U.S. Environmental Protection Agency

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How We Use Water In These United States

Water use is usually defined and measured in terms of withdrawal or consumption that which is taken and that which is used up. Withdrawal refers to water extracted from surface or ground water sources, with consumption being that part of a withdrawal that is ultimately used and removed from the immediate water environment whether by evaporation, transpiration, incorporation into crops or a product, or other consumption. Conversely, return flow is the portion of a withdrawal that is actually not consumed, but is instead returned to a surface or ground water source from a point of use and becomes available for further use.

Water use can also be divided into offstream and instream uses. Offstream water use (see Table 1 below) involves the withdrawal or diversion of water from a surface or ground water source for

- Domestic and residential uses
- Industrial uses
- Agricultural uses
- Energy development uses

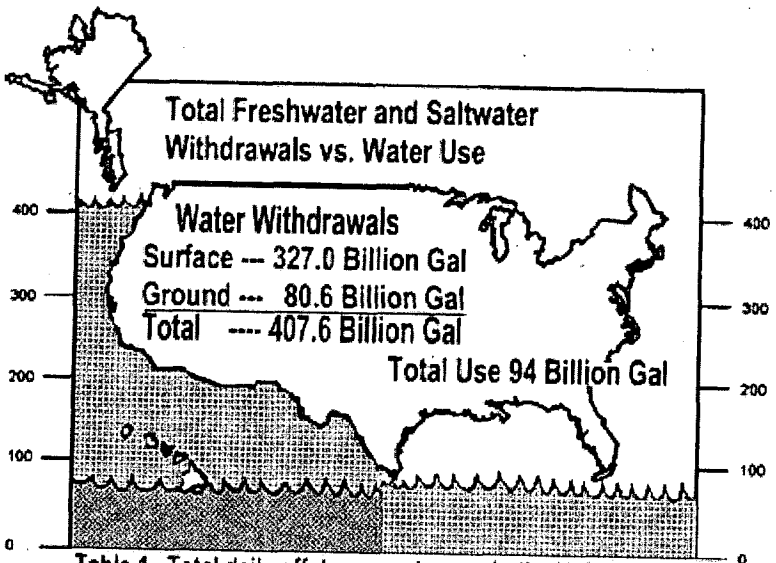


Table 1. Total daily offstream water use in the United States (Solley et al., 1993)

Instream water uses are those which do not require a diversion or withdrawal from the surface or ground water sources, such as:

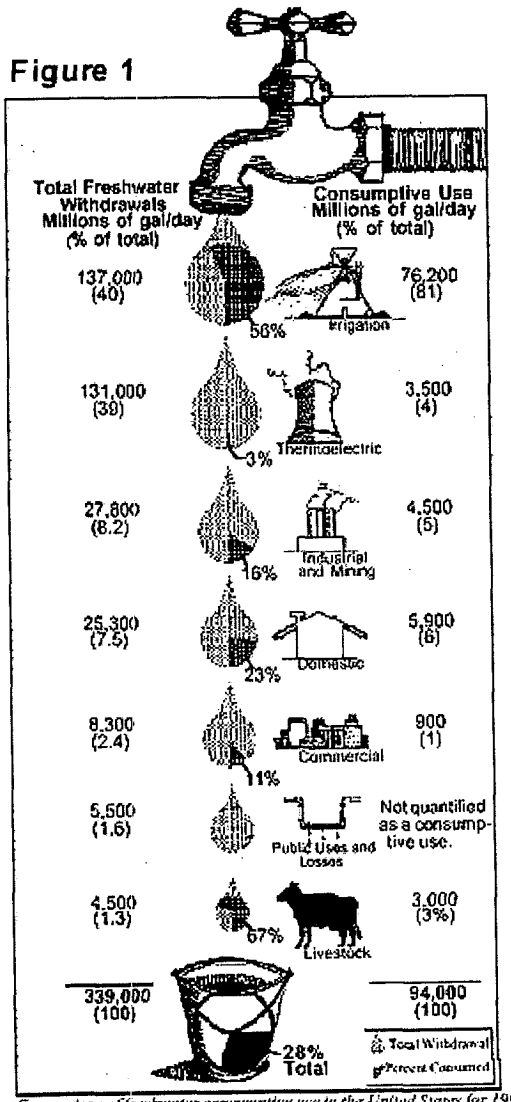
- Water quality and habitat improvement

- Recreation
- Navigation
- Fish propagation
- Hydroelectric power production

National Trends in Water Use

National patterns of water use indicate that the largest demand for water withdrawals (fresh and saline) is for thermoelectric generation (47 percent), followed by irrigation (34 percent), public supply (9 percent), industrial (6 percent), mining (1 percent), livestock (1 percent), domestic (1 percent), and commercial uses (1 percent) (Solley et al., 1993). While thermoelectric generation represents the largest demand for fresh and saline withdrawals, irrigation represents the largest demand for freshwater withdrawal alone (see Figure 1 at right). Activities that reduce the need to withdraw surface and ground water will lead to many of the beneficial effects of conserving water.

Figure 1



Comparison of freshwater consumptive use in the United States for 1990, by category (Solley et al., 1993).

National Consumption Patterns

Water consumption varies by water use category, with irrigation consuming the highest percent (81 percent) and commercial the lowest (1 percent) (see Figure 1 above). The difference between the volume of water withdrawn and that consumed is the return flow. As more good-quality water is available in return flows, more water is available for other beneficial uses.

Some categories of water use, such as irrigation and livestock watering, consume a high percentage of water that is withdrawn from surface and ground water sources. Thus, less water is available for return flows from these high-consumption activities. Other categories of use like thermoelectric power consume only a small fraction of the water they withdraw.

Categories of Water Use

With several different ways to categorize water use in the United States, this

chapter separates offstream uses into

- Municipal/public supply
- Domestic and commercial
- Industrial and mining
- Agricultural
- Thermoelectric power

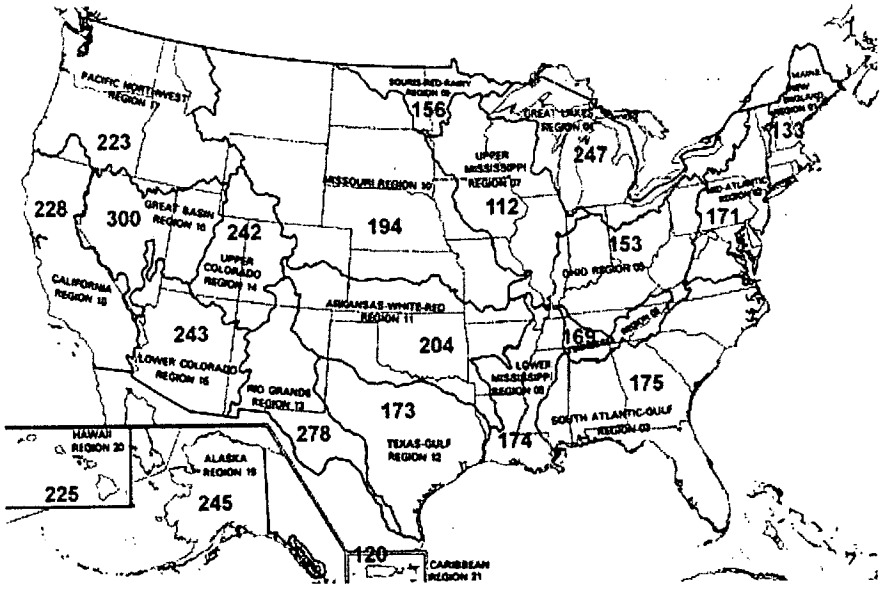
Municipal/Public Water Supply

While water withdrawals for public use can be applied to street cleaning, fire fighting, municipal parks, and public swimming pools, keep in mind that municipalities and private suppliers might also provide water for other purposes domestic/commercial, agricultural, thermoelectric power.

Per capita (per person) use of public water supplies in the United States (1990) averaged 183 gallons per day (gal/d). The average per capita use can vary greatly between communities for any number of reasons, including, but not limited to:

- Climate differences
- The mix of domestic, commercial, and industrial uses
- Household sizes
- Lot sizes
- Public uses
- Income brackets
- Age and condition of distribution system

For instance, per capita use of public water is about 50 percent higher in the West than the East mostly due to the amount of landscape irrigation in the West (see map below). However, per capita use can also vary greatly within a single state. For example, in 1985 the demand for municipal water in Ancho, New Mexico, totaled 54 gallons per capita per day (gal/cap/day) while in Tyrone, New Mexico, municipal demand topped off at 423 gal/cap/day (Grisham and Fleming, 1989). Rural areas typically consume less water for domestic purposes than larger towns.



Average use per person (gal/day) of public water in the United States by USGS water region (Solley et al, 1993)

In 1990, water withdrawn nationwide for public supplies totaled 38,530 million gallons per day (Mgal/d) (See Table 2). Although this withdrawal rate represents a 5 percent increase over 1985 amounts, the number of people supplied with water distributed through public systems also increased 5 percent during that same 5-year period. Again in 1990, surface water supplied about 61 percent of the public water supply, with ground water supplying the other 39 percent (Solley et al., 1993).

Table 2. Fate of Water in Public Water Supplies of the U. S., 1990.

Receiving Category	Volume (Mgal/Day)	Percentage of Total
Domestic	21,900	57
Commercial	5,900	15
Public Use Losses	5,460	14
Industrial	5,190	13
Thermoelectric Power	80	<1
Total	**38,530**	**100**

Of the total water withdrawn in 1990 for public supplies representing 11 percent of total U.S. offstream freshwater withdrawals 72 percent went to domestic and commercial uses, 13 percent to industrial uses, and 0.2 percent to thermoelectric power. The remaining 14 percent went to public uses such as fire protection or was lost during distribution (usually due to leaks).

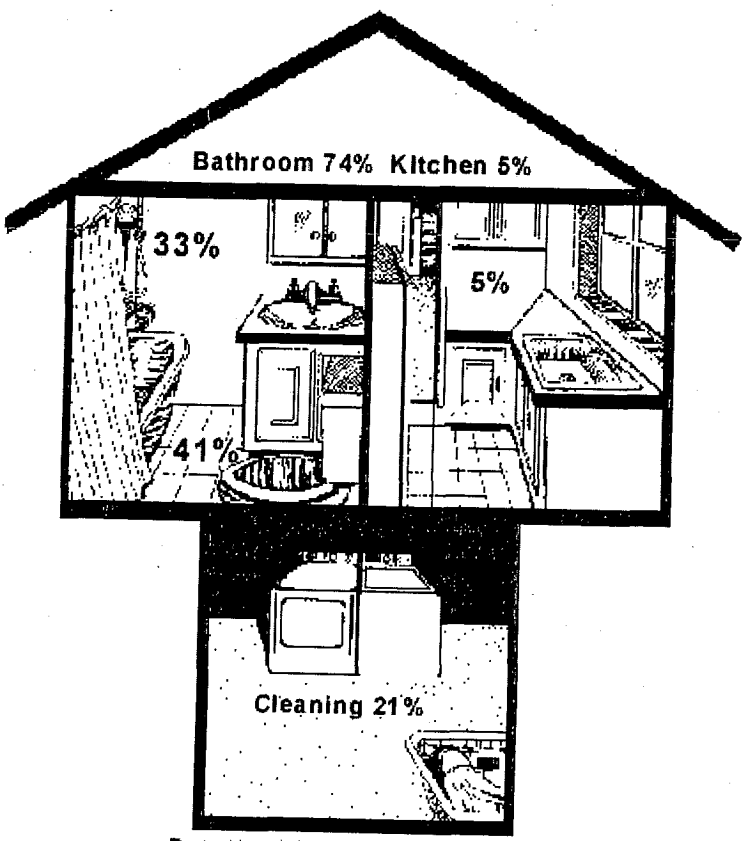
Domestic/Commercial

Domestic water use includes everyday uses that take place in residential homes, whereas commercial water uses are those which take place in office buildings, hotels, restaurants, civilian and military institutions, public and private golf courses, and other nonindustrial commercial facilities. Combined freshwater withdrawals for domestic and commercial use in 1990 totaled 33,600 Mgal/d, or 10 percent of total freshwater withdrawals for all offstream categories (see Figure 1 above).

Typical categories of residential water use include normal household uses such as

- Drinking and cooking
- Bathing
- Toilet flushing
- Washing clothes and dishes
- Watering lawns and gardens
- Maintaining swimming pools
- Washing cars.

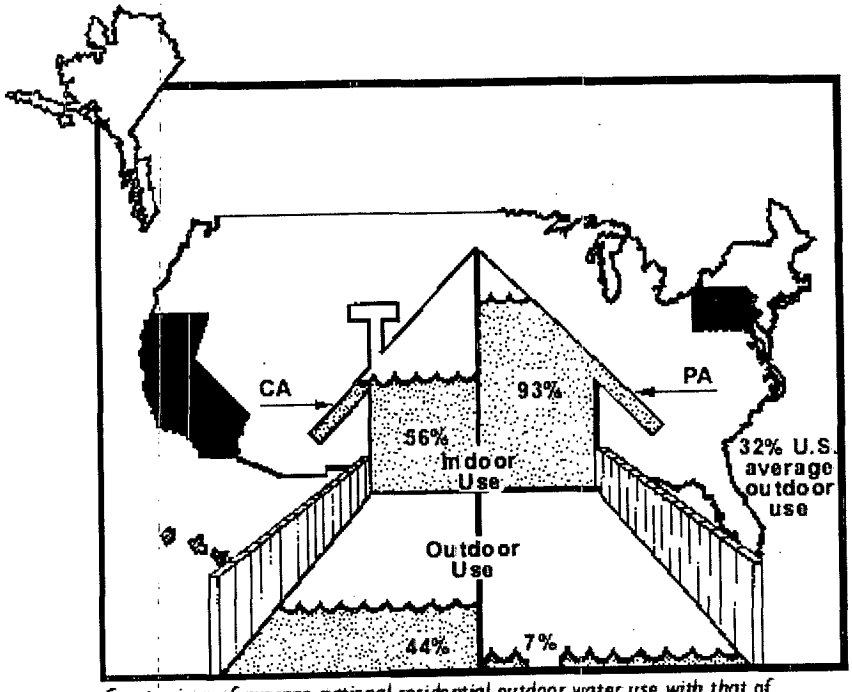
When divided into indoor uses and outdoor uses, the amount of indoor water use remains fairly constant throughout the year, with the breakdown of typical indoor water uses depicted in figure below. By far the largest percentage of indoor water use occurs in the bathroom, with 41 percent used for toilet flushing and 33 percent for bathing (USEPA, 1992).



Typical breakdown of interior water use.

Outdoor residential water use, however, varies greatly depending on geographic location and season. On an annual average basis, outdoor water use in the arid West and Southwest is much greater than that in the East or Midwest. The figure below compares the national average for residential outdoor water use with that of Pennsylvania and California, with landscape irrigation the primary application. While average outdoor water use in Pennsylvania represents only approximately 7

percent of the total residential demand, in California average outdoor use climbs to about 44 percent of the demand.



Comparison of average national residential outdoor water use with that of Pennsylvania and California (USEPA, 1992).

Industrial and Mining

Industrial water uses, estimated to be 8 percent of total freshwater use for all offstream categories, include cooling in factories and washing and rinsing in manufacturing processes. Some of the major water-use industries include mining, steel, paper and associated products, and chemicals and associated products.

Water for both industrial and mining uses comes from public supplies, surface sources, and ground water. During the 5-year span from 1985 to 1990, industrial water use in the United States decreased approximately 13 percent. In the same period, mining water use increased about 24 percent (Solley et al., 1993).

Agricultural

Agricultural water use can be divided between irrigation and livestock. Irrigation includes all water applied to farm or horticultural crops; livestock incorporates water used for livestock, dairies, feedlots, fish farms, and other farm needs.

Estimated annual water use for irrigation remained at about the same level between 1985 and 1990, with approximately 63 percent of the water used for irrigation in 1990 coming from surface water. Approximately 60 percent of the water used for livestock came from ground water sources and the remaining 40 percent from surface water sources. Combined water use for irrigation and livestock represents about 41 percent of total offstream freshwater use for 1990, (see previous Figure 1) with 40 percent going to irrigation and the lone 1 percent to livestock uses.

Not only can the loss of water from irrigation conveyance systems be significant, but the percentage of consumptive water use for agriculture is high as well an

estimated 54 percent consumption in 1985. By 1990 this had climbed to an estimated 56 percent consumption for irrigation uses and 67 percent for livestock uses (see previous Figure 1).

Thermoelectric Power Generation

This final category includes water used for the production of energy from fossil fuels, nuclear energy, or geothermal energy. Most water withdrawn for thermoelectric power production is used for condenser and reactor cooling. While 1990 estimates of freshwater withdrawals remained constant from 1985, nearly half again as much saline water was also used.

More than 99 percent of the water used for thermoelectric power production comes from self-supplied surface water, less than 0.2 percent from public supplies. In 1990, water used for thermoelectric power production represented close to 39 percent of total offstream freshwater use in the United States, but only about 3 percent was consumed (Solley et al., 1993).

The Mid-Atlantic, South Atlantic Gulf, Ohio, and Great Lakes water resource regions use the largest amounts of water for thermoelectric production. The eastern United States uses about five times more water than the West to produce about twice as much thermoelectric power (Solley et al., 1993).

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URL: http://www.epa.gov/watrhome/you/chap1.html