The Role of Water Conservation in Your Community

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www.efc.unc.edu
Terminology

• Water conservation: Any beneficial reduction in water use or in water losses
  – *Not necessarily curtailment*

• Water efficiency: Accomplishment of a function, task, process or result with the minimal amount of water feasible; tool of water conservation that reduced water demand without changing the quality of the use
Why water conservation planning?

- Maximize benefits
  - Diversify water resource portfolio
  - Cost-effectiveness
  - Customer service
  - Environmental benefits
  - Political benefits
- Meet regulatory requirements
- Eligibility for federal and state grants and funding
- It’s going to happen anyway
Diversify water resource portfolio (Drought time)

OWASA July 2006 through December 2008
From Water-using customer sales profile conducted by EFC
Does water conservation programming hurt future drought response?

Yes?

Short-term drought savings may be more difficult to achieve and the amount of water that can be saved by water rationing reduced, if water conservation reduces the “slack” in the system.

No?

If conservation ethic is a part of the community, in part due to conservation programs, customers seem to be more receptive to requests to reduce water use.
Diversify water resource portfolio (Average water use)

**TABLE 1**

Projected average-day savings for 2050*

<table>
<thead>
<tr>
<th>Customer Subgroup Classification</th>
<th>Low Range</th>
<th></th>
<th>High Range</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>percent</td>
<td>mgd</td>
<td>percent</td>
<td>mgd</td>
</tr>
<tr>
<td>General residential†</td>
<td>10</td>
<td>6.5</td>
<td>15</td>
<td>9.7</td>
</tr>
<tr>
<td>Residential indoor‡</td>
<td>20</td>
<td>2.6</td>
<td>28</td>
<td>3.6</td>
</tr>
<tr>
<td>(pre-1995 housing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential indoor§</td>
<td>31</td>
<td>1.7</td>
<td>63</td>
<td>3.5</td>
</tr>
<tr>
<td>(post-1995 housing)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Residential outdoor**</td>
<td>5</td>
<td>1.4</td>
<td>12</td>
<td>3.3</td>
</tr>
<tr>
<td>(lawn watering)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Industrial</td>
<td>10</td>
<td>1.2</td>
<td>30</td>
<td>3.7</td>
</tr>
<tr>
<td>Commercial</td>
<td>10</td>
<td>3.3</td>
<td>25</td>
<td>8.3</td>
</tr>
<tr>
<td>Wholesale</td>
<td>10</td>
<td>1.8</td>
<td>15</td>
<td>2.7</td>
</tr>
<tr>
<td>Total</td>
<td></td>
<td>18.5</td>
<td></td>
<td>34.8</td>
</tr>
</tbody>
</table>

*No significant conservation was included for fire protection, golf course, institutional and water utility classifications, which account for only 3.3 percent of total use; sources: references 6–9.
†Savings influenced by water rates and public education
‡Savings influenced by plumbing retrofits
§Savings influenced by Energy Policy Act, effective Jan. 1, 1994
**Savings influenced by watering restrictions
Cost-effectiveness

<table>
<thead>
<tr>
<th>Strategy</th>
<th>2025 Regional Potential (TAF*)</th>
<th>Timeframe (years)</th>
<th>Drought-Proof (Reliability)</th>
<th>Risk (Project Aborted)</th>
<th>Enviro Opinion</th>
<th>GHG</th>
<th>Initial Cap. Cost ($millions)</th>
<th>Annual Oper. Cost ($millions)</th>
<th>30-yr cost Treated ($/AF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Urban Water Conservation</td>
<td>1,100+</td>
<td>0-2</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>$0</td>
<td>$0.5</td>
<td>$210</td>
</tr>
<tr>
<td>Local Stormwater Capture</td>
<td>150+</td>
<td>3-5</td>
<td>Red</td>
<td>Green</td>
<td>Green</td>
<td>Green</td>
<td>$40-$63</td>
<td>$1-$3.5</td>
<td>$350+</td>
</tr>
<tr>
<td>Recycling</td>
<td>450+</td>
<td>6-10</td>
<td>Green</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Yellow</td>
<td>$480</td>
<td>$30</td>
<td>$1,000</td>
</tr>
<tr>
<td>Ocean Desalination</td>
<td>150+</td>
<td>6-10</td>
<td>Green</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>$300</td>
<td>$37</td>
<td>$1,000+</td>
</tr>
<tr>
<td>Groundwater Desalination</td>
<td>TBD</td>
<td>6-10</td>
<td>Red</td>
<td>Yellow</td>
<td>Yellow</td>
<td>Yellow</td>
<td>$24</td>
<td>$0.7</td>
<td>$750-$1,200</td>
</tr>
<tr>
<td>Transfers-Ag to Urban</td>
<td>200+</td>
<td>1-5</td>
<td></td>
<td>Red</td>
<td>Green</td>
<td>Green</td>
<td>n/a</td>
<td>n/a</td>
<td>$700+</td>
</tr>
<tr>
<td>Inter-agency Cooperation</td>
<td>**</td>
<td>0-5</td>
<td>Green</td>
<td>low</td>
<td>low</td>
<td>low</td>
<td>n/a</td>
<td>n/a</td>
<td>n/a</td>
</tr>
<tr>
<td>Groundwater Storage</td>
<td>1,500+</td>
<td>3-5</td>
<td>Yellow</td>
<td>Green</td>
<td>Green</td>
<td>Yellow</td>
<td>$68-$135</td>
<td>$13</td>
<td>$380</td>
</tr>
<tr>
<td>Surface Storage</td>
<td>0</td>
<td>10+</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>Red</td>
<td>$2,500+</td>
<td>$7.5-$15.5</td>
<td>$760-$1,400</td>
</tr>
</tbody>
</table>

* TAF: Thousand Acre-Feet
** Improves reliability and efficiency of existing supplies
Source: LAEDC

## Options in the lowest cost 2010 portfolio

<table>
<thead>
<tr>
<th>Option</th>
<th>Cost Efficiency ($/MG)</th>
<th>Capital Cost ($M)</th>
<th>Yield (MGD)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Water restrictions (no daytime watering)</td>
<td>10</td>
<td>0</td>
<td>7</td>
</tr>
<tr>
<td>Rain sensors (retrofit 25% existing systems)</td>
<td>60</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Spray rinse valves (rebate program)</td>
<td>115</td>
<td>1</td>
<td>0.3</td>
</tr>
<tr>
<td>Conservation pricing</td>
<td>125</td>
<td>14</td>
<td>6</td>
</tr>
<tr>
<td>GW for non-potable use</td>
<td>155</td>
<td>8</td>
<td>15</td>
</tr>
<tr>
<td>Multi family sub-metering (retrofit 50% existing homes)</td>
<td>165</td>
<td>6</td>
<td>2</td>
</tr>
<tr>
<td>Cooling towers (rebate program)</td>
<td>170</td>
<td>6</td>
<td>3</td>
</tr>
<tr>
<td>Tussahaw Creek reservoir expansion</td>
<td>260</td>
<td>64</td>
<td>20</td>
</tr>
<tr>
<td>Lawrenceville GW system</td>
<td>300</td>
<td>5</td>
<td>6</td>
</tr>
<tr>
<td>Dog river reservoir expansion</td>
<td>300</td>
<td>230</td>
<td>48</td>
</tr>
<tr>
<td>Showerheads and faucets (increased rebate program)</td>
<td>300</td>
<td>8</td>
<td>1</td>
</tr>
</tbody>
</table>

Figure 11 from Georgia Metro Atlanta Water Contingency Planning Task Force

Expected 2020 yield is shown for conservation options.
Customer Service

Conservation programming offers:

- An opportunity to interact positively with customers (rebates, give-aways)
- Handle high water bills with information and programming
Environmental Benefits

• Reduces:
  – sewage system failures
  – water contamination caused by polluted runoff from over-irrigating yards and agricultural lands
  – need to construct additional dams and reservoirs
  – need to construct additional water and wastewater treatment facilities
  – surface water withdrawals that degrade habitat both in streams and on land close to streams and lakes
  – Stormwater runoff

• Allows water to flow to healthier natural pollution filters
• Saves energy

WaterSense:
http://www.epa.gov/WaterSense/water_efficiency/environmental_benefits.html
Political Benefits

Community

Regional

Interstate
Components of a Program

Conservation program =
conservation measure(s) + delivery mechanism(s)

• Conservation measures
  • Technologies, plumbing fixtures, management, practices

• Delivery mechanism
  • Education, rebates, incentives, direct install, ordinances

Delivery mechanisms

Education, Public Awareness

Program Marketing, Rebates & Incentives

Legislation, Ordinances, Regulation

Information

Incentives and Active Programs

Requirement

Town of Cary, NC’s Water Conservation Program Stool
Conservation Programs: What are your options?

- Alliance for Water Efficiency Resource Library
- AWWA’s Water Efficiency Clearinghouse
- EPA’s Water Conservation Plan Guidelines (WaterSense)
- California Urban Water Conservation Council Best Management Practices
- Amy Vickers’ Handbook of Water Use and Conservation
Choosing the Right Program for Your Utility

- Considerations
  - Legal requirements
  - Customer demographics and characteristics
  - Demand forecast
  - Utility challenges
    - Infrastructure
    - Financial
    - Growth
  - Cost-benefit comparison
Choosing the Right Measures for Your Utility

Matching utility and customer characteristics to conservation measures and programs

<table>
<thead>
<tr>
<th>Utility Issue</th>
<th>Conservation Measure Example</th>
</tr>
</thead>
<tbody>
<tr>
<td>Large rental community</td>
<td>Sub-metering</td>
</tr>
<tr>
<td>Affordability concerns/Customer service</td>
<td>Residential water audits</td>
</tr>
<tr>
<td>Seasonal population</td>
<td>Seasonal rates</td>
</tr>
<tr>
<td>High summer peak</td>
<td>Reuse program, irrigation policies</td>
</tr>
</tbody>
</table>
# Price vs. Non-price Conservation Programs

<table>
<thead>
<tr>
<th></th>
<th>Price</th>
<th>Non-price</th>
</tr>
</thead>
<tbody>
<tr>
<td>Economically cost – effective¹</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Monitoring and enforcement¹</td>
<td>✔</td>
<td></td>
</tr>
<tr>
<td>Predictability¹</td>
<td></td>
<td>No advantage</td>
</tr>
<tr>
<td>Equity¹</td>
<td></td>
<td>No advantage</td>
</tr>
<tr>
<td>Political ease²</td>
<td></td>
<td>✔</td>
</tr>
</tbody>
</table>

---


Choosing the Right Plan for Your Utility

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Landscape Audits</th>
<th>Increasing Block Rates Rates</th>
</tr>
</thead>
<tbody>
<tr>
<td>Benefits</td>
<td>Concentrated</td>
<td>Dispersed</td>
</tr>
<tr>
<td>Costs</td>
<td>Dispersed</td>
<td>Concentrated</td>
</tr>
</tbody>
</table>
How high would your rates be to get him to conserve?
YOU SAY – “WHAT IF WE DON’T WANT TO ENCOURAGE WATER CONSERVATION?”

And I say – “Well, you still should be planning for it. And here’s why…”
Regulatory Requirements

• Federal
  • Environmental Impact Statements

• State
  – NC Drought Bill of 2008
  – GA Water Stewardship Act of 2010
  – SC Surface Water Permitting Bill of 2010
The “Drought Bill” (S.L. 2008-143)
143-355.4(b)(2)-(7)

Required Conservation Measures¹

- Leak detection and repair program
- Water Supply Plan/Water Shortage Response Plan
- Meter all water use
- No decreasing block rate structure for residential meters
- Reclaimed water evaluation
- Consumer education program

¹ Required if applying for funds from any of the following programs (2) for the purpose of extending waterlines or expanding water treatment capacity
How much is within your control?

- State and Federal water savings goals
- 3rd party certifications
- Neighboring utilities
<table>
<thead>
<tr>
<th>Fixture</th>
<th>Maximum Water Use Allowed (effective January 1994)</th>
<th>Water Sense</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Toilets (water closets)</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gravity-tank</td>
<td>1.6 gallons per flush (gpf)</td>
<td>1.28 gpf</td>
</tr>
<tr>
<td>Gravity-tank, white, two-piece, labeled “Commercial Use Only”</td>
<td>3.5 gpf</td>
<td>1.28 gpf</td>
</tr>
<tr>
<td>Flushometer-tank</td>
<td>1.6 gpf</td>
<td>1.28 gpf</td>
</tr>
<tr>
<td>Flushometer-valve (except blowout valve)</td>
<td>1.6 gpf</td>
<td>1.28 gpf</td>
</tr>
<tr>
<td>Blowout-valve</td>
<td>3.5 gpf</td>
<td>1.28 gpf</td>
</tr>
<tr>
<td>Electromechanical hydraulic</td>
<td>1.6 gpf</td>
<td>1.28 gpf</td>
</tr>
<tr>
<td><strong>Urinals</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any type</td>
<td>1.0 gpf</td>
<td>0.5 gpf</td>
</tr>
<tr>
<td><strong>Showerheads</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Any type (except those used for safety reasons)</td>
<td>2.5 gallons per minute (at 80 psi) or 2.2 gpm (at 60 psi)</td>
<td>2.0 gpm (at 20, 45 and 80 psi)</td>
</tr>
<tr>
<td><strong>Faucets and Replacement Aerators</strong></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Lavatory faucets</td>
<td>2.5 gallons per minute (at 80 psi) or 2.2 gpm (at 60 psi)</td>
<td>1.5 gpm (at 60 psi)</td>
</tr>
<tr>
<td>Lavatory replacement aerators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen faucets</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Kitchen replacement aerators</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Metering faucets</td>
<td>0.25 gallons per cycle</td>
<td></td>
</tr>
</tbody>
</table>
Neighboring Utilities - “Mediashed”

City of High Point July 2006 through December 2008
From Water-using customer sales profile conducted by EFC
Trends for water use in NC

Household water use in North America

When controlling for weather and other variables…..

A household in the 2008 billing year used 11,678 gallons less annually than an identical household did in 1978.

### Why?

Breakdown of Louisville (KY) Water Company residential water decline between 1990 and 2007

<table>
<thead>
<tr>
<th>Parameter</th>
<th>1990</th>
<th>2007</th>
<th>Allotment – gpd</th>
</tr>
</thead>
<tbody>
<tr>
<td>Household use – gpd</td>
<td>208</td>
<td>187</td>
<td>-21</td>
</tr>
<tr>
<td>PMDI</td>
<td>0.29</td>
<td>0.75</td>
<td>-2.6</td>
</tr>
<tr>
<td>People per household</td>
<td>2.52</td>
<td>2.38</td>
<td>-5</td>
</tr>
<tr>
<td>Educational index</td>
<td>2.45</td>
<td>2.81</td>
<td>+1.3</td>
</tr>
<tr>
<td>Average home value</td>
<td>$120,100</td>
<td>$144,600</td>
<td>+3.5</td>
</tr>
<tr>
<td>Home size</td>
<td>2,155 sq. ft.</td>
<td>2,281 sq. ft.</td>
<td>+0.6</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td></td>
<td></td>
<td>=18.8</td>
</tr>
</tbody>
</table>

18.8 GPD attributed to increased installation of low-flow appliances

New Financial Realities

Water Demand from OWASA (NC)
Local Government-Owned Water and Wastewater Utilities' Cost Recovery in FY 2009

| RED SQUARES: | Operating revenues < operating expenditures (13%) |
| YELLOW DIAMONDS: | Operating revenues < operating expenditures + principal + interest on long-term debt (24%) |
| BLUE CIRCLES: | Operating revenues > operating expenditures + principal + interest on long-term debt (63%) |

When including depreciation, nearly half of utilities do not recover operating expenses through rates.
Utility Business Model

Utility Revenues

Customer Consumption

Utility Rates
Utility Business Model

Utility Revenues

Customer Consumption
- Public information campaigns
- Technology
- Restrictions
- Weather

Utility Rates
The conservation conundrum

• Water utilities face a dilemma in encouraging water conservation
  – By selling less water, utilities have to increase rates to cover their costs
  – Customers are essentially being asked to pay more for less water
when you conserve water... we have a deficit... so I have to raise your rates!

Source: Fayetteville Observer 2/6/04
Where does the utility get its revenue?

- Water use (rates): 46%
- Taxes: 36%
- Developer fees: 18%
- Ticket Sales: 0%
What about expenses?

Utilities’ costs are mostly fixed, not dependent on the amount of water sold/used by the customers. But the majority of revenues come from the amount of water sold. If customers conserve, revenues drop significantly but not costs.

Source: CMU Director Doug Bean’s presentation to the Charlotte City Council on December 1, 2008.
The Utility Business Model Continuum

Decoupling of Revenues and Usage

Revenue completely based on usage

Complete decoupling

Customer Conservation Incentive

Customer has little to no incentive to conserve

Customer has a strong incentive to conserve

A

B

C

D

E
CASE STUDY: SEATTLE PUBLIC UTILITIES
Water Demand & Forecasts: 1930-2006

- Annual MGD
- Actual Annual
- 5-Year Moving Average
- 1967 SWD Forecast
- 1973 RIBCO Forecast
- 1980 Complan Forecast Medium
- 1980 Complan Forecast Medium-Low
- 1985 Complan Forecast-Medium
- 1993 WSP Forecast
Growth in Population & Water Consumption

Population

Total Water Consumption

0 100,000 200,000 300,000 400,000 500,000 600,000 700,000 800,000 900,000 1,000,000 1,100,000 1,200,000 1,300,000 1,400,000


0 20 40 60 80 100 120 140 160 180 200 220 240 260 280

Population

Total Water Consumption

UNC ENVIRONMENTAL FINANCE CENTER
FIGURE 2  Demand forecasts with and without conservation

Source: Graphic courtesy of Bruce Flory, Seattle Public Utilities (2009)
Financial Results – Immediate Capital Budget Reductions

Seattle Public Utilities CIP Spending
(2002-2007)

- Total CIP
- Water CIP
- DR & WW CIP

CIP Savings so far Due to Asset Management?
Water Use and Revenue

“Water demand is recalibrating according to new economic realities and public policy directives. Ignoring declining demand does make it go away – or rather, come back. The intractable manager will remain cash-flow frustrated. The enlightened manager will be better positioned for cost recovery in accordance with a fluid equilibrium.”

Strategies for financial security and conservation

- Reduction of non-revenue water losses
- Conservative finance models
- Multi-year finance plan
- Annual rate adjustments
- Customer analysis
- **Well designed** increasing block structure
- Affordability strategies
- Rethinking minimum charges
- Rethinking utility business model