



Annotated Bibliography of Water-Use Data, 1960

GEOLOGICAL SURVEY
CIRCULAR 455

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By Lois E. Randall

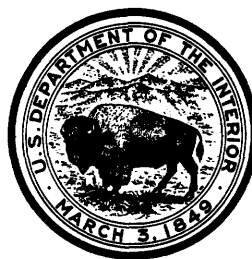


GEOLOGICAL SURVEY CIRCULAR 455

Washington
1961

United States Department of the Interior

STEWART L. UDALL, SECRETARY



Geological Survey

THOMAS B. NOLAN, DIRECTOR



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INTRODUCTION

During the last few years there has been a growing concern as to how much longer our water resources can meet adequately the growing demands for water. In evaluating the relation between dependable supply and demand, it is necessary to know as much as possible about the quantity and quality of water available by areas, how much water is being used, how and where it is used, the quality of water used, and the quality of water required by the various users. Therefore, this annotated bibliography has been prepared to aid in evaluating this relation between supply and demand.

Except for some general references at the beginning of the bibliography, the references are grouped by State and, within the State, by author. Where several reports are by the same author, the references to these reports are listed chronologically.

Many reports were intentionally omitted from this bibliography because they were not prepared in sufficient quantity to be readily available to the public, or they did not contain a significant amount of data on quantities of water used. In general, only reports published since 1955 are included.

The material for this bibliography was collected in connection with the preparation of a 1960 water-use inventory by MacKichan and Kammerer (1961).

The field offices of the Water Resources Division suggested many of the references and furnished annotations for a few of them.

BIBLIOGRAPHY

GENERAL REFERENCES

American Water Works Association, 1957, A survey of operating data for water works in 1955: *Am. Water Works Assoc. Jour.*, v. 49, no. 5, p. 555-696.

Data for 497 cities include such items as population served (retail and wholesale customers), source of supply, type of treatment, production (million gallons and gallons per capita per day), distribution, number of customers (residential, commercial, industrial, and public), monthly rates to customers, and financial analysis.

Arkansas-White-Red Basins Inter-Agency Committee, 1957, Development of water and land resources of the Arkansas-White-Red River basins: 85th Cong., 1st sess., S. Doc. 13.

Industrial and nonindustrial water-use data for Wichita, Kans., are shown for every 10 years from 1950 to 2010 on page 241. On page 539, data on the acreage irrigated for rice and other crops are given for three basins. The acreage irrigated, water requirements for rice and other crops, and the source of water, are given on pages 953, 984, and 985 for a number of water systems. For some projects the text provides data on water use.

Bohanan, Luther B., 1958, Irrigation use of water: *Am. Water Works Assoc. Jour.*, v. 50, no. 3, p. 310-314, 5 tables.

For Westernport, Md., includes data on evapotranspiration rates and amount of water required for irrigation.

For the United States and for 28 humid States, report includes data on acreage irrigated, 1949 and 1954; rate of increase in irrigation, 1949-54; and estimates of acreage, 1960-2000.

Hanson, Ross, and Hudson, H. E., Jr., 1956, Trends in residential water use: Am. Water Works Assoc. Jour., v. 48, no. 11, p. 1347-1358.

Discusses the question of how much the number of households varies with population and water use per capita versus per household. The authors use Illinois and certain towns in Illinois as examples.

MacKichan, K. A., and Kammerer, J. C., 1961, Estimated use of water in the United States, 1960:

Withdrawal and consumption of water are reported in five broad categories—public supplies, self-supplied rural, self-supplied industrial, irrigation, and waterpower. The quantity used in each of the 50 States, Puerto Rico, the Virgin Islands, and 21 regions is reported. The water is classified as fresh or saline and by source.

Meyers, J. Stuart, 1961, Evaporation from the 17 Western States, with a section on Evaporation rates, by Tor J. Nordenson: U.S. Geol. Survey Prof. Paper 272-D, 76 p., 6 figs., 9 tables.

An estimate of the amounts of water evaporated annually from the reservoirs, lakes, ponds, streams, and enclosed coastal bays in the 17 Western States.

New England-New York Inter-Agency Committee, 1957, The resources of the New England-New York region: U.S. 85th Cong., 1st sess., S. Doc. 14, p. 9-429, 86 pls., 84 tables.

Gives use of water for region by type of use, such as public supply, domestic, industrial, rural, irrigation, reuse, and salt-water. Data on use of fresh water, surface water, and ground water.

Picton, Walter L., 1956, Water use in the United States, 1900-1975: U.S. Dept. Commerce, Business and Defense Services Administration, Business Service Bull. 136, 6 p.

Daily average water use in the United States, by years, for irrigation, public water supplies, and self-supplied water. The self-supplied uses include domestic, industrial and miscellaneous, and steam electric power.

—1960, Water use in the United States, 1900-1980: U.S. Dept. Commerce, Business and Defense Services Administration, 6 p.

Tabular data include estimated water use in the United States by years and by source for irrigation, public supplies, and self-supplied rural domestic, industrial and miscellaneous, and steam electric utilities. Table 2 gives total water intake, fresh-water intake, and consumption.

Seidel, Harris F., and Carpenter, John M., 1958, Relationships of temperature and air-conditioning water use: Am. Water Works Assoc. Jour., v. 50, no. 2, p. 226-232, 2 figs., 5 tables.

Data include metered water use of 10 representative air-conditioning installations at Ames, Iowa, by months, 1951-56, during the season, in cubic feet and percent of averages; summary of temperature data, in degree days; comparison, by months, 1953, for 2 installations, of air-conditioning water use and temperature; comparison, in percent, of total by months and years of air-conditioning water use and temperature.

U.S. Bureau of Reclamation, 1959, Statistical appendix to crop report and related data: 185 p.

The related data section of the report shows, by region, project, and State for the Western States (1) the number of municipal, industrial, and other nonirrigation users; (2) the total water delivered (acre-feet) for these uses; and (3) the total water delivered for irrigation of crops.

U.S. Bureau of the Census, 1960, U.S. Census of Manufactures: 1954; Industrial water use supplement: U.S. Bur. Census Bull. MC-209 (Supp.), 51 p.

Includes water-use data by regions, States, and industry group for manufacturing by type of industrial use, by kind and

source of water, and by utility steam-generating plants. Gives quantity of water used in the metal mining, coal mining, and non-metallic minerals by industries and regions, and quantity of water used in the crude petroleum and natural gas, natural gas liquids, and oil and gas field contract services industries, by kind and source of water and by regions.

U.S. Federal Power Commission, 1957, Water requirements of utility steam electric generating plants—1954: Report FPC-DC-57.

Data by State and region includes kind of water (fresh or brackish and total intake), source of supply (public system, self-supplied surface or ground water), and recirculation.

U.S. Public Health Service, 1956, Municipal water facilities, communities of 25,000 population and over, continental United States, as of December 31, 1955: 153 p.

Includes, by community or district, the estimated population served, source of supply, plant output (average and maximum month, day, and hour), average output for domestic, commercial, industrial, and public and other use.

—1957, Municipal water facilities, communities of 25,000 population and over, continental United States and territorial possessions, as of December 31, 1956: 163 p.

Includes, by community or district, the estimated population served, source of supply, plant output (average and maximum month, day, and hour), average output for domestic, commercial, industrial, and public and other use.

U.S. Public Health Service, 1958, 1957 inventory of municipal and industrial waste facilities: Public Health Service Pub. 622, v. 1-9.

Tabulation includes, by community, district, institution, or industry, estimated population served and average daily flow.

—1959, Municipal water facilities, communities of 25,000 population and over, continental United States and territorial possessions, as of January 1, 1958: Public Health Service Pub. 661, 83 p.

Includes, by community or district, estimated population served, source of water supply, plant output (average and maximum month, day, and hour), average output for domestic, commercial, industrial, and public and other uses.

—1960, Municipal water facilities, communities of 25,000 population and over, United States and possessions, as of January 1, 1960: Public Health Service Pub. 661 (1960 ed.), 91 p.

Includes, by community or district, estimated population served, source of supply, plant output (average and maximum month, day, and hour), average output for domestic, commercial, industrial, and public and other use.

—1960-61, Municipal water facilities inventory as of January 1, 1958: U.S. Public Health Service Pub. 775, v. 1-9.

Tabulation includes, by community, estimated population served, source of supply, and average plant output.

U.S. Senate, Select Committee on National Water Resources, 1959, Water resources activities in the United States: U.S. 86th Cong., 1st sess., Comm. print 1, 59 p.

Includes for United States withdrawals of fresh and saline water by source: consumptive and nonconsumptive use for irrigation and industrial and public supplies; water demand for 1950, 1960, 1970, and 1980; uses of industrial water, fresh and saline; regional use; water requirements for a number of crops and industries; use for electric power; major water problems. Charts and text.

U.S. Senate, Select Committee on National Water Resources, 1959, National water resources and problems: U.S. 86th Cong., 2d sess., Comm. print 3, 42 p., 43 figs., 13 tables.

Includes many of the same charts as Committee print 1. Tabular data includes, by regions, present use and supply of surface and ground water available. Includes storage required to produce dependable flows and water supply for selected metropolitan areas.

U.S. Senate Select Committee on National Water Resources, 1960, Future water requirements for municipal use: U.S. 86th Cong., 2d sess., Comm. print 7, 24 p., 7 tables.

Includes projected total and per capita water use from municipal systems by regions and for selected metropolitan areas.

____1960, Future water requirements of principal water-using industries: U.S. 86th Cong., 2d sess., Comm. print 8, 101 p., 8 figs., tables.

Data include national and regional water use, 1954, 1959, 1980, 2000, for the following industry groups: Iron and steel, chemicals and allied products, pulp and paper, food and beverage, primary aluminum, primary copper, metals and nonmetals, crude petroleum and natural gas (1954 and 1980), petroleum refining (1954, 1980, and 2000), natural gas-liquid plants (1954, 1980), Pennsylvania anthracite (1954, 1980, and 2000), bituminous coal and lignite (1954, 1980).

____1960, Electric power in relation to the Nation's water resources: U.S. 86th Cong., 2d sess., Comm. print 10, 86 p., 22 tables.

Includes water requirements (1980) by regions for steam and hydroelectric power; total water circulated through condensers (1959, 1970, 1980) for rivers, lakes, brackish and sea water, cooling towers, artificial reservoirs or ponds; cooling water circulated in thermal plants (1959, 1970, 1980).

____1960, Estimated water requirements for agricultural purposes and their effects on water supplies: U.S. 86th Cong., 2d sess., Comm. print 13, 34 p., 13 figs., 14 tables.

Includes, by regions, the increase in acres irrigated from 1957 to 1980, 2000; estimated annual water requirements for irrigation, 1957, 1980, 2000; estimated effect of agricultural programs on annual onsite and downstream water supply, 1980 and 2000.

U.S. Senate, Select Committee on National Water Resources, 1960, Water supply and demand: U.S. 86th Cong., 2d sess., Comm. print 32, 131 p., 6 maps, 7 figs., 56 tables.

Data include, by regions, for years 1954, 1980, 2000 withdrawal uses and losses for agriculture, mining, manufacturing, steam-electric power, and municipalities; present supply available; storage required to produce selected dependable flows; distribution of required flow by uses; ratio of maximum obtainable supply to minimum flow requirements.

Woodward, D. R., 1957, Availability of water in the United States with special reference to industrial needs by 1980: Washington, Indus. Coll. Armed Forces, 74 p., 11 figs., 8 tables.

Data include, by industry, the typical water use and minimum requirements; by region, gross use for domestic, industrial, and agricultural needs, estimated consumption, and population served by public systems, 1955 and 1980; and relationship between supply and demand for 1955 and estimates for 1980.

ALABAMA

Alabama State Department of Public Health, 1956, Public water supplies on record: 13 p.

Tables give name of municipality, county, population, population served, plant capacity, daily usage, source of water, and other data.

____1960, Public water supplies on record: 16 p.

A table that includes name of supply, plant capacity, daily usage, and source of water.

ALASKA

Bielman, K. D., 1961, Water demands in southeastern Alaska: Alaska Sci. Conf., 11th, Anchorage 1960, Proc.

Summary of water system information includes, for several cities, the following items: Population served, average annual demand, average annual per capita demand, and estimated industrial demand as a percent of total demand. Chart shows average monthly per capita water demands for four cities in southeastern Alaska.

ARKANSAS

Arkansas Oil and Gas Commission, 1959, Factual data, Engineer's report of oil and gas reservoirs, 1959: Eldorado, Ark. 115 p.

By years through 1958 and by months for 1959, gives, in barrels, data on water produced and injected at the various oil-well field.

Arkansas University, 1956, Industrial and domestic use of water in Arkansas: Little Rock, Ark., Arkansas Univ., Coll. Business Administration, Indus. Research and Ext. Center.

Includes data on industrial use of water, by industry, from municipal systems and from privately owned sources, for 1955 (with some 1960 and 1965 estimates). Also includes domestic use of water, by municipal supplies, for 1955 and gives 1960 and 1965 estimates.

Arkansas Water Pollution Control Commission, 1960, Summary report, Sources of pollution in Upper Red River basin and Lower Red River basin—Part II: 37 p., 3 figs., 17 tables.

Gives data on water consumption for some places in the basin.

Wood, Noel H., 1957, Water use in Arkansas: Arkansas Univ., Coll. Business Administration, Indus. Research and Ext. Center, 17 p., 5 tables.

Gives data on industrial use of water by product requirements; by industry group in 1957; by source (ground or surface, municipal or privately owned) for 1957; estimates by industry group for 1975.

_____, 1959, Arkansas water resources: Arkansas Univ. Coll. Business Administration, Indus. Research and Ext. Center, 180 p., 18 figs., 75 tables.

Data include industrial water use by industry and source; domestic and municipal use, total and per capita; agricultural use (irrigation, livestock, and other). Tables give use for cooling and consumptive use.

CALIFORNIA

Bookman, Max, 1957, Urban water requirements in California: Am. Water Works Jour., v. 49, no. 8, p. 1053–1059.

Discusses population growth, population centers, urban requirements, requirements by various land uses, metropolitan area requirements for Los Angeles and San Diego areas, and future urban needs.

California Water Resources Board, 1955, Water utilization and requirements of California: California Water Resources Board Bull. 2, v. 1, 227 p., 34 figs., 181 tables; v. 2, 358 p., 19 pls., 45 tables.

Presents results of a comprehensive analysis of present and probable ultimate use of water in California for irrigation and for agricultural, domestic, industrial, and other purposes. Contains estimates of the gross water requirements. Includes unit values, consumptive use, and consumptive and nonconsumptive requirements for regions as well as for State.

COLORADO

Board of Water Commissioners, City and County of Denver, 1959, Annual report of the Board of Water Commissioners for year ending December 31, 1959: Denver, Colo., 46 p.

Statistical report on the water-supply system of the city and county of Denver. Includes population served, source of supply, water-treatment facilities, transmission and distribution systems, and consumption.

CONNECTICUT

Connecticut Water Resources Commission, 1957, Water resources of Connecticut, a report to the General Assembly: Hartford, Conn., 200 p., 10 figs., 28 tables.

Factual data and extensive discussions of present and future use and consumption of public water supplies, private supplies,

industrial (by type), agricultural (irrigation, and other), recreational, and power.

DELAWARE

Smith, J. Gordon, Haber, Richard A., Kaplovsky, A. Joel, and Simpson, Chauncey O., 1960, Intrastate water resources survey, 1959: Delaware members of the Delaware Basin Survey Coordinating Committee, Dover, Delaware, 432 p.

Data on water use, by counties and cities in Delaware, include public water supplies, rural domestic, pollution, source of water, industrial by industry, irrigation, and aquifer recharge. Estimates for 2010 and 2060.

U.S. Senate, Select Committee on National Water Resources, 1960, Water resources activities in the United States, Views and comments of the States: U.S. 86th Cong., 2d sess., Comm. Print 6, p. 31-38, 12 tables.

Tables list use of ground and surface water in Delaware for industrial, rural, domestic, and public needs and for irrigation, by county 1957. Some forecasts for 1980, 2010, and 2060.

FLORIDA

U.S. Senate, Select Committee on National Water Resources, 1960, Water resources activities in the United States, Views and comments of the States: U.S. 86th Cong., 2d sess., Comm. Print 6, p. 39-45, 3 tables.

Gives data on water use in Florida for municipal, rural, and direct industrial needs, and for irrigation, for 1956, and estimates for 1970.

GEORGIA

Thomson, M. T., Herrick, S. M., Brown, Eugene, and others, 1956, The availability and use of water in Georgia: Georgia Dept. Mines, Mining and Geol. Bull. 65, 316 p.

Includes average per capita water use in 1955, irrigation, waterpower, combined municipal, rural and industrial; urban use by

city, source of water, average and maximum use (million gallons per day and per capita) for 1955 and 1970 percent increase; industrial requirements by industry and gallons per unit; cooling water use at steam generating plants; water use for hydroelectric power; irrigation use in 1954; and data on quality of water.

HAWAII

Hawaii Water Authority, 1959, Water resources in Hawaii: 148 p., 60 figs, 9 tables.

Part 2 discusses water utilization including present use and trends in use, surface- and ground-water development, and conservation measures. Part 4 considers the water problem areas by islands. Table 9 gives water-use data by island and total for each year, 1953-57, distributor of water, type of use (domestic, irrigation, livestock, industrial, and other), and source (ground, surface).

U.S. Senate, Select Committee on National Water Resources, 1960, Water resources activities in the United States, Views and comments of the States: U.S. 86th Cong., 2d sess., Comm. Print 6, p. 48-54, 2 tables.

Gives data on amount of water used in Hawaii in 1957 by island, by distributor (Federal, city and county, State, and private), by source of water, for domestic (including municipal and military), irrigation, livestock, industrial, and other.

ILLINOIS

Davis, Velmar W., 1958, Nature and extent of irrigation in Illinois: Illinois Univ., Coll. Agriculture, Dept. Agr. Economics, AERR-24, 22 p., 2 figs, 11 tables.

Includes tabulations of acreage irrigated by crop, source of water used, and method of irrigation.

_____, 1960, Irrigation in Illinois, 1954 to 1958: Illinois Univ., Coll. Agriculture, Dept. Agr. Economics, AERR-33, 26 p., 3 figs., 13 tables.

Tabulations of acres irrigated by year by crop, type of soil, source of water, method of irrigation, and amount of water used.

Davis, V. W., and Jansen, E. F., Jr., 1960, Irrigation of field crops in Illinois, 1959: Illinois Univ., Coll. Agriculture, Dept. Agr. Economics, AERR-38, 6 p., 1 fig., 4 tables.

Tabulations of acres irrigated by soil texture, by crop, by years, and the water used per acre per irrigation.

Illinois Department of Public Health, 1955, Data on public water supplies in incorporated municipalities: 29 p.

Introductory page is a summary table. The rest of the publication is a table giving, by municipality, data that include source of water, population, treatment of water, and storage and pumpage, in million gallons per day.

_____, 1960, Data on public water supplies in incorporated municipalities, Addendum no. 1: 4 p.

Data on municipalities that have new public supply systems and are not included in the 1955 edition.

Illinois State Geological Survey, 1960, Petroleum industry in Illinois, 1959: Illinois Geol. Survey Bull. 88, 127 p., 1 pl., 5 figs., 17 tables. Published annually.

Plate 2.—Waterflood operations—gives data on water recharge of petroleum wells by wells and in thousands of barrels.

Roberts, W. J., 1960, Industrial water use in Illinois: Am. Power Conf. Proc., v. 22, p. 814-820, 4 tables.

Includes industrial water pumpage per day by source, by city area; surface-water private industrial pumpage per day by stream for steam electric power, manufacturing and processing, and total; daily pumpage of steam electric and public hydroelectric plants by water source.

Suter, Max, Bergstrom, R. E., Smith, H. F., Emrich, G. H., Walton, W. C., and Larson, T. E., 1959, Preliminary report on ground-water resources of the Chicago region, Illinois: State Water Survey and State Geol.

Survey, Cooperative Ground-Water Rept. 1, 89 p., 50 figs., 26 tables.

Tables 5-13 include data, by counties, and by aquifers on total municipal, institutional, industrial, rural nonirrigation, and farm irrigation pumpage.

INDIANA

Indiana Recovery Committee, 1957, Summary of secondary recovery operations in Indiana to January 1957: 11 p., 4 figs., tabulation.

Tabulation includes water injection and production, in barrels, for each of 82 oil wells.

Indiana State Board of Health, 1960, data on Indiana public water supplies: Bull. S.E. 10, 92 p.

For each public supply system gives population, source of water, rated capacity, average consumption, finished water storage, and other data.

Indiana Water Resources Study Committee, 1956, Indiana water resources: 44 p., 13 figs., 2 tables.

A section on water use and consumption gives data on population growth, source of water, domestic use (including municipal), rural farm and nonfarm use, industrial uses, irrigation, electric power, and miscellaneous uses. Estimates for 1975 are given.

IOWA

Iowa Natural Resources Council, An inventory of water resources and water problems: Des Moines, Iowa.

Bull. 1, 1953, Des Moines River basin: 64 p., 9 pls., 15 figs., 19 tables, 4 appendixes, bibliography.

Bull. 2, 1955, Nishnabotna River basin: 61 p., 10 pls., 15 figs., 17 tables, 3 appendixes, bibliography.

Bull. 3, 1955, Iowa-Cedar River basin: 94 p., 15 pls., 26 figs., 28 tables, 8 appendixes, bibliography.

Bull. 4, 1956, Floyd-Big Sioux River basins: 56 p., 11 pls., 15 figs., 15 tables, 3 appendixes, bibliography.

Bull. 5, 1957, Skunk River basin: 66 p., 13 pls., 13 figs., 25 tables, 5 appendixes, bibliography.

Bull. 6, Southern Iowa river basins: 70 p., 15 pls., 19 figs., 27 tables, 4 appendixes, bibliography.

Bull. 7, Northeastern Iowa river basins: 74 p., 18 pls., 17 figs., 24 tables, 5 appendixes, bibliography.

Bull. 8, Western Iowa river basins: 86 p., 18 pls., 19 figs., 26 tables, 4 appendixes, bibliography.

Each bulletin has an appendix on municipal water-supply data by city, giving population, source of water and quantity; Bulls. 1-4 give data for electric power companies with estimates of water requirements; Bull. 4 has a table on industrial uses of water; Bull. 6 has tables on rural use of water. All bulletins have a text section on water use.

KANSAS

Foley, F. C., Smrha, R. V., and Metzler, Dwight, 1955, Water in Kansas: Report to the 1955 State Legislature, 217 p., 53 figs., 33 tables.

Chapter on "Water use today and tomorrow" includes data on municipal, industrial, irrigation, agricultural, domestic, recreation, hydroelectric power water use, and on waste disposal. Tables show considerable breakdown of items.

Kansas Government Journal, 1960, Municipal utility business is big business in Kansas: Topeka, Kans., The League of Kansas Municipalities, v. 46, no. 5, p. 236-267.

Tabulation shows, by city and town, 1959 data on population, gallons of water pumped (annual and daily average) and sold, pumping and rated capacity, reservoir capacity, percent of water sold to domestic, commercial, industrial, and public (including schools).

Kansas Water Resources Board, 1958-60, State water plan studies—Part A, Preliminary

appraisal of Kansas water problems: Topeka, Kans.

Sec. 1. Marais des Cygnes Unit, 189 p., 37 figs., 22 tables, 12 appendixes.

Sec. 2. Cimarron Unit, 124 p., 5 pls., 32 figs., 15 tables, 5 appendixes.

Sec. 3. Kansas Unit, 193 p., 6 pls., 33 figs., 34 tables, 7 appendixes.

Sec. 4. Lower Arkansas Unit, 177 p., 7 pls., 44 figs., 18 tables, 6 appendixes.

Sec. 5. Walnut-Verdigris Unit, 160 p., 8 pls., 34 figs., 27 tables.

Sec. 6. Upper Republican Unit, 111 p., 6 pls., 26 figs., 20 tables.

Each section has a chapter on present water uses and future (1975) requirements. Uses include agricultural (irrigation, domestic, and stock), municipal (with and without public supplies), industrial, pollution-abatement, and other uses.

KENTUCKY

Kentucky Water Resources Study Commission, 1959, Kentucky water resources study: Kentucky Dept. Conserv., Div. Flood Control and Water Usage, 109 p., 25 figs., 22 tables.

Chapter on water uses and needs includes a table on water use for rural homes, livestock, fields in 1957-58 and in 1975 and 2000; a table on daily consumption (total and per head) for different kinds of livestock; data on irrigation and other field use with forecasts; industrial and municipal water-use data with forecasts.

Kulp, W. K., and Hopkins, H. T., 1960, Public and industrial water supplies of Kentucky: Kentucky Geol. Survey Inf. Circ. 4, 102 p., 3 figs., 13 tables.

Table 1 gives, by physiographic regions, total and daily average quantities of ground and surface water used for public and industrial supplies in 1957-59. Other tables give, for each location in each region, the population, source of supplies, and the

yearly and daily public and industrial water supplies used.

MARYLAND

Galbreath, Paul M., 1960, Maryland irrigation survey results for the crop year of 1959, including estimates by county committees for the year 1975; 13 p., 9 tables.

Tabulations of acres irrigated in 1957 and 1959 by crop for three areas, total by county, by source for areas; estimated irrigation for the year 1975 by acres of principal crop; trends for 1949, 1952, 1953, 1954, 1957, 1959, and 1975; by crop, 1959 compared with 1975 estimates.

Meyer, Gerald, 1958, The ground-water resources in The water resources of Carroll and Frederick Counties: Maryland Board Nat. Resources, Dept. Geology, Mines, and Water Resources Bull. 22, 355 p., 5 pls., 35 figs., 37 tables.

Table 5 lists use (1956-57) of ground water, by county, for institutional and public supplies, industrial and commercial supplies, and domestic and farm supplies. Table 29 shows principal water-supply facilities using surface water, 1957, by facility, with capacity and output in million gallons per day.

Overbeck, Robert M., and Slaughter, Turbit H., 1958, The ground-water resources, in The water resources of Cecil, Kent, and Queen Annes Counties: Maryland Board Nat. Resources, Dept. Geology, Mines, and Water Resources Bull. 21, 478 p., 13 pls., 18 figs., 58 tables.

Table 40 lists average daily ground-water uses by types of use (public supply, commercial and industrial, domestic, and farm) by county. Table 41 gives the normal consumption of ground water for household and farm use, by use. Table 42 gives the source and the estimated daily use of public ground-water supplies by location in each county.

MASSACHUSETTS

Water Resources Commission, 1959, Special report relative to methods of providing an

adequate water supply to the cities and towns of the Commonwealth during a period of drought or other emergency: Massachusetts H. Doc. 2791, 40 p., 3 maps, 5 figs., 5 tables.

Table 5 gives, for each city and town in Massachusetts, population and municipal water-use data—average daily use, per capita daily use, maximum day and average daily use for the maximum week.

MICHIGAN

Water Resources Commission of Michigan, 1953, Report on the water resources of the Clinton River basin: 50 p., 4 maps, 5 figs., 8 tables.

Chapter on municipal and industrial water supply gives municipal use (total, per capita, and daily use and source of water, residential and industrial); industrial use by location, source of supply, and use per day; and irrigation (acreage of projects).

———1955, Report on water resource conditions and uses in the Paw Paw River basin: 44 p., 3 maps, 4 figs., 10 tables.

Chapter on municipal and industrial water supply gives municipal use (total, per capita, and daily use and residential and industrial use) and source of water; industrial use, total and daily, by location and source of supply; and irrigation (acreage by crops and total water).

———1956, Report on water resource conditions and uses in the Flint River basin: 70 p., 5 maps, 10 figs., 13 tables.

Chapter on municipal water supplies has data on total, per capita, daily use, on sources of water, and on residential and industrial use. Irrigation data show location and acreage of projects and sources of water.

———1957, Report on water resource conditions and uses in the Huron River basin: 149 p., 2 pls., 27 figs., 17 tables.

Chapter on water use includes, by city, data on population, source of water, consumption (total, residential, industrial, and per capita); by township, industrial data on

source of water, daily use for processing, cooling, sanitary, and other; irrigation by acreage, source of water, and major crops.

———1959, Water use for irrigation: 53 p., 7 figs., 16 tables.

Includes data on acreage irrigated—for municipal use and on cropland—by counties; total by years, by counties; source of water (surface, ground, combined, and city), by river basin; acreage by crops, by years. Table 7 gives statewide data by crops for acres irrigated, average inches of water used per year, total acre-inches per year, and total cubic feet per year.

———1960, Water resource conditions and uses in the Tittabawassee River basin: 117 p., 8 maps, 11 figs., 34 tables.

Chapter on water use gives, by city, data on population, source of water, consumption (total, residential, industrial, and per capita) by industrial plant, use by source (municipal, private wells, and private surface) and daily use for processing, cooling, sanitary, other, and total; irrigation acreage by watershed, source of water, and crops.

MONTANA

Monson, O. W., Criddle, Wayne D., and Davis, Sterling, 1953, Estimated water requirements of crops in irrigated areas of Montana State Coll. Agr. Expt. Sta. Bull. 494, 23 p., 1 fig., 11 tables.

includes measured consumptive use of principal crops in irrigated areas outside Montana; estimated water requirements of principal crops for 30 areas in Montana; estimated peak monthly consumptive use of water, by crops, in various areas of Montana. Data are by crop. Coefficients are used in making their estimations.

NEW HAMPSHIRE

New Hampshire State Department of Health, 1959, Public water supplies: New Hampshire State Dept. Health, Div. Sanitary Eng., 11 p., 1 fig., 1 table.

Table includes population served, ownership, other communities served, and source of supply.

NEW JERSEY

Flink, S. J., 1958, New Jersey's water resources, *in* Review of New Jersey Business, v. 14, no. 3, p. 3-5, 13.

Estimates for industrial water use in 1975 and nonindustrial for 1965 and 1975, including residential and per capita use. Discusses what the use would be with no water shortage and with a water shortage.

NEW MEXICO

U.S. Senate, Select Committee on National Water Resources, 1960, Water resources activities in the United States, Views and comments of the States: U.S. 86th Cong., 2d sess., Comm. Print 6, p. 228-254, 3 figs., 12 tables.

Tables give use of ground and surface water in New Mexico for municipal and industrial and rural nonagricultural purposes and for irrigation. Data on acreage are included.

NEW YORK

New York State Department of Health, 1960, Public water supply data: New York State Dept. Health Bull. 19, 186 p.

For each municipality, district, or water company, data include county, source, population served, and consumption per day.

Temporary (New York) State Commission on Water Resources Planning, 1960, Dynamic planning—First step in water resources development for New York State: Legislative Doc. 24, 260 p.

Data for State as a whole include estimates for total and per capita municipal supplies for 1956, 1965, and 1975, including source of supply and population served; water for industrial supplies for some industries, for various uses in the plants

and by sources; water used for manufacturing; and water for irrigation.

OHIO

Bernhagen, R. J., 1949, Industrial ground-water pumpage in Ohio: Ohio Water Resources Board Bull. 11, 45 p., 1 fig., tables.

Includes data, by counties, on maximum and average daily pumpage and consumption of ground water by industry for 23 industries and also average daily municipal pumpage for 51 counties, by county.

Ohio Department of Natural Resources, 1959, Water inventory of the Cuyahoga and Chagrin River Basins, Ohio: Ohio Dept. Natural Resources, Div. Water Rept. 2, Ohio Water Plan Inventory, 90 p., 31 pls., 10 tables.

Tables and charts show source of water and where used; water withdrawn, consumed and returned; estimated percent of water intake consumed, by type of use; types of use in million gallons per day; water used in manufacturing, by manufacturing group; farms with piped running water and farms and acreage irrigated, by county; water use in 1955, 1975, 2000, by city area.

———1960, Water resources of southeastern Ohio: Ohio Dept. Natural Resources, Div. Water, 55 p.

Includes (by county) total, per-square-mile, and per-capita water use; source for total water withdrawn, public, and private; irrigation and rural withdrawal combined. Tabulation lists public and private supply with source by county and municipality for manufacturing, power, other industrial, irrigation and rural, domestic and commercial.

———1960, Water inventory of the Maumee River Basin, Ohio: Ohio Dept. Natural Resources, Div. Water Rept. 11, Ohio Water Plan Inventory, 112 p., 46 pls., 22 tables.

Table 4, "Principal water-using industries of basin," gives rank in water use and number of plants and employees in the industries.

Table 14, "Municipal water use," includes, by county and town, water use (total and per capita) and population served.

Table 15, "Water use," gives, by county and town, municipal and private use by source and also irrigation use.

Table 16, "Summary of water uses," gives public and private supplies (by source) for power, manufacturing, domestic and commercial, suburban homes, farm homes, livestock, golf courses, farm irrigation, greenhouses, nurseries, railroads, and sand and gravel operations.

———1960, Water inventory of the Ohio, Eagle, Straight and Whiteoak Creek Basin: Ohio Dept. Natural Resources, Div. Water Rept. 15, Ohio Water Plan Inventory, 50 p., 18 pls., 19 tables.

Table 11, "Public water systems," gives water withdrawn (surface and ground) and sewage returned by towns.

Table 12, "Public and private water use," gives use of public and private water supplies (surface and ground water for each) by kind of use—manufacturing, railroad, sand and gravel, and domestic and commercial.

Rudnick, A. R., 1959, Water use in Ohio: Ohio Dept. Natural Resources, Div. Water Rept. 6, Ohio Water Plan Inventory, 6 pls., 10 tables.

Includes data on use by public supply and private supply, surface and underground, by use (manufacturing, power, industrial, municipal, and other), by counties, by watershed, per capita, and per square mile.

———1960, Industrial water use in Ohio: Ohio Dept. Natural Resources, Div. Water Rept. 8, Ohio Water Plan Inventory, 118 p., 3 figs., 33 tables.

Includes 1955 withdrawals, returns, and amount used for cooling for all manufacturing, by basin areas, and by source of public and private supplies; withdrawals by kinds of manufacturing; public and private supply withdrawals by source of water for electric power, railroads, coal-cleaning,

and sand and gravel; gives same data as above by county and by municipality; water withdrawn for various industries with considerable industry breakdown.

Woldorf, Arthur F., 1959, Irrigation and rural water use in Ohio: Ohio Dept. Natural Resources, Div. Water Rept. 7, Ohio Water Plan Inventory, 57 p., 7 pls., 10 figs., 17 tables.

Includes data on average daily water use, by basin, for domestic, livestock, and irrigation; acres irrigated, by county and by basin; livestock, by kind; source of water, public and private, by county and by basin; irrigated land, by basin and by crop.

OKLAHOMA

Bureau of Water Resources Research, 1957[?], Water, Oklahoma's No. 1 Problem: Oklahoma Univ., Bur. Water Resources Research, 57 p.

For daily total water use and agricultural use and for daily consumption of water (by municipal and industrial users) gives data for every 5 years from 1930 to 1950 and forecasts for every 5 years from 1955 to 1980. Also gives annual requirements of 5 crops and the average daily consumption per worker for 12 industries.

Oklahoma State Department of Health, 1958, Inventory data, municipal water supplies of cities and towns located in counties of the central and southeast sections of the State:

Tabulation by county and town includes source of water, population served, total daily water use, and daily per capita use.

_____, 1958, Oklahoma municipal water supplies in counties affected by the Arkansas River basin, re: compact with Kansas:

Tabulation by county and town includes source of water, population served, total daily water use, and daily per capita use.

OREGON

Oregon University, Bureau of Municipal Research and Service, 1954, A report on

water-supply sources and water use in 187 Oregon cities: 31 p., 6 tables.

Water-use data (annual and maximum month) for cities by population group. For cities of more than 10,000 population, data by city include per capita and per customer use. Source and amount of supplies are given by city. A tabulation gives number of customers and water use and industries and their water use, by city.

PUERTO RICO

Arnow, Ted, and Crooks, James W., 1960, Public water supplies in Puerto Rico: Commonwealth of Puerto Rico, Water-Resources Bull. 2, 34 p.

Text includes number of urban and rural areas served, monthly data on water use, chemical quality of water, and population served. Section on urban supplies includes, for each urban area, population served, source of water, treatment, 1959 monthly average water production and monthly maximum production, and water analysis. Section on rural supplies shows municipality supplying water, source of water, treatment, and average monthly production.

Bogart, D. B., Arnow, Ted, and Crooks, J. W., 1960, Water problems of Puerto Rico and a program of water resources investigations: Commonwealth of Puerto Rico, Water Resources Bull. 1, 40 p.

Has a little general information on source of water, treatment, average daily consumption of 1959 municipal supplies (municipal and rural use thereof); an estimate of industrial use in 1965; irrigation use, surface and ground water; average water use for hydroelectric needs.

SOUTH CAROLINA

South Carolina Board of Health, 1960, Municipal and other major domestic water supplies in South Carolina: S. Car. Board Health.

Data, by city and town, include ownership and source of supply, daily capacity, average daily output, and population served.

SOUTH DAKOTA

South Dakota State Department of Health, 1959, South Dakota public water-supply data: 31 p.

Table gives name of city or town, population in 1950, date system was built, source of supply, pump capacity in gallons per minute storage, treatment, and chemical analysis.

U.S. Senate, Select Committee on National Water Resources, 1960, Water resources activities in the United States, Views and comments of the States: U.S. 86th Cong., 2d sess., Committee Print 6, p. 304-331, 7 pls., 8 figs., 5 tables.

Includes 1959 data and 1980 estimates for South Dakota of total water delivery and consumption (acre-feet) for population (urban and rural), livestock (cattle, sheep, and pigs), irrigation, industry, electricity, and other uses.

TENNESSEE

Cushing, E. M., and Richardson, R. M., 1957, Irrigation in Tennessee in 1955: Tennessee Dept. Conserv., Div. Geol. Inf. Circ. 4, 7 p., 2 tables.

Source of water (ground or surface), pump capacity (gallons per minute) by source, and acres irrigated, by counties.

Tennessee Water Resources Division, 1958, Irrigation in Tennessee: 16 p.

Tabulation gives, by county, total pumping capacity (surface and ground), average capacity, and hours water was used in 1958.

_____, 1959, Municipal Water Use Survey: 9 p.

Tabulation of municipalities giving average daily use of water and maximum daily use.

_____, 1961, Tennessee's water resources: 128 p., 23 figs., 22 tables.

Chapter on water use and needs includes (1) water use for livestock, rural domestic, and irrigation, 1960 and 1975; (2) industrial water use, 1954, by purpose, percent of use consumed, and source of water; (3) 1958 municipal water supplies, by source, population served, daily average pumpage,

maximum daily pumpage, average daily per capita usage (1958, 1975, 2000); and average annual hydroelectric use.

TEXAS

Daniels, Louis L., 1960, Consumptive use of water by major crops in Texas: Texas Board Water Engineers, 48 p., 4 figs., 16 tables.

Coefficients are used for arriving at estimates. Estimates were made of water consumption of different crops at various locations, by months, by season, and annually.

Keese, Carroll W., 1959, Irrigation survey: Agr. and Mech. Coll. Texas and U.S. Dept. Agriculture, 16 p.

For all Texas tabulation lists, by county, total acres irrigated, acres irrigated by sprinklers and by wells, and acres of crops and vegetables irrigated by crop.

Sherrill, D. W., 1960, High Plains irrigation survey: Agr. and Mech. Coll. Texas and U.S. Dept. Agriculture, 9 p.

By county on High Plains, data give total acres irrigated and acres irrigated by sprinklers and by wells; and by crop, acres of crops and vegetables irrigated.

Texas Board of Water Engineers, 1960, Irrigation in Texas in 1958:

Texas Board Water Engineers Bull. 6018, 254 p., 2 pls., 8 tables.

Tables give, by counties, by soil conservation districts, and river basins for total, surface water, and ground water the number of acres irrigated and the acre-feet of water used therefor. Table 6 gives, by county and by source of water, the number of acres and the acre-feet of water used for 17 crops, whereas table 7 lists the same items for the State as a whole. Table 8 gives the acreage irrigated in 1939, 1949, and 1958, by counties.

U.S. Senate, Select Committee on National Water Resources, 1960, Water resources activities in the United States, Views and comments of the States: U.S. 86th Cong., 2d sess., Comm. Print 6, p. 334-347, 6 pls., 4 tables.

By river basin in Texas, 1957, includes data on nonconsumptive use of surface water and consumptive use for municipal, mining, and industrial purposes and for irrigation. Withdrawals in 1957 of ground water by basins for municipal, irrigation, industrial, and total. Forecasts for 1965, 1975, 2000 of water requirements (industrial, nonindustrial, and total) by basins, with summary for cities of more than 5,000 population.

UTAH

U.S. Department of Agriculture, 1958, Consumptive use and irrigation water requirements of Milford Valley, Utah: U.S. Dept. Agriculture, Agr. Research Service Pub. 41-14, 45 p., 4 figs., 15 tables.

Data include acres irrigated; amount of ground water pumped, 1951-54; measured consumptive use by soil-moisture-depletion method, by crop, 1951-54; measured seasonal consumptive use rates from various areas of the West, by crops; water application efficiency tests; annual consumptive use computed from inflow-outflow data and by the integration method; and computation of annual consumptive use rates of various crops, 1951-54.

Utah State University, 1960, Farm and Home Science: Utah State Univ. Agr. Expt. Sta., 119 p.

Includes a section on present water uses and future requirements (1980). Discusses problems of development for future needs.

VIRGINIA

Virginia Advisory Legislative Council, 1955, Water resources of Virginia: Richmond, Va., Report to Governor and General Assembly, 139 p., 45 maps, 44 tables.

Tabulations include 1954 data on daily water use, by river basin, for municipal, industrial, military, and electric purposes, and for irrigation. Irrigation data includes acreage figures. Source of water is also given.

WASHINGTON

Molenaar, Aldert, Criddle, Wayne, D., and Pair, Claude H., 1952, Estimates of con-

sumptive use and irrigation requirements of crops in Washington: Washington Agr. Expt. Sta. and U.S. Soil Conserv. Service, Div. Irrig. Eng. and Water Conserv., 20 p., 1 map, 8 tables.

Table 2 is entitled "Estimates of seasonal consumptive use of water by irrigated crops in Washington." It gives, by area, inches of water used by each of eight crops. Table 2 covers total consumptive use, whereas table 3 gives same data for consumptive use minus rainfall.

Washington State Department of Health, 1958, Inventory of public water supplies: 49 p.

Data, by city or town, include population and population served, year system was started, its ownership, source of supply, safe yield in million gallons per day for surface and subsurface supply, treatment-plant capacity, average daily usage, treatment of water, and distribution storage.

WISCONSIN

Wirth, Harvey E., 1959, Water use in Wisconsin: Wisconsin State Board Health, 36 p., 6 figs., 12 tables, bibliography.

Includes totals for municipal, public and institutional use in gallons per year, million gallons per day, and per capita (total water, surface and ground); source of water and totals for residential, commercial, and industrial use; rural nonfarm and farm use; water consumption by livestock; acres irrigated. Data are given on water use for certain industries—pulp and paper, vegetable and fruit canning, dairy, and electric power. Self-supplied industrial use, surface and ground water is shown, as are progress in sewage treatment development, progress in water pollution abatement, and recreational use. Bibliography.

Wisconsin State Board of Health, 1960, Public water works and sewerage systems in Wisconsin: 13 p.

Names of places and their population are listed for water works and sewerage systems serving incorporated cities and villages. Also the ownership, source (with depth), and treatment of water supply. Treatment of public sewerage systems is also shown.