WATER USE IN WISCONSIN, 1990

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Introduction

As part of the National Water-Use Information Program, the U.S. Geological Survey (USGS) stores water-use data in standardized format for different categories of water use. The data base (Site Specific Water Use Data System) is updated annually or as more current water use information becomes available. Information about amounts of water withdrawn, sources of water, how the water was used, and how much water was returned is available to those involved in establishing water-resource policy and to those managing water resources.

In 1978, the USGS entered into a cooperative program with the Wisconsin Department of Natural Resources (WDNR) to inventory water use in Wisconsin. Since that time, two reports that summarize water use have been published (Lawrence and Ellefson, 1982; Ellefson and others, 1987). Ellefson and others (1987) present 1985 water-use data in a map and graph format. Because water use changes with time, an update report is periodically required. This report presents 1990 data in the same format as that of the 1987 report.

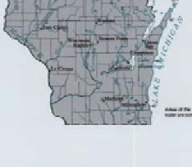
Data Collection

Water-use data in Wisconsin are generally reported by major users to State agencies as part of State permit requirements. The WDNR collects water-use data for public, industrial, irrigation, sewage treatment, and the amount of water used for power generation. The Wisconsin Public Service Commission collects information on how the public-supply water is used. Data in this report were obtained from these agencies. Estimates were made by the USGS based on population and average consumptive-use rates for water-use categories for which data were not reported.

Sources of Water

Wisconsin has an abundant supply of water. Surface water is found in 33,000 mi (miles) of streams and 15,000 lakes (U.S. Geological Survey, 1985). About two quadrillion (2X1015) gallons, or about 1/3 the volume of Lake Superior, is stored in the State as ground water.

Communities located on the shores of the Great Lakes and Lake Winnebago generally use surface water for their water supply. Communities located inland use ground water. Three principal aquifers—the sand and gravel, Silurian dolomite, and sandstone aquifers—provide most of the ground water used in the State.

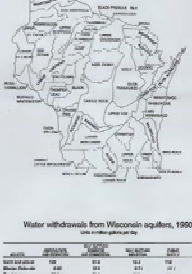


Areas of the State that use large amounts of water are consistent with population centers.

Total Water Use, By Basin

Upper number is surface-water use and lower number is ground-water use, in Mgal/d.

The largest total water use occurred in the Manitowoc-Sheboygan basin. Excluding thermoelectric-power water use, the largest amount of water was used in the Castle Rock basin, where withdrawals for industry and irrigation combined were 234 Mgal/d.



Water use, by river basin, 1990

in million gallons per day (Mgal/d)

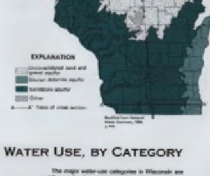
Basin name	Hydrologic unit code	Domestic	Agriculture	Irrigation	Industrial	Commercial	Thermo-electric	Public use and losses	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

Total Water Use, by Aquifer

Water withdrawals from Wisconsin aquifers, 1990

Units in million gallons per day

Aquifer	Agriculture and irrigation	Self-supplied domestic and commercial	Self-supplied industrial	Public supply	Total
Sand and gravel	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Silurian Dolomite	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Sandstone	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
Other	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]
TOTAL	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]



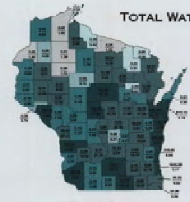
The sand and gravel aquifer is not continuous but is composed of numerous layers, lenses, terraces, and valley fillings of permeable sand and gravel. The sand and gravel aquifer overlies much of the State. Well yields from this aquifer are variable and depend on both the permeability and thickness of the sand and gravel.

The Silurian dolomite aquifer is present only along Wisconsin's eastern shore. This aquifer is the uppermost rock unit in this area. Yields from this aquifer depend on the number of fractures and solution openings intersected by wells. The aquifer is underlain entirely by a sandstone aquifer.

The sandstone aquifer is present in the southern two-thirds of the State and is largely sandstone but includes beds of dolomite and siltstone. From north-central Wisconsin, the sandstone aquifer thickens to the east, south, and west. Where the aquifer is thick, it can yield large quantities of water. The sandstone aquifer is underlain by Precambrian rocks.

Other aquifers that do not produce as much water as the aquifers described above are present in Wisconsin. The most important of these is the Precambrian aquifer, which includes all rocks of Precambrian age that underlie Wisconsin. These rocks are crystalline and yield small quantities of water through fractures. This aquifer is used mostly for domestic purposes where the other aquifers are absent. A series of very thick Precambrian sandstones can yield large quantities of water in northwestern Wisconsin.

Total Water Use, by County



Upper number is surface-water use and lower number is ground-water use, in Mgal/d.

Excluding thermoelectric power water use, the largest amounts of water were used in Outagamie, Milwaukee, and Wood Counties. This use was attributed to large industrial users and major population centers.

Water use, by county, 1990

in million gallons per day (Mgal/d)

County	Domestic	Agriculture	Irrigation	Industrial	Commercial	Thermo-electric	Public use and losses	Total
[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]	[illegible]

EXPLANATION

Water use, in millions of gallons per day

- Less than 0.1
- 0.1 - 1.0
- 1.0 - 2.0
- 2.0 - 3.0
- 3.0 - 10.0
- 10.0 - 100.0
- 100.0 - 250.0
- · Well location

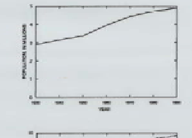
SCALE 1:5,000,000

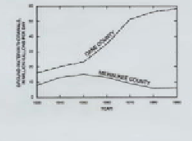
Trends in Water Use

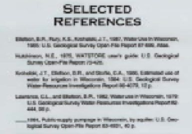
Water use in Wisconsin has increased steadily for most categories of use from 1950 through 1990, on the basis of data from the 5-year reports published by the U.S. Geological Survey. Water use for thermoelectric power production shows the fastest rate of increase (81 percent). During this period, the population of the State increased by 24 percent. Industrial self-supplied surface-water use also has increased at a steady rate as more industrial development has occurred along the Wisconsin, Fox, and Chippewa Rivers. Irrigation water use increased by 44 percent from 1980 through 1990, as irrigated acreage increased.

In Dane County, which depends on ground water for its sole source, rates of withdrawal have increased much faster than population growth.

Milwaukee County uses Lake Michigan as its principal source of water. The decrease of ground-water pumpage from 1950 through 1990 in Milwaukee County is attributed to higher water cost for some publicly supplied ground water and the increased use of surface water from Lake Michigan.







Water Use, by Category

The major water-use categories in Wisconsin are public supply, thermoelectric, industrial, commercial, agriculture, irrigation, and domestic.

Public Supply

Public supply refers to water withdrawn by public or private suppliers and delivered to domestic, commercial, and industrial users who do not supply all of their own water.

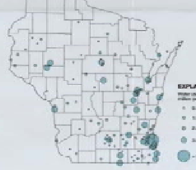
The "public use and losses" category is that use not specifically categorized, such as water use in some public parks, schools, and buildings, water used for fire control and water-main flushing, and water lost from broken water mains and from transfer and distribution systems.

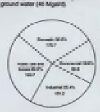
Public supplies served about 3.41 million people or 70 percent of the State's population in 1990.

A total of 593 Mgal/d (million gallons per day) was withdrawn by Public Suppliers.

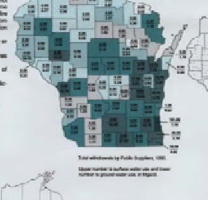
Milwaukee County is the State's largest user of public-supply surface water (182 Mgal/d).

Dane County is the State's largest user of public-supply ground water (46 Mgal/d).



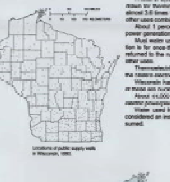


TOTAL WATER USE FROM PUBLIC SUPPLY

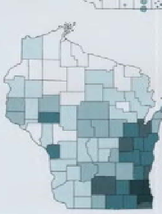


Total withdrawals by Public Suppliers, 1990.

Upper number is surface-water use and lower number is ground-water use, in Mgal/d.



Locations of public-supply wells in Wisconsin, 1990.



Power Generation

A total of 5,096 Mgal/d of surface water was withdrawn for thermoelectric-power production. This was almost 3.6 times the amount of water withdrawn for all other uses combined.

About 1 percent of water used for thermoelectric power generation was consumed.

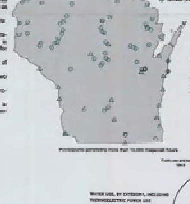
Most water used for thermoelectric power generation is for once-through cooling and the remainder is returned to the natural system, making it available for other uses.

Thermoelectric powerplants generate 67 percent of the State's electricity.

Wisconsin has 23 thermoelectric powerplants; two of these are nuclear.

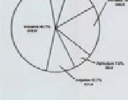
About 44,000 Mgal/d of water was used by hydroelectric powerplants.

Water used for hydroelectric power generation is considered an instream use, whereby no water is consumed.



Powerplants generating more than 10,000 megawatt-hours.

WATER USE, BY CATEGORY, INCLUDING THERMOELECTRIC POWER USE



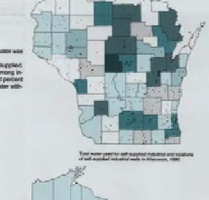
WATER USE, BY CATEGORY, EXCLUDING THERMOELECTRIC POWER USE

Self-Supplied Industrial

About 619 Mgal/d of surface and ground water was used for industrial purposes.

About 468 Mgal/d, or 76 percent, was self-supplied.

Rates of consumptive use differ widely among industry types but were estimated to be about 20 percent of ground water and 10 percent of surface-water withdrawals.



Total water used for self-supplied industrial and locations of self-supplied industrial wells in Wisconsin, 1990.

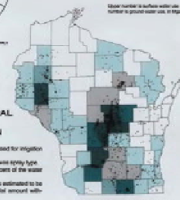
Agricultural Irrigation

About 151 Mgal/d of water was used for irrigation during 1990.

All irrigation reported in the State was spray type.

Ground water accounts for 99 percent of the water used for irrigation.

Consumptive use for irrigation was estimated to be 151 Mgal/d or 100 percent of the total amount withdrawn.



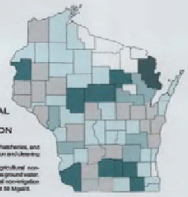
Locations of irrigation wells in Wisconsin, 1990.

Agricultural Non-Irrigation

Water used for watering stock, fish hatcheries, and other on-farm use such as dairy sanitation and cleaning are included in this category.

About 96 Mgal/d was used for agricultural non-irrigation purposes; 75 percent of this was ground water.

The consumptive use for agricultural non-irrigation use was 60 percent of the total or about 58 Mgal/d.

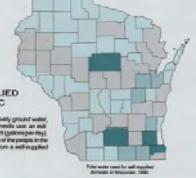


Total water used for agriculture in Wisconsin, 1990.

Self-Supplied Domestic

An estimated 90 Mgal/d, exclusively ground water, was withdrawn for self-supplied domestic use: an estimated per capita use of about 61 gpd (gallons per day).

About 1.48 million (or 30 percent) of the people in the State obtain their domestic water from a self-supplied source.



Total water used for self-supplied domestic in Wisconsin, 1990.

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