FORECASTING WATER DEMANDS AND EVALUATING WATER CONSERVATION MEASURES FOR THE METROPOLITAN NORTH GEORGIA WATER PLANNING DISTRICT

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Abstract. The newly formed Metropolitan North Georgia Water Planning District (District) is assessing the water supply, wastewater and watershed management needs for a 16-county area including metropolitan Atlanta. Over the next 30 years, the District is expecting close to a 100 percent increase in population, from about four million to nearly eight million people. The amount of potable water supply needed was determined through the use of a water demand-forecasting model, the Least Cost Planning Decision Support System (DSS). Water conservation measures were added to the model to determine their potential effectiveness and select measures appropriate for the District to implement.

DEMAND FORECASTING

The District has the task of assessing the water supply needs for the 16-county area through 2030. The population is expected to double in that time period. The demand for water supply will increase dramatically due to this growth. The District also is tasked with the evaluation of water conservation measures and the recommendation of a plan of realistic water conservation programs.

In 2001, the base year used for calculations, the 16-county district used approximately 650 MGD of water on the average day.

The most common form of water demand projections tend to be somewhat simplistic in nature. They commonly involve straight-line or numerical forecasting of the historical trends. The projections may include some reduction due to water conservation. This reduction is sometimes not based on accurate underlying information. While these methods are not fundamentally flawed, they often do not provide enough information to enable implementation of a water conservation plan, because specific means of reducing water demand are not included. Detailed information about how water is used in the area of study is needed to accurately evaluate water conservation measures. An end-use water demand model provides the level of accuracy required to evaluate conservation measures for a specific set of water users.

MODEL DESCRIPTION

The DSS is the end-use model that was used to project demands for the 16-county District. The model was developed by Maddaus Water Management, and has been used for a number of projects throughout the world over the past several years. Specific applications in the United States include Maryland, Virginia, North Carolina, and California. The DSS model has the capability to project water demands while taking into account the natural replacement of older water using fixtures and appliances with newer, more efficient ones. It also considers plumbing codes and Federal Energy Standards when evaluating the newer, water-conserving appliances, such as 1.6 gallons per flush toilets.

END-USE MODELING METHODOLOGY

A well-developed and calibrated end-use model provides detailed information about how each category of customer uses water. It includes fundamental breakdowns such as amounts used for indoor and outdoor uses. Those amounts are then disaggregated to specific end uses such as toilet flushing, or clothes washing. With this level of detail, better projections about how demands will grow based on population and employment projections can be made. Detailed demographic information, such as average household size and age of housing stock, are also necessary for the end use model to be accurate.

The calibration of the end use model is achieved through a process of "top-down" and "bottom-up" information gathering. Top-down information is information that allows broad estimates of internal and external water uses for each customer category. Some sources of this information are water production data, wastewater flow records, and customer database/billing

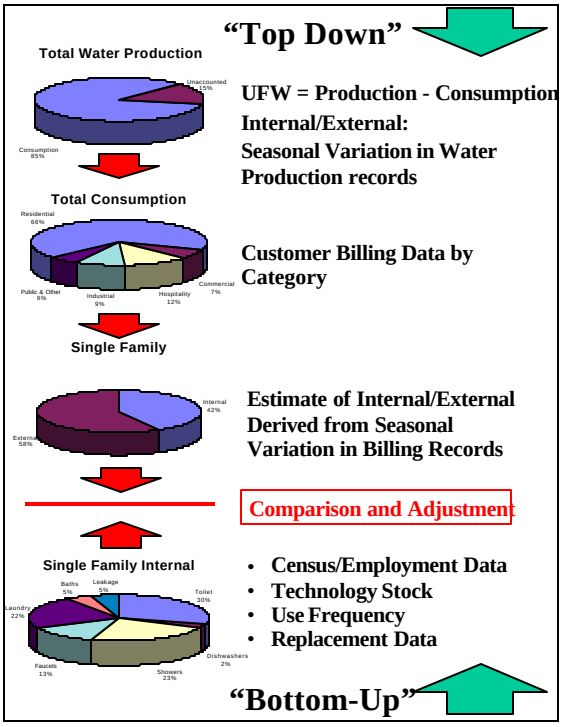

Figure 1. Use of available data to generate the end use model (Beatty 2002).

records. This top-down process records the water as it progresses from production to the end-use. The unaccounted for water (UFW) is calculated in this step. The bottom-up portion includes detailed information on water use and technology, such as frequency of use per capita or employee, stock of housing and water using appliances, replacement rates of older water using appliances, and census and employment demographics.

WATER USE PROJECTIONS

Baseline water use projections were calculated for the 16-county District. The baseline projections include reductions in per capita demand due to natural replacement of water using appliances and Georgia's water conservation-oriented plumbing codes. The analysis showed that the impact of the natural replacement of appliances and plumbing codes may reduce the water use projections by as much as 9% in 2030.

The total water demand in 2030 comes extremely close to the available yield of water resources in the District. In order to prolong the use of these resources and defer the need for new ones, water conservation is needed.

WATER CONSERVATION EVALUATION

The DSS model allows for the evaluation of the performance of water conservation measures specific to the area of study. Over 100 water conservation measures were initially screened for their effectiveness in the District according to the profile of industry, water use and climate. Twenty-five measures were

Table 1. Recommended water conservation measures

Water Conservation Measure	Description
Conservation Pricing	Eliminate declining block rate structures, implement multi-tier rates.
Low Flow Retrofit on Resale	Upon the resale of a home, require certification of low flow fixtures.
0.5 gal/flush Urinals in New Buildings	Require the use of ultra low flow urinals in all new industrial/commercial/institutional buildings
Require Rain Sensors	All new irrigation systems must have rain shutoff sensors installed.
Sub Meter Multifamily Buildings	Require that all new multi family buildings be plumbed for sub metering capability.
Reduce Unaccounted-For-Water	Require water utilities to perform system water audits, and aggressively reduce system leakage.
Residential Water Audits	Provide free water audits to customers in response to conservation pricing or rate increases.
Low Flow Retrofit Kit Distribution	Start or increase utilities' distribution program of low flow retrofit kits to targeted customers.
Commercial Water Audits	Provide free water audits to commercial customers to encourage responsible water use.
Education and Public Awareness	Dedicate more funds to Education and public awareness projects
District Review and Oversight	The District will coordinate and assist implementation of all measures, and allow substitution of other measures, where appropriate.

recommended for further consideration. These 25 measures were analyzed in the DSS model for each county. These included such measures as rebates to promote the purchase of water saving appliances and irrigation equipment, and regulations for rain sensor shutoffs for irrigation systems. Also considered were low flow spray rinse nozzles for restaurants and requirements for self-closing faucets and low flush toilets. Increased public education programs such as water audits and Xeriscape™ practices were also included. After review by and receiving input from the District's Technical Coordinating Committee and Basin Advisory Councils, aggressive UFW reduction and conservation pricing structure programs were included in preliminary recommendations for water conservation.

WATER CONSERVATION PROGRAM

This work is being used to develop a water conservation program that will become an integral part of the District's Water Supply and Water Conservation Management Plan. The draft measures currently being reviewed, if feasible, have the potential of reducing demand up to 11% by 2030. Table 1 below lists the draft water conservation measures that will be undergoing further review. These water conservation measures are aggressive and will need to be adjusted in the future as actual information on water savings in the District becomes available.

CONCLUSIONS

The application of an end use model allows for realistic calculation of savings from water conservation when compared to less rigorous approaches. By periodically updating the DSS model, it could be used as a mechanism for determining the actual resultant reductions in water use from conservation measures. Additional conservation measures could be evaluated using the updated model, to help the District and the utilities identify the best potential water conservation measures.

SELECTED REFERENCES

http://www.northgeorgiawater.org/conservation.htm

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