City of Tucson

Background
The city of Tucson is located in Pima County in the southeastern portion of Arizona. The city lies in the Tucson Basin, and has an estimated population of 543,566 residents.* Tucson Water served approximately 744,000 people in 2008, and is expected to serve a population of 990,000 by 2030.

Average annual precipitation in the valley is 12 inches, ranging up to 25 inches of rainfall at higher elevations. The average low temperature in January is 41.9 degrees (°F) and the average high temperature for July is 100 degrees (°F).†

Water Supply and Deliveries
Tucson has significantly curtailed groundwater use over the past several years in accordance with goals of the Tucson Active Management Area. From 2003-2008, groundwater use declined from 72% of total water supplies in 2003 to 50% in 2008. Tucson Water also has the largest municipal allocation of Colorado River water in the state of Arizona, delivered via the Central Arizona Project (CAP). Some 49% of the water provided by Tucson Water in 2008 was delivered to single-family residential accounts, about 17% to both commercial customers and multifamily customers, and approximately 12% was lost or unaccounted for.

Per Capita
Tucson notably reduced its gallons per capita per day (GPCD) water use from 2003 to 2008 across all metrics: single-family residential (-12.1% change); system-wide potable (-12.1%); and system-wide total (-11.0%).

<table>
<thead>
<tr>
<th>Tucson GPCD</th>
<th>2003</th>
<th>2007</th>
<th>2008</th>
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<tbody>
<tr>
<td>Per Capita Water Use</td>
<td></td>
<td></td>
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<tr>
<td>Single-Family Residential</td>
<td>116</td>
<td>107</td>
<td>102</td>
</tr>
<tr>
<td>System-Wide Potable</td>
<td>144</td>
<td>133</td>
<td>127</td>
</tr>
<tr>
<td>System-Wide Total</td>
<td>181</td>
<td>169</td>
<td>161</td>
</tr>
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Tucson Water residential accounts have a base service fee of $5.62 a month, a CAP charge of $0.05 per Ccf, and a conservation charge of $0.04 per Ccf. The base fee comprises 21% of a customer’s monthly bill for 10,000 gallons. The slope of Tucson’s average price curve is 0.1430, indicating that the average price of water increases significantly as consumption volume increases.

Rate Structure
Tucson Water uses a four-tier inclining block rate for individual residential water accounts and bills for consumption in Ccf.

<table>
<thead>
<tr>
<th>Usage Per Dwelling Unit</th>
<th>Cost</th>
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<tbody>
<tr>
<td>0–11,220 gallons (1–15 Ccf)</td>
<td>$1.39 per 748 gallons (per Ccf)</td>
</tr>
<tr>
<td>11,221–22,440 gallons (15.01–30 Ccf)</td>
<td>$5.13 per 748 gallons (per Ccf)</td>
</tr>
<tr>
<td>22,441–33,660 gallons (30.01–45 Ccf)</td>
<td>$7.25 per 748 gallons (per Ccf)</td>
</tr>
<tr>
<td>Over 33,660 gallons (over 45 Ccf)</td>
<td>$9.90 per 748 gallons (per Ccf)</td>
</tr>
</tbody>
</table>

Conservation Measures
The city of Tucson is regulated under the Total GPCD Program within the Tucson Active Management Area. According to the Arizona Department of Water Resources, Tucson is in compliance with requirements of the Total GPCD Program.

Customer Rebates
Tucson Water offers several incentive-based conservation measures, including:

- **Toilets** – $120 or 50% of the purchase price for high-efficiency toilets (1.28 gallons per flush) for residential customers; $100 or 50% of the purchase price for multifamily, commercial, and industrial customers.
- **Irrigation systems** – $5,000 or up to one-third the cost for irrigation audits for commercial irrigation customers, sub-metering, and weather-based or soil sensor-based controllers.
- **RinseSmart Program** – Free high-pressure, pre-rinse spray nozzles for restaurants and commercial kitchens.

The Tucson Water Community Conservation Task Force has also recommended a number of additional incentive-based conservation measures, including:

- Multifamily irrigation system upgrade rebate
- Commercial/industrial waterless urinal rebate
- Commercial/industrial sub-metering
- Single-family residence gray water incentive

Ordinances
**Ultra-Low-Flush Toilets in Low-Income, Owner-Occupied Housing** – Mandates the director of the water department to establish and administer a program to purchase and install ultra-low-flush toilets in low-income, owner-occupied customer dwellings, and for the purchase of ultra-low-flush toilets in city-owned, low-income housing units.

Water-Efficient Plumbing Fixtures* – Requires the use of water-efficient plumbing fixtures, including 1.6-GPF toilets and 2.5-GPM showerheads and faucets.

Xeriscape Landscaping Regulations† – Affects all commercial and multifamily construction projects and requires adherence to Xeriscape principles, including limitations on high-water-use plantings/features, requirements for low-water-use plantings, and appropriate irrigation system design.

Rainwater Collection‡ – As of July, 2010, 50% of water demand for new commercial construction landscaping must be met through the use of water harvesting practices and technologies.

Residential Gray Water§ – As of July, 2010, all new residential construction must include the installation of stub-outs for gray water systems at a later date.

Water Waste¶ – A minimum fine of $250, increasing to $500 for subsequent violations, can be levied for any of the following: (1) allowing water to escape property; (2) allowing water to pond greater than one-quarter inch, or greater than 150 square feet on any street or parking lot; (3) washing hardscapes with an open hose under normal system pressure; (4) operating misting systems in unoccupied nonresidential areas; (5) operating an irrigation system with a broken head or emitter; or (6) failing to repair a controllable leak. (This ordinance was initially enacted in 1912 at a fine of $50, which is equivalent to approximately $1,000 in today’s dollars).

Education

General Public Information – Tucson Water regularly distributes water conservation information in the form of pamphlets, brochures, and public service announcements through customer mailings and at community events. “Beat the Peak” is one of Tucson’s longest running public education campaigns.

Zanjero Program – Tucson offers a residential water-auditing program designed to maximize water conservation potential around the home. The service includes leak detection, replacement of showerheads and aerators, and adjustments of toilets. Landscaping is assessed, and appropriate irrigation requirements are determined. Customers are provided a report showing water and dollar savings potentials for the conservation measures.

Workshops – Tucson Water has developed the following programs to educate and train participants in a structured classroom setting:

- WaterSmart landscapes – Two-hour workshops targeting residential customers about (1) drip irrigation design, installation, and maintenance; (2) plant selection and design; (3) irrigation timer use and irrigation scheduling; and (4) water harvesting.
- SmartScape landscaper – A series of workshops designed to teach landscape professionals, property managers, and homeowner associations about water conservation practices in landscape management.
- SmartScape Program (previously “LOW 4”) – Landscape water conservation programs offered to commercial users, school districts, and the general public.
- Landscape water audit training.
- Turf maintenance workshops.

Youth Education Program – Includes classroom materials for specific grade levels, designed to teach about water supply, conservation, and quality issues:

- ‘Da Drops (grade 3) – Student activity book and supplemental teacher guide for classroom use designed to teach about the water cycle, groundwater, and water distribution.
- Our Water, Our Future (grade 5) – Classroom curriculum packet designed to teach students about the water cycle, water supply, and water quality.
- Tucson Toolkit (grades 7-8) – Student activity book and supplemental teacher guide designed to teach about the water cycle, water quality, and water conservation.
- High school program – The program is designed to bring water studies into broader curricular areas by building capacity among teachers and encouraging students to develop water-related projects.
Teacher Internship Program – Two-week paid internship offered to high school teachers in order to develop classroom materials.

WaterSmart Business Program – Tucson recently launched a program to encourage businesses to improve their water efficiency and awards participating entities. Facility audits targeting commercial and industrial customers are conducted to identify all uses of water and establish conservation potential.

Implementation of Conservation Measures
Tucson Water tracks several different aspects of its conservation programs, reporting the following results from several of its rebate programs:

- High-efficiency toilets
  - Single-family residential – 1,029 toilets, $91,686 of expenditures
  - Multifamily residential – 33 toilets, $2,509 of expenditures
  - Commercial – 4 toilets, $343 of expenditures

- Irrigation upgrades
  - 1 application approved for $763.70
  - Pre-rinse spray valve replacement (RinseSmart)
    - 53 spray valves and $3,084 of expenditures

Tucson has also performed a number of education-based conservation programs over the past several years:

<table>
<thead>
<tr>
<th>Program</th>
<th>FY 06–07</th>
<th>FY 07–08</th>
<th>FY 08–09</th>
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<tbody>
<tr>
<td>Water waste investigations</td>
<td>218</td>
<td>375</td>
<td>243</td>
</tr>
<tr>
<td>Commercial water audits</td>
<td>10</td>
<td>0</td>
<td>18</td>
</tr>
<tr>
<td>Workshops</td>
<td>15 (average of 15 persons per event)</td>
<td>13 (average of 16 persons per event)</td>
<td>3 (average of 12 persons per event)</td>
</tr>
</tbody>
</table>

Furthermore, Tucson Water performed 1,605 residential Zanjero water audits in calendar year 2008, and sponsored one paid summer internship with 15 middle and high school teachers in FY 2007-2008.

Funding for Conservation
In 2008, Tucson Water had a conservation budget of approximately $1 million dollars, corresponding to 1.4% of the total water utility’s budget. Tucson has 7-10 employees who work in the water conservation department, and each year spends about $1.37 per customer.

Goals for Conservation Savings
Tucson Water has no specific water conservation goals, other than to achieve a general long-term decline in per capita water usage.

Water Loss
In 2008, Tucson recorded 14,058 AF (4.58 billion gallons) of water loss, 11.9% of total supplies. System losses have remained relatively constant from 2003-2008. Tucson Water is aiming to reduce water loss by replacing over-reporting supply meters, reducing average reservoir levels to decrease system pressure, and implementing a customer-side meter replacement program. Through the implementation of improved tracking, Tucson is working to determine the quantity of water attributable to physical line losses compared to malfunctioning meters and other accounting-based causes.

Supply-Side Efficiency Measures
In 2006, Tucson Water initiated a water loss control program that aims to:

- Reduce water loss to 7% of total annual potable deliveries within the next five years and to 4% in the longer term.
- Establish the Infrastructure Leak Index to measure how efficiently the utility manages and controls leaks on an annual basis.
- Quantify discharge volumes from pipeline breaks, leaks, and planned or unplanned distribution system releases by using standardized water discharge.
- Recover lost water revenue from stuck water meters by implementing back-billing.
- Implement the Large Reclaimed Meter Inspection and Replacement Program.
- Implement the Potable Meter Inspection and Replacement Program.
- Calculate and record water loss by updating well purging procedures.
- Ensure production well meter accuracy by implementing a meter testing, calibration, and replacement program.

From September, 2004 to December, 2008, Tucson has replaced 46,532 meters as part of this water loss control program.

**Effluent Use**

The city operates under a very complicated effluent allocation structure, with most of the effluent being owned or committed to other entities around the Tucson area. In 2008, Tucson Water reused 46,300 AF of the 72,000 AF of effluent it generated, with 13,800 AF (30%) delivered for direct use and 32,500 AF delivered for recharge. Values for 2003 and 2007 are comparable to 2008 effluent uses. A portion of effluent that is discharged to the Santa Cruz River flows out of the Tucson Active Management Area.

**Additional Information**

Having recently passed an ordinance requiring the installation of gray water stub-outs in new residential construction, Tucson is exploring ways to incentivize customers to build and operate a gray water system in their home. Financial rebates are one option being considered at this point in time.

Tucson Water is keenly aware of the energy/water nexus—located at the end of the Central Arizona Project—and has incorporated avoided power costs when performing cost/benefit analyses of water conservation programs. Tucson is also exploring ways to formally incorporate carbon into a triple-bottom line approach for upcoming water resource planning documents.