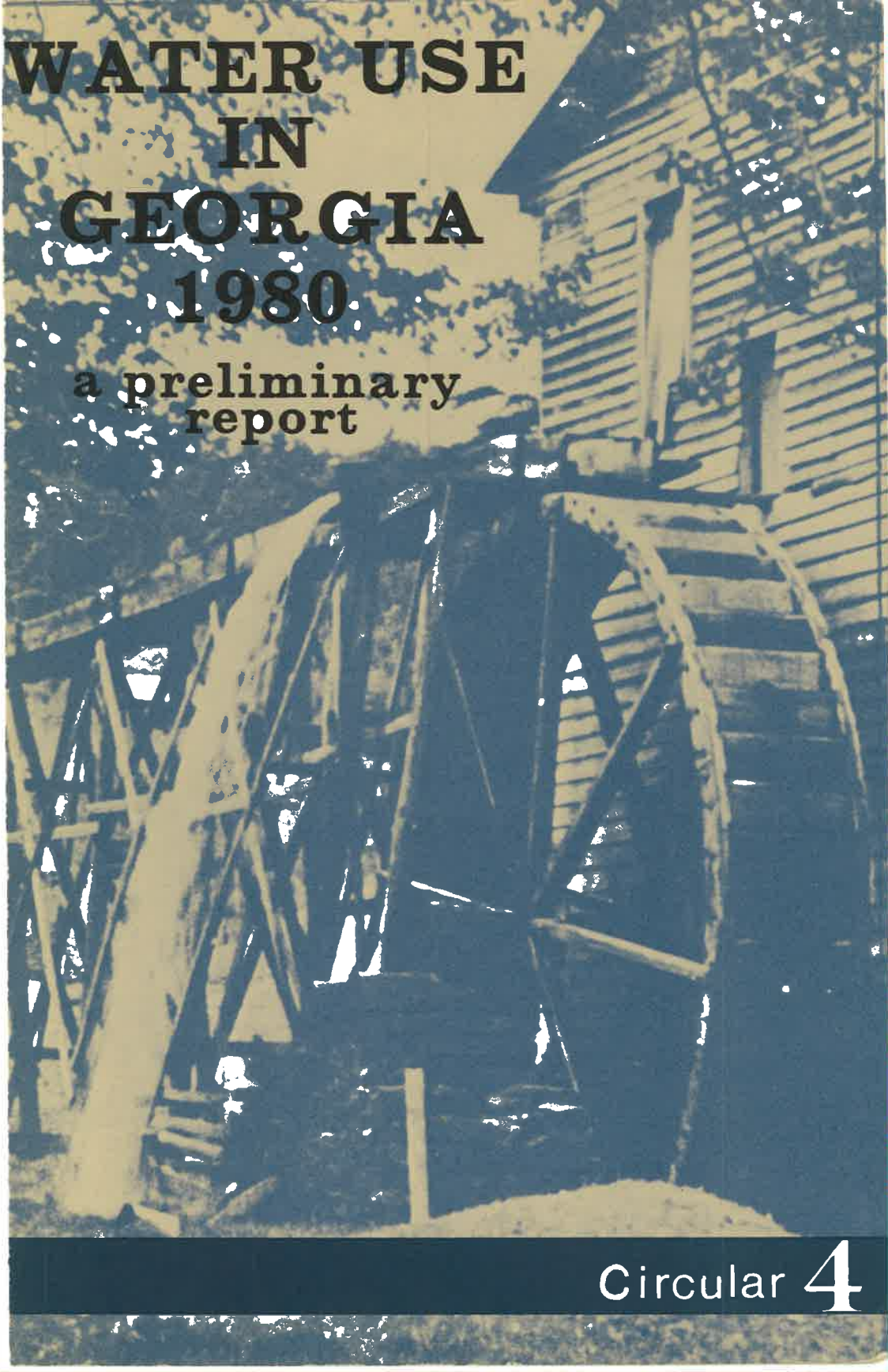
WATER USE IN GEORGIA 1980

a preliminary report



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WATER USE IN GEORGIA
1980

a preliminary report

by

Robert R. Pierce and Nancy L. Barber

1981

GEORGIA DEPARTMENT OF NATURAL RESOURCES
Joe D. Tanner, Commissioner

ENVIRONMENTAL PROTECTION DIVISION
J. Leonard Ledbetter, Director

GEORGIA GEOLOGIC SURVEY
William H. McLemore, State Geologist

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INTRODUCTION

Every day in 1980, some 7 billion gallons of fresh water were withdrawn from Georgia's rivers, streams, and ground-water aquifers. This was about 1,300 gallons of water for every man, woman, and child in the State, or some 5.2 tons of water per person. In the last 10 years, water use in Georgia increased some 26 percent.

For many years, the prevailing school of thought held that much of the southeastern United States possessed a boundless supply of water. The belief was that no water shortages would ever occur in Georgia. Increasing demands on the State's water resources because of population and industrial growth, lack of conservation, and periodic droughts have forced the realization that, while large quantities of water do exist, careful and proper management will be necessary to preserve this valuable resource.

These accelerated demands for water are creating competition among potential users in areas where the available water supply is not adequate to meet the anticipated demands. As the demand for fresh water continues to climb, not only in the quantity of water used but also in the variety of ways that water is being used, the potential for water shortages increases, no matter how plentiful water now seems. The collection of water-use data in Georgia can minimize the potential for future conflict, as these data give hydrologists information used in predicting those areas of the State where such competition for water could be expected to occur.

Although much data exists on the occurrence and distribution of the State's water resources, there are virtually no quantitative data readily available on how water is being used in the State. A study was needed to provide such data, and generally determine how much water is being withdrawn for public supply, general rural use, irrigation, self-supplied industry, and thermoelectric power generation in the State.

BACKGROUND OF STUDY

Since 1950, the U.S. Geological Survey has been preparing national estimates of water use for all categories of water users every five years. In 1970, the U.S. Geological Survey performed an inventory of water use in Georgia, the results of which were published in 1974 as the Georgia Geologic Survey's Hydrologic Report No. 2. The information in that report was extrapolated from data gained from questionnaires that were sent to a selected sample of municipalities and industries, and from the files of several state and federal agencies. All other categories were estimated except power generation, which was done by questionnaires sent to each utility company. In 1975, these figures were updated for the national water-use report published by the U.S. Geological Survey.

In 1978, the Water-Use Data Collection Project was begun to make a study of water use. The project is a joint venture of the Georgia Geologic Survey and the U.S. Geological Survey, and is structured to be compatible with the U.S. Geological Survey's ongoing National Water-Use Data System. The primary objective of the Georgia project is to develop a computerized file of information on how water is being used in the State.[1] Each entry in the file will be coded by county, river basin, user type, and water source. The information generated by the Water-Use Data Collection Project will be presented in three formats:

(1) a preliminary water-use report (this publication), which discusses estimated water use for several categories of users in the State;

(2) a water-use report giving data for water use by county and other geographic divisions; and

(3) a computerized data base which can generate water-use information on request by any of the coded categories. For example, a print-out could be produced showing all municipal water-supply withdrawals in a given river basin.

An existing data base maintained by the Environmental Protection Division's Water Protection Branch already contains some of these water-use data. Additional information is being collected from the agencies shown in table 1.

[1] The initial phase of the project will not address instream uses of water such as hydroelectric power generation, navigation, and recreation.

Table 1. Sources of Water-Use Data

USE	INFORMATION SOURCE
Public Supply	Environmental Protection Division Water Protection Branch Ground Water Program Surface Water Program
Industrial, Self-supplied	Environmental Protection Division Water Protection Branch Ground Water Program Surface Water Program Industrial Waste Program Municipal Compliance & Technical Support Program Department of Industry & Trade Georgia Manufacturing Directory
Rural Livestock	U.S. Department of Commerce U.S. Census of Agriculture University of Georgia Cooperative Extension Service Georgia Department of Agriculture Georgia Crop Reporting Service
Domestic	U.S. Department of Commerce U.S. Census of Population, 1980
Irrigation	U.S. Department of Agriculture Soil Conservation Service[1] University of Georgia Cooperative Extension Service U.S. Geological Survey Water Resources Division
Power Generation	Individual utility companies Georgia Public Service Commission

[1] Under contract to the U.S. Geological Survey, the Soil Conservation Service performed an irrigation survey of 62 counties in Georgia's Coastal Plain, the High Irrigation Water-Use Zone (fig. 2). This was a field inventory involving the plotting of irrigated fields and water sources on quadrangle maps and the completion of forms for information on irrigation equipment, water sources, and the amount of water applied in 1979.

HYDROLOGIC CYCLE IN GEORGIA

Nature, through several pathways, is able to replenish its supply of water. These pathways, generally referred to as the hydrologic cycle (fig. 1), involve the cyclic movement of water: precipitation, runoff to streams and lakes, infiltration (recharge) to the ground-water regime, evaporation, and transpiration from vegetation.

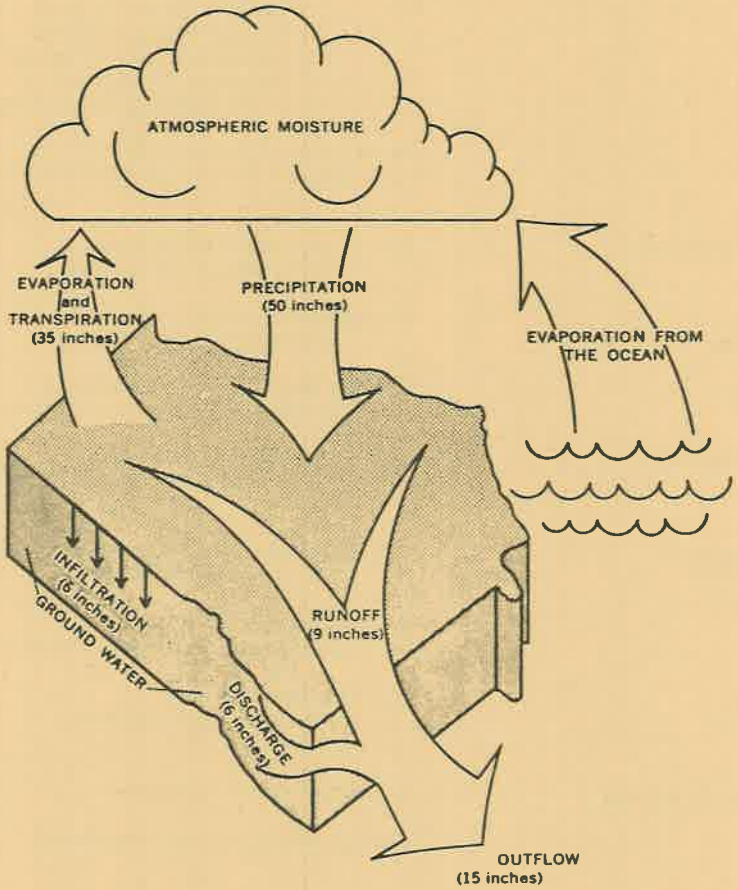


Figure 1. The hydrologic cycle in Georgia.

In Georgia, the quantity of water in the various segments of the hydrologic cycle varies significantly among the State's major physiographic provinces (fig. 2). In the Ridge and Valley province, the underlying rocks are of varying permeability so that some precipitation infiltrates while other precipitation runs off, providing a well-developed surface drainage system as well as ground-water aquifers of somewhat limited capacity. Thus, in this province water can be obtained from both surface-water and ground-water sources. In the Piedmont and Blue Ridge provinces, the underlying rocks have low permeability and can store and transmit very little water. In these two provinces, surface waters are the primary supply and ground water is limited. In the Coastal Plain, on the other hand, much of the precipitation infiltrates into the permeable sediments which lie beneath the soil, providing large reservoirs of water trapped in the pore spaces of the rocks. In this province, ground-water aquifers are the principal sources of water.

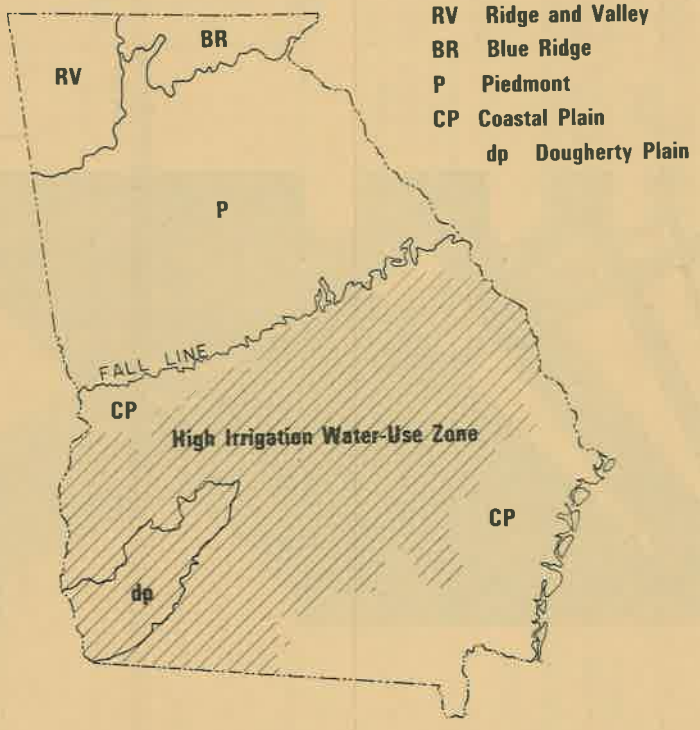
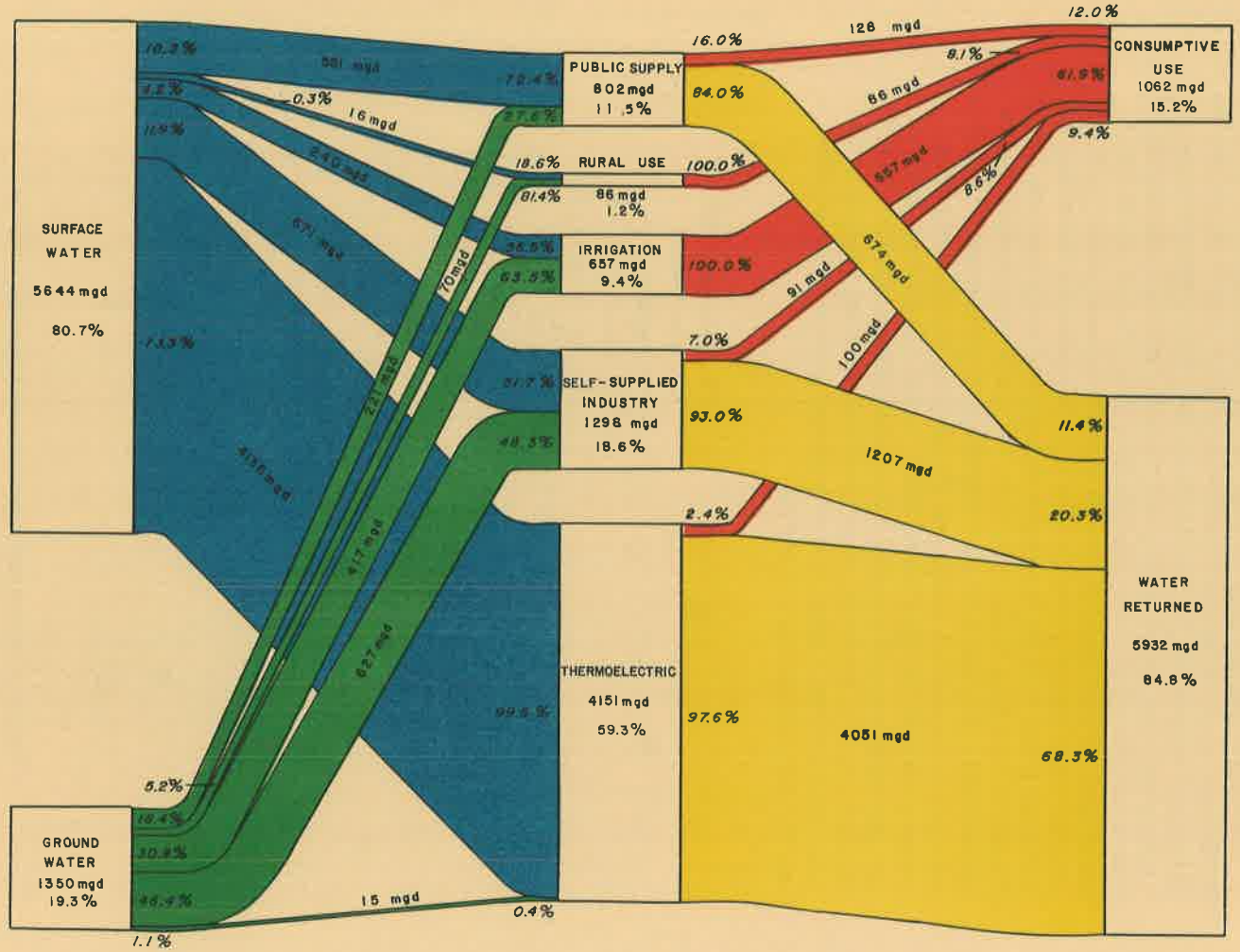


Figure 2. Physiographic provinces and the High Irrigation Water-Use Zone.


SURFACE WATER
5644 mgd
80.7%
GROUND WATER
1350 mgd
19.3%
PUBLIC SUPPLY
802 mgd
11.5%
RURAL USE
86 mgd
1.2%
IRRIGATION
657 mgd
9.4%
SELF-SUPPLIED INDUSTRY
1298 mgd
18.6%
THERMOELECTRIC
4151 mgd
59.3%
CONSUMPTIVE USE
1062 mgd
15.2%
WATER RETURNED
5932 mgd
84.8%
581 mgd
16 mgd
671 mgd
4196 mgd
70 mgd
417 mgd
627 mgd
15 mgd
126 mgd
86 mgd
657 mgd
91 mgd
674 mgd
100 mgd
1207 mgd
4051 mgd
16.0%
84.0%
100.0%
100.0%
7.0%
93.0%
2.4%
97.6%
12.0%
9.1%
61.8%
9.4%
8.6%
11.4%
20.3%
68.3%
0.4%
1.1%

Flow diagram of estimated use of water in Georgia—1980

This flow diagram summarizes the estimated water use for several categories of users, the source of this water, and how it is returned to the hydrologic cycle. For example, of the estimated 5644 mgd of surface water used, 73.3% went to thermoelectric power generation, and this amount was 99.6% of all water used in this category. Power generation accounts for an estimated 59.3% of all water used in the State—some 4151 mgd.

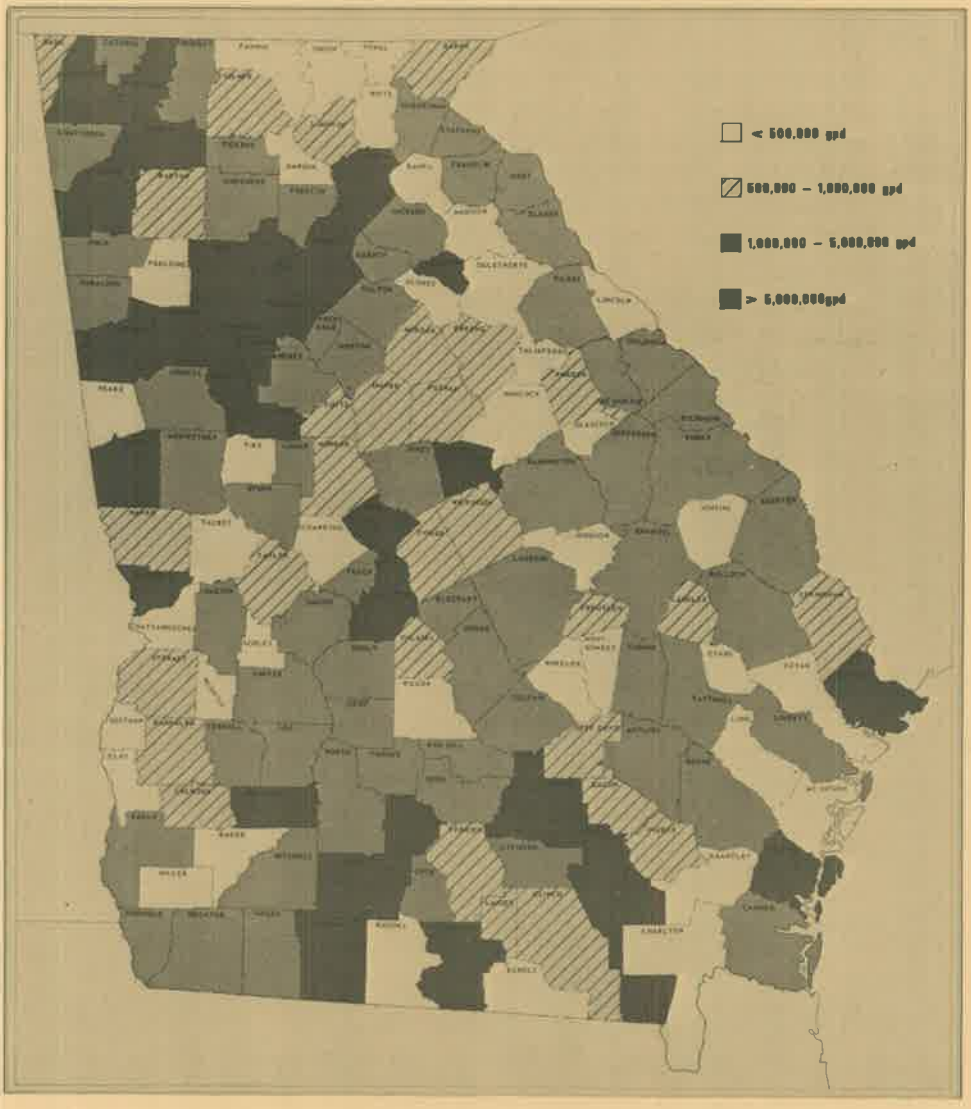


Figure 3. Public supply water use by county.

WATER USE IN THE STATE

Public supply water use for each county in the State is shown in figure 3. The map shows the concentration in the Atlanta metropolitan area of counties using more than 5 million gallons per day (mgd) of water, but also reveals a surprising amount of use in the Coastal Plain, once a predominantly rural area. Water use for public supply in Georgia has grown at a steady rate over the past 30 years concurrent with the growth in population, to reach an estimated 802 mgd in 1980 (fig. 4 and flow diagram).

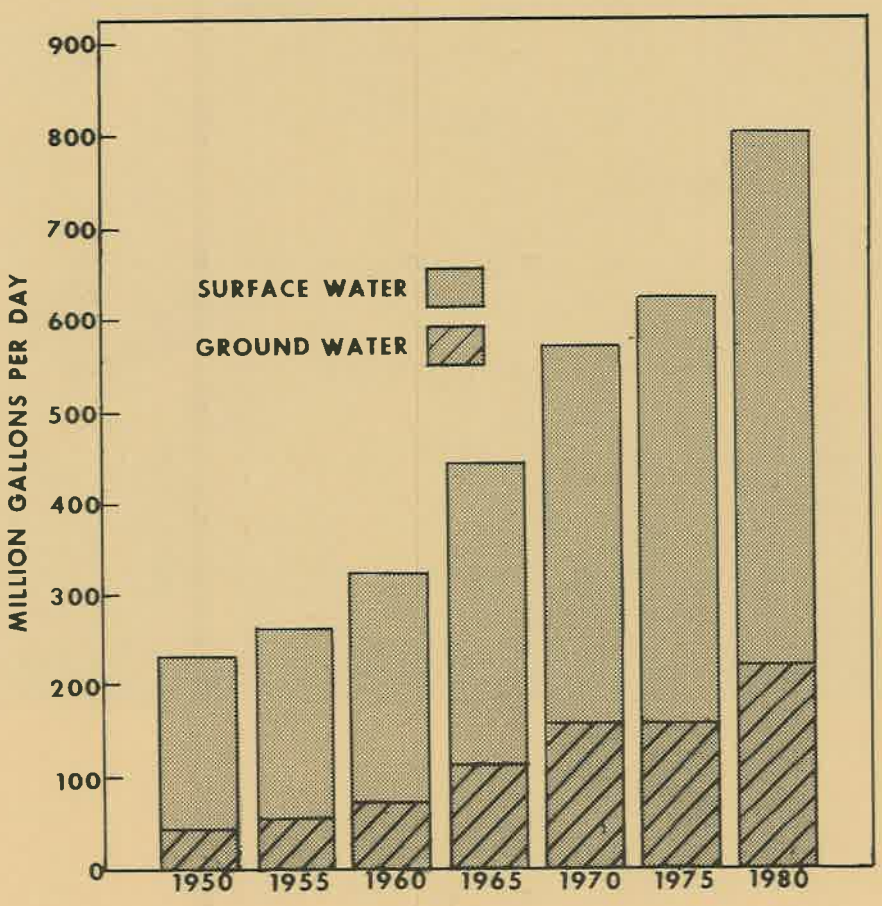


Figure 4. Water used for public supply.

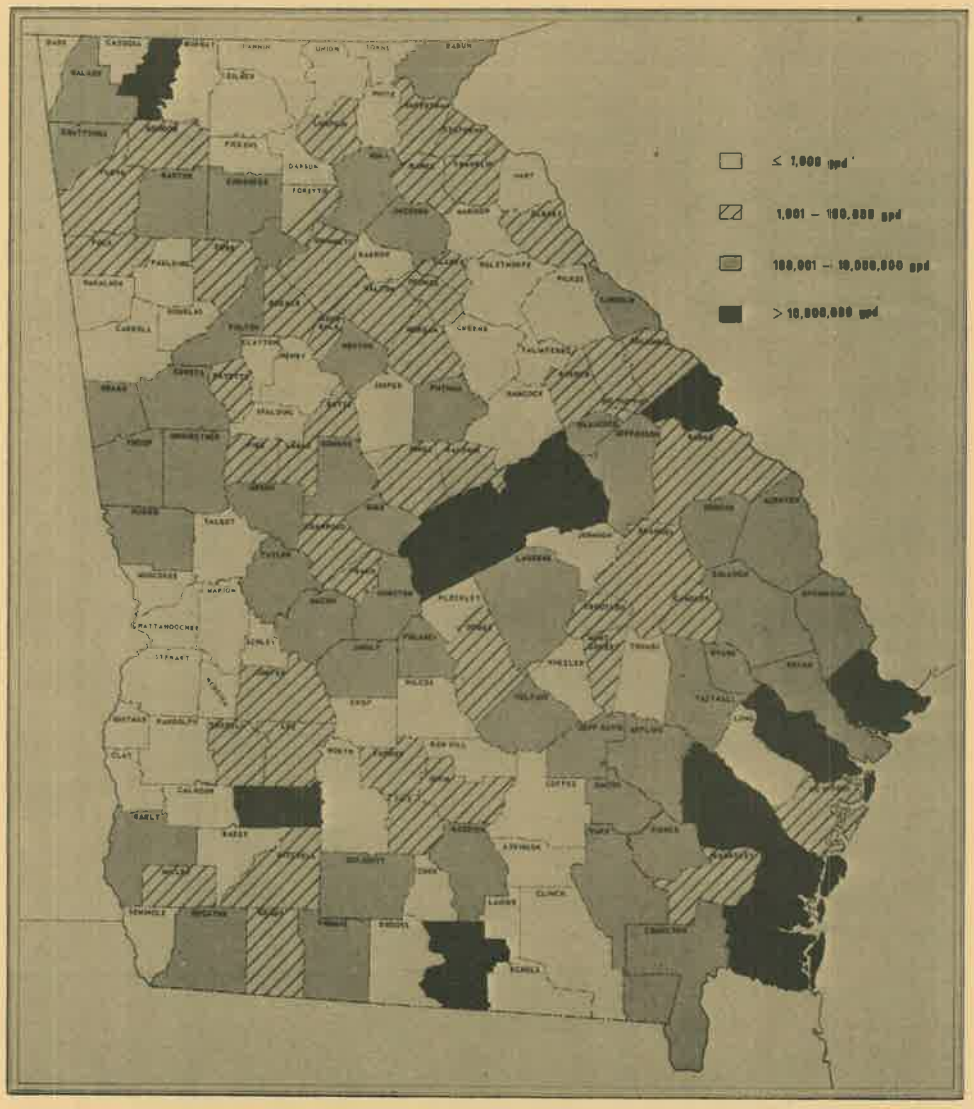


Figure 5. Industrial water use by county.

A map of industrial water use by county (fig. 5) shows the effects of the kaolin mining operations near the Fall Line (see fig. 2 for location of Fall Line), the concentration of large water-using industries on the coast, the textile mills in northwest Georgia, and the increase in industry in Dougherty and Lowndes Counties in southern Georgia. Industrial use shows a steady increase since 1950 (fig. 6) as large industries have been and continue to be attracted to Georgia in part by a readily accessible ground-water supply. Industrial use in the State is estimated to be 1,298 mgd for 1980 (see flow diagram).

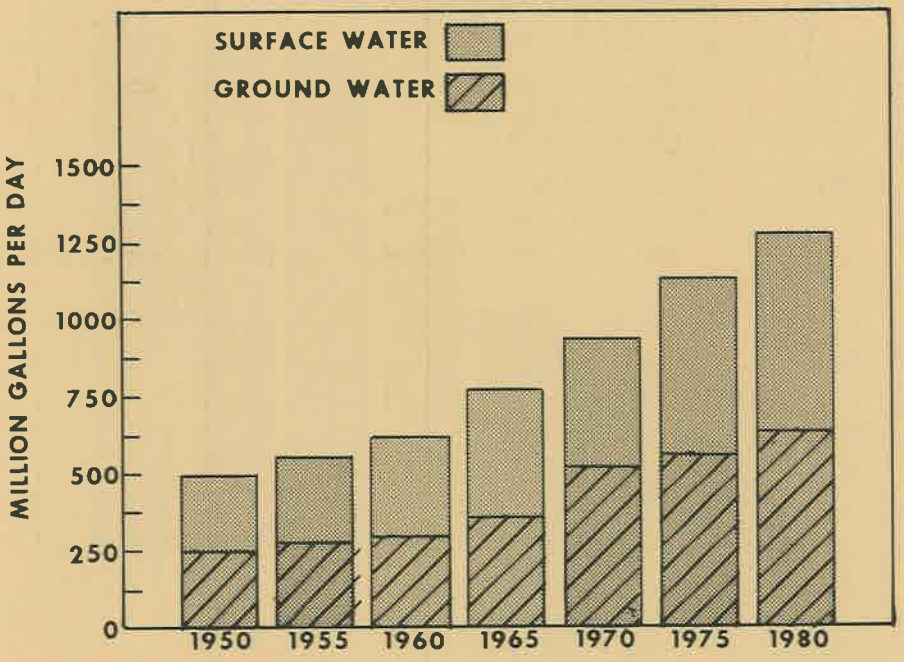


Figure 6. Industrial water use.

The users of the largest quantities of water are the utility companies, which withdraw some 4 billion gallons of water per day (see flow diagram). This water is used primarily for cooling purposes. As more than 90 percent of this water is returned (if not always to the same river basin or aquifer) with little effect on its quality, the importance of these large volumes is not as great as it might seem. Water use for power generation has not experienced any significant increase since 1970 (fig. 7), as few large power-generating facilities were added during this period and the new plants use water more efficiently than the older ones.

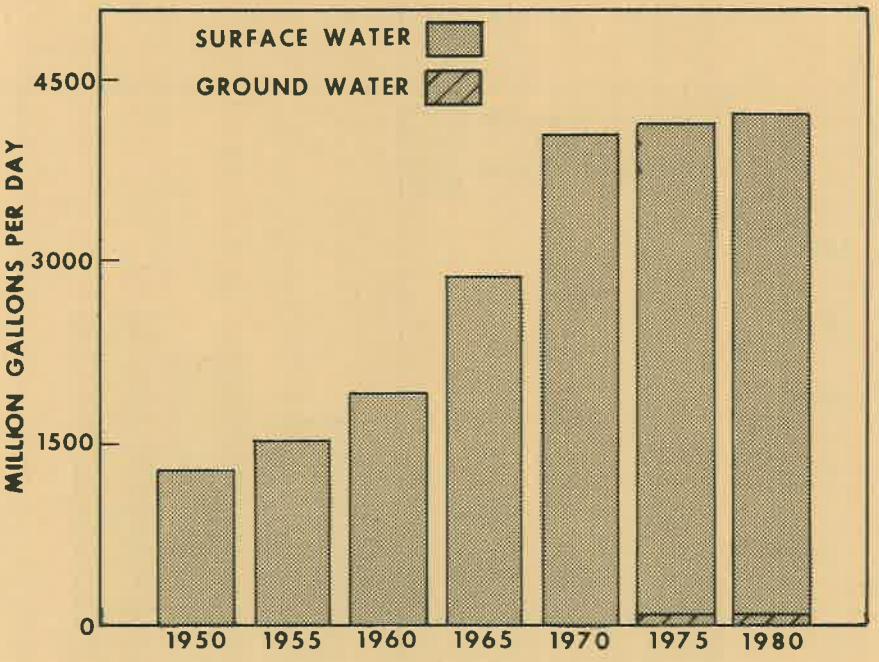


Figure 7. Water use by thermoelectric power plants.

Rural use, estimated at 86 mgd in 1980 (see flow diagram), consists of two major parts: water used for domestic purposes that is supplied by individual homeowners and the water used by livestock. The amount of water used by livestock was estimated using livestock population estimates by county, as prepared by several state and federal agencies (table 1). Domestic water use was estimated from the county populations not served by a public system, multiplied by

a per person water-use figure. Rural water use also has not experienced any significant increase (less than 5 percent) since 1970. Any gain in rural population has been offset by the expansion and addition of municipal systems to cover new areas.

Irrigation water use in Georgia has grown from almost zero in 1950 to an estimated 657 mgd in 1980 (fig. 8 and flow diagram). This growth is almost totally confined to the Coastal Plain (specifically within the High Irrigation Water-Use Zone, fig. 2), where the flatter topography and readily available water supplies have encouraged the use of irrigation. Figure 8 shows the exponential growth experienced in the quantity of water withdrawn for irrigation purposes. Farmers in south Georgia have discovered that the use of irrigation has enabled them not only to survive drought conditions, but also to produce higher crop yields in "adequate water" years with the proper application of supplemental water.

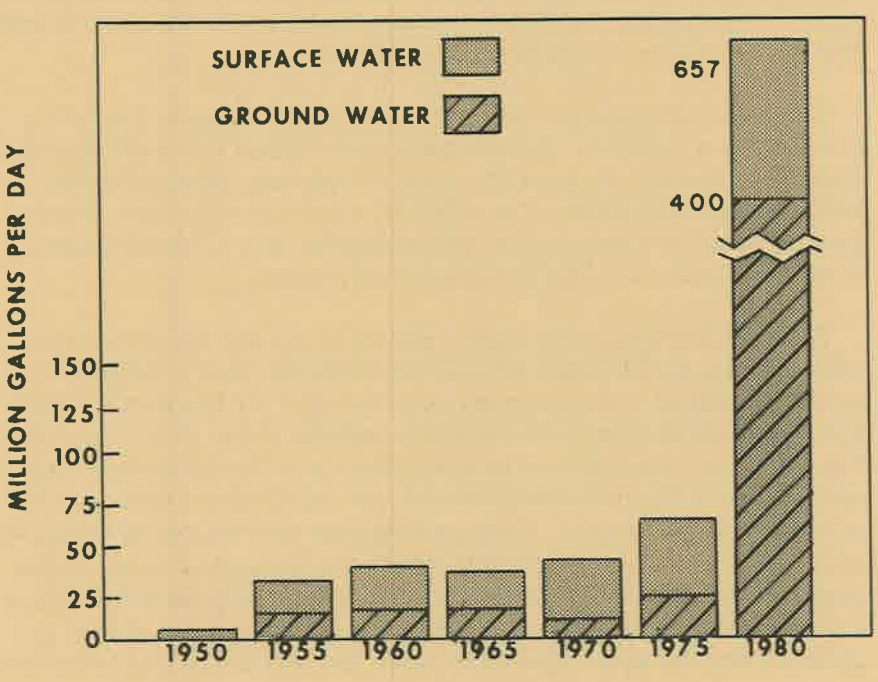


Figure 8. Irrigation water use.

WATER CONSERVATION

In the past, when more water was needed, the usual response was to increase the quantity withdrawn from lakes, streams, and aquifers. However, more water is not always the best answer to increasing water demands, especially in those cases where little additional water is available. The answer then is better management through conservation of the water already being withdrawn.

The demand for water for home use could be greatly reduced by the use of water-saving plumbing fixtures. The Georgia Legislature has enacted a bill that requires such fixtures in all new buildings and in those being remodeled when the construction involves the plumbing system. Substantial reductions in home water use could also be achieved by developing better water-use habits. Pamphlets published by several government agencies suggest such things as checking home systems for leaks, taking showers instead of baths, running dishwashers only when full, and retrofitting shower heads and toilets that use less water. If the public developed a water-conservation ethic, much water that is now wasted would be available for use.

Georgia's industries are moving toward water conservation, often as a cost-cutting measure. Manufacturers have found that water can frequently be reused, reducing the amount that they must withdraw from a fresh-water source. In addition, some industries have begun treating their own wastewater, purifying it so that it can be reused in some other phase of their manufacturing process.

The use of irrigation has grown rapidly in the last five years, and with this growth has come an increase in wasted water. Irrigation systems designed without proper consideration for topography and soil characteristics can cause extensive erosion as the water runs off. The use of soil tensiometers or other devices to determine how much water has actually penetrated the soil can reduce the chances of over- or under-applying water. Running irrigation systems during the cooler parts of the day and at night will reduce the amount of water lost to evaporation. Irrigation can produce spectacular crop increases at any time and mitigate losses in drought years, but only if the system is designed and the water applied to make the best use of this technique.

CONCLUSIONS

Information already collected indicates that greater and greater demands are being made on Georgia's most important natural resource: clean, fresh water. Increases in population, new industries, and irrigation use are requiring vast quantities of additional water. As water usage grows, the need for detailed water-use information also increases. Continuing improvements, revisions, and updates of the water-use data base will provide necessary information on water-use patterns.

The increased use of water is not uniform throughout the State, but varies widely by geographic location and type of water use. The use of water in the Coastal Plain has grown tremendously in the past decade as the area attracted more industry, with its associated population growth, and as many south Georgia farmers turned to irrigation. This rapid growth is creating competition among various water users, particularly in the Dougherty Plain District in southwest Georgia. As competition increases, better management of Georgia's water supply becomes more important; the Georgia Water-Use Data System contributes part of the basic information to aid this management effort.

Water is commonly thought of as being a renewable resource, but it is, nevertheless, limited and is very susceptible to degradation. Just as energy resources like coal and oil must be used wisely, so must water be carefully utilized to protect the water resources of the State and ensure adequate supplies for the future.

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