

A NATIONAL WATER-USE INFORMATION PROGRAM

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ABSTRACT

The U.S. Geological Survey has compiled estimates of water use every five years since 1950. These estimates have been derived from many sources, and have a wide range of accuracy. Therefore, they fall short of providing a national data base that is both current and reliable. In 1977, the Congress of the United States recognized the need for uniform information on water use and directed the U.S. Geological Survey to establish a National Water-Use Information Program to complement the Survey's data on the availability and quality of the Nation's water resources.

The National Water-Use Information Program was designed as a cooperative program between the States and the Federal Government. The goals of the program are: to collect and compile water-use data; to develop and refine computerized water-use data systems at both the State and national levels; to devise new methods and techniques to improve the collection and analysis of water-use information; and to disseminate this information to those involved in establishing water-resources policy and to those managing the resources.

The program that started in 1978 in 20 States now includes participation by 47 States. Water-Use information is being compiled for 12 categories of use. Each State will have a automated data system that contains site-specific information about the water use in each category. The National Water-Use Data System will contain information for the 12 categories of use summarized by counties and river basins within each State.

The national system will aid in defining how much fresh and saline surface water and ground water is withdrawn and for what purpose, how much water is consumed during use, and how much water is returned to a water body (stream, lake, or aquifer) after use.

INTRODUCTION

In the past, national efforts to collect and compile water-use data were carried out on an ad hoc sometimes irregular and infrequent basis by several Federal agencies and other interested organizations. However, there was not a single source for accurate, consistent, timely and accessible water-use information. The National Water-Use Information Program, designed to be that single source, began in October 1977 when the Congress appropriated funds for the Fiscal year 1978 budget. This congressional approval was in recognition of the insufficient water-use information available to assist in resolving problems that arose in some parts of the United States including competing uses for water, water shortages due to excessive withdrawals, and water shortages during the 1976-77 drought. It also was recognized by participants in the preparation of the Second National Assessment of the Nation's Water Resources, (U.S. Water Resources Council, 1978, The Nation's Water Resources - 1975-2000) that a common water use data base was as important as the need for consistency in the data. Thus the need for a standardized system of determining how much water is used, where it is used, for what purpose it is used, how much is consumed during use, and how much is returned to the source after use was recognized and the National Water-Use Information Program was implemented and funded.

The U.S. Geological Survey through its Federal-State Cooperative Program has, for many years, been routinely collecting detailed information on the quantity and quality of the Nation's surface and ground waters. Close and continuing working relationships have been established with States and local water agencies.

Also, since 1950, the Survey has published a report every 5 years on estimated use of water in the United States. Therefore, it was logical that detailed water-use information be incorporated into the U.S. Geological Survey's program to complement the data on availability and quality of the Nation's water resources. The National Water-Use Information Program became a part of the Survey's Federal-State Cooperative Program in fiscal year 1978. The relationship between the U.S. Geological Survey and the State agencies in the water-use program is shown in figure 1. As is customary for its other programs, the Geological Survey represents the national interests and the State agencies represent the State and local interests. The user and beneficiaries of this program are varied as shown in figure 1.

PROGRAM OBJECTIVES

The objective of the National Water-Use Information Program are to determine as a Nation -

- * how much fresh and saline surface and ground water is withdrawn
- * how the water is used
- * how much of the water is consumed during use
- * how much water is returned for further use

The need to compile information about changes in water quality associated with the various categories of use also is recognized as an objective. However, this effort has been postponed until additional resources are available to the program.

NATIONAL WATER-USE INFORMATION PROGRAM

A FEDERAL-STATE COOPERATIVE EFFORT TO
COLLECT, STORE, ANALYZE, AND DISSEMINATE
WATER-USE INFORMATION

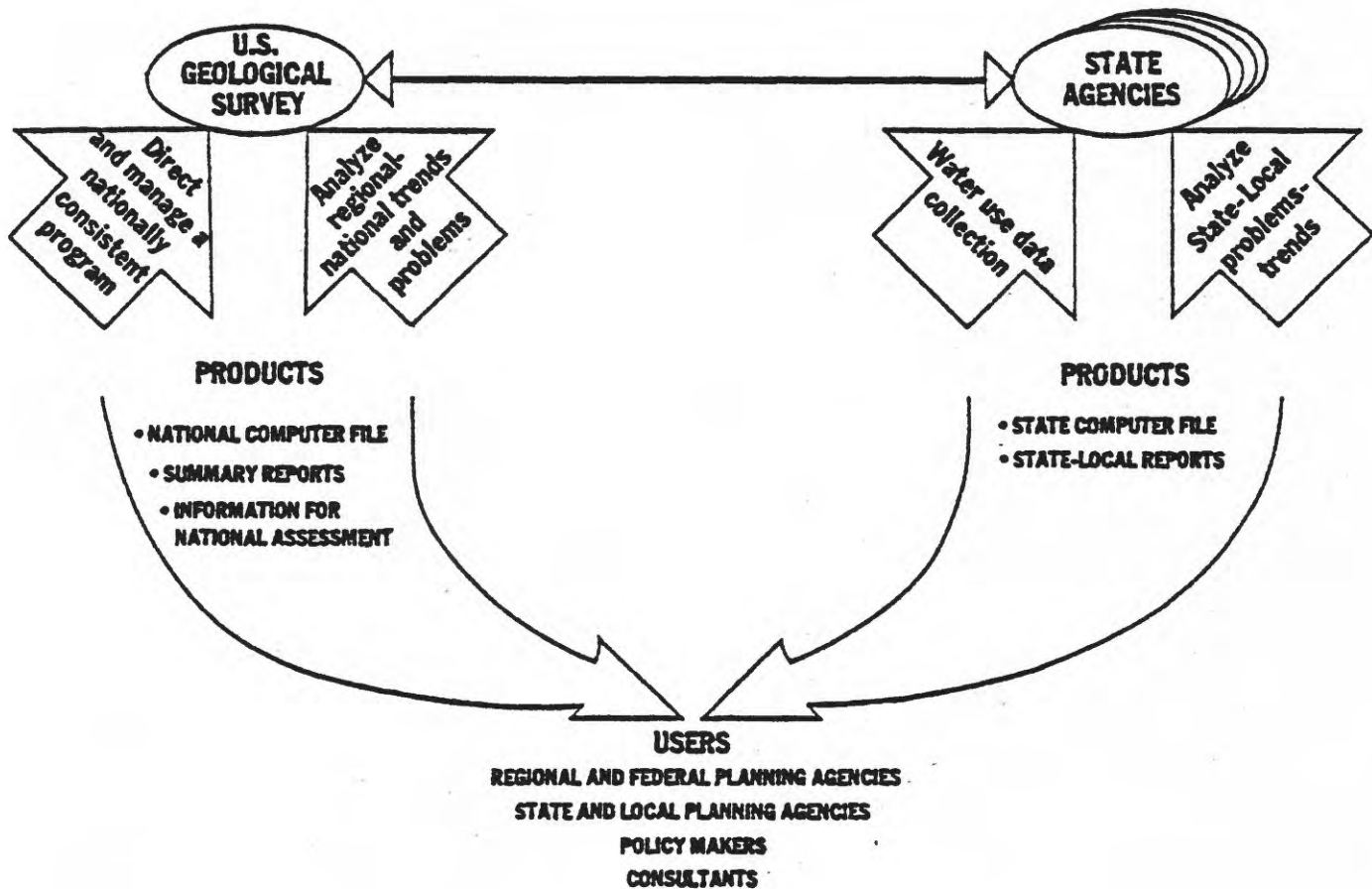


Figure 1.--Federal-State Cooperative Water-Use Information Program

In order to accurately compile water-use information, the data must be collected systematically, stored so that they are available on demand, and methods and techniques of collecting and analyzing the data need to be improved and standardized. On the basis of these needs, four specific goals were chosen for the program:

1. Collect and compile water-use data.
2. Develop a computerized data storage and retrieval system.
3. Devise new methods and techniques to improve and standardize the collection and analysis of water-use information.
4. Disseminate water-use information.

In the remainder of this paper, these four goals will be expanded upon.

COLLECTION OF WATER-USE DATA

Three types of water-use data are needed for this program: Withdrawal data, return flow data, and usage data. These data are being collected for 12 categories of use by State and local agencies and/or Geological Survey personnel. Various methods are being used to obtain the water-use data. Direct methods include personal visits to all users in a category or personal visits to a sampling of users. Indirect methods include using reported data, conducting phone or mail surveys, and estimating the water-use based on statistical methods or other estimation techniques. Each type of data and the categories of use are explained below.

Withdrawal Data

Data on withdrawals of water from both surface- and ground-water sources are the core of all water-use information. For example, the 5-year summaries of estimated water use published by the Geological Survey are based on this kind of information. However, withdrawal data are not always readily available in some States and there is little uniformity in reporting the data. Many States require water users to obtain a permit before withdrawing water from either surface- or ground-water sources. These permits may require the water user to report annually the total volume of water withdrawn but it may be necessary for different types of data to be reported to several different agencies or organizations. Other States do not require permits for withdrawals or if permits are required they do not require that the volume of water withdrawn be reported. The States that have collected water-use data have made the data available to the Geological Survey for the 5-year summary reports. The National Water-Use Information Program is attempting to strengthen and to standardize ongoing State efforts, and is helping to initiate water-use programs in those States not heretofore active.

Return-Flow Data

In contrast to requirements for water withdrawals, there are Federal and State laws that require permits before returning waste water to surface-water bodies. Some States require permits for disposal of waste on or into the ground and others are considering doing the same. When discharge permits are required, there generally is a requirement to report both the volume and quality of the discharged waste water. Existing data on volume and quality of the discharged waters are being made available to the National Water-Use Information Program. Where there is a lack of return-flow data, programs must be implemented to provide this information.

Usage Data

Information about the use of the water from the point of withdrawal to the point of return (discharge) is essential to understanding the relationship of consumptive use and losses to particular categories and types of use. If the amounts of water delivered to and released from an individual category of use or a specific user are known, improved coefficients can be derived to better estimate consumptive use by category and location of use. Usage data are vital to improving the capability to model systems and predict future demands.

Water-Use Categories

In order to classify the data being collected, we have identified 12 major categories of water use. These categories are:

Agriculture:	Power generation:	Industrial
Irrigation	Fossil fuel	Mining
Nonirrigation	Geothermal	Public supplies
Commercial	Hydroelectric	Sewage treatment
Domestic	Nuclear	

Each water user or water-using facility is assigned a 4-digit Standard Industrial Classification (SIC) code that uniquely identifies the use and enables us to aggregate similar use. As shown in figure 2, these categories are used in the data base and in the reports that are available to the information user.

It is recognized that other types of water use exist, such as navigation, preservation, quality improvement, recreation, treaties, and aquaculture, but at present the scope of the National Water-Use Information Program does not include the collection of data for these uses. This does not preclude, however, any State compiling information for these uses.

WATER-USE INFORMATION

TYPES OF WATER USE INFORMATION COLLECTED

- Agriculture
(irrigation and nonirrigation)
- Commercial
- Domestic
- Mining
- Industrial
- Power Generation
(fossil fuel, geothermal,
hydroelectric, nuclear)
- Public Supplies
- Sewage Treatment

INFORMATION USE

- Policy Formulation
- River Basin/Regional
Planning
- State Planning
- National Planning
- Economic
Development

Figure 2.--Types of Water-Use Information Collected and
Information Use

DEVELOPMENT OF COMPUTERIZED DATA STORAGE AND RETRIEVAL SYSTEM

The second goal of the National Water-Use Information Program is to develop a computerized system to store and retrieve the data. The system was designed in two components (1) the National Water-Use Data System and (2) the State Water-Use Data System. Each of these components is described below.

National Water-Use Data System

The National Water-Use Data System (NWUDS) is the computerized data storage and retrieval system designed specifically as the national-level computer file for water-use information. It became operational in July 1979. The NWUDS, a data base managed by the System 2000 data base management system, is designed to store and disseminate three types of data -- withdrawal, usage, and return flow (discharge). Because these data are meant to complement the data on water quantity and quality, the NWUDS is an integral part of the U.S. Geological Survey's National Water Data Storage and Retrieval System (WATSTORE).

The national data base was designed to minimize the costs of storage and retrieval. Four data files based on the concept of withdrawal/return (source) versus usage were created. These files are: (1) a SOURCE county/State file, (2) a SOURCE hydrologic unit/State file, (3) a USAGE county/State file, and (4) a USAGE hydrologic unit/State file.

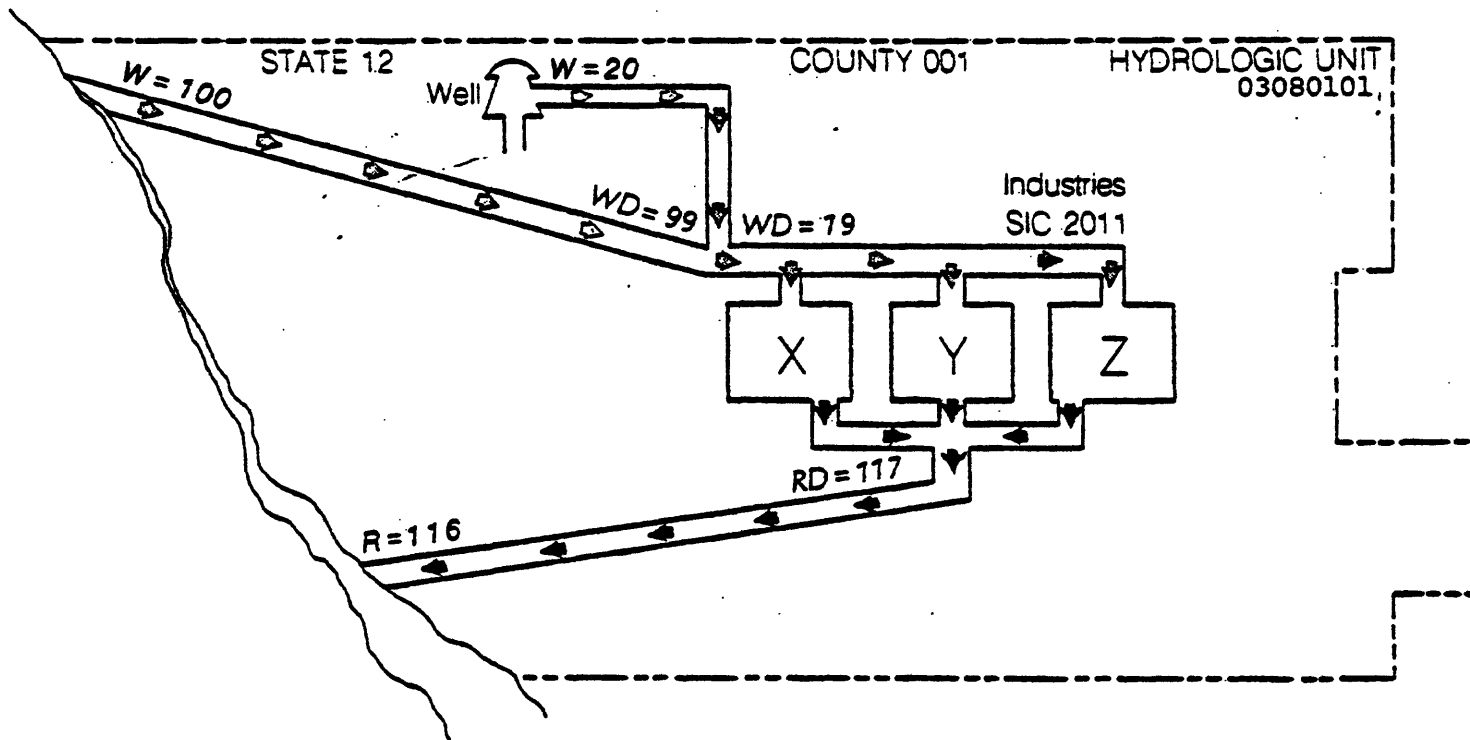
The SOURCE files contain aggregated information on the amount of water withdrawn from a surface- or ground-water source and on the amount of water returned to the source. The USAGE files contain aggregated information on how much water was received at the place of use and how much water was discharged after use. This information is aggregated in two ways -- by counties within the State and by hydrologic units within the State -- thus, the names of the files.

A simple example, shown in figure 3, will help understand the differences between the files and the concept of withdrawal/return versus usage data.

In State 12, county 001, and hydrologic unit 03080101, the combined withdrawal by industries X, Y, and Z, was 120 million gallons per day (Mgal/d) of which 100 Mgal/d was from a surface-water source and 20 Mgal/d was from a ground-water source. The combined return flow that was discharged by the industries and reached the water source was 116 Mgal/d. These data are stored in the SOURCE county/State File for county 001 and State 12 and the SOURCE hydrologic unit/State file for hydrologic unit 03080101 and State 12.

The amount of water actually received at the place of use was 99 Mgal/d from surface water and 19 Mgal/d from ground water; 2 Mgal/d was considered lost in transit, by leakage, and so on. After using the water, the industries discharged 117 Mgal/d. These data are stored in the USAGE county/State and USAGE hydrologic unit/State files. Note, that in figure 3, conveyance loss between the point of discharge and the receiving surface-water source is 1 Mgal/d.

The purpose of the SOURCE and USAGE files is to reduce the possibility of double counting of the water by separating the source (withdrawal/return) information from the usage information. As mentioned earlier, each water-using facility is



SOURCE DATA FILE	+	USAGE DATA FILE	=	WATER-USE INFORMATION
Mgal/d		Mgal/d		Mgal/d
W - Withdrawn from:		WD - Delivered to industries		Withdrawals
Surface water	100	Surface water	99	Usage
Ground water	20	Ground water	19	Return flow
R - Returned to		RD - Released from industries		Consumptive use
Surface water	116		117	Conveyance losses

Figure 3.--Aggregated water-use information derived from SOURCE and USAGE data files

assigned a 4-digit SIC code that uniquely identifies the use and enables the NWUDS to aggregate similar uses. This makes it possible for the data user who wants information about current demands for water to access the SOURCE file for withdrawal/return data, and for another data user who needs current information about water use of one or more of the 12 categories to access the USAGE file.

State Water-Use Data System

The National Water-Use Information Program is a cooperative effort between the State and Federal governments, and the common needs are considered jointly in planning and managing the program. One of the program's goals is for each State to have a State Water-Use Data System (SWUDS). Because the individual States are the source of all the water-use data and the SWUDS is the repository for these data, each State data system should meet the specific needs of that State as well as the needs of the national data system. The SWUDS also can contain other information that is meaningful to the State, but may not be needed by the NWUDS.

The State data system will contain the measurements and estimates of water use for individual users or facilities. The type of data collected and stored in the system are: name of user, location of withdrawal and return, source (ground water or surface water), annual and monthly volumes of withdrawals and returns, quality of withdrawal (fresh or saline), area irrigated by type of crop, volume of water applied by type of crop, population served by public supplies, monthly and annual power production, and monthly and annual power production capacity. The data that are to be included in the national data system are aggregated (summarized) by the State data system and transferred to the national system.

DEVISE NEW METHODS AND TECHNIQUES FOR DATA COLLECTION

The Water-Use Program is new therefore standard methods and techniques for collecting the data are just now being developed and tested. Historically, water-use information has been compiled by using mail questionnaires and personal interviews for a specific type of data. This approach is labor intensive and it cannot be used as the primary means for data acquisition in a comprehensive information program. Techniques are being developed to statistically sample for a particular water-use category within a State or water resources region. Methods also are being developed to indirectly determine current water use and to enable predicting future demands such as irrigation use and industrial use. Examples of techniques now being tested are remote sensing, which has been useful in some areas to determine the areas of irrigated lands, and the relationship between water use, consumptive use, and industrial processes. The standard methods and techniques will be documented in a chapter in the "National Handbook of Recommended Methods of Water Data Acquisition" published by Office of Water Data Coordination, U.S. Geological Survey.

DISSEMINATE WATER-USE INFORMATION

The National Water-Use Information Program will make available a broad range of water-use information designed to meet the needs of those Federal, State, and local agencies involved in managing the Nation's water resources. Figures 4 and 5 are examples of how the information can be shown.

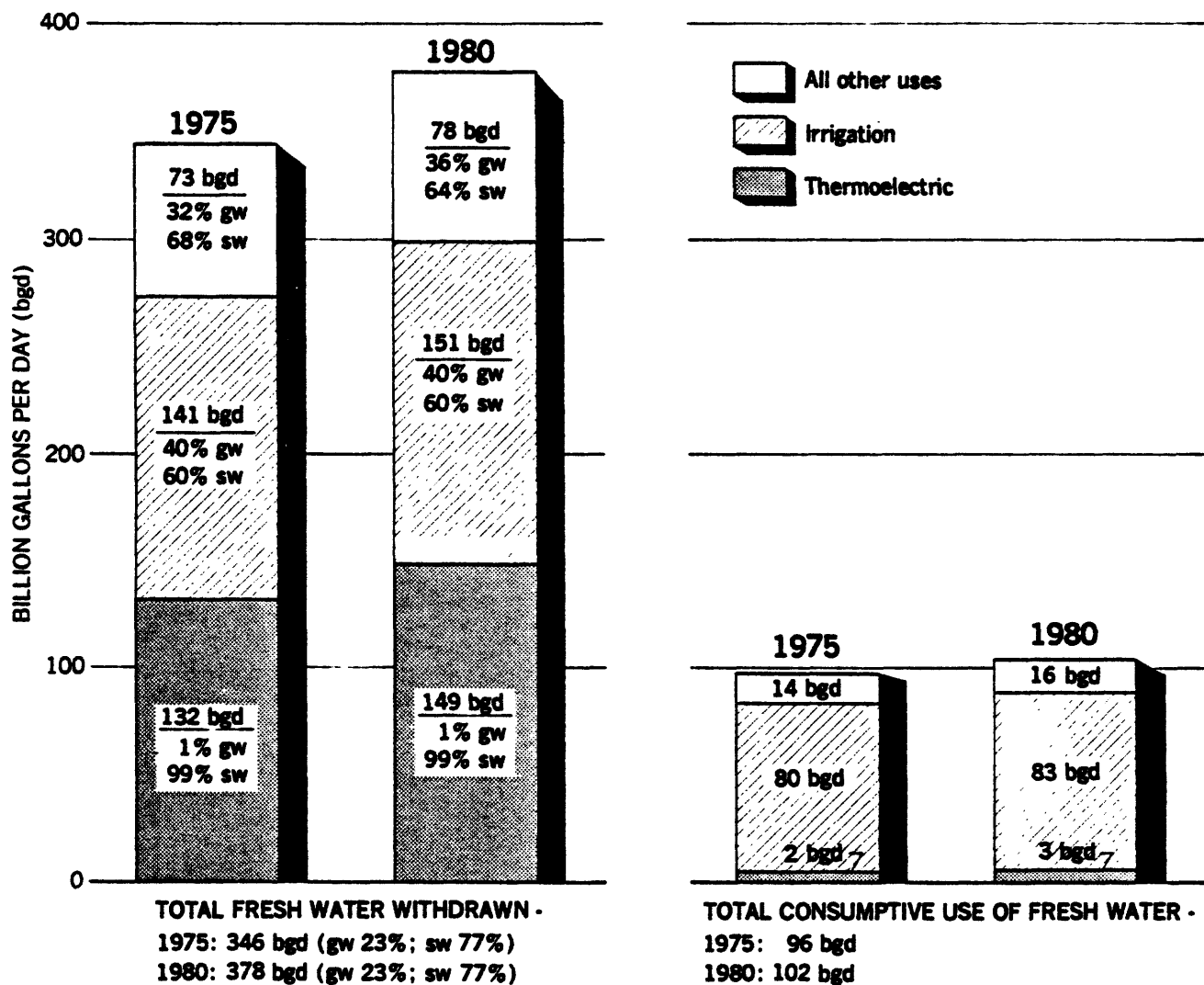


Figure 4.--Comparison of freshwater withdrawal and consumptive use for 1975 and 1980

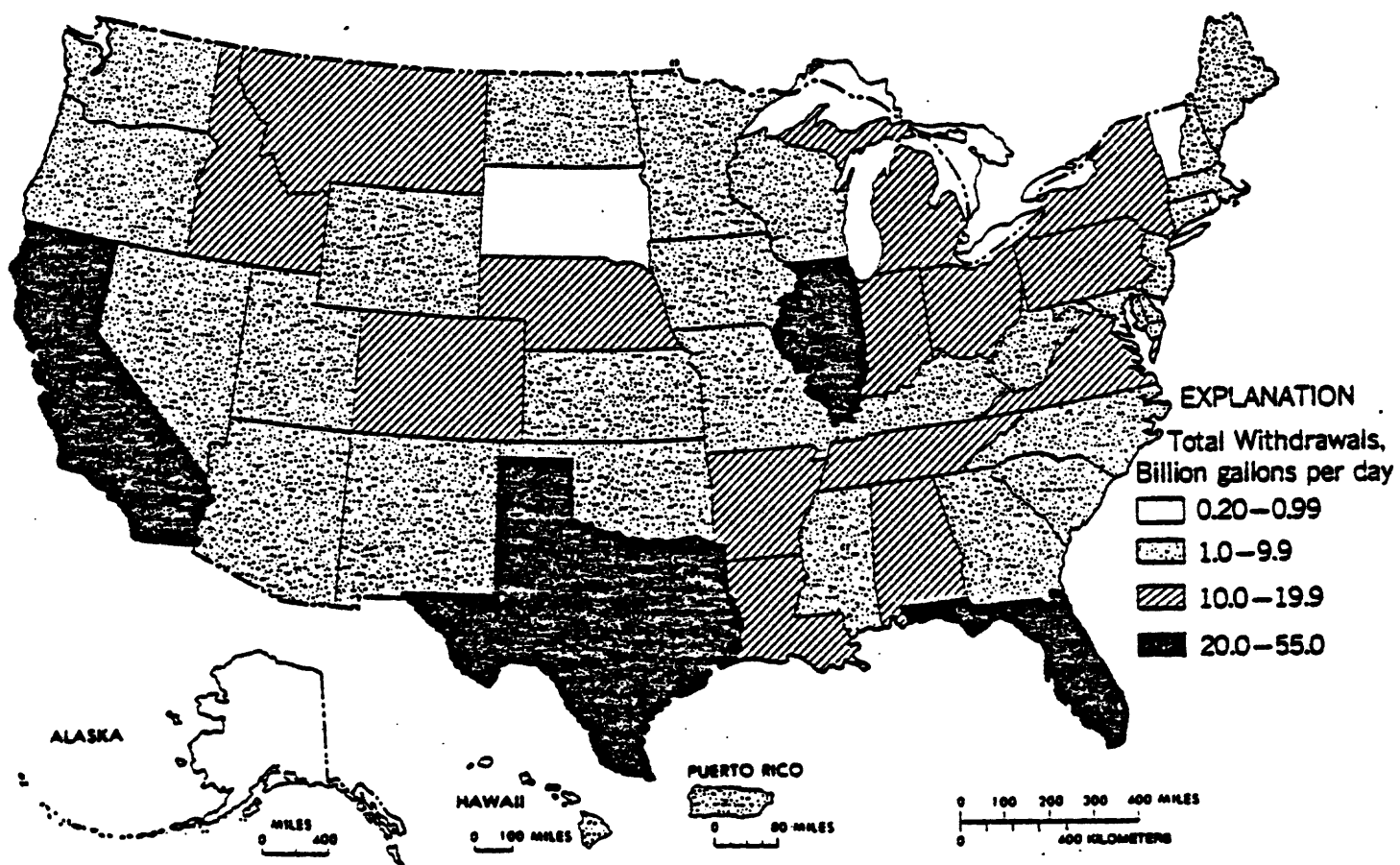


Figure 5.--Total Water Withdrawals by States in 1980

Detailed reporting of water withdrawals, return flows, and usage will be possible in all States because of the actual measurements and estimates of water use by individual users or facilities are contained in the State Water-Use Data System. Summary reports can be prepared for the Nation based on the aggregated information supplied by the States to the national data system.

Several States, including, Florida, Georgia, Michigan, Maryland, North Dakota, Utah, Arizona, and Hawaii, have prepared reports summarizing water use for all categories of use. Other States have prepared reports for one or more specific categories of use. The compilation of a national summary report, "Estimated Water Use in the United States in 1980," U.S. Geological Survey Circular was improved in content and accuracy by the availability of this program. The report will be available later this year.

The data stored in the National Water-Use Data System is available through the U.S. Geological Survey's National Water Data Storage and Retrieval System (WATSTORE). This water-use data base can be accessed by all registered users of WATSTORE and the National Water Data Exchange (NAWDEX). Users of water data not registered with one of these systems can obtain information by contacting one of the NAWDEX assistance centers. At the present time, the National Water-Use Data System does not contain a large amount of data. Individual States have entered some data to test the system. However, data are not available for all States for any one year or any one category of use.

SUMMARY

The National Water-Use Information Program was started because there is a pressing need for water-use information that can provide reliable guidance to Federal, State, and local water authorities with responsibility for water policy, planning, management, and development. The Program is designed to standardize the collection of water-use data, computerize the data for ease of storage and retrieval, and improve the methods of disseminating the information. As part of the U.S. Geological Survey's Federal-State Cooperative Program, the Water-Use Program is based on the mutual needs of the State and Federal governments. These needs are designed to be met by the State Water-Use Data System. Each State data base will contain the measurements and estimates of water use by individual users or facilities and related information to meet the specific needs of each State. The National Water-Use Data System will contain aggregated data provided by the States. Thus, site-specific information about water withdrawals, return flows, and usage of water will be available from the States (within limits of confidentiality) and aggregated information will be available for the Nation as a whole from the national data system.

The National Water-Use Information Program began in October 1977 and it is just now becoming truly national in scope. In the future, we plan to expand our information base to include data on water-quality changes associated with use of the water and, if justified by need and feasibility, to include data on other water uses such as navigation and recreation. The cooperation and assistance of the States is absolutely essential in order to develop standard methods and techniques that will result in consistent, reliable, accurate, and timely water-use information that will meet the needs for better planning and management of the Nation's water resources at both the State and national level.