

Evaluation of U.S. domestic per capita water use coefficients

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Problem:

In the United States, ground water provides about 98 percent of self-supplied domestic use and one-third of public water supplies. Domestic (household) water use, expressed in terms of gallons per capita per day (gpcd), is a frequently requested derivative of water withdrawal data produced by the USGS National Water Use Information Program. There is great interest in current domestic gpcd averages and how they compare with published estimates from previous years. In some instances, researchers rely on USGS per-capita averages to estimate residential indoor and outdoor uses. Estimates of domestic consumptive use, in turn, depend on the calculation of quantities used and the separation of indoor from outdoor uses.

Domestic water use is estimated by USGS for both self-supplied and public-supplied populations. Because self-supplied domestic use is rarely metered, it is typically calculated using per capita use coefficients and the residual population after public-supplied populations are tabulated. For some States, these coefficients are derived from domestic delivery data, under the assumption that self-supplied domestic per capita use is similar to that observed in public-supplied areas. Other States use domestic per capita coefficients that have been employed for decades, thus lending no value to the withdrawal estimates other than to reflect population changes. Sometimes, domestic delivery estimates are generated using these same uniform coefficients, or coefficients that were used for deliveries in 1995 and prior years. Trends from state to state and from year to year are thus rendered less clear. Residual public-supply deliveries, public use, and losses for states that keep domestic delivery per capita constant or change it arbitrarily also are difficult to interpret.

Objectives:

Evaluate per capita averages for both self-supplied and public-supplied domestic water use, as observed in AWUDS data for 1985, 1990, 1995, and 2005. Identify differences in methods, variability in ranges, and trends from year to year. Compare these data with analysis of per capita use in a sample of cities selected from different areas of the nation. This evaluation will be used to provide recommendations for the 2010 and subsequent compilations, as well as for Water Census evaluations of domestic use.

Approach:

The objectives and major tasks will be accomplished using the following approaches:

- 1) Summarize average domestic per capita uses for self-supplied and public-supplied populations in each State from the 1985-2005 compilations. Using the 2005 documentation files, identify States in each USGS region for which coefficients have not changed over the years or have been based on arbitrary values. Calculate domestic deliveries as a percent of total deliveries excluding public use and losses as an additional tool for determining whether the delivery gpcd coefficients are reasonable.

- 2) Select six States, plus Kansas, for detailed analysis of public-supply records. States will be chosen to provide a range of climatic conditions, which are a major determinant of outdoor water use. Develop a list of up to ten community water systems (CWS) in each State to be included in the survey, with assistance from the respective WSC water-use specialist and information from the USEPA Safe Drinking Water Information System (SDWIS). A truly random sample is not possible, because CWS are needed who can provide metered data on withdrawals and sales, and who do not have complicated delivery systems that prevent a clear association between water delivered and population served.
- 3) Obtain basic information on total withdrawals, numbers of service connections, and water sold to residential customers from each water supplier chosen for the survey. Begin by requesting data for 2009. If possible, also obtain information for 2005-2008, and 2010 as available. Phone contact is the recommended approach to requesting information from the CWS, because reaching the right person is more likely than when a survey form is mailed. Also, the cooperation of multiple State agencies would not be needed as would be the case for a mailed survey form. Follow up by phone, fax, and email is most efficient for both the researcher and the person who provides the data.
- 4) Determine population served for each year that data is provided. This number can be obtained from the supplier, from Census data, from average population per household, or a combination of these tools. Calculate per capita use for domestic deliveries for each CWS for each year of data.
- 5) For each of the seven States, establish a range of gpcd values based on observed billing and population served. If large differences are apparent for CWS within a certain State or between different years, attempt to identify possible causes (data problems, climatic differences, etc.) Determine mean, median, and standard deviation for gpcd values in each State surveyed.
- 6) Statistically evaluate the gpcd values and develop models that can be used to estimate of self-supplied domestic water use. Per capita averages also can be used to quality assure data on domestic delivery water use.

Benefits and products:

The benefits of this study are to demonstrate the ranges in per capita uses, among states and over time. Comparison of this information to coefficients used in the 2005 compilation can be used to improve or corroborate coefficients used for the 2010 water-use compilation.

During the several years it typically takes for the compilation data to be submitted, reviewed, and approved, assistance with estimation of domestic water use will be available from the principal

investigator for states that need help. Given that many states have no water-use specialist assigned for this work and no money to pay for the required data compilation, the availability of per capita coefficients and expertise in using them with population data could be very cost-effective.

The results of this study will be incorporated into subsequent versions of the National Water Use Information Program "Guidelines for preparation of State water-use estimates" which is published in the USGS Techniques and Methods series. A journal article also will be written and submitted for publication in 2011.

Budget:

FY2010 - \$100,000 (salaries for data collection and analysis, report preparation)

FY2011 - \$100,000 (salaries for compilation data estimates and review, report preparation)

FY2012 - \$60,000 (salaries for compilation data estimates and review)

Personnel:

GS-12 Hydrologists, one-half time for 2010 and 2011 and one-quarter time 2012

Student/Junior hydrologists, as needed for 2010 and 2011