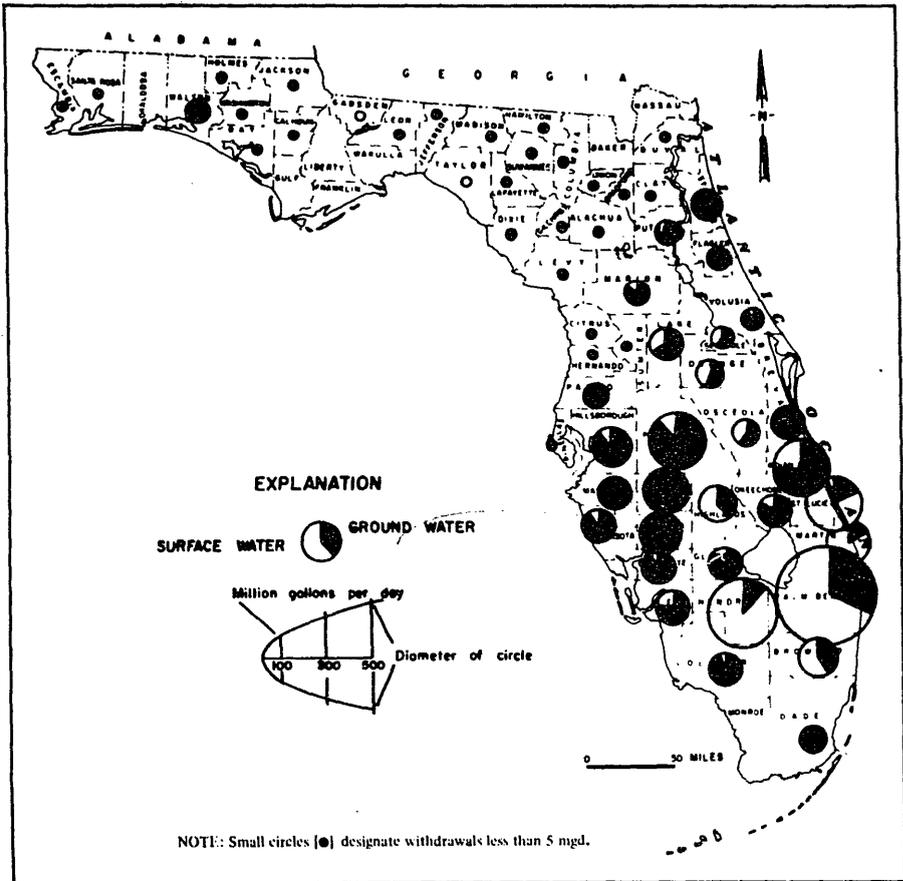


Figure 3. Water withdrawn for irrigation (including conveyance losses) by counties in Florida, 1970

SELF-SUPPLIED INDUSTRIAL WATER, EXCLUDING THERMOELECTRIC POWER USE

SOURCE AND RELIABILITY OF DATA

Estimates of self-supplied industrial water (which excludes that obtained from public supplies) in Florida in 1970 were obtained by personal communication with officials of industrial plants and institutions in Florida that supply their own water. Most of the self-supplied industrial use of water in Florida, excluding thermoelectric power use, was for mining phosphate, processing pulp and paper products, mining limerock, processing chemicals, manufacturing or processing other miscellaneous products, and institutional use, including air conditioning.

Estimates of self-supplied industrial water use were coordinated with estimates by the Florida Department of Natural Resources, made as part of their water and related land-resource assessments of river basins. Results given herein are considered to be valid.

WATER WITHDRAWN

Self-supplied industrial water withdrawn in Florida in 1970 was estimated to be 926 mgd of fresh water and 132 mgd of saline water. Of the fresh water used, 735 mgd or nearly 80 percent of the total, was ground water, and the remainder was surface water. Most of the self-supplied industrial saline water was used in Hillsborough County (table 6 and figure 4).

The largest industrial use of fresh water was 318 mgd for phosphate mining and processing, most of which was in Polk and Hillsborough Counties.

Pulp and paper processing required 237 mgd, the second largest industrial use of fresh water. All the pulp and paper processing plants are in the northern part of the State.

Processing of chemical products required 97 mgd of fresh water, and processing of citrus products required 86 mgd of fresh water. Water withdrawn for limerock mining was estimated to be 29 mgd. All other self-supplied industrial users of fresh water required nearly 158 mgd.

CONSUMPTIVE USE

About 163 mgd, or about 18 percent, of the total fresh water self supplied by industry was consumed. Although most of the water withdrawn was returned to a source for possible reuse, the water quality may have been

Table 6. Self-supplied water for industrial use, by counties in WRC subregions in Florida, 1970.

County	Water withdrawn (million gallons per day)						Fresh-water use by major classifications (million gallons per day)						
	Ground water		Surface water		Ground and Surface		Water Consumed fresh	Phos- phate mining	Pulp and paper process- ing	Citrus process- ing	Lime- rock mining	Chemical products process- ing	Other
	Fresh	Saline	Fresh	Saline	Fresh	Saline							
WRC Subreg. 0307													
Baker	—	—	—	—	—	—	2.5	—	—	—	—	—	—
Nassau	50.0	—	—	2.0	50.0	2.0	—	—	50.0	—	—	—	—
Subreg. total	50.0	—	—	2.0	50.0	2.0	2.5	—	50.0	—	—	—	—
WRC Subreg. 0308													
Brevard	.4	—	—	—	.4	—	.2	—	—	.2	—	—	.2
Clay	1.5	—	—	—	1.5	—	.2	—	—	—	—	—	1.5
Duval	60.9	—	—	20.0	60.9	20.0	4.0	—	19.0	—	—	11.4	30.5
Flagler	—	—	—	2.0	—	2.0	—	—	—	—	—	—	—
Lake	19.4	—	—	—	19.4	—	.5	—	—	14.1	—	—	5.3
Marion	2.1	—	0.1	—	2.2	—	.1	—	—	1.5	—	—	.7
Orange	7.0	—	—	—	7.0	—	.5	—	—	7.0	—	—	—
Putnam	15.5	—	16.0	5.0	31.5	5.0	1.2	—	31.5	—	—	—	—
St. Johns	—	—	—	—	—	—	—	—	—	—	—	—	—
Seminole	.5	—	—	—	.5	—	.2	—	—	—	—	—	.5
Volusia	.5	—	—	—	.5	—	.3	—	—	—	—	—	.5
Subreg. Total	107.8	—	16.1	27.0	123.9	27.0	7.2	—	50.5	22.8	—	11.4	39.2
WRC Subreg. 0309													
Broward	2.0	—	1.0	—	3.0	—	1.0	—	—	—	—	—	3.0
Collier	.5	—	—	—	.5	—	.1	—	—	—	—	—	.5
Dade	7.7	—	2.7	—	10.4	—	4.1	—	—	—	—	—	10.4
Glades	.4	—	—	—	.4	—	.2	—	—	—	—	—	.4
Hendry	.1	—	.2	—	.3	—	—	—	—	—	—	—	.3
Highlands	.1	—	—	—	.1	—	.1	—	—	.1	—	—	—
Indian River	.5	—	—	—	.5	—	.1	—	—	.5	—	—	—
Lee	.3	0.4	4.0	—	4.3	0.4	.2	—	—	—	4.0	—	.3
Martin	.5	—	—	—	.5	—	.2	—	—	—	—	—	.5
Monroe	—	—	—	—	—	—	—	—	—	—	—	—	—
Okeechobee	.2	—	—	—	.2	—	.1	—	—	—	—	—	.2
Osceola	.1	—	—	—	.1	—	.1	—	—	—	—	—	.1
Palm Beach	26.6	—	1.8	—	28.4	—	7.3	—	—	—	—	—	28.4
Polk	236.0	—	71.0	—	307.0	—	48.0	271.0	—	28.6	—	—	7.4
St. Lucie	1.2	—	—	—	1.2	—	1.0	—	—	.6	—	—	.6
Subreg. total	276.2	.4	80.7	—	356.9	.4	62.5	271.0	—	29.8	4.0	—	52.1
WRC Subreg. 0310													
Charlotte	0.1	—	—	—	0.1	—	0.1	—	—	—	—	—	.1
Citrus	.2	—	—	—	.2	—	.1	—	—	.1	—	—	.1
DeSoto	.7	—	—	—	.7	—	.2	—	—	.2	—	.5	—
Hardee	.1	—	—	—	.1	—	.1	—	—	—	—	—	.1
Hernando	.6	—	—	—	.6	—	.5	—	—	.3	.1	—	.2
Hillsborough	40.0	86.4	11.9	—	51.9	86.4	5.2	45.9	—	2.8	—	—	3.2
Levy	—	—	—	—	—	—	—	—	—	—	—	—	—
Manatee	3.0	—	—	—	3.0	—	.5	—	—	—	—	3.0	—
Pasco	30.0	—	—	—	30.0	—	23.0	—	—	30.0	—	—	—
Pinellas	2.0	—	—	—	2.0	—	1.6	—	—	.4	—	—	1.6
Sarasota	7.6	—	—	0.8	7.6	.8	.3	—	—	.1	—	—	7.5
Sumter	18.5	—	—	—	18.5	—	.5	—	—	—	18.5	—	—
Subreg. total	102.8	86.4	11.9	.8	114.7	87.2	32.1	45.9	—	33.9	18.6	3.5	12.8
WRC Subreg. 0311													
Alachua	1.4	—	—	—	1.4	—	.3	—	—	—	—	—	1.4
Bradford	1.4	—	—	—	1.4	—	—	1.4	—	—	—	—	—
Columbia	—	—	—	—	—	—	—	—	—	—	—	—	—
Dixie	.9	—	—	—	.9	—	.3	—	—	—	—	—	.9
Gilchrist	—	—	—	—	—	—	—	—	—	—	—	—	—
Hamilton	18.4	—	—	—	18.4	—	6.1	—	—	—	—	18.4	—
Lafayette	—	—	—	—	—	—	—	—	—	—	—	—	—
Madison	—	—	—	—	—	—	—	—	—	—	—	—	—
Suwannee	7.1	—	—	—	7.1	—	.3	—	—	—	6.3	—	.6
Union	.6	—	—	—	.6	—	.3	—	—	—	—	—	.6
Subreg. total	29.8	—	—	—	29.8	—	7.3	1.4	—	—	6.3	18.4	3.7

continued

Table 6. Self-supplied water for industrial use, by counties in WRC subregions in Florida, 1970.

County	Water withdrawn (million gallons per day)						Fresh-water use by major classifications (million gallons per day)						
	Ground water		Surface water		Ground and Surface		Water Con- sumed fresh	Phos- phate mining	Pulp and paper process- ing	Citrus process- ing	Lime- rock process- ing	Chemical products process- ing	Other
	Fresh	Saline	Fresh	Saline	Fresh	Saline							
WRC Subreg. 0312													
Franklin	-	-	-	-	-	-	-	-	-	-	-	-	-
Gadsden	0.1	-	2.1	-	2.2	-	0.6	-	-	-	-	-	2.2
Jefferson	.2	-	-	-	.2	-	.1	-	-	-	-	-	.2
Leon	27.9	-	-	-	27.9	-	.8	-	-	-	-	-	27.9
Liberty	.8	-	.5	-	1.3	-	.6	-	-	-	-	-	1.3
Taylor	53.7	-	-	-	53.7	-	5.4	-	53.7	-	-	-	-
Wakulla	.7	-	.4	-	1.1	-	.1	-	-	-	-	-	1.1
Subreg. total	83.4	-	3.0	-	86.4	-	7.6	-	53.7	-	-	-	32.7
WRC Subreg. 0313													
Calhoun	-	-	-	-	-	-	-	-	-	-	-	-	-
Gulf	19.0	-	36.0	15.8	55.0	15.8	9.1	-	55.0	-	-	-	-
Jackson	1.2	-	-	-	1.2	-	.2	-	-	-	-	-	1.2
Subreg. total	20.2	-	36.0	15.8	56.2	15.8	9.3	-	55.0	-	-	-	1.2
WRC Subreg. 0314													
Bay	2.0	-	.05	-	2.05	-	.5	-	2.0	-	-	-	.05
Escambia	47.8	0.1	42.9	-	90.7	.1	27.1	-	26.2	-	-	54.3	10.2
Holmes	-	-	-	-	-	-	-	-	-	-	-	-	-
Okaloosa	4.7	-	-	-	4.7	-	1.6	-	-	-	-	-	4.7
Santa Rosa	10.3	-	-	-	10.3	-	5.2	-	-	-	-	9.5	.8
Walton	1.2	-	-	-	1.2	-	.2	-	-	-	-	-	1.2
Washington	-	-	-	-	-	-	-	-	-	-	-	-	-
Subreg. total	66.0	.1	42.95	-	108.95	.1	34.6	-	28.2	-	-	63.8	16.15
State Total	736.2	86.9	190.6	45.6	926.8	132.5	163.1	318.3	237.4	86.5	28.9	97.1	158.6

changed to an extent that reuse for the purpose withdrawn was not feasible without treatment. Chemical, bacteriological, or thermal pollution may increase with each withdrawal, and the quality of the resulting water may become a more important factor than the quantity of water in determining its suitability for reuse. Information regarding the quality of the water returned to a source was not available.

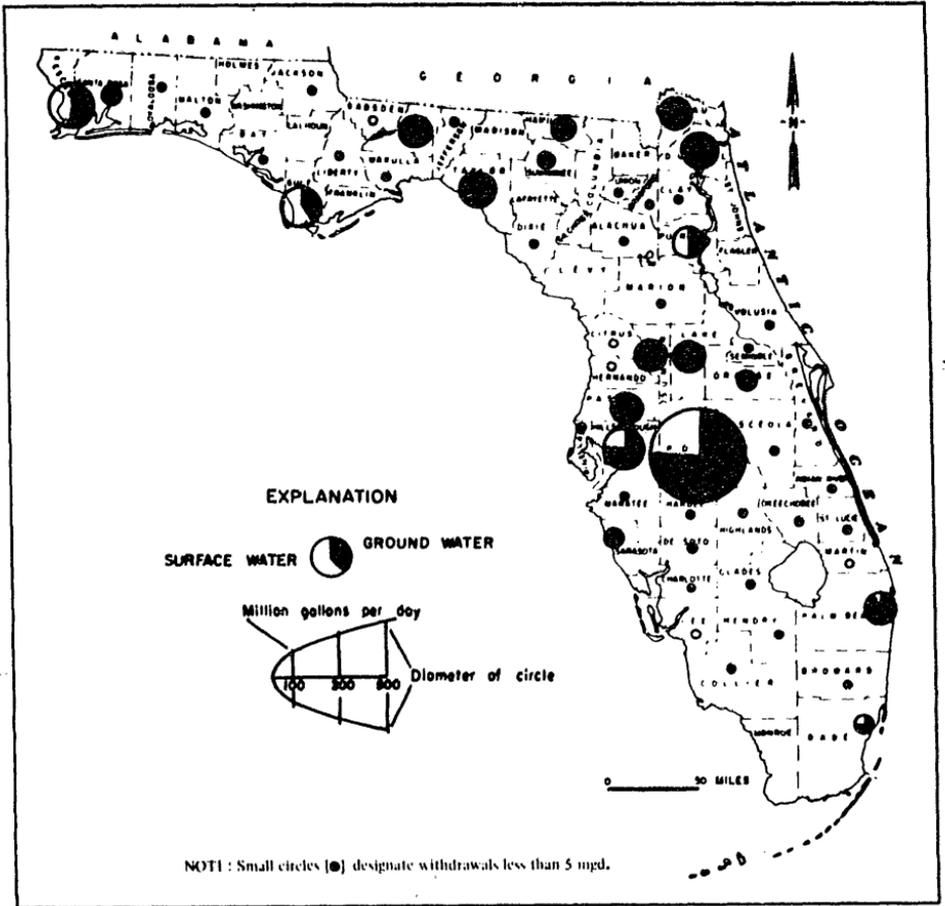


Figure 4. Self-supplied industrial fresh-water (excluding thermoelectric power use) withdrawals by counties, in Florida, 1970

THERMOELECTRIC POWER

SOURCE AND RELIABILITY OF DATA

Estimates of water use for condenser cooling and of electrical power generated at thermoelectric power plants were obtained by personal communication with power company officials or with plant superintendents. This water was self-supplied, and the estimates of water use were based on pumping records or power production records. These estimates are considered to be reliable.

WATER WITHDRAWN

Because large quantities of water are required for condenser cooling, most thermoelectric power plants in Florida are located on the coast and use saline or brackish water withdrawn from bays or estuaries. However, some plants are located inland and draw water from large rivers or lakes. Only a small amount of ground water is used for cooling and for other purposes at the plants (boiler feed, domestic use at plant, and sprinkling of plant grounds). Most of the water is used in a flow-through operation with no recycling. Some of the small generating plants located on fresh water bodies in the interior of the State probably recycle some of their cooling water and use cooling ponds or towers to remove part of the absorbed heat. However, quantitative information regarding recycling was not obtained as a part of this inventory.

The data given in table 7 for water withdrawn for thermoelectric power production during 1970 in Florida totaled 11,100 mgd. About 9,300 mgd, or 84 percent, was saline surface water; 1,700 mgd, or 15 percent, was fresh surface water; and the remaining 1 percent was ground water. The most significant ground-water use was 50 mgd of saline water reported for Monroe County. Figure 5 shows the areal distribution of water use for thermoelectric power production.

Power produced during 1970 by thermoelectric plants in Florida was reported for this inventory to be 57.3 billion kilowatt hours. (Preliminary figures released by the Federal Power Commission in 1971 show that 55.4 billion kilowatt hours was produced by thermoelectric plants in Florida in 1970.) An average of 70 gallons of water was required per kilowatt hour of power produced.

Table 7. Water used for thermoelectric power, by counties in WRC Subregions in Florida, 1970

County	Cooling water				Other water			Water consumed (mgd)		Average annual generation (KW/1 x 10 ⁶)	
	Self supplied		Ground water (mgd)		Public Supply (mgd)	Self supplied		Fresh	Saline		
	Fresh	Saline	Fresh	Saline		Surface (mgd)	Ground (mgd)				Public Supply (mgd)
WRC Subreg. 0307											
Baker	--	--	--	--	--	--	--	--	--	--	
Nassau	--	43	--	--	--	--	--	--	0.2	(a)	
Subreg. Total	--	43	--	--	--	--	--	--	.2	(a)	
WRC Subreg. 0308											
Brevard	--	1,077	0.3	0.09	0.06	--	--	0.2	10.0	5,572	
Clay	--	--	--	--	--	--	--	--	--	--	
Duval	--	767	--	--	--	--	0.3	.2	7.5	4,183	
Flagler	--	--	--	--	--	--	--	--	--	--	
Lake	--	--	--	--	--	--	--	--	--	--	
Marion	--	--	--	--	--	--	--	--	--	--	
Orange	128	--	--	--	--	--	0.1	.5	--	231	
Putnam	123	--	--	--	--	--	.05	.65	--	364	
St. Johns	--	--	--	--	--	--	--	--	--	--	
Seminole	--	--	--	--	--	--	--	--	--	--	
Volusia	406	--	--	--	--	--	.01	.04	3.15	1,750	
Subreg. Total	657	1,844	.3	.09	.06	--	.36	.14	4.7	17.5	12,100
WRC Subreg. 0309											
Broward	--	1,678	0.1	--	0.3	--	--	.2	15.9	8,925	
Collier	--	--	--	--	--	--	--	--	--	--	
Dade	--	1,183	--	--	--	--	0.04	0.09	.1	10.3	5,788
Glades	--	--	--	--	--	--	--	--	--	--	
Hendry	--	--	--	--	--	--	--	--	--	--	
Highlands	226	--	--	--	--	--	--	.02	.4	245	
Indian River	--	72	.1	--	--	--	--	.1	.3	177	
Lee	--	552	--	--	--	--	.04	.06	.1	4.4	2,465
Martin	--	--	--	--	--	--	--	--	--	--	
Monroe	--	--	--	50.0	--	--	--	.2	.2	.5	308
Okeechobee	--	--	--	--	--	--	--	--	--	--	
Osceola	--	--	1.6	--	--	--	--	--	--	Small	
Palm Beach	--	564	--	--	.5	--	--	.2	7.4	4,166	
Polk	110	--	--	--	.4	--	--	1.4	4.4	672	
St. Lucie	--	150	--	--	.02	--	--	--	.4	202	
Subreg. Total	336	4,199	1.8	50.0	1.22	--	.08	.57	2.7	39.2	22,948
WRC Subreg. 0310											
Charlotte	--	--	--	--	--	--	--	--	--	--	
Citrus	--	112	--	--	--	--	0.02	--	.02	6.5	3,650
DeSoto	--	--	--	--	--	--	--	--	--	--	
Hardee	--	--	--	--	--	--	b/	--	--	8	
Hernando	--	--	--	--	--	--	--	--	--	--	
Hillsborough	--	1,899	--	--	0.05	--	--	1.2	.5	12.0	6,770
Levy	--	--	--	--	--	--	--	--	--	--	
Manatee	--	--	--	--	--	--	--	--	--	--	
Pasco	--	--	--	--	--	--	--	--	--	--	
Pinellas	--	954	--	--	--	--	--	.6	.3	7.1	4,020
Sarasota	--	--	--	--	--	--	--	--	--	--	
Sumter	--	--	--	--	--	--	--	--	--	--	
Subreg. Total	--	2,965	--	--	.05	--	.02	1.8	.8	25.6	14,448
WRC Subreg. 0311											
Alachua	--	--	--	--	1.0	--	--	.8	--	406	
Bradford	--	--	6.5	--	--	--	.2	.2	--	24	
Columbia	--	--	--	--	--	--	--	--	--	--	
Dixie	--	--	--	--	--	--	--	--	--	--	
Gilchrist	--	--	--	--	--	--	--	--	--	--	
Hamilton	--	--	--	--	--	--	--	--	--	--	
Lafayette	--	--	--	--	--	--	--	--	--	--	
Madison	--	--	--	--	--	--	--	--	--	--	
Suwannee	173	--	--	--	--	--	--	1.5	--	832	
Union	--	--	--	--	--	--	--	1	--	--	
Subreg. Total	173	--	6.5	--	1.0	--	.2	--	2.5	--	1,262

continued

Table 7. Water used for thermoelectric power, by counties in WRC subregions in Florida, 1970.

County	Cooling water				Other water			Water consumed		Average annual generation (KWH x 10 ⁶)	
	Self supplied				Self supplied			Water consumed			
	Ground water (mgd)				Public Supply (mgd)	Surface (mgd)	Ground (mgd)	Public Supply (mgd)	Water consumed		
	Fresh	Saline	Fresh	Saline	(mgd)	Fresh	Fresh	(mgd)	Fresh		Saline
WRC Subreg. 0312											
Franklin	-	-	-	-	-	-	-	-	-	-	
Gadsden	-	-	-	-	-	-	-	-	-	-	
Jefferson	-	-	-	-	-	-	-	-	-	-	
Leon	-	-	-	-	-	-	c/	-	-	12	
Liberty	-	-	-	-	-	-	-	-	-	-	
Taylor	-	-	-	-	-	-	-	-	-	-	
Wakulla	160	-	-	-	-	-	0.3	-	1.4	-	
Subreg. Total	160	-	-	-	-	-	.3	-	1.4	-	
WRC Subreg. 0313											
Calhoun	-	-	-	-	-	-	-	-	-	-	
Gulf	-	-	-	-	-	-	-	-	-	-	
Jackson	144	-	1.4	-	-	-	-	-	.9	-	
Subreg. Total	144	-	1.4	-	-	-	-	-	.9	-	
WRC Subreg. 0314											
Bay	-	274	.1	-	-	-	-	-	.3	3.5	
Escambia	205	15	.8	-	-	-	-	-	6.4	-	
Holmes	-	-	-	-	-	-	-	-	-	3,420	
Ocala	-	-	-	-	-	-	-	-	-	-	
Santa Rosa	-	-	-	-	-	-	-	-	-	-	
Walton	-	-	-	-	-	-	-	-	-	-	
Washington	-	-	-	-	-	-	-	-	-	-	
Subreg. Total	205	289	.9	-	-	-	-	-	6.7	3.5	
State Total	1,675	9,340	10.9	50.1	2.3	-	1.0	2.5	19.7	86.0	

a/ Annual generation by two plants serving industries not reported.

b/ Small amount (about 50 gpd) at plant.

c/ Small amount for drinking, baths, etc. at plant.

CONSUMPTIVE USE

In spite of the large quantities of water used in thermoelectric power production, little water is consumed. In 1970, the amount of fresh water consumed by thermoelectric power plants in Florida was estimated at 20 mgd, and the saline water at 86 mgd, both small in comparison with the water circulated through the plants.

RURAL SUPPLY

The quantity of water withdrawn for rural domestic and livestock supply in Florida is relatively small compared with other uses, and, therefore, no county-by-county estimates were made for 1970. Only regional (WRC Subregions) estimates were made by using per capita rates for population and livestock (table 8). Population estimates were from the U. S. Bureau of Census (1970) and livestock and poultry estimates were from the U. S. Department of Agriculture (1971).

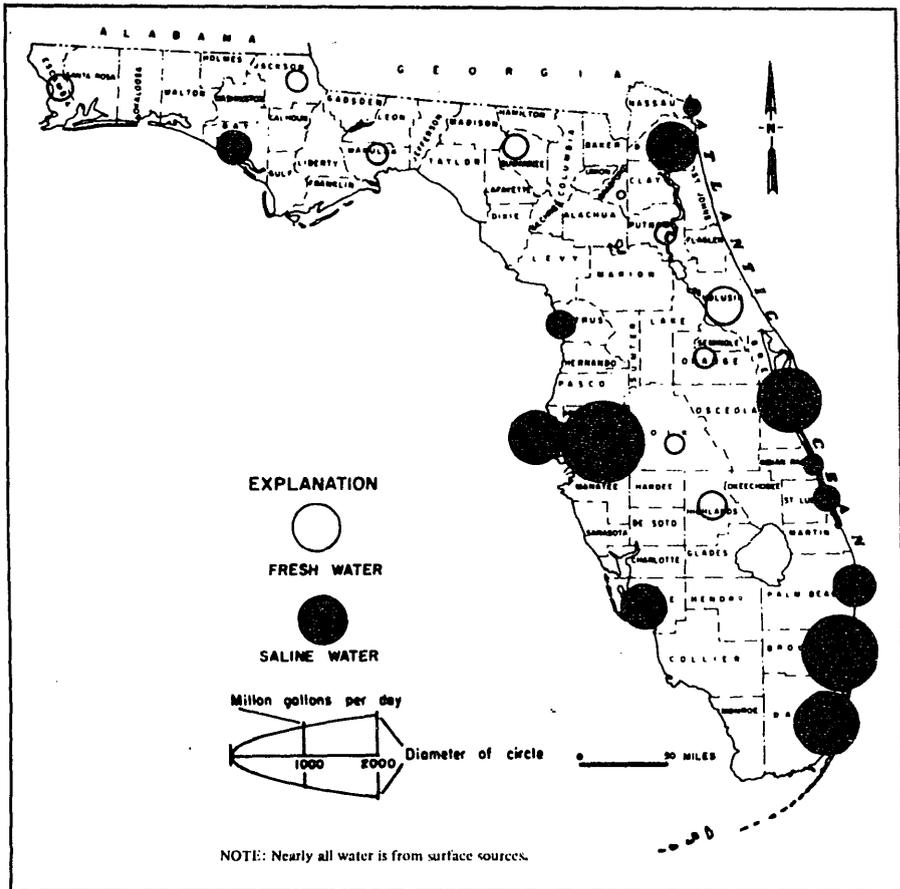


Figure 5. Water withdrawn for thermoelectric power by counties in Florida, 1970

DOMESTIC USE

Rural domestic use was estimated to be 120 gallons per day per person in 1970 (117 gpd in 1965). The population served by rural supply in 1970 was considered, in this report, to be the difference between the total population (6,789,400) and the population served by all public supply systems (5,410,500), or about 1,379,000 persons. The total rural domestic use in 1970, as shown in table 8, was estimated to be 165 million gallons per day of ground water, of which 80 percent, or 130 mgd, was estimated to be consumed.

Table 8. Water for rural use by Water Resources Council subregions in Florida, 1970

WRC subregion in Florida	Domestic use			Livestock use			Domestic and Livestock use			
	With- drawn ground water (mgd)	Con- sumed (mgd)	Surface water (mgd)	Withdrawn		Con- sumed (mgd)	Withdrawn			Con- sumed (mgd)
				Ground water (mgd)	All water (mgd)		Surface water (mgd)	Ground water (mgd)	All water (mgd)	
0307	2.2	1.5	0.1	0.4	0.5	0.5	0.1	2.6	2.7	2.0
0308	53.0	41.0	.9	3.5	4.4	4.4	.9	56.5	57.4	45.4
0309	23.0	18.0	5.5	5.2	10.7	10.7	5.5	28.2	33.7	28.7
0310	48.0	38.0	2.4	5.4	7.8	7.8	2.4	53.4	55.8	45.8
0311	9.0	7.5	1.0	1.7	2.7	2.7	1.0	10.7	11.7	10.2
0312	8.0	6.5	.8	.5	1.3	1.3	.8	8.5	9.3	7.8
0313	3.3	2.5	.7	.2	.9	.9	.7	3.5	4.2	3.4
0314	18.5	15.0	.6	1.1	1.7	1.7	.6	19.6	20.2	16.7
Florida total	165.0	130.0	12.0	18.0	30.0	30.0	12.0	183.0	195.0	160.0

LIVESTOCK

Estimates of water use by livestock in 1970 in Florida were computed as follows:

Livestock	Number of head	Use per head (gpd)	Total (mgd)
Cattle	1,864,000	15	28.0
Sheep	5,600	2	—
Hogs	374,000	3	1.1
Chickens	17,099,100	.04	.7
		Total (rounded)	30

Based on information obtained by the more detailed inventory of rural water use in 1965, it was estimated that 18 mgd of water for livestock was ground water, and 12 mgd was surface water in 1970. The total amount used for livestock was considered to be consumed.

SUMMARY OF ALL USES

Table 9 summarizes by WRC subregion the estimated water withdrawal and consumption in Florida for 1970. Of the several uses, the major category of use of the total amount withdrawn was for electric power production. Of the 15,300 mgd total withdrawn from all sources, nearly 11,100, or 72 percent, was used for electric power production. However, 9,390 mgd of the 11,100 mgd was saline water used in the flow-through operation for condenser cooling. Less than 1 percent of the saline water used in this operation was consumed.

The largest use of fresh water was for irrigation. The counties in southern Florida, constituting WRC subregion 0309, used 1,560 mgd or 75 percent of the total 2,100 mgd used in Florida during 1970.

Industry, other than thermoelectric power plants, required 926 mgd of fresh water and 132 mgd of saline water, both self-supplied. An additional 166 mgd from public supply systems was estimated for industrial use.

As shown in table 9, the total fresh water used in 1970 was obtained in nearly equal quantities from surface-water and ground-water sources, 2,900 mgd and 2,860 mgd, respectively.

Considering both fresh and saline water, about 2,250 gpd per capita was used to meet all water requirements of Florida during 1970. Considering only fresh water, the water requirements were 849 gpd per capita.

Table 9. Summary of estimated water withdrawal and consumption by Water Resources Council subregions in Florida, 1970

WRC sub- region in Florida	Total popula- tion (thou- sands)	Public sup- plies	Rural domestic and live- stock	Irriga- tion	power (electric utility) use	Thermo- electric Self- supplied industrial use	Total with- drawals	Sources of water withdrawn				Total water con- sumed (mgd)
								Ground		Surface		
								fresh	saline	fresh	saline	
0307	29.8	3	3	0	43	52	101	56	0	0	45	5
0308	1,598.2	191	57	186	2,500	151	3,085	489	23	701	1,872	234
0309	2,856.1	432	34	1,556	4,588	357	6,967	1,404	50	1,314	4,199	1,155
0310	1,425.5	141	56	330	2,965	202	3,694	563	86	80	2,965	372
0311	201.6	27	12	12	180	30	261	86	0	175	0	43
0312	181.4	17	9	3	160	86	275	108	0	167	0	25
0313	52.1	2	4	1	145	72	224	27	0	181	16	15
0314	444.8	70	20	11	495	109	705	130	0	286	289	85
Florida total	6,789.5	884	195	2,099	11,076	1,059	15,313	2,864	159	2,904	9,386	1,934

The estimated total water consumed by all uses in 1970 was 1,930 mgd, most of which was fresh water. About one third of all the fresh water withdrawn from the source was consumed.

TRENDS IN WATER USE, 1950-70

Trends in population and water withdrawn for major uses in Florida for 1950 to 1970 are shown in table 10 and figure 6.

Estimates for 1950, 1955, and 1960 are given in reports by MacKichan (1951, 1957) and by Mackichan and Kammerer (1961). Estimates of water use in 1956 are given in a report by the Florida Water Resources Study Commission (1956). The 1965 estimates are from county-by-county inventories made by the Florida District for the national report by Murray (1968) and given by Pride (1970). The 1970 estimates are given in this report. Population estimates are from the U. S. Bureau of Census (1950, 1960, 1970) and the Florida Development Commission (1955, 1956, 1965).

Figure 6 shows that public supply use has increased uniformly at the same general rate as population growth. The trend of water use for irrigation has also increased but is not as uniform as the trend for public supply use. The dashed line in figure 6 shows the trend of water use for irrigation from 1950 to 1970. The solid line connects the estimated water use for irrigation at 5-year intervals and for 1956. The estimate of use for irrigation in 1970 is considered to be more reliable than that for any previous year. The 1965 estimate is now considered to be too high, both in irrigated acres and in withdrawal rates. The dashed line is, thus, a more representative estimate of water use for irrigation than the individual estimates shown. The downward trend from 1965 to 1970, indicated by the solid line, is considered to be incorrect, and water use for irrigation probably increased from 1965 to 1970.

Industrial water use, as shown in figure 6, includes water used for the production of thermoelectric power and for other industries that supply their own water. Both fresh and saline water is included. Saline water accounted for 3,360 mgd of the total industrial water use in 1960, 6,260 mgd of the total in 1965, and 9,540 mgd of the total use in 1970. Before 1960, the relative quantities of fresh and saline water for industrial use was not reported.

The average per capita use of all water increased from 332 gpd in 1950 to about 2,250 gpd in 1965 and 1970. Considering fresh water only, the average per capita use increased from 590 gpd in 1955 (the first year for which records are available on the differentiation between fresh and saline water) to 759 gpd in 1960, and 1,180 gpd in 1965, and decreased to 849 gpd in 1970.

Although the total use of water continues to increase sharply, the per capita use of fresh water seems to be somewhat stabilized or even reduced from 1965 to 1970. However, as previously mentioned, the estimates of water

Table 10. Population and estimated water use in Florida, 1950-70

Years included in inventory	Total population (thousands)	Total water withdrawn (mgd)										Per capita use (gpd)	Total water consumed (mgd)
		Industrial uses						All uses					
		Public supplies	Rural and livestock	Irrigation	Thermoelectric power production	Other industry	All industrial uses	Fresh	Saline	All water	Fresh water only		
1950	2,771	170	55	410	(a)	(a)	286	(a)	(a)	921	(a)	332	(a)
1955	3,670	319	38	510	(a)	(a)	1,945	2,167	645	2,812	590	766	(a)
1956	3,941	390	(a)	1,182	(a)	(a)	2,227	(a)	(a)	3,799	(a)	964	(a)
1960	4,951	530	110	660	4,800	1,020	5,820	3,760	3,360	7,120	759	1,438	1,210
1965	5,805	710	142	3,200	8,100	961	9,061	6,852	6,261	13,113	1,180	2,259	1,639
1970	6,789	884	195	2,099	11,076	1,059	12,135	5,768	9,545	15,313	849	2,255	1,934

(a) Data not available.

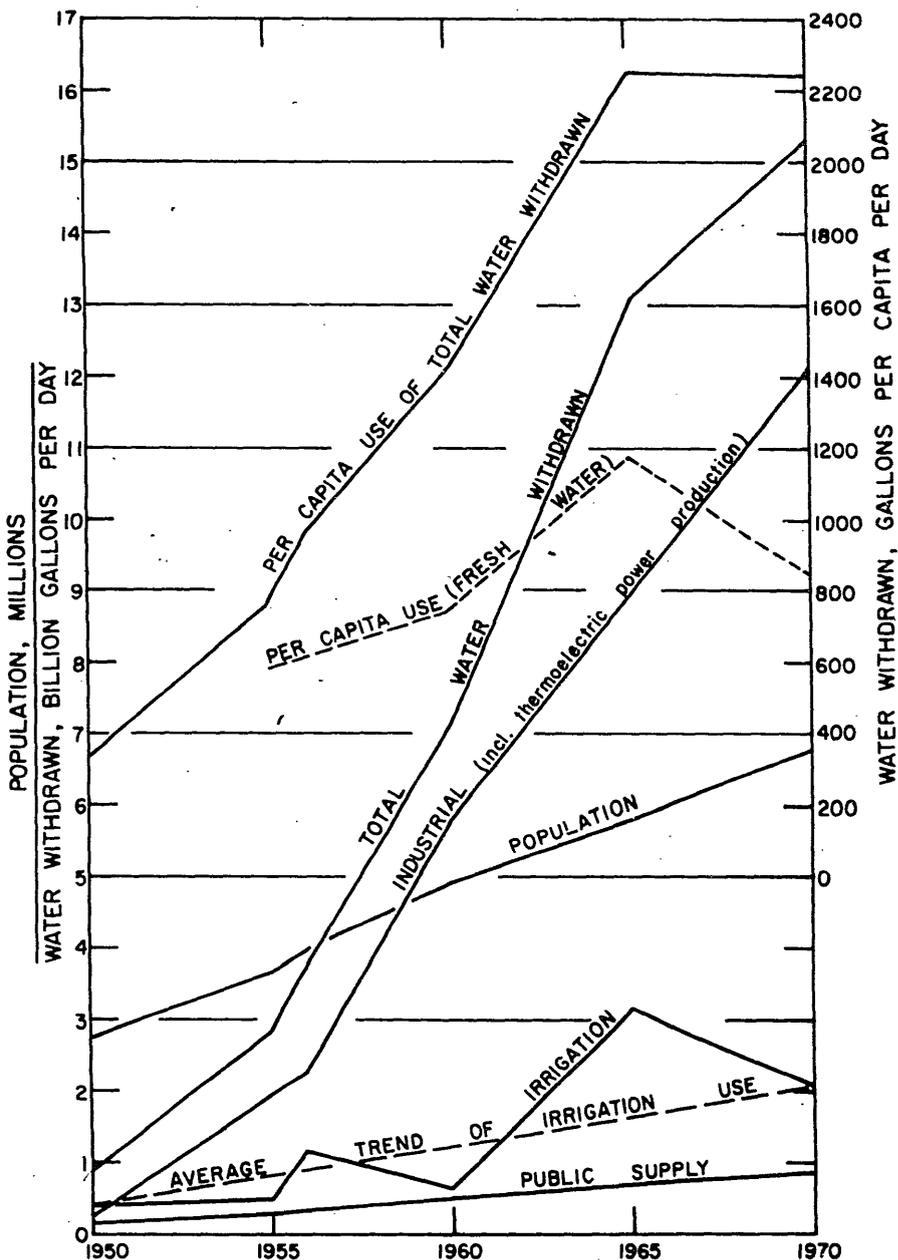


Figure 6. Trends in population and withdrawals of water in Florida, 1950-70

used for irrigation made in 1965 now seem to be considerably too high, which would account for part of the apparent reduction in per capita use from 1965 to 1970.

The greatest increase in use from 1950 to 1970 was for saline water used for condenser cooling in thermoelectric power production.

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