City of Dallas Water Conservation
Five-Year Strategic Plan
Updated June 2010

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DALLAS WATER UTILITIES

ALAN PLUMMER ASSOCIATES, INC.
ENVIRONMENTAL ENGINEERS AND SCIENTISTS
TBPE Registration No. 13

In association with
Amy Vickers & Associates, Inc.
CP&Y, Inc.
Miya Water
BDS Technologies, Inc.

ALAN PLUMMER ASSOCIATES, INC.

ENVIRONMENTAL ENGINEERS • DESIGNERS • SCIENTISTS

0356-018-01

August 2, 2010

Ms. Carole Davis
Dallas Water Utilities
1500 Marilla, Room 5A South
Dallas, Texas 75201

Re: City of Dallas
Water Conservation Five-Year Strategic Plan

Dear Ms. Davis:

Alan Plummer Associates, Inc. is pleased to present the *City of Dallas Water Conservation Five-Year Strategic Plan*, updated June 2010. This document defines water conservation goals for Fiscal Years (FY) 2010-11 through 2014-15 and presents recommended measures and budgetary efforts to achieve these goals.

Implementation of the recommended water conservation measures are targeted to provide an annual average reduction in water consumption of approximately 23.8 million gallons per day by FY 2014-15. Budgetary needs for the Water Conservation Division, developed in conjunction with the recommended water conservation measures, are projected to be $11.5 million by FY 2014-15.

We appreciate the opportunity to provide this service to the City of Dallas. Please contact me if you should have any questions pertaining to this plan.

Very truly yours,

ALAN PLUMMER ASSOCIATES, INC.

Tim Noack, P.E.
Principal

TN/bkm

Enclosure

cc: Ms. Amy Vickers, Amy Vickers & Associates, Inc.
Mr. Chris Schmid, CP&Y, Inc.
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City of Dallas Water Conservation Five-Year Strategic Plan

Updated June 2010

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8/2/2010

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ES. Executive Summary

Water conservation is an important element of Dallas's long range water supply strategy. In 2005, Dallas Water Utilities (DWU) developed a Water Conservation Five-Year Strategic Plan (Strategic Plan) that defined water conservation goals for Fiscal Year (FY) 2004-05 through FY 2008-09 and recommended water conservation strategies and budgets to achieve these goals (Ref. 1). From FY 2001-02 through FY 2008-09, ongoing water conservation efforts and implementation of the Strategic Plan have helped Dallas to save approximately ninety-eight billion gallons (300,751 acre-feet) of water.

This document defines new water conservation goals for FY 2010-11 through FY 2014-15 and recommends water conservation strategies and budgets to achieve the new goals.

ES.1. Strategic Planning Process

This document was developed through a multi-faceted approach that included review of the previous water conservation planning effort; through review of numerous water conservation programs, initiatives, data, and literature; and through input from DWU staff, water conservation staff from other cities, City of Dallas wholesale customer cities, and stakeholders. City of Dallas water use data were examined to identify strategic areas to target for additional water conservation opportunities. Numerous water conservation strategies were evaluated using screening criteria, a benefit-cost analysis, and other means to determine their suitability for implementation during the five-year planning period. New water conservation goals were established, and recommended strategies were constructed into a framework plan and presented to customer cities, stakeholder groups, and DWU for comment. Feedback was analyzed and used to develop the Updated Strategic Plan.

ES.2. City of Dallas Water Use Profile

To make recommendations that are technically sound and economically feasible, water conservation planners must understand the customer make-up and water use patterns of the service area. For FY 2003-04 through FY 2007-08, DWU provided summary data showing monthly water use by water user category. Categories included residential, general service (GS), optional general service (OGS), municipal, wholesale, and unbilled. In the summary data:[1]

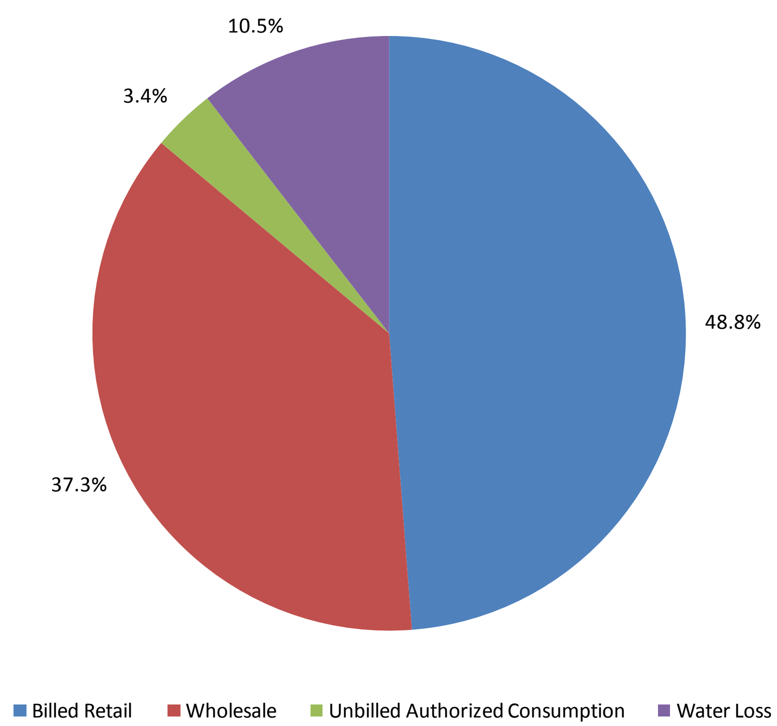
- Residential water use is assumed to be single-family residential water use.
- GS water users include multi-family residential, commercial, and light industrial customers.
- OGS water users consist primarily of large industrial customers.
- Municipal water users consist primarily of city facilities.

[1] There may be minor deviations from these assumptions, but they do not significantly affect the analysis of water use by category.

- Unbilled water, also known as non-revenue water, is a combination of unbilled authorized consumption and water loss. Unbilled authorized consumption includes unbilled municipal uses, ozone cooling water at the Water Treatment Plants (WTPs), main flushing, firefighting, meter testing, and other uses.

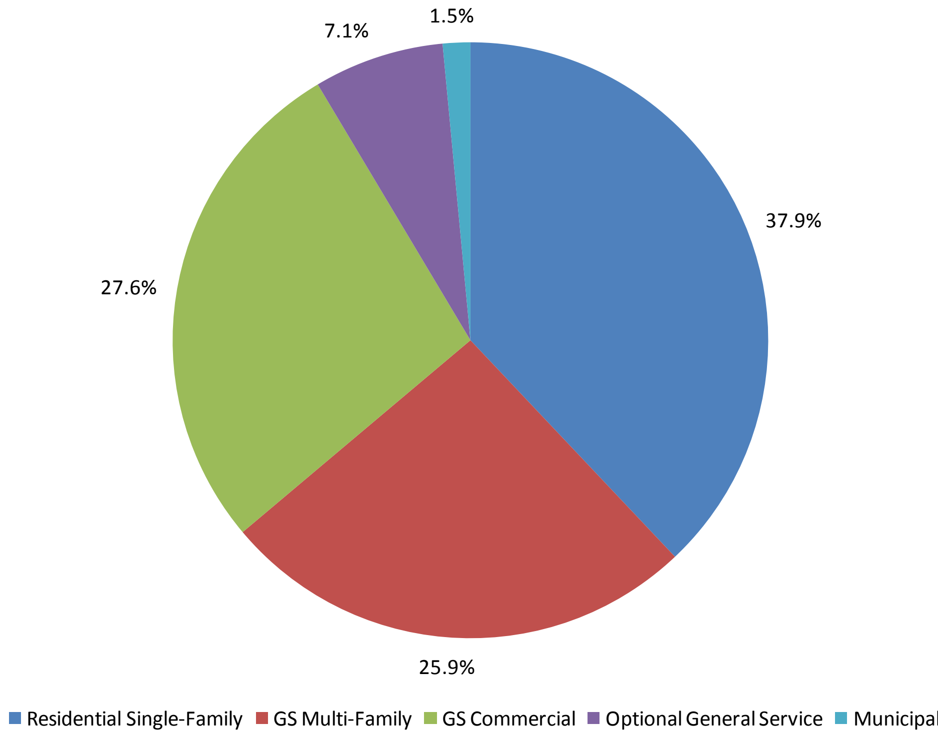
During the analysis period, total Dallas water use ranged from 141 to 170 billion gallons per year. Total water use can be divided into billed retail water sales, wholesale water sales, unbilled authorized consumption, and water loss (Figure ES-1). Billed retail water sales accounted for 48.8 percent of total water use during the analysis period, and wholesale water sales account for 37.3 percent.

Figure ES-1: Summary of DWU Total Water Use, FY 2003-04 to FY 2007-08



Currently, Dallas provides water to more than 294,000 active retail customers. The division of billed retail water use into customer categories is shown in Figure ES-2. Single-family residential customers comprise the largest water use category, accounting for 37.9 percent of billed retail water use during the analysis period.

Figure ES-2: Summary of DWU Billed Retail Water Use, FY 2003-04 to FY 2007-08



Understanding "base" and "seasonal" water use amounts helps in the targeting of water conservation strategies. Base water use is:

- Generally associated with indoor water uses or other water uses that remain relatively constant throughout the year,
- Estimated to be the amount of water used in the minimum water use month for a given year, and
- Assumed to be constant throughout each year for each category.

Seasonal water use is:

- Generally associated with irrigation and cooling water uses and
- Estimated to be all water use greater than the base use.

Base and seasonal water uses are shown by category and year in Figures ES-3 and ES-4. Among retail customers, residential (single-family), GS commercial and government, and municipal accounts used about 37 to 40 percent of all water supplied for seasonal purposes (Figure ES-4). GS multi-family and OGS accounts had much lower seasonal water use.

Figure ES-3: Seasonal Water Use by Category, FY 2003-04 to FY 2007-08

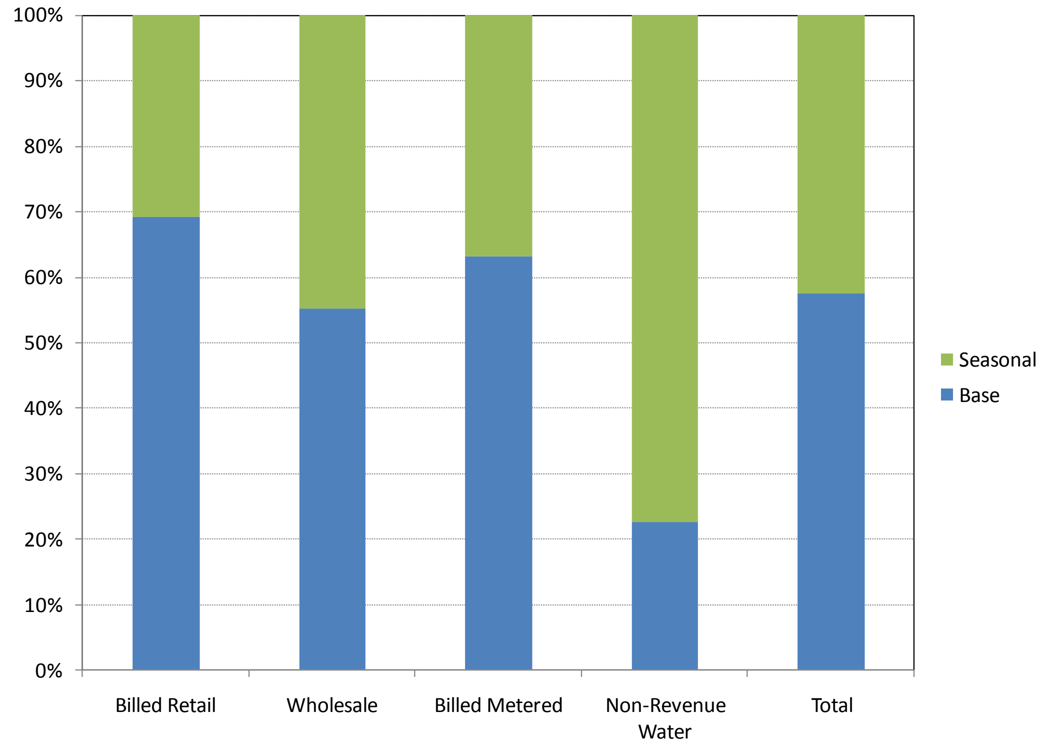
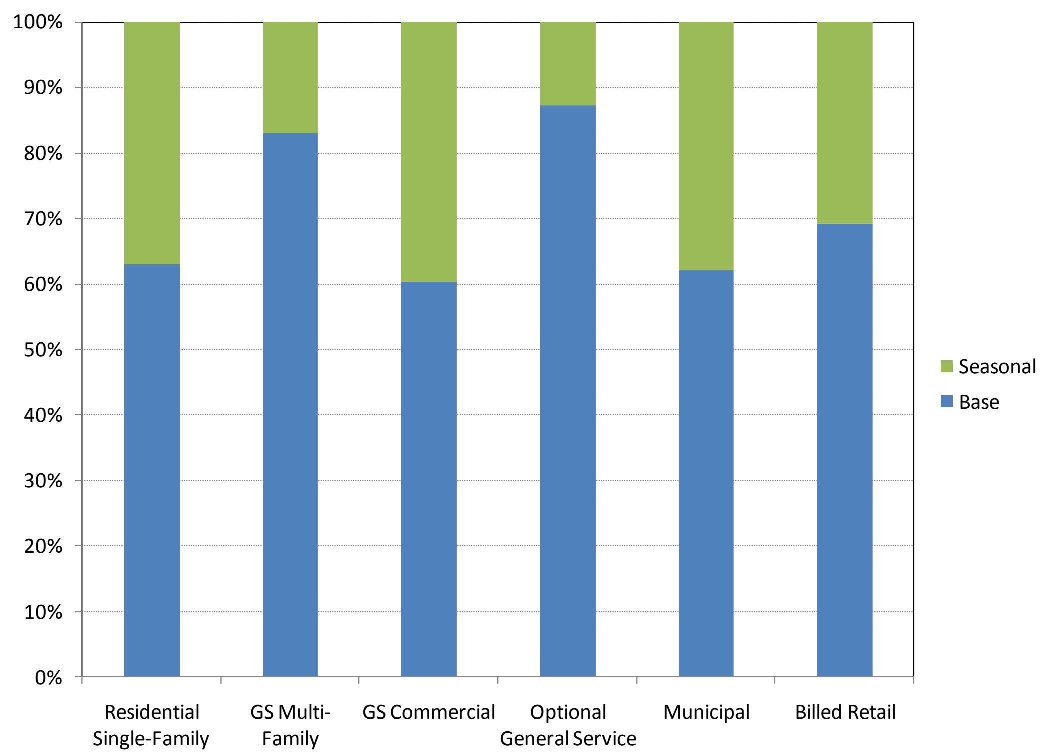
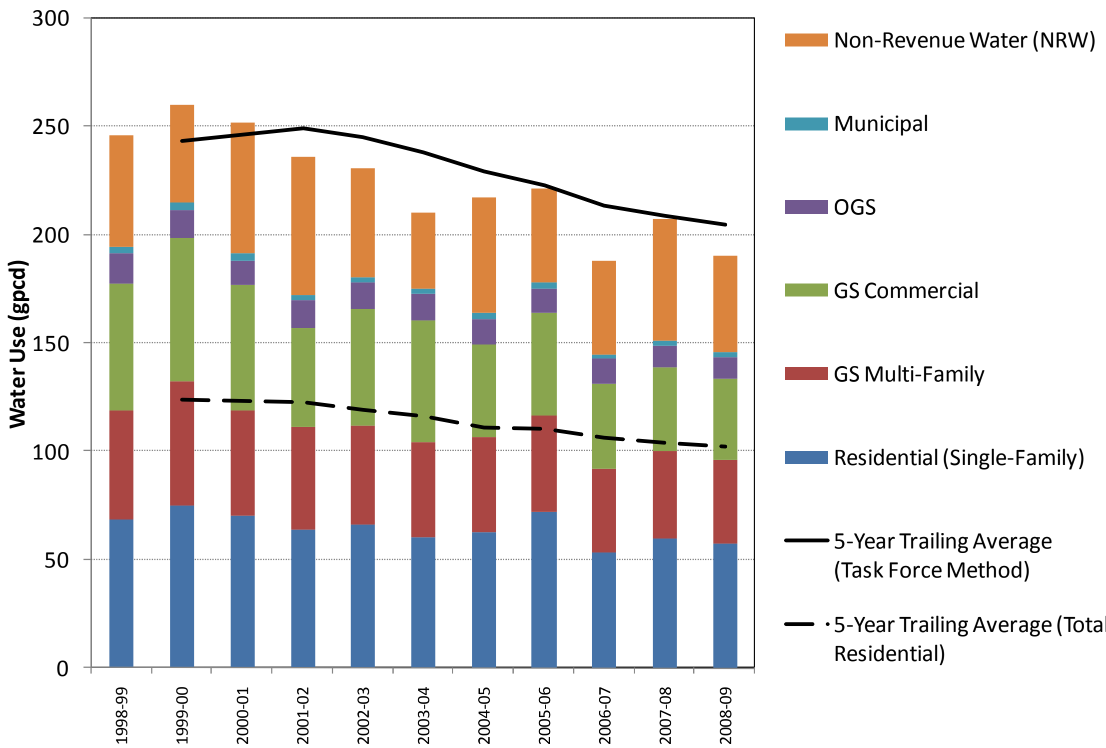


Figure ES-4: Seasonal Billed Retail Water Use by Category, FY 2003-04 to FY 2007-08



The Water Conservation Implementation Task Force recommended standard methodologies for calculating total per capita water use (in gallons per capita per day, or gpcd) and residential per capita water use (Ref. 2). Using this methodology, total per capita water use for the City of Dallas (including billed retail water use, unbilled authorized consumption, and water loss) was calculated for the last eleven years (Figure ES-5). Total per capita water use has steadily declined from its FY 1999-00 peak to present.

Figure ES-5: Normalized Retail Water Use



Some of the variability in annual water use can be attributed to differences in weather from year to year. To better filter out the impact of weather on the annual data, five-year trailing averages were calculated for total retail water use and total residential water use (Figure ES-5). By the Task Force Method (described in Section 5.3), the five-year trailing average total water use has steadily declined from about 249 gpcd in FY 2001-02 to about 205 gpcd in FY 2008-09, a total reduction of 17.7 percent, or 2.75 percent per year. During the same period, the five-year trailing average residential water use has declined from about 123 gpcd to about 102 gpcd, a total reduction of 16.7 percent, or about 2.6 percent per year.

ES.3. Identification and Screening of Potential Water Conservation Strategies

Potential water conservation strategies were compiled from various sources, including recommendations by task forces and planning groups, literature sources, 2005 Strategic Plan recommendations that have not yet been implemented, and programs implemented in other cities that have successful water conservation efforts. Potential water conservation strategies are presented in Appendix H.

Based on the DWU water use profile, screening criteria were developed to help determine which new or enhanced water conservation strategies would be most effective for Dallas during the next five years. Using these screening criteria, the strategies in Table ES-1 were selected for detailed evaluation of probable water savings, benefits, and costs. These strategies address a broad range of customer types and water use types.

Table ES-1: Customer and Water Use Types Addressed by Measures Selected for Detailed Evaluation

Measure	Customer Type				Water Use Type	
	SF	MF	ICI	Utility	Indoor	Outdoor
Enhanced Real Loss Reduction				✓	✓	
Enhanced Apparent Loss Reduction				✓	✓	✓
Water-Wise Landscape Design Requirements	✓	✓	✓			✓
ICI Water-Efficient Equipment Rule			✓		✓	
Twice-Weekly Irrigation Schedule	✓	✓	✓			✓
ICI Customer Water Audits			✓		✓	✓
ICI Training Programs			✓		✓	✓
ICI Business Partnership Program			✓		✓	✓
ICI Hospitality Program			✓		✓	✓
Residential Irrigation System Incentive	✓	✓				✓
ICI Financial Incentives			✓		✓	✓
Enhanced Residential Toilet Incentive	✓	✓			✓	
Residential Clothes Washer Incentive	✓	✓			✓	
Additional Savings – Existing Real Loss Program				✓	✓	
House Bill 2667 High-Efficiency Toilet Law	✓	✓	✓		✓	
TOTAL	6	6	9	3	12	9

SF = Single-family residential
MF = Multi-family residential
ICI = Industrial, commercial, and institutional

ES.4. Detailed Evaluation of Selected Water Conservation Strategies

The goals of the Updated Strategic Plan include the following:

- Develop and implement water conservation programs aimed at:
    - Reducing seasonal peak demands
    - Reducing water loss and waste
    - Decreasing per capita water use (gpcd)
- Continue a heightened public awareness of water conservation in Dallas and the North Texas region.
- Continue and enhance conservation practices that will maintain quality of life and allow economic growth and development.
- Continue to include broad-based public and private stakeholder groups in new program development and implementation processes.
- Continue to lead by example by upgrading city facilities with water-efficient fixtures, landscapes, and irrigation systems wherever possible.
- Assist in facilitating regional conservation efforts among Dallas Water Utilities (DWU) wholesale customer cities and neighboring municipalities.
- Target an average 1.5 percent per year reduction in per capita consumption for the five-year planning period.
- Establish the foundation for continuation of water savings targets for the following five-year period and succeeding five-year intervals.

The strategies listed in Table ES-1 were evaluated based on the following:

- DWU's water conservation goals for the next five years
- Projected water savings
- Probable benefits
- Probable costs
- Feedback from wholesale customer cities and other stakeholders.

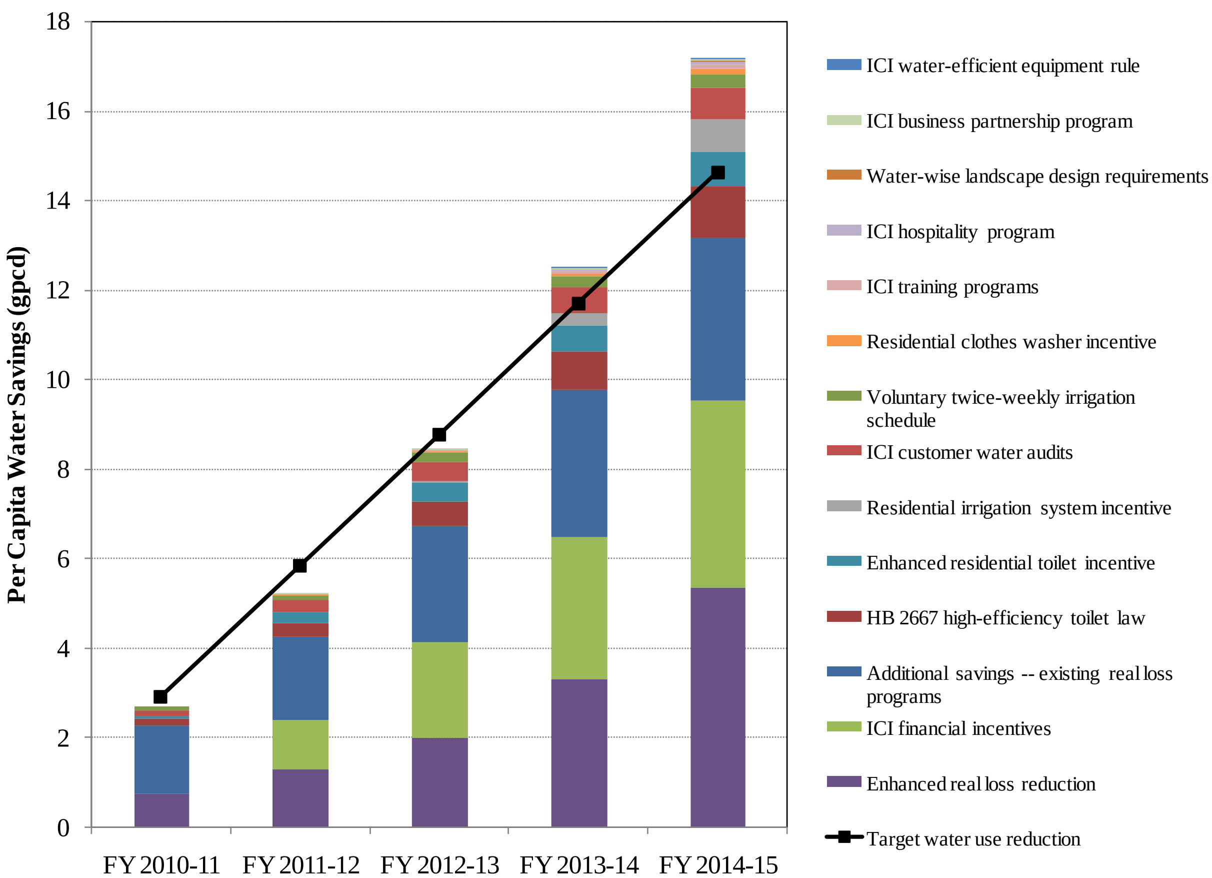
After careful consideration, all strategies listed in Table ES-1 are recommended for implementation during the next five years. In addition, considering how effective DWU's water conservation program has been over the last several years (Figure ES-5), all of the water conservation strategies presently employed by DWU are recommended for continuation or enhancement under the Updated Strategic Plan.

Finally, DWU should continue to pursue implementation of its planned direct and indirect recycled water projects. Although recycling of treated wastewater effluent is an important water efficiency strategy, DWU conducts recycled water planning separately from water conservation planning (as described in Section 6.1). No independent water savings projections or budget recommendations for recycled water projects have been developed as part of the Updated Strategic Plan.

Projected Water Savings

Projected water savings for each recommended water conservation strategy were estimated based on historical water use patterns, literature values, and experience with other utilities. Figure ES-6 shows the projected water savings by strategy on a per capita water use basis (gpcd), ordered from greatest projected savings to least. The selected strategies are projected to achieve the target per capita water use reduction (an average of 1.5 percent per year, or about 2.9 gpcd per year) by the last two years of the planning period. The three most important strategies to achieving the savings goal are enhanced real loss reduction, ICI financial incentives, and additional savings from existing real loss programs.

Figure ES-6: Projected Per Capita Water Savings from Selected Strategies



Benefit-Cost Analysis

Water conservation has both economic and non-economic benefits. Water conservation:

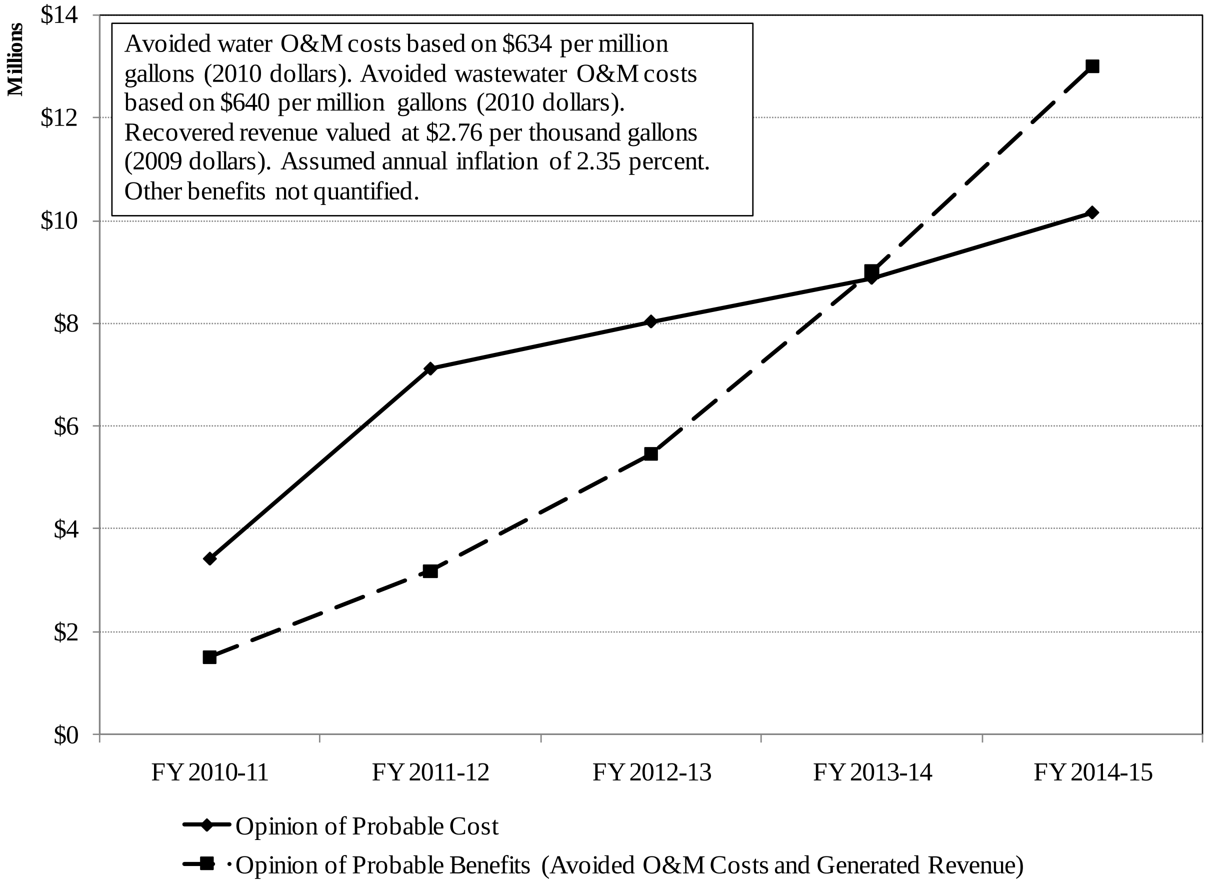
- Extends the life of existing water supplies and delays the need to develop expensive future water supplies. Costs associated with developing new water supplies (or purchasing new water) can include capital costs for construction of reservoirs, pumping facilities, pipelines, treatment plants, water storage, and related facilities; costs of obtaining water rights and permits; and operation and maintenance (O&M) costs such as labor, energy, and chemicals.
- Reduces peak requirements, extending the life of existing infrastructure. Water system infrastructure is sized to meet peak demands. When peak demands are reduced through water conservation, the need for infrastructure expansion is delayed.
- Lowers capital and operating costs of the existing system. Deferral of new water supply development or infrastructure expansion allows the utility to avoid associated capital costs. In addition, operational costs, such as power and chemicals, are reduced.
- Positions the city to obtain future water rights. In the Long Range Water Supply Plan (Ref. 3) and in the 2011 Region C Initially Prepared Plan (Ref. 4), Dallas has identified future water sources that would involve interbasin transfer of raw water. An interbasin transfer authorization requires that the applicant "has developed and implemented a water conservation plan that will result in the highest practicable levels of water conservation and efficiency achievable within the jurisdiction of the applicant" (Ref. 5).
- Other benefits include positive environmental effects, improved customer good will, continued growth and economic development, a reduction of Dallas's carbon footprint, and a positive image of Dallas.

Typically, capital costs are developed for specific projects in specific locations. However, probable water savings have been developed for the city as a whole and not for specific locations in the water system. Therefore, the avoided capital costs are difficult to quantify. In addition, other avoided capital costs are somewhat speculative, since not all decisions have been made about future water supplies for Dallas. Therefore, the benefit evaluation in the Updated Strategic Plan includes only avoided water and wastewater O&M costs and additional revenue generated through enhanced apparent loss reduction.

An opinion of probable cost for each recommended water conservation strategy was developed based on program participation assumptions, recent Water Conservation Division and Operations Division budgets, reported costs at other water utilities, and unit cost assumptions in the Alliance for Water Efficiency Water Conservation Tracking Tool (Ref. 6). By FY 2013-14, the probable economic benefit from avoided O&M costs and generated revenue are projected to exceed the probable cost of implementing the recommended strategies (Figure ES-7).

There may be additional benefits (e.g., avoided capital costs) and additional costs (e.g., increases in water rates) that have not been considered in the benefit-cost analysis.

Figure ES-7: Opinions of Probable Economic Benefit and Probable Cost for Selected Strategies



ES.5. Recommended Implementation Plan, FY 2010-11 through FY 2014-15

The Updated Strategic Plan is designed to provide the next steps in a long-range, disciplined approach to water conservation. While significant analysis and efforts have gone into development of the Updated Strategic Plan, the Plan should be reassessed annually to make sure that Dallas is achieving its water conservation goals, to revamp programs if necessary, and to take advantage of new water conservation opportunities, such as federal or state funding for water conservation. The overall conservation program should be flexible, allowing strategies to be adjusted based on continued feasibility and support of goals, feedback from stakeholders and focus groups, and public participation or interest.

The recommended implementation plan consists of new or enhanced water conservation strategies, detailed action schedules, DWU staff increases, and budgets as presented in the following sections.

Recommended New or Enhanced Water Conservation Strategies

The recommended new or enhanced water conservation strategies are projected to enable DWU to meet its water conservation goals, to be less expensive than other water supply alternatives, and to provide positive net economic benefits over the next twenty years. These strategies may be grouped into three major elements of the Plan:

- City Leadership and Commitment
- Education and Outreach Initiatives
- Rebate and Incentive Programs

City Leadership and Commitment

Strategies within the City Leadership and Commitment element demonstrate a strong commitment to water conservation; in other words, the city "leads by example." The visible efforts and actions of the City of Dallas with respect to its own water use will be the best example of the city's commitment to water conservation. Positive efforts and actions conducted by the city will impact others and encourage like-mindedness in water conservation, not only by DWU customers, but also by others throughout the region. Water conservation leadership includes adopting and promoting water conservation practices at city facilities and continuing and enhancing water conservation-oriented ordinances and policies. Recommended water conservation strategies within the City Leadership and Commitment element are presented in Table ES-2.

Education and Outreach Initiatives

The goal of Education and Outreach Initiatives is to maintain a heightened public awareness of water conservation in Dallas and the surrounding region and to reduce water use and waste by changing customer behavior. Recommended water conservation strategies within the Education and Outreach Initiatives element are presented in Table ES-3.

Rebate and Incentive Programs

Rebate and incentive programs offer targeted customer groups financial motivation to conserve water. Recommended water conservation strategies within the Rebate and Incentive Programs element are presented in Table ES-4.

Table ES-2: Recommended Water Conservation Strategies: City Leadership and Commitment Element

Strategy	Description
Enhanced Real Loss Reduction	Enhanced real loss reduction includes several recommended elements, as described below. This strategy will help DWU meet or surpass its goals of surveying the entire distribution system for leaks every 2.5 years and reducing leakage so that the Infrastructure Leakage Index is less than or equal to three. ▪ Continue existing leak detection and repair efforts. ▪ Task 1: Develop and track water loss performance indicators (Table 8-4) on a monthly basis. This could include automated monitoring of water audit data through software programming and third party review and reporting of data. Use the results to target water loss resources (e.g., leak detection and repair crews). ▪ Task 2: Validate water use in the American Water Works Association (AWWA) water balance categories (Figure 5-17) through field testing where possible. Improvements in data validation could include: o Perform additional meter testing and analysis of meter test results (this could include all sizes of meters from residential to production meters). Maintain calibration of the production meters and the largest commercial/industrial meters, as these will have the greatest impact on overall average meter accuracy if they are in error. Use the analysis of the meter testing results to refine the meter accuracy assumption in the system water audit. o Conduct water loss audits on a pressure zone level. Since smaller district metered areas (DMAs) are not considered at this time, conduct pressure zone water balances to improve the level of accuracy of the system water audit. Analyze minimum flow characteristics and estimate leakage. Conduct leakage detection surveys on the pressure zone and evaluate and record the reduction in real losses. o Review and evaluate the pressure reducing valve (PRV) maintenance and replacement program. Tasks could include more frequent monitoring of PRV vaults and continued trending and analysis of collected data.

Table ES-2 Continued: Recommended Water Conservation Strategies: City Leadership and Commitment Element

Strategy	Description
Enhanced Real Loss Reduction (Continued)	▪ Task 3: Add leak detection and repair personnel and equipment and conduct additional training. Analyze the economic level of leakage, including a financial review of the costs of the leak detection and repair program and benefits from the reduction of leakage (e.g., reduced treatment and distribution costs, reduced number of emergency callouts and main breaks, etc.). ▪ Task 4: Continue to plan, develop, and implement water loss recommendations from previous water audits and efficiency studies. Monitor and document milestones reached as the result of recommendations made in the Water Efficiency Study (Ref. 7), the internal City Auditor's Report (Ref. 8), and the Texas Water Development Board's Analysis of Water Loss (Ref. 9). ▪ Task 5: Maximize advanced metering infrastructure (AMI) monitoring capabilities. Use detailed water use monitoring capabilities in the downtown corridor to identify potential leakage on the customer side of the meters. Other uses could include monitoring and providing information on consumption patterns for ICI water users. ▪ Task 6: Evaluate, purchase, and implement leakage management software specifically designed to enhance leak detection efforts. Examples include ILMSS LEAKS Suite (Ref. 10) and Crowder Consulting's NETBASE Water Distribution Management Software (Ref. 11). This will improve cost-benefit analyses and targeting of leak detection and repair efforts and assist in pressure management.
Enhanced Apparent Loss Reduction	Enhanced apparent loss reduction includes several recommended components, as described below. This strategy will help DWU identify and correct apparent losses, generating additional revenue for the utility. ▪ Continue existing apparent loss reduction efforts.

Table ES-2 Continued: Recommended Water Conservation Strategies: City Leadership and Commitment Element

Strategy	Description
Enhanced Apparent Loss Reduction (Continued)	▪ Task 1: Dedicate water loss management analysts to find, trend, and correct discrepancies within the metering and billing systems. ▪ Task 2: Improve meter accuracy by reviewing all residential meter volumes and changing out meters that have exceeded the warranty limits. There are a number of two-, 1.5-, one-, and ¾-inch meters with flow volumes in excess of the warranty limits (Figure 5-18). Target customers that use a volume of water that would exceed the meter warranty within five years for participation in DWU water conservation programs to help reduce their water use to within the normal range of the meter warranty. If this is not possible, conduct a meter-sizing analysis and replace the meter with a meter of appropriate size for the water use. ▪ Task 3: Identify customers that are billed for water service and not for wastewater service (and vice versa), and verify that these customers do not receive both services. Correct any discrepancies that are identified. In a study conducted from 2004 to 2006 by Utility Revenue Management (Ref. 12), a number of accounts were found where customers were being billed for water, but not for wastewater. ▪ Task 4: Evaluate and correct accounts with misclassified premise types. Update premise types as the water use associated with an account changes. For example, review the fireline classification, as more than fifty fireline accounts were found to have significant, regular monthly usage, which should not occur. Reclassify these accounts or remove the fireline meters and replace them with properly-sized retail meters. As another example, review the cross-tabulation of total water use by premise type and customer type (Appendix A) for accounts with inappropriate combinations of premise type and customer type. ▪ Task 5: Interface with all relevant DWU Divisions; collate, organize, and analyze all water loss data, including performance indicators (Table 8-4); and prepare performance reports that document water loss reduction. ▪ Task 6: Conduct an analysis of unauthorized use and customers not currently receiving a correct bill. Initial review would include analysis of accounts that consistently read zero, identification of addresses with no water service, etc.

Table ES-2 Continued: Recommended Water Conservation Strategies: City Leadership and Commitment Element

Strategy	Description
Water-Wise Landscape Design Requirements	Upon City Council approval and adoption, revise the city's landscape ordinance to limit turf areas in all new landscapes and require low-water-use landscaping in other areas. Other requirements could include minimum soil depths, soil amendments, and turfgrass summer dormancy capability. Turfgrass requires more water than native grasses and low-water-use plants. Reducing the turfgrass area in new landscapes will reduce irrigation water use.
ICI Water-Efficient Equipment Rule	Upon City Council approval and adoption, adopt an ordinance requiring certain water efficiency standards for new and newly-occupied ICI establishments. Example requirements could include repairing all leaks, retrofitting high-flow plumbing fixtures, and other equipment and service requirements, depending on the nature of the business. Collaborate with the city's Building Inspection Office to verify installation of water efficiency measures prior to occupancy.
Recycled Water Projects	Continue efforts necessary to implement the Cedar Crest Pipeline Extension by 2011 to make recycled water available to the Dallas Zoo and other customers for non-potable uses. Continue development of the White Rock Pipeline Alternative project (which will provide recycled water from the Central Wastewater Treatment Plant (WWTP) to irrigation and industrial customers in the White Rock Creek Corridor), or other projects. Continue efforts necessary to complete the Main Stem Trinity River Pump Station by 2013; this will allow significant indirect reuse for potable purposes, as discussed in Section 6.1.

Table ES-3: Recommended Water Conservation Strategies: Education and Outreach Initiatives Element

Strategy	Description
Education & Outreach Initiatives	
Voluntary Twice-Weekly Irrigation Schedule	Through the Public Awareness Campaign, encourage all customers to limit irrigation to a maximum of two days per week from April 1 through October 31. Twice-weekly irrigation will reduce over-watering while also allowing customers to meet plant needs.
ICI Customer Water Audits	Visit an ICI establishment with the company's engineers or other employees knowledgeable about company water use; review all end uses of water; identify potential water-efficiency improvements and potential costs; directly install small, low-cost devices as appropriate; document the findings; inform the company of applicable DWU water conservation programs; and follow up with the company to track implementation of the recommendations. Complete the ICI customer water audit at no cost to the customer. Make the program available to all ICI customers but target the top ten percent of ICI customers in terms of water use.
ICI Training Programs	Develop, lead, and manage ongoing water efficiency training programs for: ▪ ICI facility managers for premise types that use the most water, and ▪ Irrigators, with a focus on EPA WaterSense programs. Topics will include industrial cooling and process, food processing, irrigation management, and leakage control. Bi-monthly or quarterly training programs are recommended. Make the program available to all ICI customers but target the top ten percent of ICI customers in terms of water use. Work with local businesses, green building organizations, and energy utilities to seek their input on the curriculum development and certification process. As facility managers and irrigators become more aware of available water-efficient technologies and methods, they will begin to implement these measures. ICI training programs could increase participation in other water conservation programs.

Table ES-3 Continued: Recommended Water Conservation Strategies: Education and Outreach Initiatives Element

Strategy	Description
ICI Business Partnership Program	Establish an ongoing Business Partnership Task Force or work group for the purpose of engaging the ICI community in DWU's water conservation program, particularly business leaders who represent companies that are top water users. Meet four to six times per year for discussion of water conservation practices, sharing of conservation success stories, and discussion of DWU ICI water conservation programs. Target the top one percent of ICI customers in terms of water use. Increased awareness of the value of ongoing water efficiency practices should lead to water savings for the participating customers.
ICI Hospitality Program	Engage hotels, motels, and restaurants in the city's water conservation program and train hospitality staff on methods to reduce water use and waste. Measures would include water on request, reuse of towels and linens, etc. DWU would provide printed materials to encourage guest participation: table cards, door hangers, pillow cards, etc.

Table ES-4: Recommended Water Conservation Strategies: Rebate and Incentive Programs Element

Strategy	Description
Residential Irrigation System Incentive	Offer a rebate or other incentive worth up to $200 to single- and multi-family residential customers that retrofit their existing irrigation systems with water-conserving equipment. Qualifying equipment may include: ▪ Drip irrigation equipment ▪ Spray heads with greater distribution uniformity ▪ Weather-based irrigation controllers ▪ Other devices Make the program available to all residential customers but target the top twenty-five percent of single- and multi-family residential customers in terms of water use.
ICI Financial Incentives	Implement a site-specific rebate program for ICI customers to promote water-efficient equipment installation and upgrades. Examples could include cooling processes, plumbing fixtures, laundry processing, medical/dental devices, landscape irrigation, rainwater harvesting, etc. Target the top ten percent of large ICI customers for two-thirds or more of the program resources, but use the remainder to target small/medium businesses. Candidates could include office buildings, hotels/motels, restaurants, grocery stores, Laundromats, schools, manufacturers, food processing, and parks/golf courses. Customers propose water-efficiency improvements and project the associated water savings and costs. After review of the proposal, DWU decides whether to fund a portion of the cost (up to an anticipated maximum amount of $100,000 per customer) for water efficiency measures that meet certain water savings performance standards. The customer installs the approved water-efficiency measures. Upon confirmation of installation, DWU rebates a portion of the measure costs. DWU could also establish financial partnerships with energy utilities and green building organizations. Similar programs operated by Austin Water Utility and San Antonio Water System could serve as models during development of this strategy.
Enhanced Residential Toilet Incentive	Expand the “New Throne for Your Home” program to replace additional existing single- and multi-family residential toilets that use 3.5 gallons per flush or more with high-efficiency toilets (1.28 gallons per flush or less).

Table ES-4 Continued: Recommended Water Conservation Strategies: Rebate and Incentive Programs Element

Strategy	Description
Residential Clothes Washer Incentive	DWU would offer rebates worth up to $100 for single-family residential customers and worth up to $250 for multi-family residential customers for replacing older, inefficient clothes washers with water-efficient models (modified energy factor of at least 1.8 and water factor of no more than 7.5). Efficient clothes washers use up to sixty percent less energy and up to forty percent less water than conventional machines.

Recommended DWU Staff Increases

Some of the recommended water conservation strategies require no additional DWU labor (e.g., voluntary twice weekly irrigation schedule).[2] For others (e.g., residential clothes washer incentive), it is anticipated that DWU will hire a contractor to implement the strategy. The remaining recommended strategies will require increases in DWU staff, as summarized by strategy and fiscal year in Table ES-5.[3] In summary, it is recommended that DWU fund and create twenty-nine new full-time equivalents (FTEs) during the five-year implementation period, with sixteen FTEs in the Operations Division, eleven FTEs in the Water Conservation Division, and two FTEs shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

Recommended Water Conservation Division Budgets

The recommended water conservation strategies will be implemented by several DWU Divisions, so the associated costs will be included in several Division budgets. A five-year budget for the Water Conservation Division was developed in conjunction with the conservation strategy recommendations (Table ES-6). Existing water conservation programs should continue to be funded at existing levels (adjusted for inflation). Additional funding is recommended for seven new or enhanced water conservation strategies. Recommended Water Conservation Division annual budgets over the next five fiscal years range from about $5.2 million to $11.2 million.

The Water Conservation Division budgets in Table ES-6 include operating costs (labor, incentives, etc.) but do not include major capital expenditures for recycled water pipelines or pipeline replacement costs. Budget items for other Divisions are presented in Chapter 10.

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[2] However, some of the recommended measures will require staff time for employees of other city departments. For example, under the recommended ICI water-efficient equipment rule, DWU would collaborate with the Building Inspection Office to verify installation of water efficiency measures prior to occupancy.

[3] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

Table ES-5: Recommended DWU Staff Increases

Recommended Water Conservation Strategies[a]	Recommended DWU Staff Increases (FTEs) FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15	Five-Year Total	Division
City Leadership and Commitment							
Enhanced Real Loss Reduction							
- Field personnel (leak detection)	+2.00	+2.00		+4.00		+8.00	Operations
- Field personnel (leak repair)	+1.00	+3.00	+1.00	+3.00		+8.00	Operations
Enhanced Apparent Loss Reduction							
- Management analyst	+1.00			+1.00		+2.00	Shared[b]
Water-Wise Landscape Design Requirements							
- Plan evaluation, construction compliance			+1.00			+1.00	Water conservation
Education and Outreach Initiatives							
ICI Customer Water Audits							
- Site visits, analysis, reporting	+0.50					+0.50	Water conservation
ICI Training Programs							
- Outreach, development, training	+0.50					+0.50	Water conservation
ICI Hospitality Program							
- Outreach, development, operations	+0.50					+0.50	Water conservation
Rebate and Incentive Programs							
Residential Irrigation System Incentive							
- Site visits, analysis, verification		+0.50		+2.25	+3.00	+5.75	Water conservation
- Clerical				+0.75	+1.25	+2.00	Water conservation
ICI Financial Incentives							
- Clerical	+0.25					+0.25	Water conservation
- Site visits, analysis, verification		+0.25				+0.25	Water conservation
Enhanced Residential Toilet Incentive							
- Site visits, verification		+0.25				+0.25	Water conservation
Water Conservation Division Subtotal	***+1.75***	***+1.00***	***+1.00***	***+3.00***	***+4.25***	***+11.00***	
Operations Division Subtotal	***+3.00***	***+5.00***	***+1.00***	***+7.00***		***+16.00***	
Shared[b]	***+1.00***			***+1.00***		***+2.00***	
TOTAL	**+5.75**	**+6.00**	**+2.00**	**+11.00**	**+4.25**	**+29.00**	

[a] Some recommended water conservation strategies/tasks not shown. Either they require no additional labor or it is anticipated that DWU will hire contractors to execute them.
[b] Shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

Table ES-6: Recommended Water Conservation Division Budgets by Fiscal Year

Budget Item	Status	Recommended Water Conservation Division Budgets[a]				
		FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Salaries and Benefits	Existing	$608,523	$622,800	$637,400	$652,400	$667,700
Other Operating Expenses	Existing	$1,060,263	$1,085,200	$1,110,700	$1,136,800	$1,163,500
Public Awareness Campaign	Existing	$1,380,000	$1,412,400	$1,445,600	$1,479,600	$1,514,400
Minor Plumbing Repair Program	Existing	$400,000	$409,400	$419,000	$428,900	$439,000
Environmental Education Initiative	Existing	$274,000	$280,400	$287,000	$293,700	$300,600
Pre-Rinse Spray Nozzle Program	Existing	$290,250	$297,100	$304,100	$311,200	$318,500
New Throne for Your Home	Existing	$550,770	$563,700	$577,000	$590,600	$604,500
Cooling Tower Audits	Existing	$75,510	$77,300	$79,100	$81,000	$82,900
Existing Budget Items Subtotal		***$4,639,316***	***$4,748,300***	***$4,859,900***	***$4,974,200***	***$5,091,100***
ICI Customer Water Audits[b]	Additional	$0	$27,500	$28,100	$28,800	$29,500
ICI Training Programs	Additional	$25,800	$26,200	$26,800	$27,400	$28,100
ICI Hospitality Program	Additional	$50,000	$102,400	$104,800	$107,200	$109,700
Residential Irrigation System Incentive	Additional	$0	$42,100	$94,300	$695,100	$1,581,000
ICI Financial Incentives	Additional	$500,000	$2,983,200	$3,023,500	$3,047,600	$3,072,200
Enhanced Residential Toilet Incentive[c]	Additional	$0	$928,600	$950,400	$972,700	$995,600
Residential Clothes Washer Incentive	Additional	$0	$76,600	$153,300	$214,000	$481,900
Next Update to the Strategic Plan	Additional	$0	$0	$0	$699,100	$0
Additional Budget Items Subtotal		***$575,800***	***$4,186,600***	***$4,381,200***	***$5,791,900***	***$6,298,000***
Recommended Total Budget		**$5,215,116**	**$8,934,900**	**$9,241,100**	**$10,766,100**	**$11,389,100**

[a] The existing budget is assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[b] Extension of the Cooling Tower Audit program. Projected additional costs only.

[c] Extension of the New Throne for Your Home program. Projected additional costs only.

1. Introduction, Objectives, and Goals

Conservation is an important element of Dallas' Long Range Water Supply Plan (Ref. 3). In 2005, Dallas Water Utilities (DWU) developed a Water Conservation Five-Year Strategic Plan (Strategic Plan) that defined water conservation goals for Fiscal Year (FY) 2004-05 through FY 2008-09 and recommended water conservation strategies and budgets to achieve these goals (Ref. 1).[4] From FY 2001-02 through FY 2008-09, ongoing water conservation efforts and implementation of the Strategic Plan have helped Dallas to save approximately ninety-eight billion gallons (300,751 acre-feet) of water.

This document, the Updated Water Conservation Five-Year Strategic Plan (Updated Strategic Plan), defines new water conservation goals for FY 2010-11 through FY 2014-15 and recommends water conservation strategies and budgets to achieve the new goals.

1.1. Historical Background and the Need for Water Conservation

Dallas, as well as the surrounding North Central Texas area, has experienced a pattern of sustained growth over the past several decades. This growth would not have been possible without an adequate and reliable water supply. After experiencing water shortages during the drought years of the 1950s, Dallas chose to become a regional water utility to ensure a dependable and adequate water supply for its customers. To accomplish this, Dallas has conducted ongoing planning efforts to identify water sources needed to meet the higher demands of increasing population and economic development. Dallas has successfully developed several water supply sources and has identified others for near-term and long-term development. However, development of new water sources is difficult and expensive. Water conservation results in less water usage per person, allowing more people to be served with the same water supply, and deferring the need for new supplies.

In addition, the Long Range Water Supply Plan and the 2011 Region C Initially Prepared Water Plan (Ref. 4) recommend new water supplies for Dallas that will be located in other river basins. It is anticipated that these new supplies will be required by about 2040. To obtain the interbasin transfer authorization required for these new supplies, Dallas will have to demonstrate that it "has developed and implemented a water conservation plan that will result in the highest practicable levels of water conservation and efficiency achievable within the jurisdiction of the applicant" (Ref. 5).

For these reasons, it is important for Dallas to continue to increase its water use efficiency. Well-publicized, aggressive water conservation efforts will engender efficient use of Dallas' water. This Updated Water Conservation Five-Year Strategic Plan is recommended as a blueprint for Dallas' continued water conservation efforts.

[4] The City of Dallas fiscal year begins October 1.

1.2. *Strategic Plan Development Process*

This document was developed through a multi-faceted approach that included review of the previous water conservation planning effort; through review of numerous water conservation programs, initiatives, data, and literature; and through input from DWU staff, water conservation staff from other cities, City of Dallas wholesale customer cities, and stakeholders.

The following outline describes the process utilized in the development of the Updated Strategic Plan.

Data Collection and Analysis

DWU provided the following data for use in development of the Updated Strategic Plan:

- Monthly water consumption of City of Dallas customers by major category (residential, general service, optional general service, municipal, wholesale, and unbilled) as well as selected sub-categories by various customer types (FY 2003-04 through FY 2007-08).
- Monthly water loss data (FY 2002-03 through FY 2007-08).
- Monthly water consumption for all City of Dallas retail water customers (November 2004 through June 2009).
- Monthly water consumption of City of Dallas retail customers by major category and rate block (FY 2005-06 through FY 2006-07).
- Historical retail water rates (FY 2002-03 through FY 2007-08).
- Itemized annual Water Conservation Division budgets (FY 2003-04 through FY 2007-08).
- Annual water conservation program implementation statistics and projected water savings (FY 2003-04 through FY 2008-09).[5]
- Descriptions of DWU water conservation measures.
- Number of water meters for DWU retail water customers by major category (FY 2003-04 through FY 2007-08).
- Annual estimates of the retail DWU water customer population (FY 2001-02 through FY 2007-08)
- Projected population and water demands by decade through 2060.
- Retail water costs for raw and treated water (FY 2007-08).
- Daily rainfall and temperature information (FY 2002-03 through FY 2007-08).

Housing data were obtained from the U.S. Census Bureau. Other data were obtained from various sources.

Coordination with Other Water Conservation Planning Efforts

The consultant team reviewed draft and final documents produced by other ongoing water conservation planning efforts, such as the Water Conservation Implementation Task Force

[5] FY 2008-09 water savings provided through April 2009.

(created by the Texas Legislature in 2003 pursuant to Senate Bill 1094), the Water Conservation Advisory Council (created by the Texas Legislature in 2007 pursuant to Senate Bill 3), and the Region C Water Planning Group.

Review of Water Conservation Programs in Other Large Cities

The consultant team interviewed representatives of the following six Southwestern utilities regarding their water conservation programs and policies:

- Albuquerque Bernalillo County Water Utility Authority (Albuquerque, New Mexico)
- Austin Water Utility (Austin, Texas)
- Denver Water (Denver, Colorado)
- San Antonio Water System (San Antonio, Texas)
- San Diego County Water Authority (San Diego, California)
- Southern Nevada Water Authority (Las Vegas, Nevada)

Review of the DWU Water Conservation Program

The existing DWU water conservation program and the Water Conservation Five-Year Strategic Plan (Ref. 1) were reviewed.

Review of Other City of Dallas Plans

The consultant team reviewed the 2005 Update to the Long Range Water Supply Plan (Ref. 3), the Recycled Water Implementation Plan (Refs. 14 and 15), and other City of Dallas planning documents. In addition, the team coordinated with other City of Dallas water planning efforts (*e.g.*, the recent update to the DWU Wastewater System Master Plan, which is not yet complete).

Development of Candidate Water Conservation Strategies

Numerous water conservation strategies were examined and considered during the strategic planning process. These strategies were derived from several resources, including recommendations by task forces and planning groups, literature sources, Strategic Plan recommendations that have not yet been implemented, and programs implemented in other cities that have successful water conservation programs.

Evaluation of Water Conservation Strategies

Water conservation strategies identified from the above resources were compiled into a list as candidate strategies. Each candidate strategy was researched and evaluated to determine if it should be recommended for implementation during the five-year planning period. The evaluation included an initial screening of the strategies to determine their applicability for use by Dallas, using screening criteria developed from DWU's water use profile. Strategies passing the initial screening were subjected to a benefit-cost analysis and weighed against feedback from customer cities, stakeholder groups, and DWU. A final list of recommended strategies was developed and incorporated into the Updated Strategic Plan.

Development of the Updated Strategic Plan

In collaboration with DWU and stakeholder groups, the consultant team developed the recommended strategies into the Updated Strategic Plan, including implementation schedules, budgets, and methods.

1.3. Use of the Updated Strategic Plan

The Updated Strategic Plan provides recommendations and guidance for a balanced plan of water conservation strategies to be implemented over the five-year period FY 2010-11 through FY 2014-15. The types of water conservation strategies, implementation dates, and levels of anticipated funding are designed to achieve the Updated Strategic Plan's water conservation goals and targets. The Updated Strategic Plan also establishes a foundation for continuation of water savings targets for the following five-year period.

The Updated Strategic Plan is intended to be implemented with a "common sense" approach, whereby progress assessments are conducted annually and adjustments are made as necessary to address changing needs and conditions, while achieving the stated goals and targets.

1.4. Long-Term Goals

A successful water conservation program is not self-sustaining. Therefore, proactive efforts must continue beyond the five-year strategic planning horizon to achieve long-term water conservation goals. Continued support by the Dallas City Council, active involvement by stakeholders and DWU customers, a continuous program of education and public awareness, and on-going re-evaluation of the water conservation program are necessary to meet Dallas' long range water conservation goals and water supply needs.

2. State of Texas Initiatives and Requirements for Water Conservation

State of Texas water conservation requirements and initiatives include water conservation legislation, the Regional Water Planning process, the Water Conservation Implementation Task Force, and the Water Conservation Advisory Council. Each of these is discussed below.

2.1. Water Conservation Legislation

Water conservation legislation in Texas since 2003 is summarized below.

Table 2-1: Summary of Recent Water Conservation Legislation

Year	House/ Senate Bill Number	Description
2003	HB 645	Limited property associations from creating/enforcing rules that undermine water conservation.
	HB 1152	Provided nonprofit water supply corporations with statutory authority to enforce water conservation practices and levy fines.
	HB 2660	Required quantified five-year and ten-year water savings targets for water conservation plans.
	HB 2661	Required TCEQ to develop graywater standards.
	HB 2663	Required TCEQ to establish quantifiable goals for drought contingency plans.
	HB 3338	Required water utilities to perform water audits every five years.
	SB 1094	Created a task force on water conservation to review, evaluate, and recommend levels of water use efficiency and conservation for Texas.
2005	HB 1224	Required the Texas Water Development Board (TWDB) to conduct a study to determine the effects, if any, of take-or-pay contracts on efforts to conserve water.
	HB 1225	Authorized TCEQ to exempt a state water right from cancellation for non-use if the non-use resulted from a water conservation measure that was part of a water conservation plan submitted by the water right holder.
	HB 2428	Required that new commercial pre-rinse spray valves for sale in Texas beginning January 1, 2006, must use no more than 1.6 gallons per minute.
	HB 2430	Required the TWDB to establish a Rainwater Harvesting Evaluation Committee to evaluate the potential for rainwater harvesting in Texas and to recommend minimum water quality guidelines and standards and treatment methods for potable and nonpotable indoor uses of rainwater.

Table 2-1 Continued: Summary of Recent Water Conservation Legislation

<table>
<tr><td rowspan="2">2007</td><td>HB 4/SB 3</td><td>Required the TWDB to develop and implement a statewide water conservation public awareness campaign.

Created the Water Conservation Advisory Council. The Advisory Council is discussed in detail in Section 2.4.

Required the submission of water conservation plans to the Texas Water Development Board (TWDB) by retail public utilities that provide water service to 3,300 or more connections. Required that each of these entities submit an annual report to the TWDB on the entity's progress in implementing its water conservation plan and requiring enforcement.

For structures that are connected to a public water system and have a rainwater harvesting system for indoor use, required that the structure must have cross-connection safeguards and that the rainwater harvesting system may be used only for non-potable indoor purposes.

Required the Texas Higher Education Coordinating Board to encourage institutions of higher education to develop curriculum and provide instruction regarding on-site water reclamation system technologies, including rainwater harvesting, condensate collection, or cooling tower blow down. Required that new state buildings (and major renovation projects) use these technologies for landscape watering and nonpotable indoor use where practical and feasible.</td></tr>
<tr><td>HB 1656</td><td>Required municipalities with population of twenty thousand or more to implement a landscape irrigation permitting, inspection and enforcement program that includes minimum standards and specifications for designing, installing, and operating irrigation systems.</td></tr>
<tr><td>2009</td><td>HB 2667</td><td>Required the following water-saving standards for plumbing fixtures to be phased in between 2010 and 2014:

▪ Shower head output cannot exceed 2.5 gallons of water per minute
▪ Urinals cannot use more than 0.5 gallons of water per flush
▪ Toilets cannot use more than 1.28 gallons of water per flush

Allowed local governments to pass an ordinance to opt out of water efficiency requirements if their drainage or sewer system requires more water to operate efficiently.

Established standards for waterless urinals.</td></tr>
</table>

2.2. Regional Water Planning Process

Pursuant to Senate Bill 1 legislation passed by the 75th Texas Legislature in 1997, the Texas Water Development Board (TWDB) was tasked to address Texas water supply needs with a new fifty-year water plan. The TWDB created sixteen regional water-planning groups and established regulations governing the regional planning efforts. Dallas and the area it serves are located within Region C. The Region C Water Planning Group (RCWPG) completed the Region C Water Plan in 2001 (Ref. 16) and updated it in 2006 (Ref. 17). Currently, the RCWPG is working to update the Region C Water Plan by 2011 and has published the 2011 Region C Initially Prepared Water Plan (Ref. 4).

The 2006 Region C Water Plan recommended water conservation strategies for 271 municipal water users. For Dallas, the plan recommended three sets of water conservation strategies: the basic package, the expanded package, and the accelerated package. The basic package, which was recommended for all municipal water users with a projected water need, consisted of the following conservation measures:

- Low-flow plumbing fixture rules (included in the water demand projections)
- Public and school education
- Water use reduction due to increasing water prices
- Water system audit, leak detection and repair, and pressure control
- Federal residential clothes washer standards

The expanded package, which was recommended for 129 of 271 municipal water users, consisted of the following conservation measures:

- Water conservation pricing structure
- Water waste prohibition
- Coin-operated clothes washer rebate
- Residential customer water audit
- Industrial, commercial, and institutional (ICI) general rebate
- ICI water audit, water waste reduction, and site-specific conservation program
- Reuse of treated wastewater effluent.

The accelerated package, which contained elements from Dallas's Strategic Plan, consisted of the following water conservation measures:

- Acceleration of elements from the Basic and Expanded packages (earlier or broader implementation).
- Inspect city facilities and retrofit inefficient plumbing fixtures with low-water-use fixtures.
- Convert appropriate sections of city-owned landscapes to "water-wise" landscapes.
- Retrofit city-owned irrigated areas with high-efficiency sprinkler heads and weather-sensitive irrigation controller technology.
- Review and revise existing city ordinances, codes, and standards as necessary to ensure that water-conserving principles are maintained. Consider adoption of new codes and

standards that will further advance water conservation (e.g., graywater/recycled water, landscaping, plumbing fixtures, metering, irrigation, etc.)

- Improve water conservation code enforcement.
- Implement rebate and incentive programs:
    - Rain-freeze sensors
    - Faucet aerator and showerhead retrofits
    - Toilet retrofits
    - Water-efficient washing machine (residential)
    - Pre-rinse spray nozzles for commercial restaurants, schools, hospitals, and similar facilities
    - Other

The projected water savings in Dallas from the three recommended water conservation packages in the 2006 Region C Water Plan are shown in Table 2-2.

Table 2-2: Projected Dallas Water Conservation Savings, 2006 Region C Water Plan

Conservation Package	Projected Dallas Water Conservation Savings (mgd)					
	2010	2020	2030	2040	2050	2060
Basic	9.04	16.10	20.06	23.67	29.40	35.58
Expanded	0.10	1.22	7.83	10.83	11.40	11.82
Accelerated	6.56	4.98	0.42	0.00	0.00	0.00
TOTAL	15.70	22.30	28.30	34.50	40.80	47.40

mgd = million gallons per day

Water conservation strategies in the 2011 Region C Initially Prepared Water Plan are also grouped in basic, expanded, and accelerated packages. For 2011, the RCWPG moved the water conservation pricing structure and water waste prohibition strategies to the basic package, added landscape irrigation restrictions to the expanded package, and removed the ICI general rebate strategy from the expanded package. The projected water savings in Dallas from the three recommended water conservation packages in the 2011 Region C Initially Prepared Water Plan are shown in Table 2-3.

Table 2-3: Projected Dallas Water Conservation Savings, 2011 Region C Initially Prepared Water Plan

Conservation Package	Projected Dallas Water Conservation Savings (mgd)					
	2010	2020	2030	2040	2050	2060
Basic	9.65	17.80	22.62	27.39	33.76	43.61
Expanded	0.24	0.90	2.09	3.08	3.31	3.70
Accelerated	6.57	4.99	0.42	0.00	0.00	0.00
TOTAL	16.46	23.68	25.13	30.47	37.07	47.30

It is anticipated that the water conservation strategies recommended for Dallas in the final 2011 Region C Water Plan will reflect the recommendations of the Updated Strategic Plan.

2.3. Water Conservation Implementation Task Force

The Water Conservation Implementation Task Force (Task Force), with members appointed by the TWDB, was created to fulfill the mandate of the legislation incorporated in Section 6 of Senate Bill 1094. The Task Force was assigned several tasks, including identifying, evaluating, and selecting best management practices (BMPs) for municipal, industrial, and agricultural water uses and evaluating the cost and benefits of the selected BMPs.

The Task Force developed TWDB Report 362, *Water Conservation Best Management Practices Guide* (Ref. 18). This guide, released in November 2004, included twenty-two BMPs for municipal water users, fifteen BMPs for industrial water users, and twenty BMPs for agricultural water users. Report 362 serves as a resource for entities that volunteer to implement BMPs that are appropriate for their situation. Applicable BMPs were considered for inclusion in the Strategic Plan.

In addition to Report 362, the Task Force also produced a Report to the 79th Legislature (Ref. 2). This report, also issued in November 2004, recommended a standardized methodology for reporting and using per-capita water use data as follows:

- Total per-capita water use is defined as the total amount of water diverted and/or pumped for potable use divided by the total population. Indirect reuse diversion volumes shall be credited against total diversion volumes for the purpose of calculating per capita water use for targets and goals.
- Residential per capita water use is defined as single-family plus multi-family consumption divided by the total population.

The report to the legislature also set targets and goals to be considered by water providers. For municipal water providers, the report recommended consideration of a minimum annual reduction of one percent in total per-capita water use, based upon a five-year rolling average, until such time as the entity achieves a total per capita water use of 140 gallons per capita per day (gpcd) or less.

The report to the legislature further recommended that the State (through the TWDB) work with manufacturers of water-using equipment, water utilities, water users, and others to reduce overall statewide indoor water use to 50 gpcd through education, research, and funding programs.

2.4. Water Conservation Advisory Council

At the recommendation of the Water Conservation Implementation Task Force, the Texas Legislature (through passage of Senate Bill 3 and House Bill 4 in 2007) created a standing Water Conservation Advisory Council. The Advisory Council is composed of twenty-three members representing each of twenty-three entities or interest groups.

Duties of the Water Conservation Advisory Council include:

- Monitoring trends in water conservation implementation.
- Monitoring new technologies for possible inclusion by the TWDB as best management practices in the Water Conservation Best Management Practices Guide developed by the Water Conservation Implementation Task Force.
- Monitoring the effectiveness of the TWDB's statewide water conservation public awareness program and associated local involvement in implementing the program.
- Developing and implementing a state water management resource library.
- Developing and implementing a public recognition program for water conservation.
- Monitoring the implementation of water conservation strategies by water users included in regional water plans.
- Monitoring target and goal guidelines for water conservation to be considered by the TWDB and TCEQ.
- Conducting a study to evaluate the desirability of requiring the TWDB to (a) designate as certified water conservation training facilities entities and programs that provide assistance to retail public utilities in developing water conservation plans; and (b) give preference to certified water conservation training facilities in making loans or grants for water conservation training and education activities.

No later than December 1 of each even-numbered year, the Council is to submit to the Legislature a report on progress made in water conservation in Texas. The first of these reports, submitted in 2008, contained 11 recommendations (Ref. 19). The recommendations most applicable to DWU addressed the topic of implementation and measurement of water conservation savings:

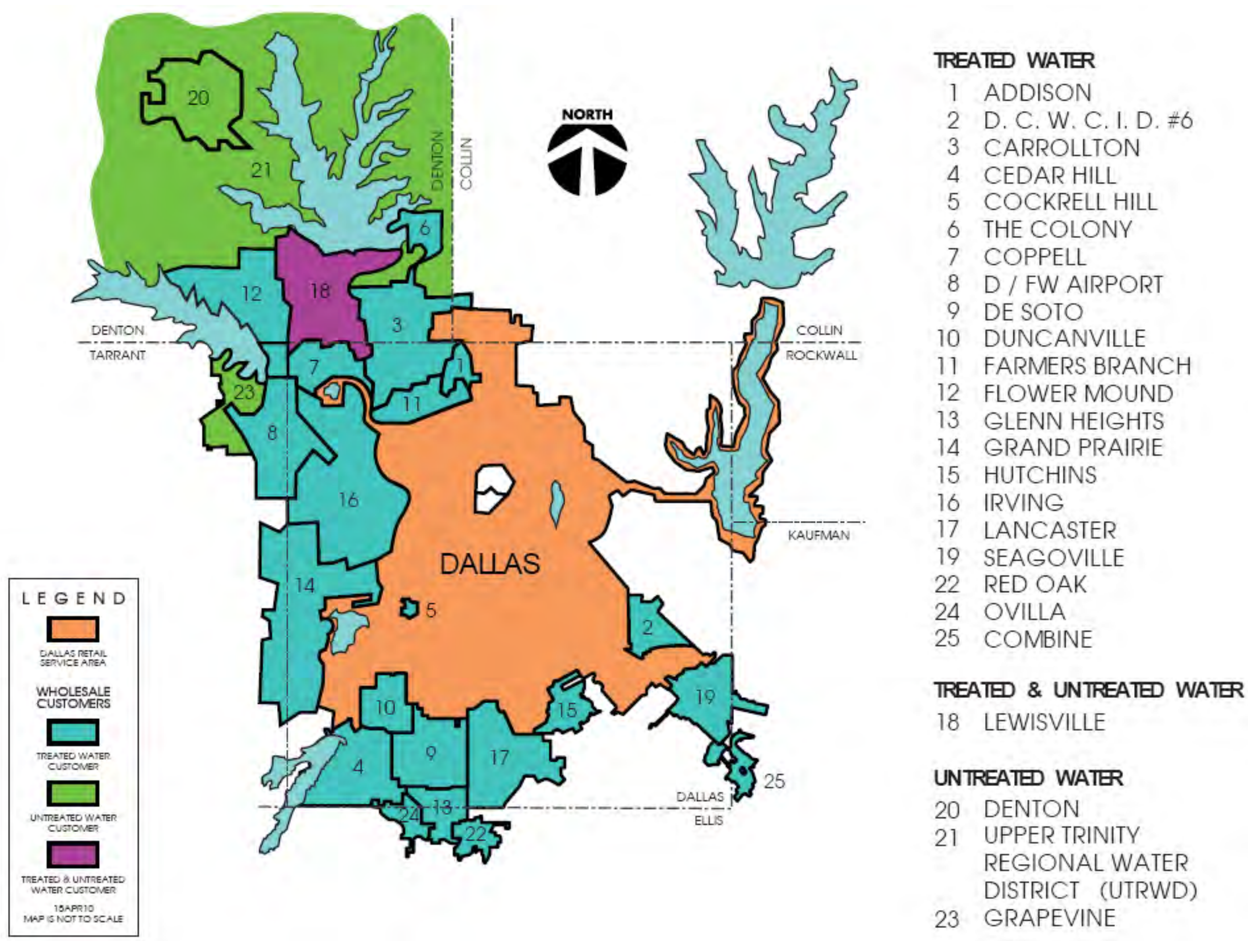
- Develop methodology, metrics, and standards for water conservation implementation measurement and reporting.
- Develop specific guidelines for how gallons per capita per day should be determined and how it should be applied to population-dependent water use only.
- Develop reporting guidelines for improved data collection.
- Expand data collection efforts to include all water providers and water use categories.
- Develop a pilot project for water use data reporting.
- Develop a pilot project for determining population figures appropriate for certain water use metrics.

To address its multiple charges, the Advisory Council operates in six subcommittees, or workgroups. The Metrics & Trends Workgroup is working through details of the recommendations listed above. Agendas and minutes of the Workgroup meetings are available from the Water Conservation Advisory Council web site (Ref. 20).

3. Description of the DWU Water System

DWU's water system consists of water supply reservoirs, water treatment facilities, distribution and wastewater collection systems, and wastewater treatment plants. Recycled water projects, existing and proposed, are also components of the DWU water system. DWU supplies treated water to City of Dallas residents. In addition, DWU supplies treated water to twenty-two wholesale customers and supplies raw water to four wholesale customers (Figure 3-1).

Figure 3-1: DWU Wholesale Service Area and Customers

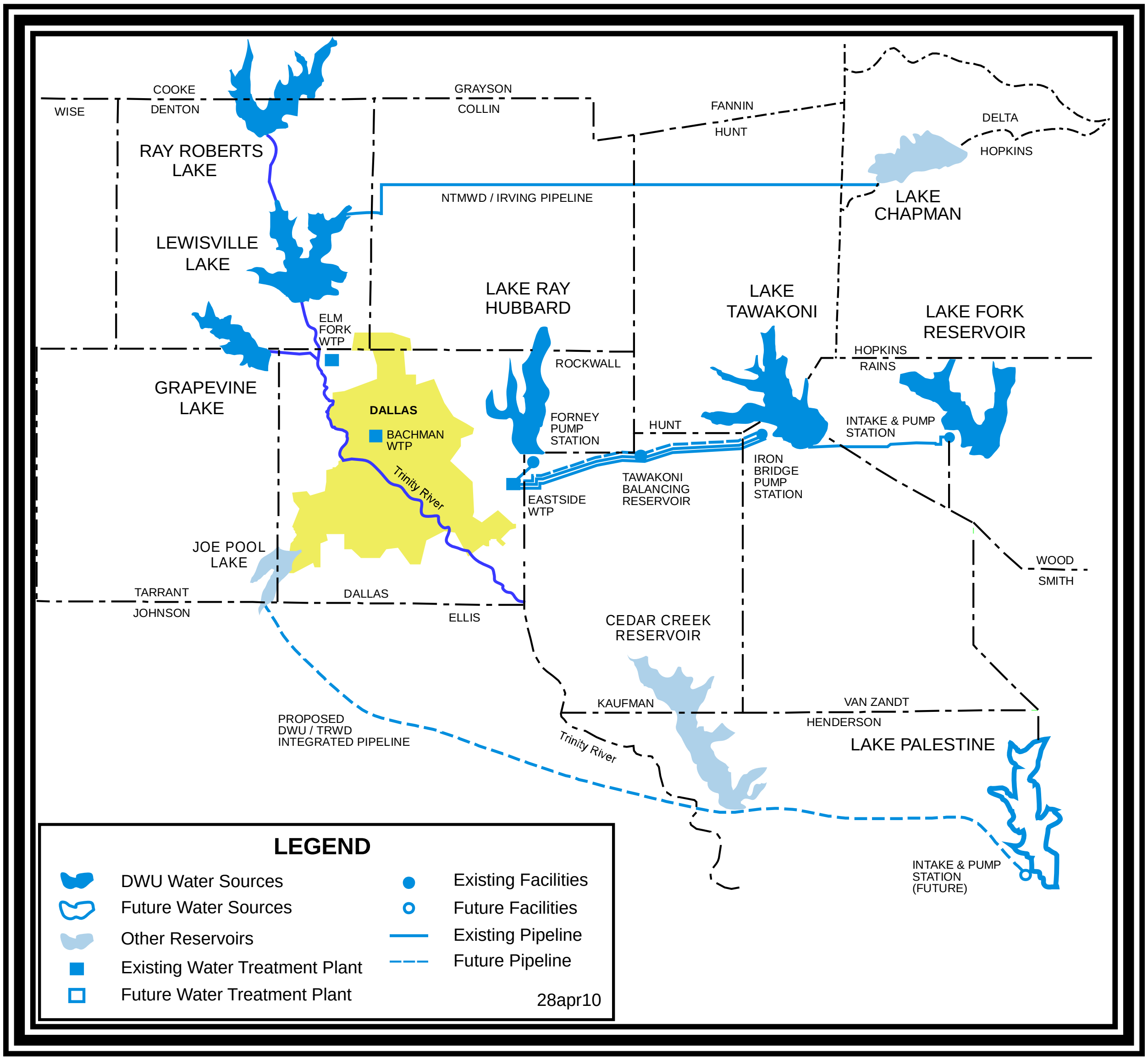


City of Dallas

3.1. Water Supply Sources

The reservoirs comprising DWU's system are subdivided into the western and eastern systems (Figure 3-2). This designation corresponds to DWU's overall water treatment system infrastructure, which includes the two western water treatment plants, Bachman Water Treatment Plant (WTP) and Elm Fork WTP, and one eastern water treatment plant, East Side WTP.

Figure 3-2: Dallas Water Supply System



City of Dallas

Western System

Dallas holds water rights in the following western system reservoirs and watersheds:

- Ray Roberts Lake
- Lewisville Lake
- Grapevine Lake
- Elm Fork Channel of the Trinity River (above Frazier Dam)

Dallas also holds water rights for uncontrolled portions of the Elm Fork of the Trinity River watershed (*i.e.*, areas located downstream of Lewisville Lake and Grapevine Lake which contribute streamflow to DWU's water supply diversion points on the Elm Fork).

Eastern System

Dallas holds water rights in the following eastern system reservoirs and watersheds:

- Lake Ray Hubbard
- Lake Tawakoni
- Lake Fork

DWU also holds water rights in Lake Palestine, but this reservoir is not presently connected to the DWU water system. In addition, DWU treats raw water from Lake Chapman for the City of Irving and delivers the treated water to the City of Irving.

Others

DWU holds storage and diversion rights for White Rock Lake, located on White Rock Creek in northeastern Dallas.

DWU also receives return flows of treated wastewater effluent into its reservoirs.

Table 3-1 presents a summary of the current water rights associated with each of the reservoirs comprising DWU's raw water sources.

3.2. Water Treatment Plants

DWU maintains three water treatment plants (Elm Fork, Bachman, and East Side) serving both retail and wholesale customers (Figure 3-3). The treatment plants have a combined current net treatment capacity of 900 million gallons per day (mgd) and a current firm high-service pumping capacity of 905 mgd. The net treatment capacity is the total treatment capacity minus the water needed for plant operations (generally 10 percent). Currently all three plants utilize enhanced softening to treat water. Ozone is used as the primary disinfectant and is supplemented with chloramines to provide a disinfection residual within the distribution system. Recently DWU performed a water quality analysis which has resulted in the recommendation to convert the treatment process at all three plants from enhanced softening to enhanced coagulation and biological filtration.

Table 3-1: Summary of Available Water Supply Sources to DWU

Source	Source System	Source Type	Firm Yield Available to DWU for 2010[a] (mgd)
Elm Fork Channel/ Ray Roberts Lake/ Lewisville Lake System[b]	Western	Reservoir	152.3
Grapevine Lake[c]	Western	Reservoir	6.5
Elm Fork Channel (CF 75)	Western	Other	10.0
Elm Fork Channel (Permit 5414)	Western	Other	8.9
Lake Ray Hubbard	Eastern	Reservoir	53.9
Lake Tawakoni	Eastern	Reservoir	163.9
Lake Fork	Eastern	Reservoir	107.0
Lake Palestine (Unconnected)	Eastern	Reservoir	102.0
Return Flows[a]	Both	Other	30.5
Total Connected			**533.0**
Total Available			**635.0**

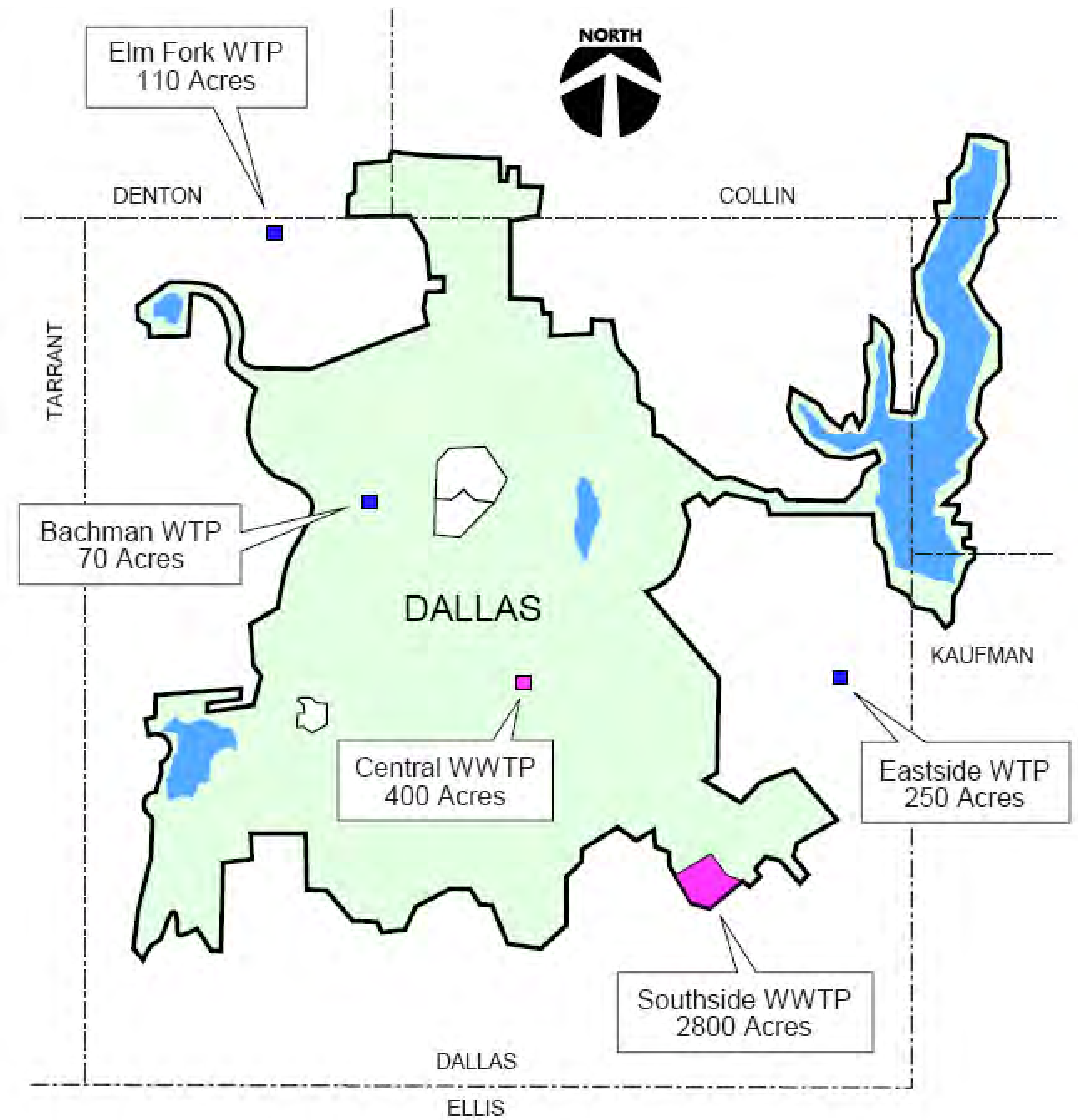
[a] 2005 Update to the Long Range Water Supply Plan (Ref. 3). "mgd" stands for million gallons per day.

[b] The firm yield of the Elm Fork Channel/Ray Roberts Lake/Lewisville Lake System is based on a system operations yield. DWU's share is 74.0% of Ray Roberts Lake firm yield, and 95.1835% of Lewisville Lake firm yield.

[c] DWU's share of Grapevine Lake firm yield is limited by the reservoir allocation plan.

- The Elm Fork WTP is located in Carrollton near I-35 and Whitlock Lane. It has a current net treatment capacity of 310 mgd and a firm high-service pumping capacity of 324 mgd. The Elm Fork WTP receives gravity flow through the Elm Fork of the Trinity River from Ray Roberts Lake, Lewisville Lake, and Grapevine Lake. The intake structure, located north of the Carrollton dam, diverts water by gravity flow to two low-service pump stations. One pump station is located at Broadway and Whitlock Lane and the other is on the plant site. Recently two new high-service pumps were installed that increased the overall firm pumping capacity at the plant by 72 mgd.

Figure 3-3: DWU Water and Wastewater Treatment Plants



City of Dallas

- The Bachman WTP is located north of Love Field Airport and adjacent to Bachman Lake. Bachman is Dallas' oldest WTP and has a current net treatment capacity of 150 mgd, current storage capacity of 12.6 million gallons (mg), and a firm high-service pumping capacity of 180 mgd. Raw water is diverted from the Elm Fork of the Trinity River through Fishing Hole Lake to the Raw Water Pump Station (PS) which is located off-site from the WTP. The raw water is then pumped to the Ozone Facility located at the plant. Recent improvements increased the treatment and pumping capacities of the plant to their current levels.

- The East Side WTP is located in Sunnyvale. The East Side WTP is Dallas' largest WTP and has a current treatment capacity of 440 mgd and a firm high-service pumping capacity of 401 mgd. The East Side WTP receives raw water from three reservoirs (Lake Ray Hubbard, Lake Tawakoni, and Lake Fork) via three raw water pump stations and one balancing reservoir. From the east, the Iron Bridge PS (at Lake Tawakoni) and the Lake Fork PS pump raw water to the Tawakoni Balancing Reservoir (TBR). From the TBR, raw water flows by gravity into the Ozone Facility located at the plant. The Forney Raw Water PS pumps raw water from Lake Ray Hubbard directly to the Ozone Facility.

  Several improvements are currently in progress to increase the overall capacity of the eastern system. The Lake Fork PS has recently been completed, along with a new raw water transmission line that connects it to the Iron Bridge PS. New raw water pipelines from Lake Tawakoni to the TBR and from TBR to the East Side WTP are currently in the planning phases. In addition, improvements are presently under way at the East Side WTP to increase the treatment capacity of the plant from 440 mgd to 540 mgd and to implement the new enhanced coagulation and biological filtration treatment scheme. Lastly, improvements to treated water storage, pumping, and transmission are under way as described below.

  Currently the new Transfer Pump Station No. 3 (TPS3), which will ultimately house eight pumps, is under construction at East Side WTP. This pump station will increase the firm pumping capacity out of East Side WTP from 401 mgd to 701 mgd. Also, four new 15 mg ground storage reservoirs are under construction at the East Side WTP. The new ground storage reservoirs will increase storage capacity at the plant from 6 mg to 60 mg.

3.3. Treated Water Storage and Distribution Systems

The DWU treated water storage and distribution system consists of seventeen pressure zones, twenty-five pump stations, twelve ground storage reservoirs, and nine elevated storage tanks. The ground storage reservoirs and elevated storage tanks have a total storage capacity of 201 mg and 15.5 mg, respectively.

DWU's treated water distribution system contains approximately 4,980 linear miles of pipe, which can deliver approximately 760 mgd. The capacity of the treated water distribution system is constantly being upgraded and reassessed to improve the ability of the distribution system to meet customer needs and to replace aging infrastructure. Currently several new pump stations are in the design phase, are under construction, or recently have been completed. These new pump stations will replace existing pump stations.

To connect the new TPS3 at East Side WTP to the system and to fully realize a pumping capacity increase at the East Side WTP, a new 120-inch diameter water transmission pipeline is in the planning phase. This new pipeline will travel roughly southwest from TPS3 at the East Side WTP to the proposed Wintergreen PS and ground storage reservoir located on the southeast side of the city. From there the new pipeline will travel west and tie into the existing Sorcey Road PS on the southwest side of the city.

The Wintergreen PS and ground storage reservoir has been proposed but is not yet in the planning phase. The proposed facilities would supply treated water to the southeast service area and to customer cities, with remaining water pumped to the existing Sorcey Road PS as described above.

3.4. Raw and Treated Water Costs

Two main components figure into the cost for both raw and treated water: capital costs and operation and maintenance (O&M) costs. These costs are discussed below for raw and treated water.

Raw Water Costs

Capital costs associated with the delivery of raw water include, but are not limited to, the following:

- Planning, permitting, design, and construction of new reservoirs
- Design and construction of new raw water pump stations
- Design and construction of new raw water transmission mains

O&M costs associated with the delivery of raw water include, but are not limited to, the following:

- Purchase of raw water from other regulating entities
- O&M of reservoirs (including reimbursements for U.S. Army Corps of Engineers lakes)
- O&M of raw water pump stations (power required to pump raw water is a majority of the O&M costs)
- O&M of raw water transmission mains

Treated Water Costs

Capital costs associated with the treatment and delivery of treated water include, but are not limited to, the following:

- Design and construction of new water treatment plants or modifications to existing water treatment plants
- Design and construction of new treated water pump stations
- Design and construction of new treated water transmission mains
- Design and construction of new treated water ground storage reservoirs
- Design and construction of new treated water elevated storage tanks
- Design and construction of new distribution system pipelines

O&M costs associated with the treatment and delivery of treated water include, but are not limited to, the following:

- O&M of water treatment plants (chemicals required to treat the water represent a majority of the O&M costs)
- O&M of treated water pump stations (power required to pump treated water is a majority of the O&M costs)
- O&M of treated water transmission mains
- O&M of treated water ground storage reservoirs
- O&M of treated water elevated storage tanks
- O&M of the treated water distribution system

Costs for both raw and treated water were provided by DWU. Table 3-2 summarizes the retail costs for both raw and treated water for FY 2008-09.

Table 3-2: FY 2008-09 Raw and Treated Water Costs

Type	Costs ($/1000 gallons)
Raw Water	$0.4744[a]
Treated Water	$2.76[b]

[a] The Raw Water cost is the price that DWU charges for raw water sold to wholesale customer cities.

[b] The Treated Water cost is total revenue from retail treated water sales divided by the retail treated water sales volume.

3.5. Wastewater Treatment Plants

DWU operates two wastewater treatment plants (WWTPs) - Central and Southside - that serve the City of Dallas and eleven wholesale wastewater customer cities (Figure 3-3). The WWTPs have a combined annual average flow permitted capacity of 260 mgd. A general description of the plants is as follows:

- Central WWTP has a rated treatment capacity of 150 mgd and is located four miles south of downtown. The Central WWTP permit includes a future capacity of 200 mgd. The annual average flow for FY 2008-09 was 101 mgd.[6] The Central WWTP consists of two parallel treatment trains known as the Dallas Plant and White Rock Plant. Each plant has influent pump stations, preliminary treatment facilities, primary clarification, trickling filters, and secondary clarifiers. The combined flow from the Dallas and White Rock plants is then pumped to common aeration basins, final clarifiers, chlorination, filtration,

[6] The annual average flow reported for the Central WWTP in the Strategic Plan (Ref. 1) was 135 mgd. Much of the decrease is due to water conservation efforts.

and dechlorination facilities. Sludge from the Central WWTP is pumped approximately thirteen miles to the Southside WWTP.

- Southside WWTP has a rated treatment capacity of 110 mgd and is located eighteen miles southeast of downtown. The annual average flow for FY 2008-09 was 57 mgd.[7] The Southside WWTP consists of an influent pump station, preliminary treatment facilities, primary clarification, aeration basins, secondary clarifiers, chlorination, filtration, and dechlorination facilities. The sludge handling facilities at the Southside WWTP include solids thickening, anaerobic digestion, solids dewatering, and dedicated land disposal.

A small portion of the city's wastewater is transported to the Trinity River Authority (TRA) Central Regional Wastewater Treatment Facility and to the City of Garland Duck Creek WWTP.

3.6. Summary of Changes

Table 3-3 summarizes the changes in the DWU water system since publication of the 2005 Strategic Plan.

[7] The annual average flow reported for the Southside WWTP in the Strategic Plan (Ref. 1) was 75 mgd. Much of the decrease is due to water conservation efforts.

Table 3-3: Summary of DWU System Changes Since 2005

Raw Water	▪ Lake Fork connected ▪ New Lake Fork Pump Station (302 mgd firm pumping capacity) ▪ New Raw Water Transmission Lines (from Lake Fork PS to Iron Bridge PS)
Elm Fork WTP	▪ Increased high-service pumping capacity (to 324 mgd)
Bachman WTP	▪ Increased treatment capacity (from 115 mgd to 150 mgd) ▪ Increased treated water storage (from 10.4 mg to 12.6 mg) ▪ Increased high-service pumping capacity (from 115 mgd to 180 mgd)
East Side WTP	▪ Increased treatment capacity (from 440 mgd to 540 mgd, under construction) ▪ Increased storage capacity (from 6 mg to 60 mg, under construction) ▪ Increased high-service pumping capacity (from 401 mgd to 701 mgd, under construction)
Treated Water Distribution System (Capacity Increases)	▪ Sunset Pump Station ▪ Doran Pump Station ▪ Camp Wisdom Pump Station ▪ Alta Mesa Pump Station
Southside WWTP	▪ Process improvements (under construction) ▪ Increased dewatering capacity ▪ Pump station improvements
Central WWTP	▪ Recycled water line serving Cedar Crest Golf Course ▪ Increased filter capacity by 136 mgd ▪ Process improvements

4. Population and Water Supply/Demand Forecasts

The ability to plan for the future relies heavily on the ability to project water demand based on changes in population. This chapter summarizes population and water demand projections for DWU and provides information about recommended future water supply sources.

4.1. Population Projections

Population projections were provided by DWU (Table 4-1 and Figure 4-1) and are based on the values in the 2005 Update to the Long Range Water Supply Plan (Ref. 3). Figure 4-1 shows gradual growth in the City of Dallas population but substantial growth in the population of the wholesale customer cities. The increase in wholesale population will cause the demand for wholesale water to increase.

Table 4-1: Population Projections for City of Dallas and Customer Cities[a]

City/Region	2010	2020	2030	2040	2050	2060
City of Dallas	1,312,324	1,451,878	1,525,450	1,598,222	1,650,000	1,700,000
Current Wholesale Customer Cities[b]	1,452,177	1,786,424	2,093,651	2,352,346	2,589,734	2,783,982
Potential Wholesale Customer Cities[c]	5,500	7,500	8,800	10,500	14,000	22,000
Total	2,770,001	3,245,802	3,627,901	3,961,068	4,253,734	4,505,982

[a] 2005 Update to the Long Range Water Supply Plan (Ref. 3).

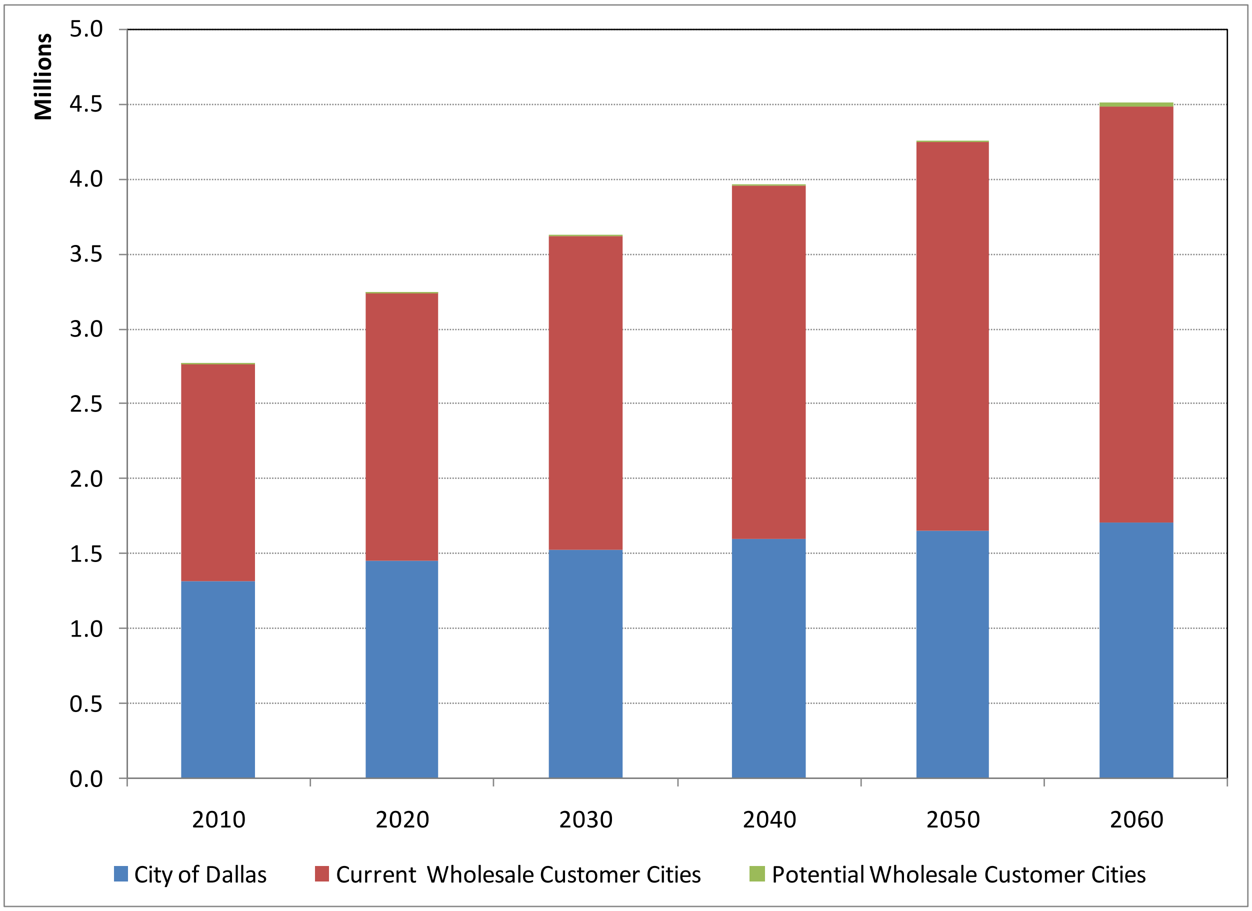
[b] Treated and raw water wholesale customer cities (Figure 3-1). Wholesale customer cities that are also served by other water providers reflect only that population served by DWU. Population projections for wholesale customer cities with fixed demand contracts are not reflected in the population projections.

[c] City of Wilmer.

4.2. Water Demand Projections

Water demand projections were provided by DWU (Table 4-2 and Figure 4-2) and are based on the values in the 2005 Update to the Long Range Water Supply Plan (Ref. 3). Dallas generally plans for its water delivery and treatment systems based on a one-year, or “short-term,” drought (Ref. 3). Table 4-2 summarizes average daily demand during a short-term drought for the City of Dallas, its wholesale customer cities, and potential wholesale customer cities. Table 4-2 shows that the City of Dallas water demand is projected to increase gradually but that the Customer Cities demand is projected to double in four decades. This demand is significant and will need to be closely monitored to ensure that resources are available to meet the demand.

Figure 4-1: Projected Populations for DWU Service Area



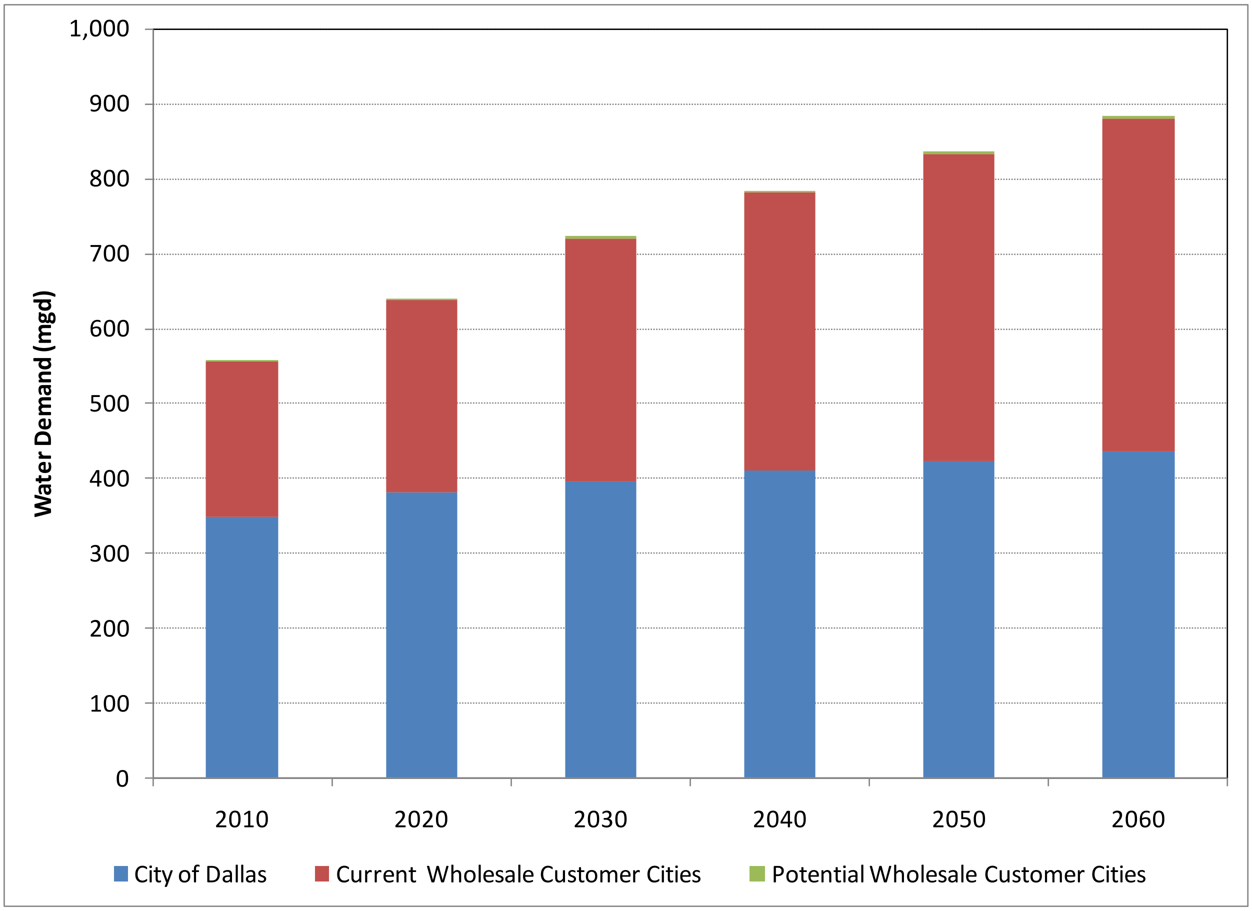
2005 Update to the Long Range Water Supply Plan (Ref. 3)

Table 4-2: Average Day Water Demand Projections During a Short-Term Drought[a] (mgd)

City/Region	2010	2020	2030	2040	2050	2060
City of Dallas	347.8	380.4	395.1	410.7	422.4	435.2
Current Wholesale Customer Cities[b]	208.3	257.1	325.0	369.9	410.2	443.9
Potential Wholesale Customer Cities[c]	2.2	2.4	2.5	2.7	3.1	3.9
Total	558.3	639.8	722.6	783.3	835.7	883.0

[a] 2005 Update to the Long Range Water Supply Plan (Ref. 3)
[b] Treated and raw water wholesale customer cities (Figure 3-1).
[c] Johnson County SUD and City of Wilmer.

Figure 4-2: Projected Average Day Water Demand for DWU Service Area During a Short-Term Drought



2005 Update to the Long Range Water Supply Plan (Ref. 3)

4.3. Future Water Supply Sources

Two recent plans are available that outline Dallas's plans for additional water supply sources in the future: the 2005 Update to the Long Range Water Supply Plan (Ref. 3) and the 2011 Region C Initially Prepared Water Plan (Ref. 4). Future water supplies in these plans are summarized in the following sections.

2005 Update to the Long Range Water Supply Plan

DWU's Long Range Water Supply Plan (LRWSP), updated in 2005, proposed several additional strategies for meeting future water demands. These include the following:

- Conservation. Includes conservation savings targeted through the Strategic Plan (Ref. 1) plus additional savings through a long-term water conservation plan.

- Recycle. Implementation of recommendations contained in DWU's Recycled Water Implementation Plan would result in the use of 138 mgd of recycled water by 2022 (Refs. 14 and 15).
- Connection of existing supplies.
    - Connect Lake Palestine by 2015.
    - Acquire and connect a new Sulphur River Basin Water Supply by 2035. This includes five potential water supply services:
        - Purchase Wright Patman Lake water from the City of Texarkana.
        - Reallocation of a portion of Wright Patman Lake's flood pool to municipal storage.
        - System operations between Chapman Lake and Wright Patman Lake.
        - The new George Parkhouse Reservoir
        - The new Marvin Nichols Reservoir
- Acquire and connect water supply from either Fastrill Lake or Toledo Bend by 2045.

Costs for future water supply alternatives were estimated in the LRWSP using a fifty-year life cycle and thirty-year debt financed at an interest rate of six percent per year. The fifty-year life cycle evaluation was selected because water supply infrastructure has a usable life well in excess of a thirty-year financing period and because some alternatives have a significant cost that will be incurred by the city for the entire term of the project. Estimated raw water costs (assumed to be in 2005 dollars) ranged from $196 per acre-foot ($0.60 per thousand gallons) for indirect recycling to Lewisville Lake to $815 per acre-foot ($2.50 per thousand gallons) for Wright Patman (System Operations). Table 4-3 presents a comparison of future water supply alternatives ranked by the 50-year life cycle cost.

2011 Region C Initially Prepared Water Plan

Currently, the Region C Water Planning Group is working to update the Region C Water Plan by 2011. The Initially Prepared Plan (IPP) is a draft plan that proposes strategies that largely mirror those in the Long Range Water Supply Plan, but the strategies have been altered somewhat to account for recent planning developments. Recommended future water supplies include the following:

- Conservation. Includes long-term water conservation savings similar to those projected in the 2006 Region C Water Plan. The projected conservation savings are summarized in Table 2-3.
- Overdrafting of existing supplies. DWU's existing permits allow overdrafting of some of its reservoirs. This is a short-term strategy until other supplies are brought online.
- Acquire water right to additional supply in Lake Ray Hubbard by 2011. Urbanization of the watershed has increased runoff to Lake Ray Hubbard.

Table 4-3: City of Dallas Water Supply Alternatives Ranked by 50-Year Life Cycle Costs[a]

Raw Water Supply Strategy	Supply (mgd)	50-Year Cost ($/kgal)	50-Year Cost ($/ac-ft)
Indirect recycle (to Lewisville Lake)	60.0	$0.60	$196
Indirect recycle (to Lake Ray Hubbard)	60.0	$0.63	$205
Direct recycle	18.3	$0.73	$238
Marvin Nichols Reservoir (Option A - co-op project, Dallas portion)	100.0	$0.80	$261
Marvin Nichols Reservoir (Option C - to Lake Lavon)	100.0	$0.82	$267
George Parkhouse II Reservoir	100.0	$0.85	$277
Fastrill Lake (integrated w/ Lake Palestine)	100.0	$0.93	$303
Lake Palestine (Option B - to South East WTP)	98.0	$0.96	$313
Lake Palestine (Option A - to East Side WTP)	98.0	$0.96	$313
Marvin Nichols Reservoir (Option B - to Ray Roberts Lake)	100.0	$1.06	$345
Columbia Lake (integrated w/ Lake Palestine)	32.0	$1.07	$349
Oklahoma Water (Option A - to Lake Lavon)	100.0	$1.09	$355
Lake Texoma (Option B)[b]	72.3	$1.17	$381
Wright Patman Lake (co-op project, Dallas portion)	116.0	$1.19	$388
Toledo Bend Reservoir (Option B - co-op project, Dallas portion)	89.0	$1.23	$401
Wright Patman Lake (flood pool reallocation)	100.0	$1.39	$453
Oklahoma Water (Option B - to Ray Roberts Lake)	100.0	$1.42	$463
Lake o' the Pines	80.0	$1.45	$472
Lake Texoma (Option A)	100.0	$1.48	$482
Wright Patman Lake (Texarkana purchase)	100.0	$1.50	$489
Lake Livingston	100.0	$1.57	$516
Toledo Bend Reservoir (Option A)	179.0	$1.74	$567
Mesa Ground Water	179.0	$1.75	$570
Sam Rayburn Reservoir/B.A. Steinhagen Lake	100.0	$2.25	$733
Wright Patman Lake (System Operations)	100.0	$2.50	$815
Minimum		$0.60	$196
Maximum		$2.50	$815
Mean		$1.25	$406
Median		$1.17	$381

[a] From the 2005 Update to the Long Range Water Supply Plan (Ref. 3). Based on fifty-year life cycle and thirty-year debt service using a six percent annual interest rate. Does not include treatment or distribution costs. Costs assumed to be in 2005 dollars.

[b] The unit cost for Lake Texoma (Option B) has been reduced by the unit cost of water treatment ($0.25) since the other options do not include conventional water treatment.

- Recycle. Construct a pump station by 2013 to deliver water from the Main Stem of the Trinity River to the North Texas Municipal Water District (NTMWD) East Fork Wetland pump station. By agreement with NTMWD, DWU would then capture return flows from NTMWD wastewater treatment plants in Lake Ray Hubbard for indirect reuse. Additional direct, non-potable reuse, as recommended by DWU's Recycled Water Implementation Plan, would result in the use of 18.25 mgd of recycled water by 2015 (Ref. 14).
- Construct an additional pipeline from Lake Tawakoni by 2015. This pipeline would allow use of the full yield of Lake Tawakoni and Lake Fork.
- Connect Lake Palestine by 2018 (using a pipeline shared with TRWD).
- Acquire and connect water supply from Wright Patman Lake by 2035. This would involve reallocation of a portion of Wright Patman Lake's flood pool to municipal storage.
- Acquire and connect water supplies from an unknown source. This supply will replace Fastrill Lake in the long-term plan. There have been conflicting plans for land use at the Fastrill Lake site: DWU has planned to construct Fastrill Lake, but the U.S. Fish and Wildlife Service has planned to use much of the site for a wildlife refuge. The U.S. Supreme Court recently declined to hear an appeal of a decision by the 5th Circuit Court of Appeals that ruled against construction of Fastrill Lake and in favor of the wildlife refuge (Ref. 21). This decision appears to eliminate Fastrill Lake (at the planned site) as a source of future water supply. No replacement supplies have yet been identified, but candidates include: additional water conservation, Lake Texoma, Toledo Bend Reservoir, Lake O' the Pines, Lake Livingston, Ogallala groundwater in Roberts County, Marvin Nichols Reservoir, Lake Columbia, George Parkhouse Reservoir (North), George Parkhouse Reservoir (South), the Neches River, and water from Oklahoma.

Costs for future water supply alternatives were estimated in the Region C IPP using thirty-year debt financed at an interest rate of six percent per year. During the amortization period, available raw water cost estimates ranged from $0.94 per thousand gallons for recycling water with the Main Stem Trinity River pump station to $2.37 per thousand gallons to connect Lake Palestine. Table 4-4 presents a comparison of future water supply alternatives ranked by unit costs during the amortization period.

Table 4-4: City of Dallas Water Supply Alternatives Ranked by Unit Costs[a]

Raw Water Supply Strategy	Supply (mgd)	Pre-Amortization Unit Cost ($/kgal)	Post-Amortization Unit Cost ($/kgal)
Conservation	87.2[b]	n/a	n/a
Overdrafting of Existing Supplies	22.3	n/a	n/a
Additional Lake Ray Hubbard	141.4	n/a	n/a
Recycle – Main Stem Trinity PS	36.6	$0.94	$0.16
Recycle – Direct Reuse	18.3	$1.22	$0.32
Additional Pipeline from Lake Tawakoni	61.7	$1.71	$0.29
Wright Patman Lake	100.0	$2.34	$0.56
Connect Lake Palestine	95.8	$2.37	$0.60
Lake Fastrill Replacement Strategy	100.0	Unknown	Unknown

a From the 2011 Region C Initially Prepared Water Plan (Ref. 4). Based on thirty-year debt service using a six percent annual interest rate. Does not include treatment or distribution costs.

b Includes projected water savings of 47.3 mgd by DWU retail customers (as shown in Table 2-3) and projected water savings of 39.9 mgd by DWU wholesale water customers.

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5. City of Dallas Water Use Profile

To make recommendations that are technically sound and economically feasible, water conservation planners must understand the customer make-up and water use patterns of the service area. In this Chapter, DWU water use data are used to identify water use patterns by customer type and water use type.

5.1. Description of Available DWU Water Use Data

DWU provided summary data showing monthly water use by water user category and monthly customer billing data for all accounts. These two sets of water use data are discussed in the following sections.

Water User Categories

For FY 2003-04 through FY 2007-08, DWU provided summary data showing monthly water use by water user category. Categories included residential, general service (GS), optional general service (OGS), municipal, wholesale, and unbilled. In the summary data, "residential" water use is assumed to be single-family (SF) residential water use. GS water users include multi-family (MF) residential, commercial, and light industrial customers. OGS water users consist primarily of large industrial customers.[8]

Water reported as "unbilled" is actually a combination of unbilled authorized consumption and water loss. Unbilled authorized consumption includes unbilled municipal uses, ozone cooling water at the Elm Fork WTP, main flushing, firefighting, meter testing, and other uses. Water loss is discussed in Section 5.6. In the remainder of the Updated Strategic Plan, the combination of unbilled authorized consumption and water loss is called "non-revenue water," since the utility is not paid for this water. This terminology is consistent with American Water Works Association water use categories discussed in Section 5.6.

Customer Billing Data

Monthly customer billing data from November 2004 through June 2009 was provided for all retail customer accounts. DWU switched its billing software from the Customer Information and Account Billing System (CIABS) to a Systems Applications and Products (SAP) system in February 2008. For the period from November 2004 through January 2008, the customer billing data were extracted from the CIABS database. For the period February 2008 through June 2009, the customer billing data were extracted from the SAP database.[9]

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[8] There may be minor deviations from these assumptions, but they do not significantly affect the analysis of water use by category.

[9] Water use data analysis was limited to FY 2003-04 through FY 2007-08. Earlier data were analyzed in the original Strategic Plan, and this period represents the next five years of water use. During the data analysis, FY 2007-08 was the latest fiscal year for which complete data were available.

DWU has assigned each account a customer type (Table 5-1) and a premise type (Table 5-2) that can be used to summarize the customer billing data. The premise types and customer types are slightly different between the CIABS and SAP databases, as shown in the tables.

Table 5-1: Retail Customer Types

SAP Customer Type	CIABS Customer Type
Residential	Residential - Taxable
	Residential - Tax Exempt
Commercial	Commercial - Taxable
	Commercial - Tax Exempt
Industrial	Industrial - Taxable
	Industrial - Tax Exempt
Governmental	Federal Government
	State Government
	County Government
	City Government
	Independent School District
	Dallas Water Utilities
	Other Government
n/a[a]	Street Acct - Not Specific To Address (Premise)

[a] There is no corresponding customer type in the SAP data set.

There is not a one-to-one relationship between the premise types and the customer types. For example, different customers with the office building premise type have been assigned commercial, governmental, and industrial customer types. The predominant customer types shown in Table 5-2 come from cross-tabulation of total water use from February 2008 through June 2009 (from the SAP system) by premise type and customer type (Appendix A). The predominant customer types were used during the data quality control process discussed in the next section. Accounts with the "Unknown" premise type were traced to multi-family housing developments.

Table 5-2: Premise Types

Premise Type	Description	SAP	CIABS	Predominant Customer Type Based on Total Water Use
A	Single Family Residential	✓	✓	Residential
B	Multi-Family/Townhome - Master Metered	✓	✓	Commercial[a]
C	Duplex - Individual Metered	✓	✓	Residential
D	Duplex - Master Metered	✓	✓	Residential
E	Apartment # Individual Metered	✓	✓	Residential
F	Apartment/Condo Master Metered	✓	✓	Commercial[a]
G	Mobile Home - Individual Metered	✓	✓	Residential
H	Mobile Home - Master Metered	✓	✓	Commercial[a]
I	Hotel/Motel	✓	✓	Commercial
J	Office Building	✓	✓	Commercial
K	Shopping/Mall Centers	✓	✓	Commercial
L	Factory/Manufacturer	✓	✓	Industrial
M	Warehouse	✓	✓	Commercial
N	Vehicle Servicing/Washing	✓	✓	Commercial
O	Restaurant	✓	✓	Commercial
P	Laundry	✓	✓	Commercial
Q	Food And Kindred Processing	✓	✓	Industrial
R	Other Business	✓	✓	Commercial
S	Park/Golf Courses	✓	✓	Commercial
T	Schools	✓	✓	Governmental
U	Fire Station	✓	✓	Governmental
V	Hospital	✓	✓	Commercial
W	Church	✓	✓	Commercial
X	Median Strip	✓	✓	Commercial
Y	Vacant Lot or Raw Land	✓	✓	Commercial
Z	Portable Meter	✓	✓	Commercial
0	Street Acct - Not Specific To Address		✓	Other
1	Non-Premise		✓	Other
2	Wholesale	✓	✓	Other
3	Assumed To Be Commercial	✓	✓	Commercial
4	Bar	✓	✓	Commercial
5	Sandwich Shop	✓	✓	Commercial
6	Cemetery/Agri Business	✓	✓	Commercial
7	Parking Lot	✓	✓	Commercial
8	Automobile Dealers	✓	✓	Commercial
9	Retail	✓	✓	Commercial
	Not Assigned	✓		Other
	Service Station	✓		Commercial
	Unknown	✓		Commercial[a]
	VLNDRESI	✓		Residential

[a] With the exception of Duplex - Master Metered, the master-metered multi-family residential premise types are generally categorized using the commercial customer type.
[b] The “VLNDRESI” premise type consists of vacant residential land.

5.2. Data Quality Control

Prior to water use analysis, APAI performed quality control checks on the water consumption data and adjusted the data according the findings. The data quality control procedures are reported in detail in Appendix B. Adjustments to the reported water use data included:

- In nine instances, reported monthly water use of more than 95 million gallons for a single residential meter was changed to zero gallons.
- Where the reported summary data were significantly less than the sums of the customer billing data (and were inconsistent with summary data from other years), the reported summary data were replaced with the sum of the customer billing data for the relevant customer or premise types. These adjustments were made to April 2008 residential water use, August 2006 and November 2007 multi-family GS water use, and December 2006 municipal water use.
- Spikes in the OGS, municipal, and non-revenue water data suggest that some meter readings included water use over a period longer than one month. Averaging was performed to better distribute the reported water use to the months when it was actually used.

The water use analyses described in the following sections is based on the adjusted water use data.

5.3. Water Use by Category (FY 2003-04 to FY 2007-08)

Total DWU water use for the five year period from FY 2003-04 to FY 2007-08 can be divided into billed retail water use, wholesale water use, unbilled authorized consumption, and water loss (Figure 5-1). Billed retail water use is the sum of the residential, GS, OGS, and municipal water uses. Wholesale water use includes treated water provided by DWU to 23 wholesale customers (listed in Figure 3-1). Unbilled authorized consumption includes unbilled municipal uses, ozone cooling water at the Elm Fork WTP, main flushing, firefighting, meter testing, and other uses.

Billed retail water use for the same period can be broken into the residential, GS, OGS, and municipal categories (Figure 5-2). The GS water use category in Figure 5-2 has been divided into multi-family and commercial segments.

Annual and monthly water uses by category are shown in Figures 5-3 and 5-4. Even with averaging to adjust the non-revenue water data (Figure B-7), some of the adjusted monthly non-revenue water data indicate negative water use.[10] These negative values are not shown in Figure 5-4.

[10] In reality, negative water use does not occur. The remaining negative values are likely a result of meters being read on different days.

Figure 5-1: Summary of DWU Total Water Use, FY 2003-04 to FY 2007-08

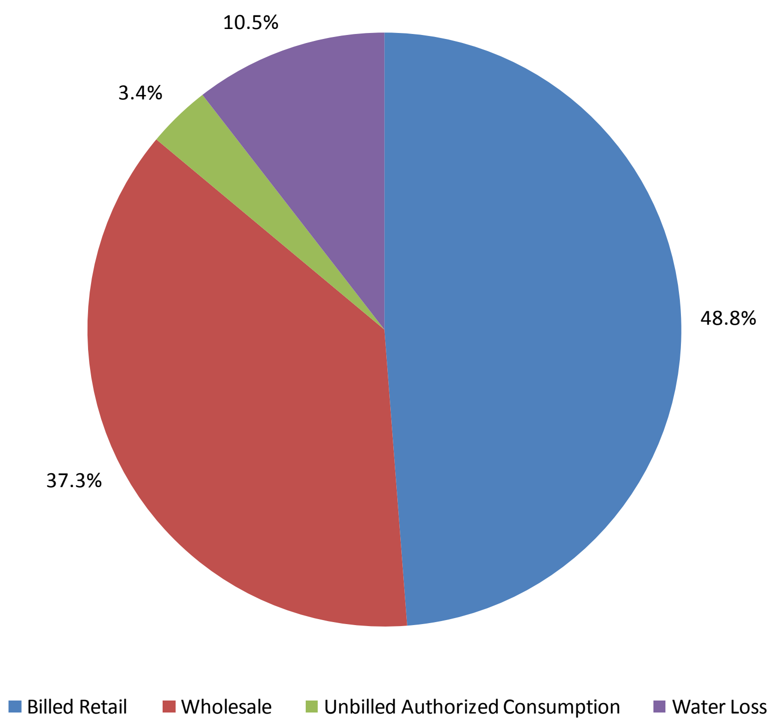


Figure 5-2: Summary of DWU Billed Retail Water Use, FY 2003-04 to FY 2007-08

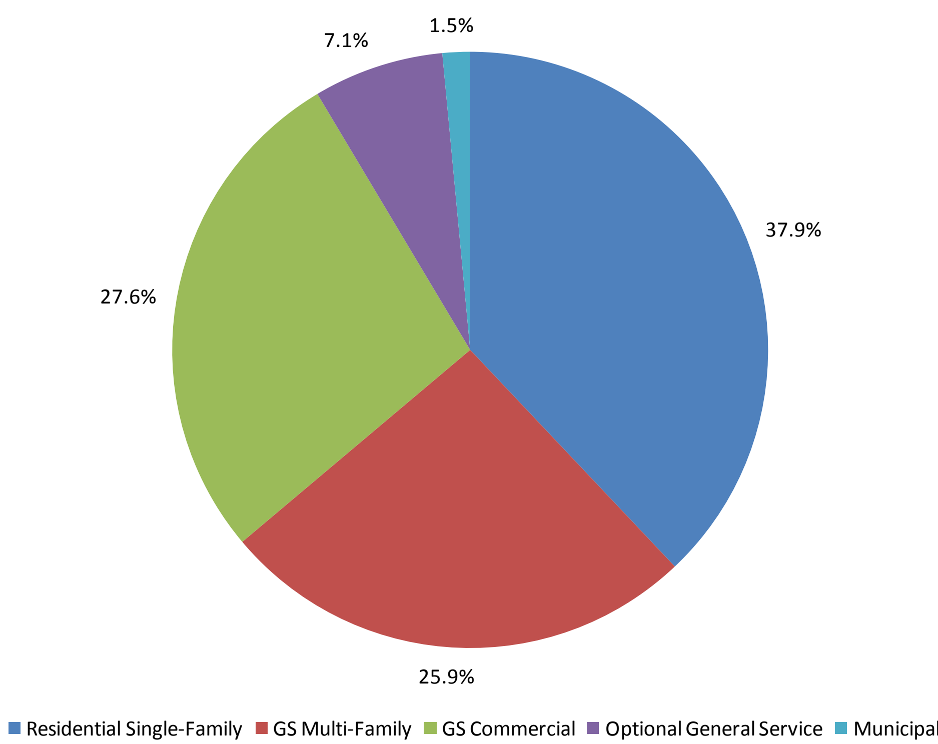


Figure 5-3: Annual Summary of DWU Water Use, FY 2003-04 to FY 2007-08

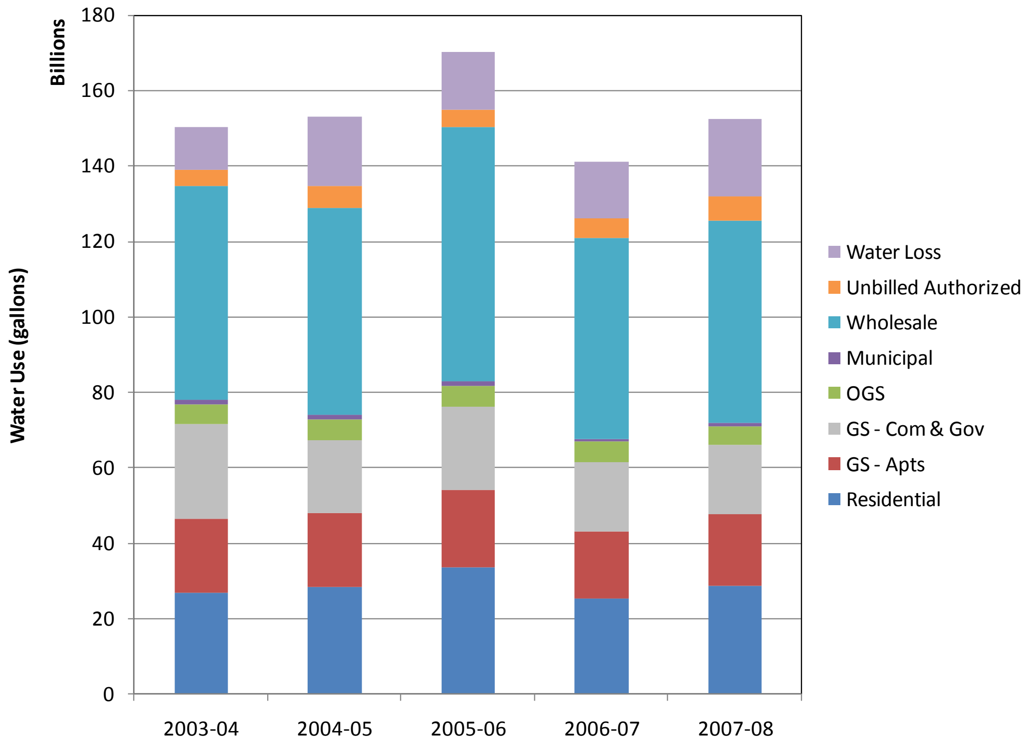
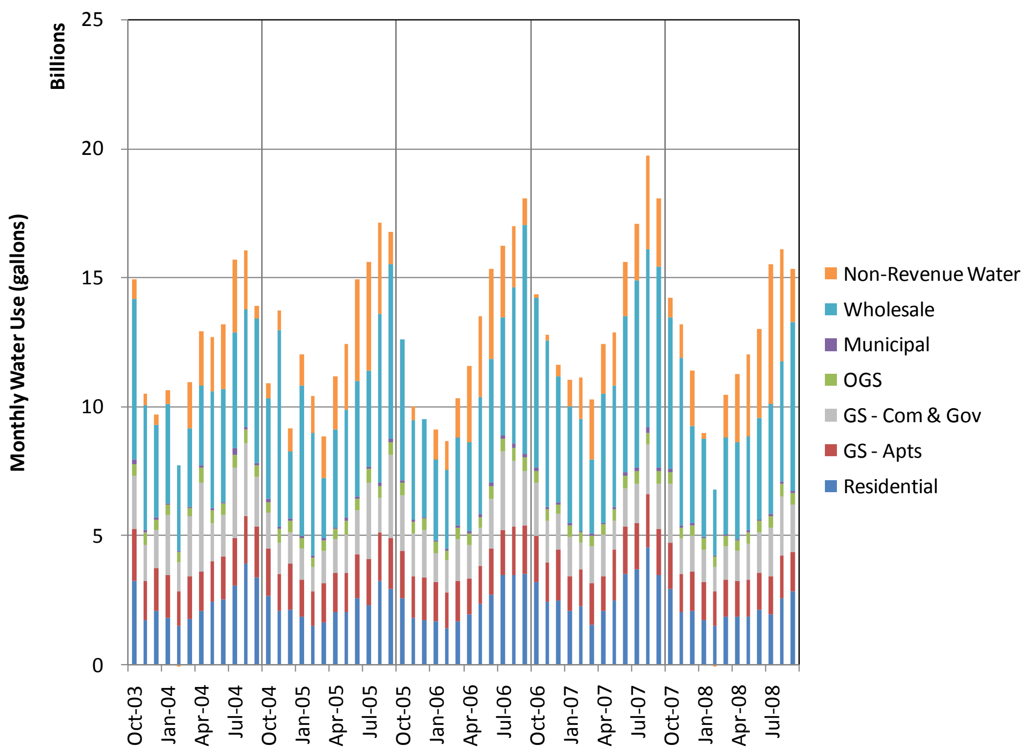


Figure 5-4: Monthly Water Use by Category, FY 2003-04 to FY 2007-08



Seasonal Water Use Patterns

The study of seasonal water use is an important component of water conservation planning. The capacity of the water treatment and distribution system is based primarily on meeting peak demands. If peak demands can be reduced, many upgrades to the system can be delayed or even avoided. In North Central Texas, peak usage occurs in the summer when lawn and landscape irrigation is at a maximum (Figure 5-4). Therefore, it is necessary to investigate seasonal water use.

Understanding "base" and "seasonal" water use amounts helps in the targeting of water conservation strategies. Base water use is:

- Generally associated with indoor water uses or other water uses that remain relatively constant throughout the year;
- Estimated to be the amount of water used in the minimum water use month for a given year; and
- Assumed to be constant throughout each year for each category.[11]

Seasonal water use is:

- Generally associated with irrigation and cooling water uses and
- Estimated to be all water use greater than the base use.

Base and seasonal water uses are shown by category and year in Figures 5-5 and 5-6.

Consistent with Figure B-7, the non-revenue water in Figure 5-5 has a very large seasonal component (77.5 percent), which may indicate that some customer meters are not registering correctly during high summer water use (high flows through the meters). Wholesale customers have a greater seasonal use (44.8 percent) than do the retail customers (30.8 percent). Approximately 42.5 percent of all water used during FY 2003-04 to FY 2007-08 was used on a seasonal basis.

Among retail customers, residential (single-family), GS commercial and government, and municipal accounts used about 37 to 40 percent of all water supplied to these users during FY 2003-04 to FY 2007-08 for seasonal purposes (Figure 5-6). GS multi-family and OGS accounts had much lower seasonal water use.

[11] Some analysts estimate base water use as the average winter water use (December, January, and February). However, some irrigation does take place in the winter, particularly during extended dry periods. To better separate seasonal and base water uses, the base water use for each year was estimated from the minimum water use month.

Figure 5-5: Seasonal Water Use by Category, FY 2003-04 to FY 2007-08

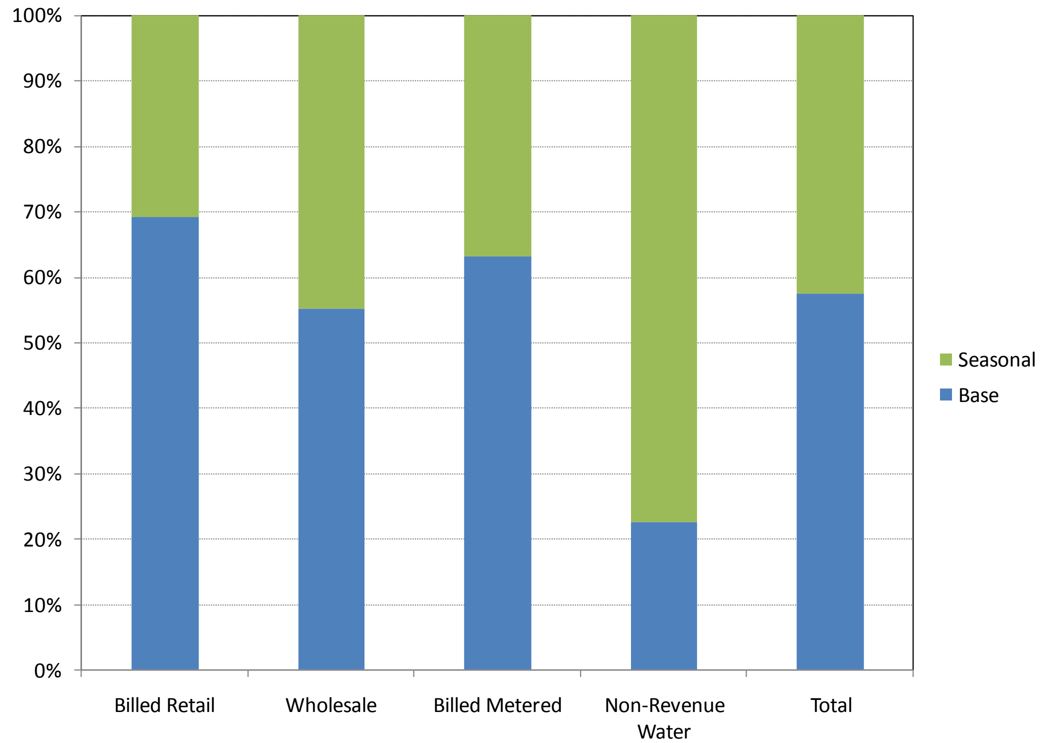
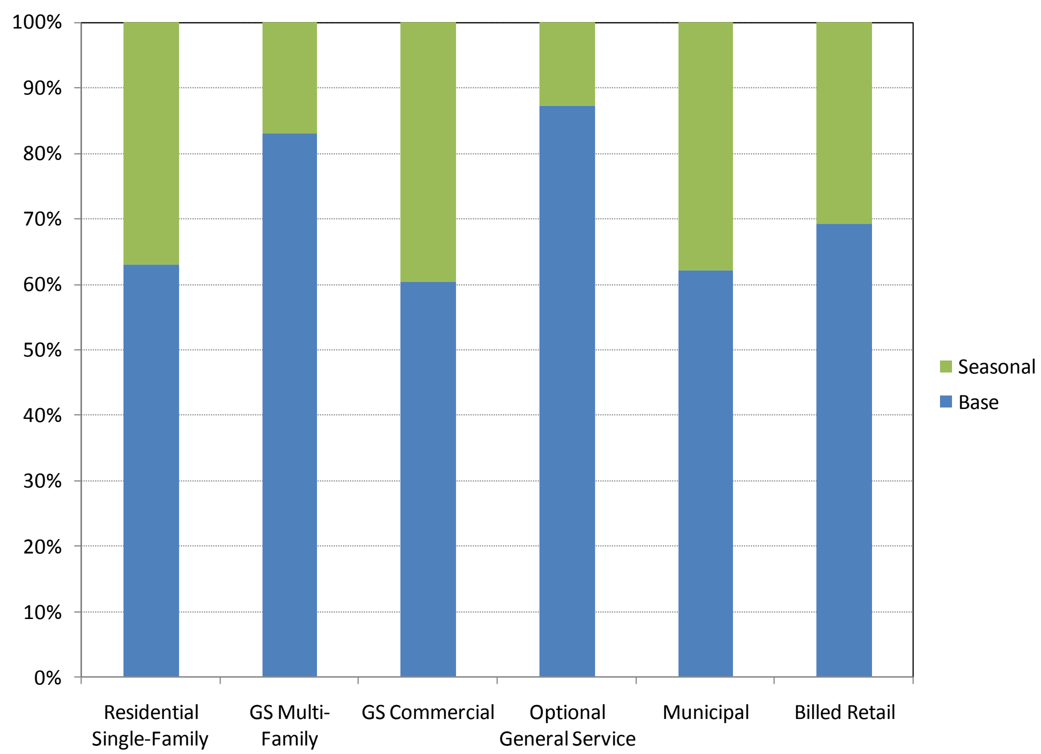


Figure 5-6: Seasonal Billed Retail Water Use by Category, FY 2003-04 to FY 2007-08



Normalization of Retail Water Use

Suppose that a utility analyst would like to compare water use between three golf course customers: a nine-hole course, an eighteen-hole course, and a twenty-seven-hole course. Comparing total water use for these customers would probably not reveal which customer used water most efficiently. The largest course, with more acreage to irrigate, will likely use more water than the smaller courses, even if it uses water efficiently. For a meaningful comparison, water use for each course must be adjusted to the same unit basis (e.g., gallons per acre per day or gallons per hole per day). The process of adjusting the water use so that it is directly comparable between accounts is called normalization. Where possible, water used for a given purpose should be normalized by the factors that most influence that use. Sample normalization units are shown in Table 5-3 for DWU premise types.

Normalizing by the number of residents is appropriate for indoor residential water use, because indoor water uses are relatively similar from residential customer to residential customer and because the volume of indoor water use directly depends on the number of residents. Outdoor residential water use depends less on the number of residents than the number of dwelling units, average lot size, and other factors. Therefore, normalization of total residential water use (indoor and outdoor) by the number of residents may be somewhat less informative. At the other end of the spectrum, normalizing water use at industrial facilities by the number of residents in Dallas does not make sense at all, because industrial water use does not depend on the number of Dallas residents. For a given category, it may be informative to normalize water use in more than one way.

Traditionally, DWU and other utilities across the state have normalized their water use by the number of residents. This may be useful as a way to track water conservation progress within a utility but is not necessarily valid for comparison of water use between different utilities.[12] In addition, there is no universally accepted method of calculating per capita water use. For example, some cities have excluded “unaccounted-for” or non-revenue water, while others have included this component in their calculations.

Task Force Method

As discussed in Section 2.3, the Water Conservation Implementation Task Force defined total per-capita water use as the total amount of water diverted and/or pumped for potable use divided by the total population (Ref. 2). The Task Force also recommended crediting indirect reuse diversion volumes against total diversion volumes for the purpose of calculating per capita water use for targets and goals. To date, DWU has not taken credit for indirect reuse in its per capita water use estimates. As discussed in more detail in Section 6.2, DWU should follow the Task Force recommendation by developing water accounting procedures to track indirect reuse volumes and credit them against per capita water use.

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[12] For example, a city with a large industrial base and a relatively small population may have the same per capita water use as a city with very few industrial/commercial accounts and a much larger population, even though the reasons for the water use are very different.

Table 5-3: Potential Normalization Units by Premise Type

Premise Type	SAP Premise Type	Normalization Units
A	Single Family Residential	Resident, dwelling unit
B	Multifamily/Townhome - Master Metered	Resident, dwelling unit
C	Duplex - Individual Metered	Resident, dwelling unit
D	Duplex - Master Metered	Resident, dwelling unit
E	Apartment # Individual Metered	Resident, dwelling unit
F	Apartment/Condo Master Metered	Resident, dwelling unit
G	Mobile Home - Individual Metered	Resident, dwelling unit
H	Mobile Home - Master Metered	Resident, dwelling unit
I	Hotel/Motel	Guest, bed, room
J	Office Building	Employee, square foot, parking space
K	Shopping/Mall Centers	Square foot, parking space
L	Factory/Manufacturer	Employee
M	Warehouse	Employee, square foot, parking space
N	Vehicle Servicing/Washing	Vehicle, washing bay
O	Restaurant	Meal, seat, table
P	Laundry	Clothes washer
Q	Food And Kindred Processing	NA[a]
R	Other Business	Child (day care), seat (theater), passenger (airport), inmate (prison)
S	Park/Golf Courses	Acre, weather variables
T	Schools	Student
U	Fire Station	Firefighter, truck
V	Hospital	Bed
W	Church	Attendee, member
X	Median Strip	Acre, weather variables
Y	Vacant Lot or Raw Land	Acre, weather variables
Z	Portable Meter	NA[a]
3	Assumed To Be Commercial	NA[a]
4	Bar	Customer, seat, table
5	Sandwich Shop	Meal, seat, table
6	Cemetery/Agri Business	Acre, weather variables
7	Parking Lot	Parking space, acre
8	Automobile Dealers	Vehicle sold, parking space
9	Retail	Square foot
	Not assigned	NA[a]
	Service Station	NA[a]
	Unknown	NA[a]
	VLNDRESI	Acre, weather variables

[a] "NA" means that no suitable normalization unit has been identified.

[b] The "VLNDRESI" premise type consists of vacant residential land.

Finally, the Task Force defined residential per capita water use as single-family plus multi-family consumption divided by the total population. The “Task Force Method” is used below (without credit for indirect reuse) for tracking DWU retail water use from year to year.

Dallas Method

For internal calculations of per capita water use, DWU excludes wholesale sales and industrial sales (OGS accounts) and normalizes by the total retail population. The “Dallas Method” is also used below to track DWU non-industrial retail water use from year to year.

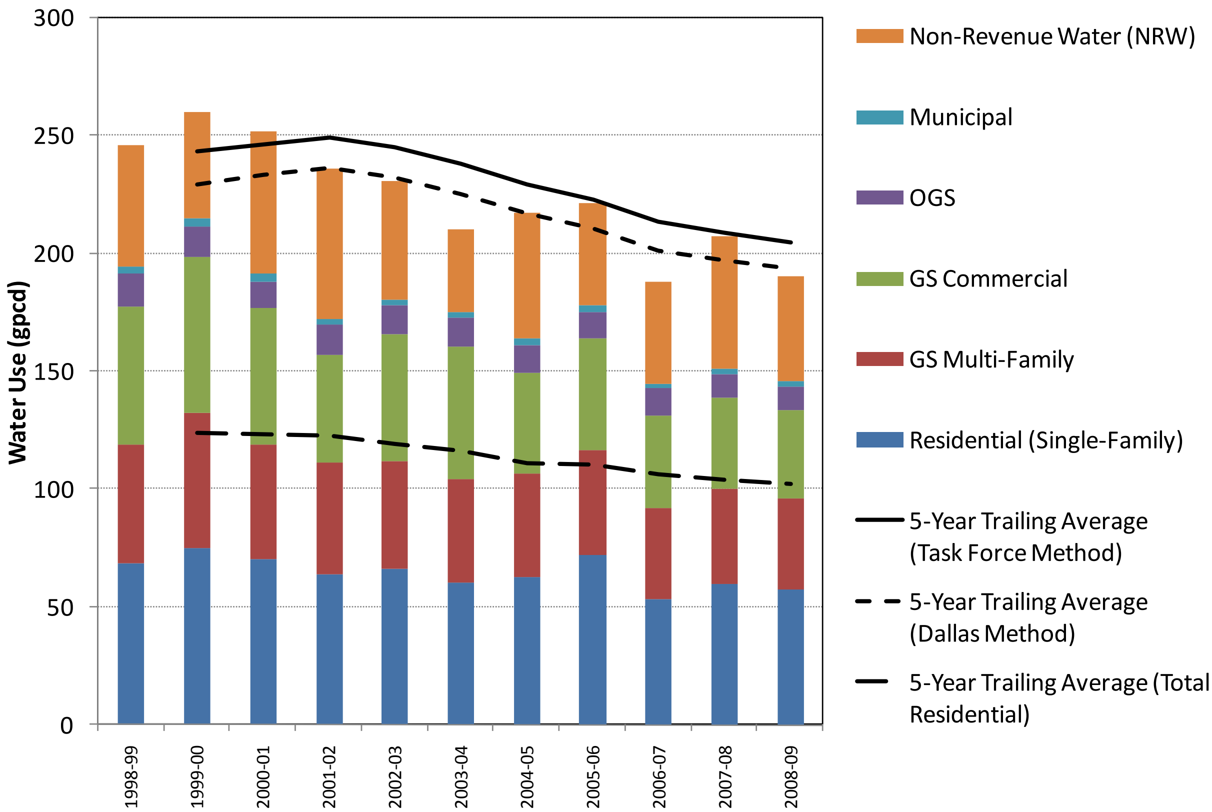
Normalized Retail Water Use

The adjusted category data were normalized by population (Figure 5-7). Normalized retail water use has steadily declined from its FY 1999-00 peak to present. Some of the variability in annual water use can be attributed to differences in weather from year to year. To better filter out the impact of weather on the annual data, five-year trailing averages were calculated for total retail water use (Task Force and Dallas Methods) and total residential water use (Figure 5-7).[13] By the Task Force Method, the five-year trailing average total water use has steadily declined from about 249 gpcd in FY 2001-02 to about 205 gpcd in FY 2008-09, a total reduction of 17.7 percent, or 2.75 percent per year. During the same period, the five-year trailing average residential water use has declined from about 123 gpcd to about 102 gpcd, a total reduction of 16.7 percent, or about 2.6 percent per year.

During the daytime, the Dallas population increases by approximately 19.1 percent (Ref. 22). This commuter population contributes to the total per capita water use.

[13] For example, the five-year average per capita consumption for FY 2008-09 is the average of the annual per capita consumption estimates for FY 2004-05 to FY 2008-09.

Figure 5-7: Normalized Retail Water Use



5.4. Analysis of Residential Water Use

The following sections present the available DWU residential water use data, analyze residential water demand, and identify top water users by premise type.

Residential Customer Billing Data

The residential customer billing data analyzed in this section were obtained from the SAP system and span the seventeen months from February 2008 through June 2009. This period was selected for analysis because it represents the latest provided residential water use data. As shown in Table 5-2, there are ten residential premise types (A through H, Unknown, and VLNDRESI).[14] A total of 296,907 residential accounts were analyzed. Of those accounts, 294,753 are active

[14] Customer billing records with premise types, B, F, H, and Unknown are predominantly classified with the commercial customer type, although they represent water use in multi-family residential dwellings. To achieve the best estimate for actual residential water use, these premise types will be analyzed as residential water use.

accounts with non-zero water use during the analysis period, and 2,154 are inactive accounts for which no water usage was recorded.[15]

Residential Water Use Analysis

During the seventeen-month period between February 2008 and June 2009, the total residential water demand (defined from the billing data) was approximately 66.4 billion gallons of water, or 65.3 percent of billed retail water during the period.

Customer types (residential, commercial, industrial, and governmental) are also specified in the billing data.[16] The residential customer type primarily consists of single-family residential accounts, and the commercial customer type primarily consists of master-metered apartments, townhomes, and condominiums. The total residential water demand described above can be broken down by customer type:

- Residential: 38.2 percent of billed retail water,
- Commercial: 27.1 percent of billed retail water,
- Governmental: 0.1 percent of billed retail water, and
- Industrial: less than 0.1 percent of billed retail water.[17]

Summary of Residential Water Demand by Premise Type

Figure 5-8 shows total residential water demand by premise type for the seventeen-month time period. The two premise types that have the highest water demand are Single Family Residential and Apartment/Condo Master Metered (56.5 percent and 38.9 percent, respectively). Combined, these two premise types account for 93.7 percent of residential accounts and 95.4 percent of residential water demand (Table 5-4).

Table 5-5 summarizes average summer water usage, average minimum month water usage (representing winter water use), average annual water usage, and summer to winter ratio for each premise type. The summer to winter ratios represent the water use variation throughout the seventeen months analyzed. The Single Family Residential premise type has the second highest summer-to-winter ratio (2.14), indicating higher irrigation water use than the other residential premise types (except the VLNDRESI premise type, which has very low total water use).

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[15] Multiple records can exist for one account number. This is due to the fact that some residential properties have multiple meters (records). The total usage for each account is the accumulation of water usage for all associated records. A total of 340,121 residential records were present in the data set.

[16] The actual field name in the SAP database is "Acct_Determ_ID_Cont".

[17] Twenty accounts with premise type Apartment/Condo Master Metered or Multi-Family/Townhome - Master Metered are classified with the Governmental customer type. One account with premise type Multi-Family/Townhome - Master Metered is classified with the Industrial customer type. DWU should verify that these customer types are correct.

Figure 5-8: Total Residential Water Demands by Premise Type, February 2008 -- June 2009

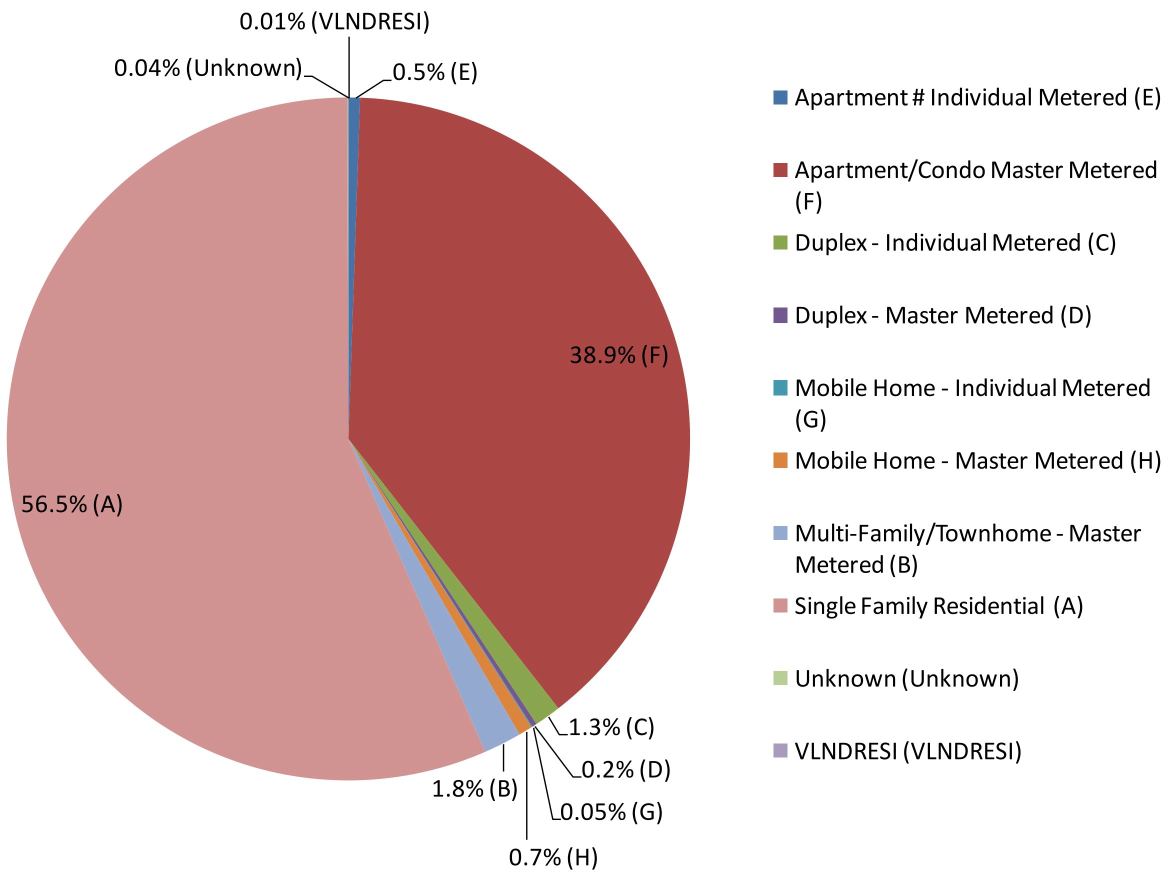


Table 5-4: Distribution of DWU's Residential Water Demands and Accounts by Premise Type, February 2008 – June 2009

Premise Type	Premise Type Description	Total Demand (mg)	Cumulative Percentage of Total Demand	Total Number of Accounts	Percentage of Total Accounts	Number of Active Accounts	Cumulative Percentage of Active Accounts
A	Single Family Residential	37,541	56.5%	272,547	91.9%	270,804	91.9%
F	Apartment/Condo Master Metered	25,856	95.4%	5,366	1.8%	5,252	93.7%
B	Multi-Family/Townhome - Master Metered	1,188	97.2%	380	0.1%	347	93.8%
C	Duplex - Individual Metered	833	98.5%	11,782	3.9%	11,618	97.7%
H	Mobile Home - Master Metered	435	99.1%	84	0.0%	79	97.7%
E	Apartment # Individual Metered	364	99.7%	5,353	1.8%	5,273	99.5%
D	Duplex - Master Metered	155	99.9%	1,013	0.3%	1,006	99.9%
G	Mobile Home - Individual Metered	31	100.0%	368	0.1%	361	100.0%
Unknown	Unknown	25	100.0%	1	0.0%	1	100.0%
VLNDRESI	Vacant Land Residential	5	100.0%	13	0.0%	12	100.0%
TOTAL		66,433	100.0%	296,907	100.0%	294,753	100.0%

Table 5-5: Average Residential Customer Water Use by Premise Type, February 2008 – June 2009

Premise Type	Premise Type Description	Average Summer Usage[a] (gal/day)	Minimum Month Usage[b] (gal/day)	Average Annual Water Usage (gal/day)	Summer-to-Winter Ratio
A	Single Family Residential	113,549,859	52,994,517	72,753,619	2.14
F	Apartment/Condo Master Metered	59,438,700	44,911,918	50,108,174	1.32
B	Multi-Family/Townhome - Master Metered	2,745,570	1,604,470	2,302,537	1.71
C	Duplex - Individual Metered	1,932,229	1,278,893	1,614,486	1.51
H	Mobile Home - Master Metered	975,963	731,681	842,959	1.33
E	Apartment # Individual Metered	770,704	446,039	704,567	1.73
D	Duplex - Master Metered	378,651	230,705	300,346	1.64
G	Mobile Home - Individual Metered	72,496	53,919	59,616	1.34
Unknown	Unknown	51,508	0	48,422	n/a
VLNDRESI	Vacant Land Residential	20,412	2,369	10,534	8.61
TOTAL		179,936,091	102,254,512	128,745,260	1.76

[a] Average use for the months of July, August, and September.

[b] Average use for the minimum use months during the period (one month in FY 2007-08 and one month in FY 2008-09). This represents winter water use and is assumed to be primarily indoor water use.

Residential water conservation programs should focus on the Single Family Residential and Apartment/Condo Master Metered premise types, because they account for the large majority of residential water demand, and because the Single Family Residential premise type has a relatively high summer-to-winter ratio.

Top Residential Water Users

To obtain a better representation of the water usage for residential accounts, an analysis of water use was completed for single-family residential accounts and for accounts with other residential premise types (multi-family residential). This analysis was conducted for the twelve-month period from February 2008 through January 2009. A twelve-month period was selected to allow estimation of the percentage of annual consumption used for outdoor purposes. As shown in Tables 5-6 and 5-7, the outdoor water use percentages for all single- and multi-family residential accounts are similar to those estimated for the five year period from FY 2003-04 through FY 2007-08 (Figure 5-6).

Table 5-6 summarizes water usage for the top single-family residential accounts by percentage of accounts. The top one percent of single-family residential accounts has notably higher indoor and outdoor demands when compared to the average of all single-family residential accounts. Table 5-7 summarizes water usage for the top multi-family residential accounts by percentage of accounts. The top one, ten, and twenty-five percent of multi-family residential accounts have notably higher indoor and outdoor demands compared to the average of all multi-family residential accounts.

Table 5-6: Average Single-Family Residential Water Use by Top Water Users, February 2008 – January 2009

Single-Family Account Percentile	Number of Active Accounts	Average Account Demand (gal/day)	Average Account Indoor Demand[a] (gal/day)	Average Account Outdoor Demand[b] (gal/day)	Outdoor Water Use Percentage[c]
All Accounts	270,804	286	188	98	34.2%
Top 1% Accounts	2,708	3,288	1,277	2,011	61.2%
Top 10% Accounts	27,080	1,093	534	559	51.2%
Top 25% Accounts	67,701	701	383	319	45.4%
Top 50% Accounts	135,402	481	291	190	39.5%
Bottom 50% Accounts	135,402	90	76	14	15.3%

[a] Average demand for the minimum use month for the aggregated accounts.

[b] Calculated by subtracting average account indoor demand from the average account demand.

[c] One year's data (or multiples thereof) must be used to estimate an annualized outdoor water use percentage. The outdoor water use percentage for the chosen period, February 2008 through January 2009, represents recent residential water use and is reasonably consistent with the historical average (Figure 5-6).

Table 5-7: Average Multi-Family Residential Water Use by Top Water Users, February 2008 – January 2009

Multi-Family Account Percentile	Number of Active Accounts	Average Account Demand (gal/day)	Average Account Indoor Demand[a] (gal/day)	Average Account Outdoor Demand[b] (gal/day)	Outdoor Water Use Percentage[c]
All Accounts	23,936	2,376	2,017	359	15.1%
Top 1% Accounts	239	68,198	53,334	14,863	21.8%
Top 10% Accounts	2,394	20,672	17,157	3,516	17.0%
Top 25% Accounts	5,984	9,198	7,780	1,417	15.4%
Top 50% Accounts	11,968	4,705	3,982	724	15.4%
Bottom 50% Accounts	11,968	47	43	3	7.3%

[a] Average demand for the minimum use month for the aggregated accounts.

[b] Calculated by subtracting average account indoor demand from the average account demand.

[c] One year's data (or multiples thereof) must be used to estimate an annualized outdoor water use percentage. The outdoor water use percentage for the chosen period, February 2008 through January 2009, represents recent residential water use and is reasonably consistent with the historical average (Figure 5-6).

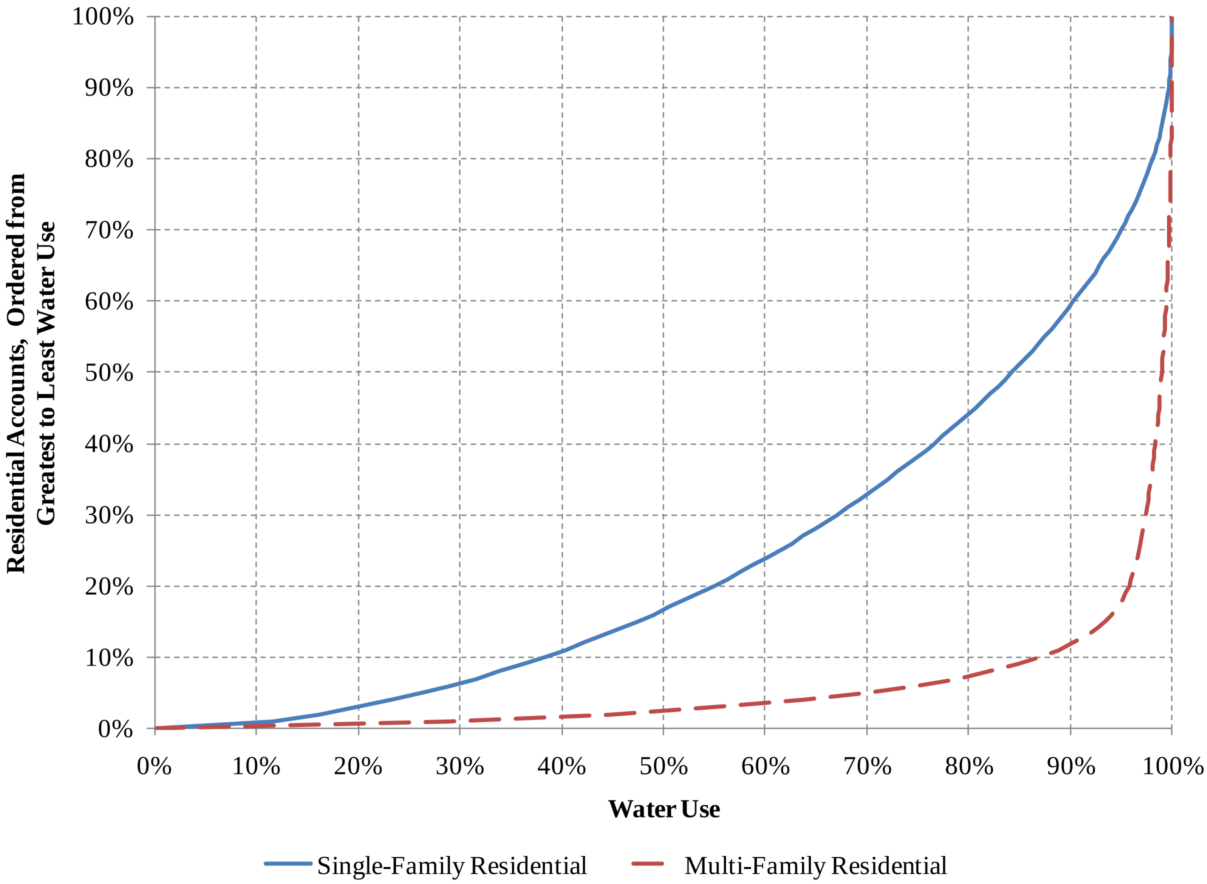
Figure 5-9 illustrates the distribution of residential water demand by the number of residential accounts (ordered from greatest to least water-using accounts) for single- and multi-family residential accounts. In each category, the top twenty-five percent of accounts used more than sixty percent of the total water demand.

Outdoor/Irrigation Demands

Monthly water demand trends for Single Family Residential and Apartment/Condo Master Metered customers (the two largest water-using residential premise types) were compared with the estimated monthly turf water deficit and the average air temperature (Figure 5-10).[18] The monthly turf water deficit is meant to represent turf irrigation requirements; a positive turf water deficit means that turf water needs exceed natural precipitation and that irrigation is necessary to avoid turf stress.

[18] The monthly turf water deficit is the monthly turf water requirement minus monthly rainfall. The monthly turf water requirement is the potential evapotranspiration times the turf coefficient times the quality coefficient. Monthly rainfall data were obtained for Love Field. Potential evapotranspiration data were obtained from the Texas ET Network at the Dallas AgriLife Center Station (April 2008 through June 2009) and the Irving Station (February 2008 through April 2008). Monthly turf coefficients for warm season grasses (such as St. Augustine) were used, and the quality coefficient corresponded to low turf stress.

Figure 5-9: Distribution of Residential Water Use by Number of Accounts, February 2008 – June 2009

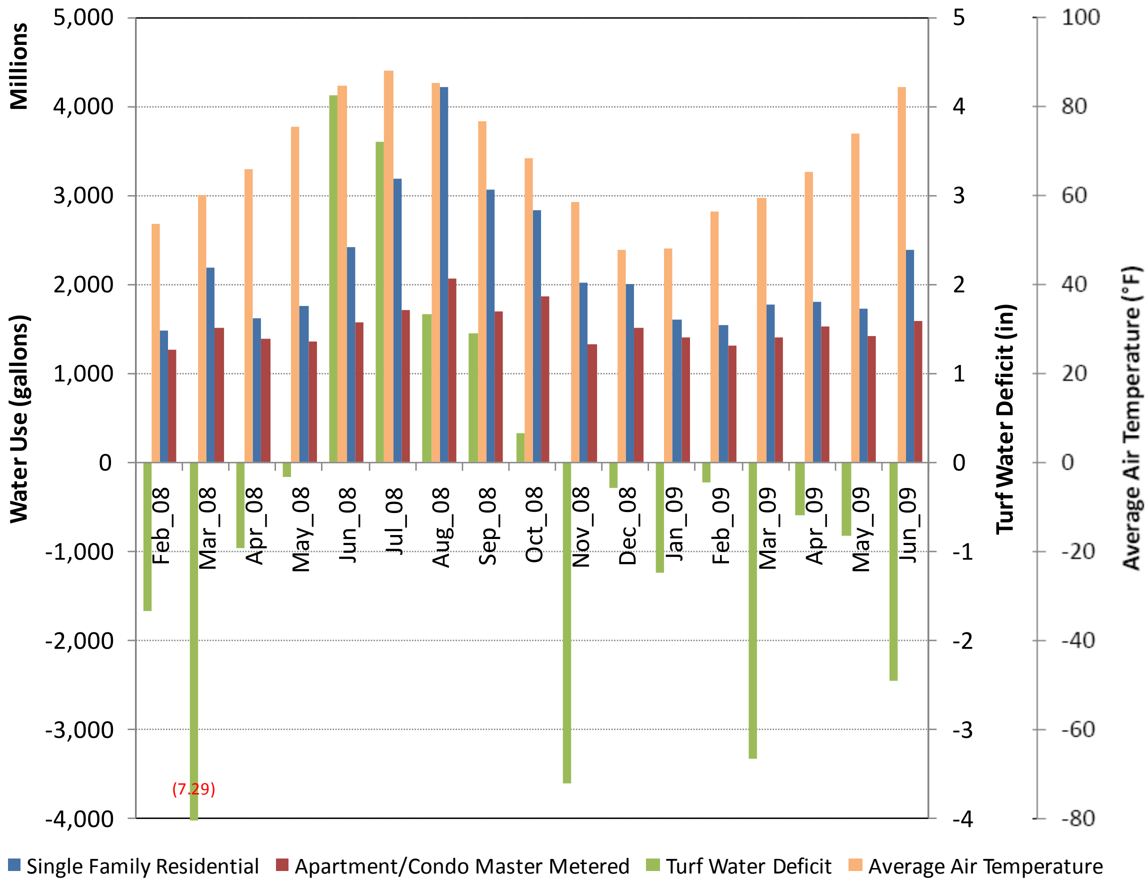


There is a substantial increase in residential water demand in the summer, especially for Single Family Residential premise type (Figure 5-10). For a given month, residential water demand has a moderate correlation with the turf water deficit and a stronger correlation with average air temperature.[19] The correlations are actually stronger between residential water demand for a given month and average air temperature and turf water deficit for the previous month, suggesting that people may incorporate recent climate history into their irrigation decisions.

Although average air temperature and turf water deficit have a significant influence on residential water demand, the relationships are complex (Figure 5-10). Based only on these factors, it would be expected that monthly water use in June 2009 (average air temperature of 84.4º F and turf water deficit of -2.46 inches) would be less than monthly water use in June 2008 (average air temperature of 84.6º F and turf water deficit of 4.13 inches). Since water use was similar during these two months, it is likely that other factors are also influencing water demand.

[19] The correlation with turf water deficit has coefficients of 0.45 for Single Family Residential and 0.44 for Apartment/Condo Master Metered. The correlation with average air temperature has coefficients of 0.67 for Single Family Residential and 0.60 for Apartment/Condo Master Metered.

Figure 5-10: Monthly Water Demand for Selected Premise Types and Monthly Turf Water Deficit, February 2008 – June 2009



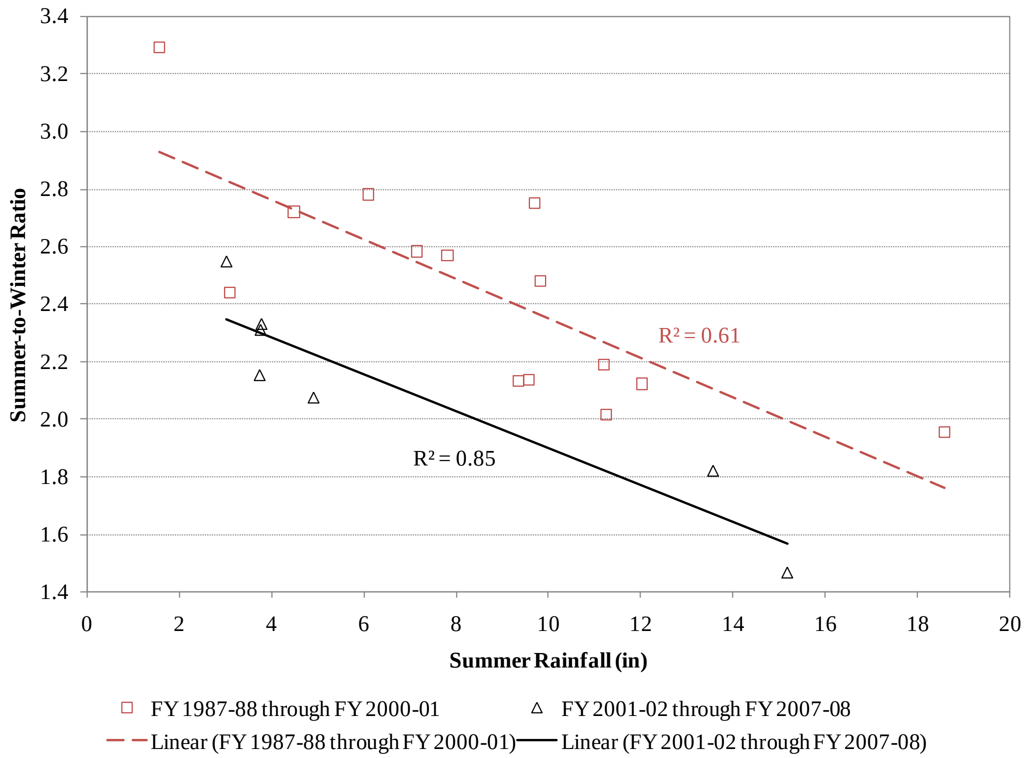
Outdoor water use statistics were calculated for the Residential water use category for the period from FY 1987-88 through FY 2007-08 (Table 5-8). A comparison of the average statistics for the period through FY 2000-01 and the period since FY 2001-02 (when time-of-day watering restrictions were enacted) shows progress in residential water conservation. Although the retail service population increased by approximately 8.4 percent from FY 2000-01 through FY 2007-08, average indoor water use increased by only 2.5 percent. In addition, although there has been less rainfall during the period since time-of-day watering restrictions were enacted, average summer water use has decreased by twelve percent. There appears to be a significant relationship between the summer-to-winter ratio and summer rainfall (Figure 5-11). Since time-of-day watering restrictions were enacted, this relationship has shifted downward, resulting in less outdoor water use for a given amount of summer rainfall.

Table 5-8: Residential Category Indoor vs. Seasonal Water Usage

Fiscal Year	Total Water Use (kgal)	Minimum Month Water Use[a] (kgal)	Total Indoor Water Use (kgal)	Total Outdoor Water Use (kgal)	Outdoor Water Use Percentage	Average Summer Month Water Use[b] (kgal)	Summer-to-Winter Ratio[c]	Annual Rainfall[d] (in)	Summer Rainfall[d] (in)
FY1987-88	30,755,644	1,527,090	18,325,082	12,430,562	40.4%	3,789,922	2.5	28.38	9.84
FY1988-89	25,078,227	1,258,787	15,105,449	9,972,778	39.8%	2,461,906	2.0	49.52	18.60
FY1989-90	29,342,194	1,511,695	18,140,335	11,201,859	38.2%	3,884,413	2.6	39.90	7.82
FY1990-91	26,395,412	1,482,750	17,792,996	8,602,416	32.6%	3,161,587	2.1	40.19	9.37
FY1991-92	26,088,061	1,396,746	16,760,950	9,327,112	35.8%	3,058,562	2.2	53.74	11.22
FY1992-93	27,838,057	1,448,721	17,384,657	10,453,401	37.6%	3,941,127	2.7	35.06	4.49
FY1993-94	25,459,625	1,498,081	17,976,974	7,482,650	29.4%	3,020,396	2.0	39.20	11.27
FY1994-95	25,654,810	1,328,262	15,939,149	9,715,661	37.9%	3,431,306	2.6	51.88	7.16
FY1995-96	29,445,828	1,415,957	16,991,482	12,454,346	42.3%	3,027,169	2.1	21.18	9.59
FY1996-97	26,463,532	1,528,176	18,338,116	8,125,417	30.7%	3,244,047	2.1	48.93	12.05
FY1997-98	34,693,926	1,498,419	17,981,030	16,712,896	48.2%	4,933,031	3.3	30.88	1.58
FY1998-99	29,279,164	1,624,830	19,497,961	9,781,203	33.4%	3,964,761	2.4	35.63	3.11
FY1999-00	32,569,083	1,580,638	18,967,651	13,601,432	41.8%	4,350,717	2.8	31.43	9.71
FY2000-01	30,704,109	1,402,367	16,828,409	13,875,700	45.2%	3,901,396	2.8	43.00	6.11
Average through FY 2000-01	*28,554,834*	*1,464,466*	*17,573,589*	*10,981,245*	*38.5%*	*3,583,596*	*2.4*	*39.21*	*8.71*
FY2001-02	28,215,659	1,594,531	19,134,367	9,081,292	32.2%	3,307,926	2.1	32.43	4.91
FY2002-03	29,271,389	1,473,559	17,682,707	11,588,682	39.6%	3,433,964	2.3	30.25	3.78
FY2003-04	26,792,558	1,480,731	17,768,776	9,023,783	33.7%	2,695,084	1.8	34.72	13.58
FY2004-05	28,159,685	1,389,736	16,676,830	11,482,855	40.8%	3,210,089	2.3	29.64	3.76
FY2005-06	33,541,382	1,525,289	18,303,472	15,237,911	45.4%	3,886,040	2.5	28.40	2.87
FY2006-07	25,057,089	1,496,336	17,956,037	7,101,052	28.3%	2,194,046	1.5	52.28	15.19
FY2007-08	28,443,077	1,553,139	18,637,673	9,805,404	34.5%	3,343,110	2.2	31.74	3.74
Average since FY 2001-02	*28,497,263*	*1,501,903*	*18,022,837*	*10,474,425*	*36.8%*	*3,152,894*	*2.1*	*34.23*	*6.85*

[a] Second-lowest month usage used in FY 1998-99 and FY 1999-00, because reported lowest month usage is much lower than lowest month usage in other years.
[b] June, July, and August
[c] Ratio of average summer month water use to minimum month water use.
[d] Love Field

Figure 5-11: Residential Category Summer-to-Winter Ratio vs. Summer Rainfall



Normalization of Residential Water Use

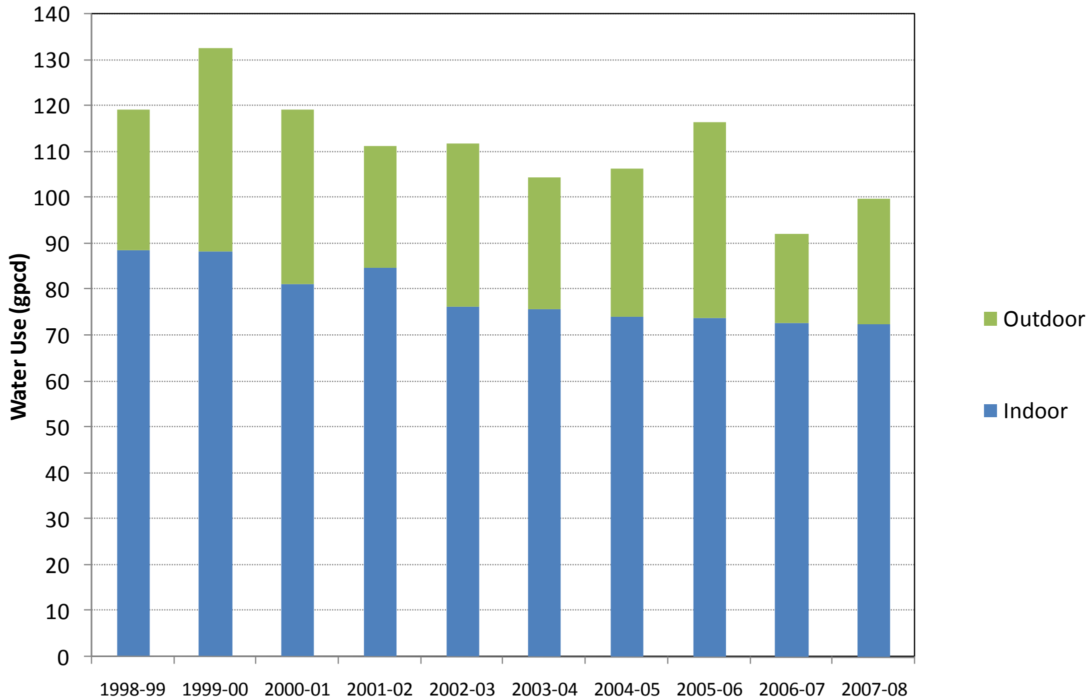
As discussed in Section 5.3, indoor residential water use should be normalized by the number of residents. Using similar procedures to those discussed on page 5-7, residential base and seasonal components were estimated to represent indoor and outdoor water use, respectively (Figure 5-12). Total indoor residential water use (both single-family and multi-family) has decreased from 88.5 gpcd in FY 1998-99 to 72.5 gpcd in FY 2007-08. Total residential water use shows a similar decline, but it varies from year-to-year due to climatic influences. The summers of 2000 and 2006 were very hot and dry, and outdoor water use was greater during these periods. From FY 1998-99 through FY 2007-08, total residential water use has ranged from 133 gpcd to 92 gpcd.

Key Findings about Residential Water Use

Key findings from the analysis of residential water use between February 2008 and June 2009 are:

- The premise types with the largest water demand among the residential premise types are Single Family Residential and Apartment/Condo Master Metered (Table 5-5). These two premise types accounted for 36.6 percent and 25.2 percent, respectively, of all retail water sales (not just residential) from February 2008 through June 2009.

Figure 5-12: Normalized Total Residential Water Use



- Twenty-five percent of Single Family Residential customers accounts for more than sixty percent of Single Family Residential water use (Figure 5-9). Ten percent of multi-family residential customers account for more than eighty-five percent of multi-family residential water use. These top water users have much greater indoor and outdoor water use than the average account (Tables 5-6 and 5-7).
- There is a moderate correlation between residential water demand and the turf water deficit for a given month and a stronger correlation between residential water demand and average air temperature for a given month (Figure 5-10). The correlations are actually stronger between residential water demand for a given month and average air temperature and turf water deficit for the previous month, suggesting that people may incorporate recent climate history into their irrigation decisions.
- Average summer month water use has decreased by twelve percent since time-of-day watering restrictions were enacted (Table 5-8), and per capita indoor water use has decreased by eighteen percent over nine years (Figure 5-12).

5.5. Analysis of ICI Water Use

This section describes industrial, commercial and institutional (ICI) water demands and use characteristics in the DWU system. The following sections present an analysis of the water efficiency-related features of DWU's ICI demands, including total water use, water use by premise type, seasonal water use patterns, and top (highest water-using) customer water use characteristics.

ICI Customer Billing Data

The ICI customer billing data used in this section were obtained from the SAP system and span seventeen months (February 2008 through June 2009). ICI customer accounts were identified by selecting all meters classified by customer type as commercial, industrial, and governmental and excluding all premise types already defined as residential (A through H, Unknown, and VLNDRESI).[20]

Excluding the wholesale premise type, there are twenty-seven ICI premise types in the SAP database: I through Z, 3 through 9, Not Assigned, and Service Station (Table 5-2). These premise types represent a total of 29,910 customer accounts.[21] Of these ICI accounts, 28,101 (ninety-four percent) are active and 1,809 (six percent) are inactive accounts (no water usage recorded from February 2008 through June 2009). Inactive accounts were not considered in the evaluation of ICI water use.

The "Not Assigned" premise type was combined with "Assumed to be Commercial," so twenty-six ICI premise codes are presented in the analysis that follows.

ICI Water Use Analysis

Over thirty-five billion gallons of water was used by DWU's ICI customer sector during the seventeen-month period between February 2008 and June 2009. ICI water demands during FY 2007-08 represented nearly thirty-one percent of DWU's total water use.

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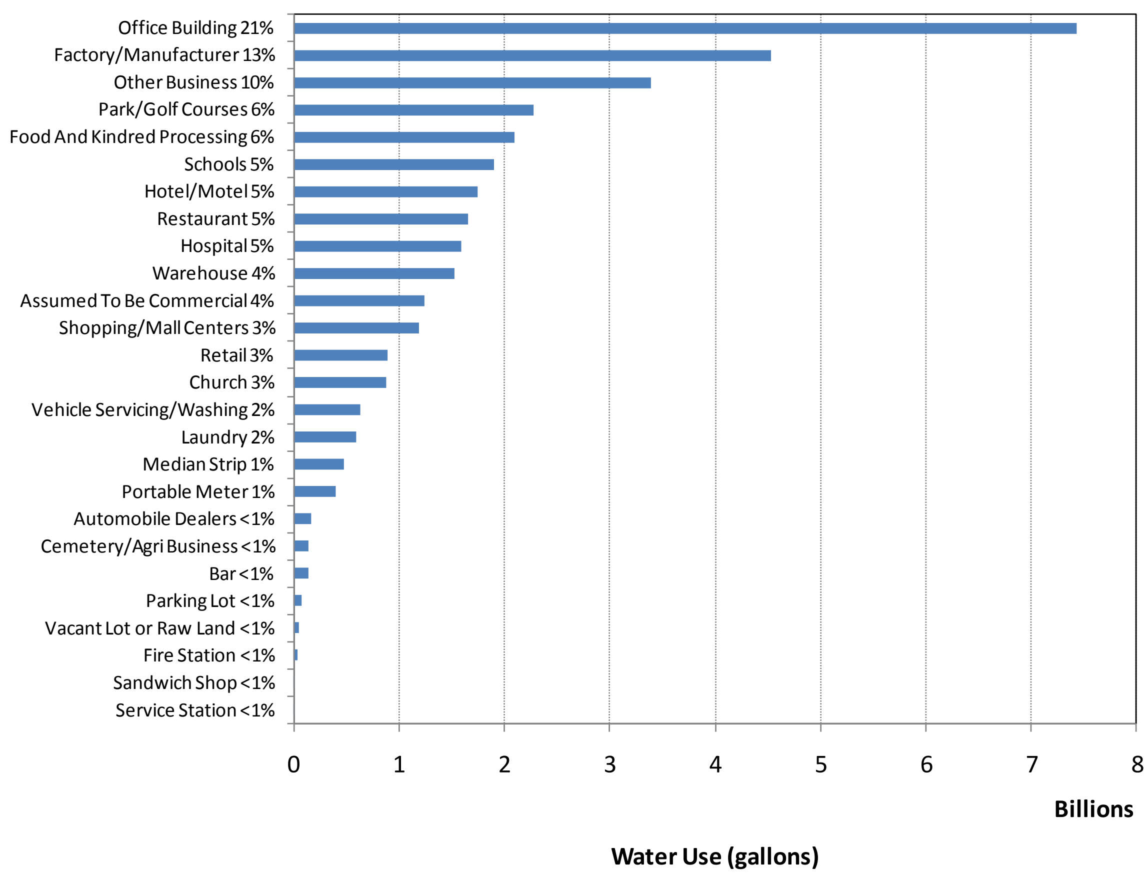
[20] There are 139 meters with ICI premise types (I through Z, 2 through 9, Not Assigned, and Service Station in Table 5-2) that are classified as residential in the customer type. These records should be examined carefully to determine whether the premise type or the customer type is misclassified. Compared to overall ICI water use, these records represent a very small volume of water use, and these records were excluded from the analysis of ICI water use.

[21] Multiple records can exist for one account number. This is due to the fact that some ICI properties have multiple meters (records). The total usage for each account is the accumulation of water usage for all associated records. A total of 42,585 ICI records have customer type commercial, industrial, or governmental.

Distribution of ICI Water Demand by Premise Type

The distribution of DWU's water demands by twenty-six ICI business premise codes from February 2008 through June 2009 is shown in Figure 5-13.[22] Approximately fifty percent of Dallas's ICI water use is congregated among four premise types: office buildings are the single largest user (twenty-one percent), followed by factories/manufacturers (thirteen percent), unclassified other businesses (ten percent), and parks/golf courses (six percent). Those four premise users, along with five additional premise types – food and kindred processing, school, hotel/motel, restaurant and hospital – use more than seventy-five percent of all ICI water demands. In sum, nine out of twenty-six ICI premise types use more than seventy-five percent of all ICI demands; these nine premise users also represent slightly more than fifty percent of all active ICI customer accounts (Table 5-9).

Figure 5-13: Total ICI Water Use by Premise Type, February 2008 – June 2009



[22] For a single portable meter account, February 2008 water use was corrected from 99,900,000 gallons to 7,000 gallons, the average consumption during the other 16 months.

Table 5-9: Distribution of ICI Water Use and Accounts by Premise Type, February 2008 – June 2009

Premise Type		Total Demand (mg)	Percentage of Demand	Cumulative Percentage of Demand	Active Accounts	Percentage of Active Accounts	Cumulative Percentage of Active Accounts
J	Office Building	7,424	21.2%	21.2%	4,495	16.0%	16.0%
L	Factory/Manufacturer	4,528	12.9%	34.1%	612	2.2%	18.2%
R	Other Business	3,388	9.7%	43.7%	5,433	19.3%	37.5%
S	Park/Golf Courses	2,280	6.5%	50.2%	647	2.3%	39.8%
Q	Food And Kindred Processing	2,098	6.0%	56.2%	159	0.6%	40.4%
T	Schools	1,900	5.4%	61.6%	709	2.5%	42.9%
I	Hotel/Motel	1,746	5.0%	66.6%	254	0.9%	43.8%
O	Restaurant	1,657	4.7%	71.3%	1,821	6.5%	50.3%
V	Hospital	1,599	4.6%	75.9%	194	0.7%	51.0%
M	Warehouse	1,527	4.4%	80.2%	2,005	7.1%	58.1%
3	Assumed To Be Commercial	1,239	3.5%	83.7%	2,682	9.5%	67.7%
K	Shopping/Mall Centers	1,190	3.4%	87.1%	1,653	5.9%	73.5%
9	Retail	890	2.5%	89.7%	2,010	7.2%	80.7%
W	Church	884	2.5%	92.2%	1,673	6.0%	86.6%
N	Vehicle Servicing/Washing	639	1.8%	94.0%	1,378	4.9%	91.5%
P	Laundry	593	1.7%	95.7%	213	0.8%	92.3%
X	Median Strip	478	1.4%	97.1%	446	1.6%	93.9%
Z	Portable Meter	397	1.1%	98.2%	781	2.8%	96.7%
8	Automobile Dealers	171	0.5%	98.7%	258	0.9%	97.6%
6	Cemetery/Agri Business	146	0.4%	99.1%	46	0.2%	97.8%
4	Bar	138	0.4%	99.5%	311	1.1%	98.9%
7	Parking Lot	76	0.2%	99.7%	145	0.5%	99.4%
Y	Vacant Lot or Raw Land	56	0.2%	99.9%	57	0.2%	99.6%
U	Fire Station	35	0.1%	100.0%	76	0.3%	99.8%
5	Sandwich Shop	6	0.0%	100.0%	38	0.1%	100.0%
1	Service Station	2	0.0%	100.0%	5	0.0%	100.0%
	TOTALS	35,087	100.0%		28,101	100.0%	

Top Users

To obtain a better representation of the water usage for ICI accounts, an analysis of ICI water use was completed for the twelve-month period from July 2008 through June 2009. A twelve-month period was selected to allow estimation of the percentage of annual consumption used for outdoor purposes. Table 5-10 summarizes water usage for the top ICI accounts by percentage of accounts. The top ICI accounts have notably higher indoor and outdoor demands when compared to the average of all ICI accounts.

Figure 5-14 illustrates the distribution of ICI water demand by the number of ICI accounts (ordered from greatest to least water-using accounts). The top one percent of ICI accounts used more than forty-four percent of the total ICI water demand, and the top ten percent of ICI accounts used almost eighty percent of the total ICI water demand.

Seasonal Demands

Average water demands for active ICI accounts by premise type were evaluated for maximum, minimum and average month as well as maximum month-to-average month characteristics from February 2008 through June 2009 (Table 5-11). Premise types with the greatest maximum month-to-average month ratios are assumed to have the greatest seasonal water use (Figure 5-15).

<u>Potential ICI Data Quality Control Issues</u>

There are potential data quality control issues that would significantly affect the apparent seasonal water use for the premise types with the top 5 maximum month-to-average month ratios:

- The Vacant Lot or Raw Land premise type had the greatest maximum month-to-average month ratio (4.88). However, usage of 8,304,400 gallons was recorded for a single account in August 2008 -- approximately fifty-one percent of the maximum month usage for the entire premise type. The same account used approximately three hundred gallons in other months. Without this single account, the maximum month-to-average month ratio for Vacant Lot or Raw Land would be 2.82.
- The Service Station premise type had the next highest maximum month-to-average month ratio (2.97). However, there are only five active accounts in this premise type, so it is not clear whether this ratio reflects actual water use at all service stations.
- The Factory/Manufacturing premise type had a maximum month-to-average month ratio of 2.49. However, it appears that meters were not read for the largest Factory/Manufacturing customer in July 2008 and that the reported water use for August 2008 includes usage for both July and August 2008. If the reported August 2008 usage for the Factory/Manufacturing largest customer is spread evenly to July and August 2008, the maximum month-to-average month ratio for Factory/Manufacturing would be 1.81.

Table 5-10: Average ICI Account Water Use by Top Water Users, July 2008 – June 2009

Account Group	Number of Active Accounts	Average Account Demand (gal/day)	Average Account Indoor Demand[a] (gal/day)	Average Account Seasonal Demand[b] (gal/day)	Seasonal Water Use Percentage[c]
All ICI Accounts	28,101	2,527	1,826	701	27.7%
Top 1% ICI Accounts	281	110,288	70,627	39,661	36.0%
Top 10% ICI Accounts	2,810	20,094	14,793	5,301	26.4%
Top 25% ICI Accounts	7,025	9,380	6,774	2,606	27.8%
Top 50% ICI Accounts	14,051	4,988	3,670	1,318	26.4%
Lower 50% ICI Accounts	14,050	80	56	24	29.9%

[a] Average demand for the minimum use month for the aggregated accounts.

[b] Calculated by subtracting average account indoor demand from the average account demand.

[c] One year's data (or multiples thereof) must be used to estimate an annualized outdoor water use percentage. The unusually high number of "zero reads" in February 2008 artificially reduces estimated water use for this month and interferes with the estimates of base and seasonal water use. Therefore, the average account water use was calculated for different periods for ICI customers and residential customers (Tables 5-6 and 5-7). The outdoor water use percentage for the chosen period, July 2008 through June 2009, represents recent ICI water use is reasonably consistent with the historical average for the combination of GS Commercial and Optional General Service (Figure 5-6).

Figure 5-14: Distribution of ICI Water Use by Number of Accounts, February 2008 – June 2009

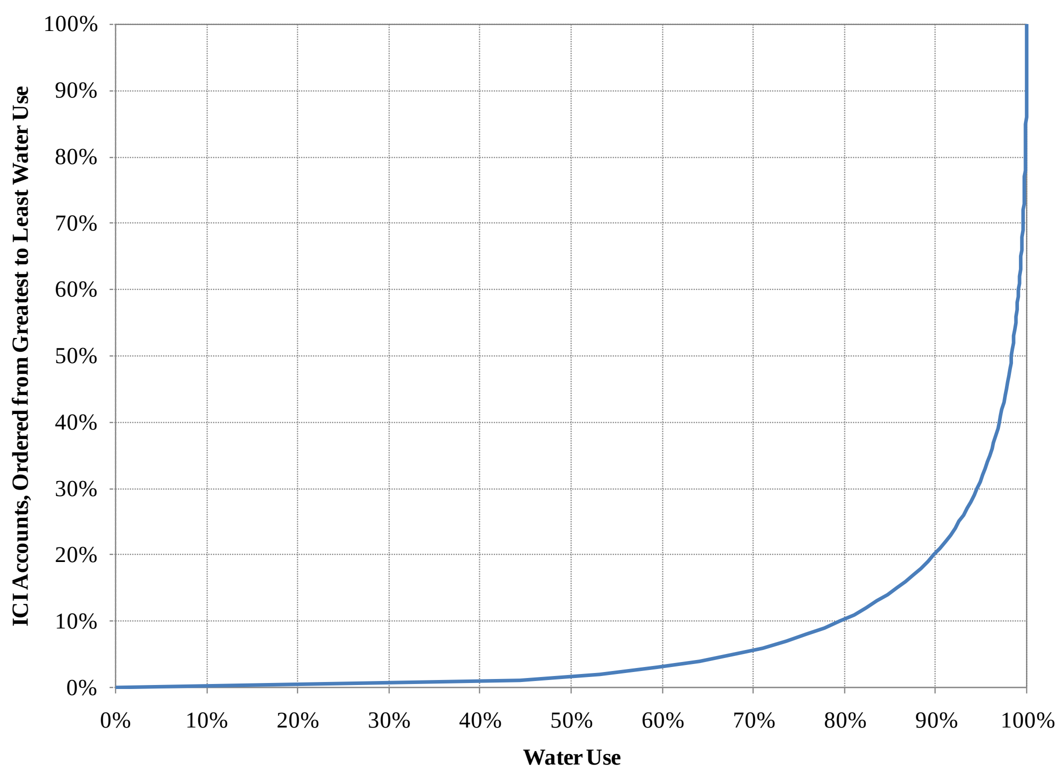
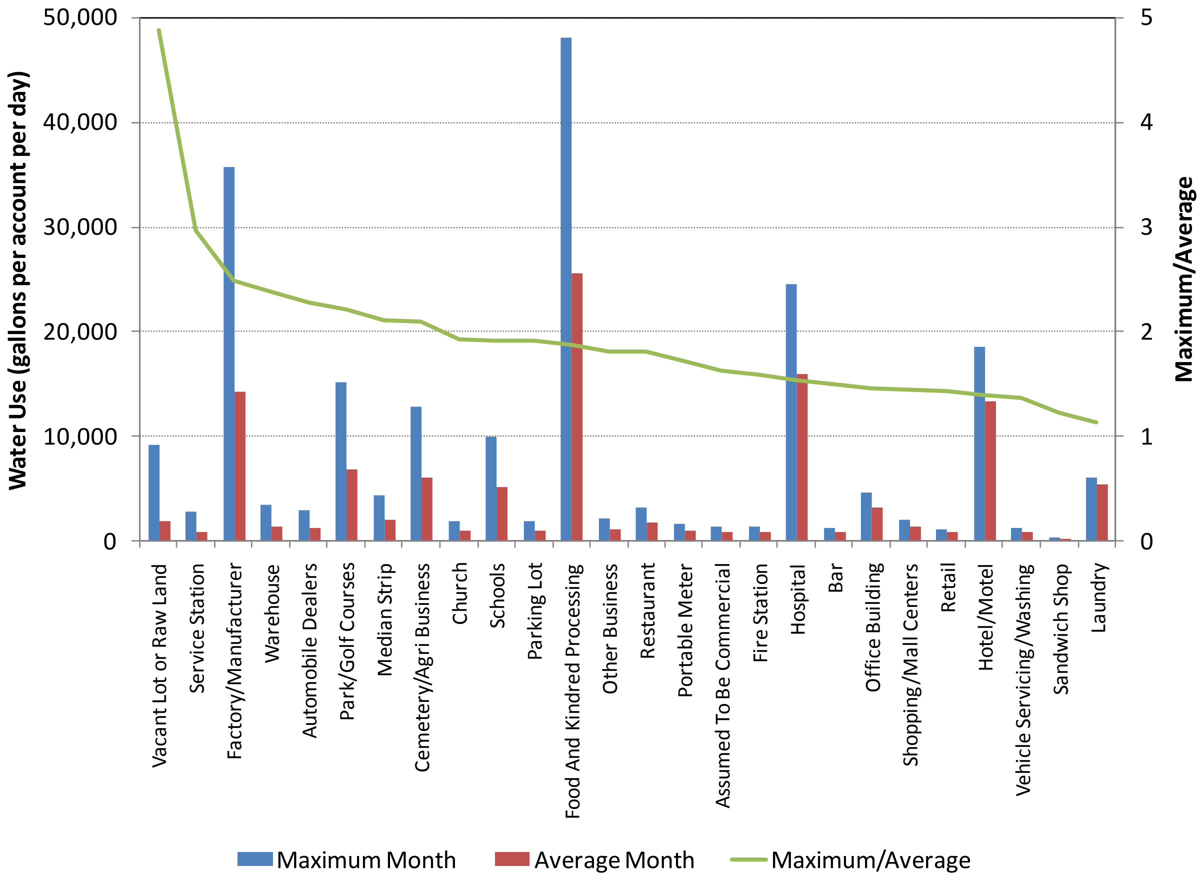


Table 5-11: Average ICI Account Water Use by Premise Type

Premise Type	Maximum Month (gal/acct/day)	Average Month (gal/acct/day)	Minimum Month (gal/acct/day)	Maximum Month/ Average Month
Food And Kindred Processing	48,109	25,572	14,164	1.88
Factory/Manufacturer	35,737	14,338	1,584	2.49
Hospital	24,537	15,969	6,002	1.54
Hotel/Motel	18,574	13,319	8,716	1.39
Park/Golf Courses	15,168	6,830	1,131	2.22
Cemetery/Agri Business	12,899	6,149	2,562	2.10
Schools	9,979	5,193	2,717	1.92
Vacant Lot or Raw Land	9,258	1,898	546	4.88
Laundry	6,146	5,398	4,515	1.14
Office Building	4,669	3,201	1,616	1.46
Median Strip	4,380	2,078	559	2.11
Warehouse	3,511	1,476	448	2.38
Restaurant	3,187	1,763	1,302	1.81
Automobile Dealers	2,926	1,284	597	2.28
Service Station	2,817	950	52	2.97
Other Business	2,185	1,208	758	1.81
Shopping/Mall Centers	2,024	1,396	856	1.45
Church	1,979	1,024	559	1.93
Parking Lot	1,935	1,012	510	1.91
Portable Meter	1,698	984	111	1.73
Assumed To Be Commercial	1,465	896	473	1.64
Fire Station	1,433	902	630	1.59
Bar	1,293	860	509	1.50
Vehicle Servicing/Washing	1,235	899	674	1.37
Retail	1,230	858	602	1.43
Sandwich Shop	370	300	215	1.23
AVERAGE	3,687	2,420	1,253	1.52

Figure 5-15: ICI Account Maximum and Average Day Demand by Premise Type, February 2008 to June 2009



- The Warehouse premise type had a maximum month-to-average month ratio of 2.38. However, there are seven accounts that have reported October 2008 usage of approximately ten million gallons and minimal usage in other months. In addition, the largest warehouse customer had exceptionally high water use in September 2008. If these accounts are excluded, the maximum month-to-average month ratio for the Warehouse premise type would be 1.35.
- The Automobile Dealers premise type had a maximum month-to-average month ratio of 2.28. However, usage of 9,999,700 gallons was recorded for a single account in October 2008 -- approximately forty-three percent of the maximum month usage for the entire premise type. The same account used approximately one hundred gallons in other months. Without this single account, the maximum month-to-average month ratio for Vacant Lot or Raw Land would be 1.56.

To better quantify seasonal ICI water demand patterns, DWU should further investigate these potential ICI data quality control issues. Even so, some conclusions may be drawn about seasonal uses based on correlations with climate factors, as discussed below.

Correlations with Climate Factors

Total monthly water demand for all twenty-six ICI premise types and monthly turf water deficit are shown in Figure 5-16. Although monthly turf water deficit and average air temperature influence ICI water demand (correlation coefficients of 0.42 and 0.65, respectively), the relationships are complex. Based only on these factors, it would be expected that monthly water use in June 2009 (average air temperature of 84.4º F and turf water deficit of -2.46 inches) would be less than monthly water use in June 2008 (average air temperature of 84.6º F and turf water deficit of 4.13 inches). Since water use was similar during these two months, it is likely that other factors are also influencing water demand.

Of the premise types with a maximum month-to-average month ratio of two or more, the following have at least moderate correlations between monthly water use and the monthly turf water deficit and average air temperature for a given month:[23]

- Vacant Lot or Raw Land (0.34 and 0.49, respectively)
- Park/Golf Courses (0.54 and 0.32)
- Median Strip (0.45 and 0.62)
- Cemetery/Agri Business (0.51 and 0.45)

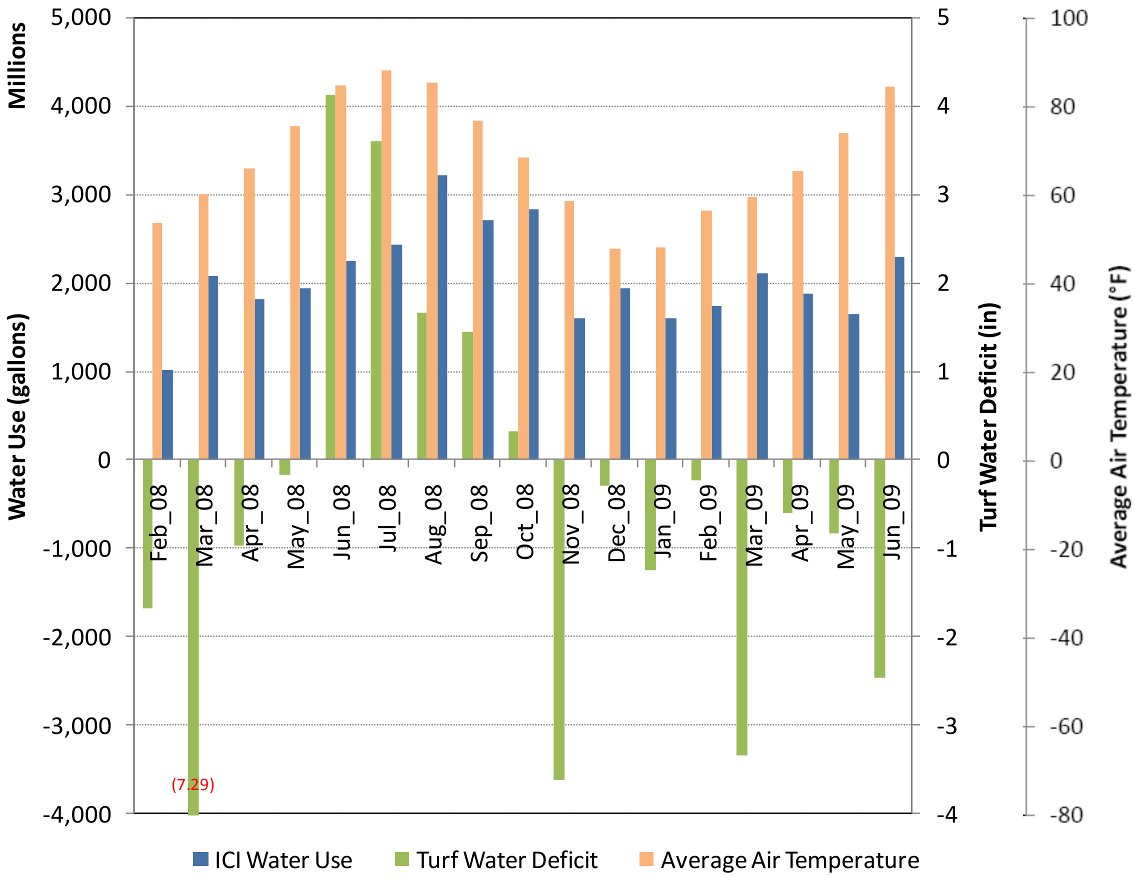
These correlations are consistent with irrigation use at these properties. For these premise types, water use actually has higher correlations with monthly turf water deficit and average air temperature for the previous month, suggesting that these businesses may incorporate recent climate history into their irrigation decisions. In addition, the moderate correlations suggest that there are opportunities among these premise types to alter their irrigation practices to reduce overwatering and still meet plant water needs.

Water use by Automobile Dealers is slightly less correlated with monthly water use and the monthly turf water deficit and average air temperature for a given month (0.34 and 0.43, respectively). In addition to irrigation, Automobile Dealers may have other seasonal uses that happen to correlate with the turf water deficit and/or average air temperature but are unrelated to irrigation.

The other premise types with maximum month-to-average month ratio of two or more (Service Stations, Factory/Manufacturer, and Warehouse) have weak correlations with monthly turf water deficit and average air temperature, suggesting that seasonal uses for these premise types are unrelated to irrigation.

[23] The monthly turf water deficit is the monthly turf water requirement minus monthly rainfall. The monthly turf water requirement is the potential evapotranspiration times the turf coefficient times the quality coefficient. Monthly rainfall data were obtained for Love Field. Potential evapotranspiration data were obtained from the Texas ET Network at the Dallas AgriLife Center Station (April 2008 through June 2009) and the Irving Station (February 2008 through April 2008). Monthly turf coefficients for warm season grasses (such as St. Augustine) were used, and the quality coefficient corresponded to low turf stress.

Figure 5-16: ICI Monthly Water Use and Monthly Turf Water Deficit, February 2008 – June 2009



Normalization of Commercial and Industrial Water Use

Key factors were used to normalize water use for the office building, hotel/motel, and hospital premise types, as well as for total commercial and industrial consumption (Table 5-12). Normalized water use for each of these premise types is discussed in the following sections.

Table 5-12: FY 2007-08 Normalized Commercial and Industrial Water Use by Premise Type

Premise Type	Water Use (gal)	Key Factor		Normalized Water Use[24]	
Office Building	5,321,542,100	107,961,500	occupied square feet[a]	0.135	gallons/ occupied square foot/ day
Hotel/Motel	1,273,732,200	14,676,000	occupied room-nights[b]	86.8	gallons/ occupied room/night
Hospital[e]	1,107,062,200	6,791	total beds[c]	445	gallons/ bed/day
Commercial & Industrial Total	22,448,404,400	$97,000,000,000	gross city product[d]	$4.32	economic output dollars/ gallon
		1,082,660	employees[d]	56.7	gallons/ employee/ day
		407,000,000	commercial square feet[d]	0.151	gallons/ square foot/ day

[a] Year-end 2008 total office space was 131.5 million square feet with a vacancy rate of 17.9 percent (Ref. 23).

[b] In 2008, there were approximately 67,000 hotels rooms in the Dallas Metropolitan Division (MD) (Ref. 24). In FY 2007-08, approximately 14,676,000 room-nights were sold (Refs. 24, 25).

[c] Estimated from numerous sources, primarily individual hospital web sites.

[d] Employment as of July 2008; commercial building space as of September 2008 (Ref. 23).

[e] From inspection of the account owner names, accounts with the “hospital” premise type appear to include doctors’ offices, clinics, animal hospitals, convalescent homes, and other facilities in addition to hospitals. Hospital water use should be identified and normalized on a case-by-case basis.

Office Buildings

At the end of 2008, Dallas had approximately 131.5 million square feet of office space and a vacancy rate of 17.9 percent (Ref. 23). Based on this information, FY 2007-08 office building water use was 0.135 gallons per occupied square foot per day, or 49.3 gallons per occupied square foot per year.[24] Office building water use generally consists of bathroom, irrigation, and cooling uses.

The AWWA Research Foundation sponsored a study of office building water use (Ref. 26). Based on 25th percentile values developed from field studies and audit data, this study concluded that an efficient office building would use 26 to 35 gallons per square foot per year. Median values from the audit data and field studies were 37.5 and 40.6 gallons per square foot per year, respectively.

[24] Some commercial premise types, such as office buildings, may not operate on weekends and holidays and may operate for only about 250 working days in a year. In this technical memorandum, all normalizations of FY 2007-08 water use by number of days in the year are based on 366 days in the year.

Other literature sources (Table 5-13) cite water demand planning values ranging from 0.093 to 0.19 gallons per square foot per day. The planning values on the higher end of the range (0.14 and 0.19) pre-date the 1992 federal water-efficient plumbing fixture standards (maximum of 1.6 gallons per flush, etc.), so these values have less significance when evaluating water use in office buildings constructed since 1992.

Table 5-13: Normalized Office Building Water Use

Data	Normalized Water Use (gal)		Source	Description
	(gal/sf/day)[25]	(gal/sf/yr)		
FY 2007-08 DWU Billing Data	0.121	44.1		Based on occupied square feet
Literature	n/a	37.5, 40.6	Ref. 26	50th percentile values from audit data and field studies
		27.6	Ref. 27	Median usage for 132 office buildings in Australia
		26, 35	Ref. 26	25th percentile value from audit data and field studies
	0.19	n/a	Ref. 28[a]	Planning value for new office buildings
	0.14		Ref. 28[a]	Planning value for old office buildings
	0.134		Ref. 29	Water demand planning value
	0.093		Refs. 30, 31	Water service planning value

[a] These planning values pre-date federal low-flow plumbing fixture standards (maximum of 1.6 gallons per flush, etc.).

[25] It has been assumed that all office water use benchmarks with units of gallons per square foot per day are based on occupied square feet and are based on total days in the year (not "working" days). These factors were not specifically addressed in the literature sources.

Hotels/Motels

In FY 2007-08, Dallas had 67,000 hotel and motel rooms, and 14,676,000 room-nights were sold (Refs. 24, 25). Hotel/motel water use in FY 2007-08 was about 86.8 gallons per occupied room per day. Major hotel/motel water uses are bathroom, kitchen, sanitation, laundry, irrigation, and cooling uses.

The AWWA Research Foundation sponsored a study of hotel water use (Ref. 26). Based on 25th percentile values developed from field studies and audit data, this study concluded that an efficient hotel would use 108 to 109 gallons per occupied room per day. Median values from the field studies and audit data were 141 and 149 gallons per occupied room per day, respectively.

Other literature sources (Table 5-14) cite "satisfactory" hotel water use ranging from 53 to 148 gallons per occupied room per day and average hotel water use ranging from 53 to 159 gallons per room per day. The hotel type (luxury, mid-range, or budget) and the services offered at the hotel can greatly affect water use.

Of the top one hundred ICI customers, eight have the "hotel/motel" premise type. At least three of these have normalized water use ranging from 173 to 234 gallons per occupied room per day, which exceeds the literature values in Table 5-14.

Hospitals

Dallas has approximately 6,791 hospital beds.[26] Based on this information, FY 2007-08 hospital water use averaged 445 gallons per bed per day. However, from inspection of billing account owner names, accounts with the "hospital" premise type appear to include doctors' offices, clinics, animal hospitals, convalescent homes, and other facilities in addition to traditional hospitals. Therefore, hospital water use should be identified and normalized on a case-by-case basis.

Major hospital water uses are bathroom, kitchen, sanitation, laundry, process rinse, irrigation, and cooling uses. Literature sources (Table 5-15) cite average use and water demand planning values ranging from 250 to 400 gallons per bed per day.

Of the top one hundred ICI customers, nine have the "hospital" premise type. At least two of these hospitals have normalized water use (510 and 1,224 gallons per bed per day, respectively) that exceeds the literature values in Table 5-15.

[26] Estimated from numerous sources, primarily individual hospital web sites.

Table 5-14: Normalized Hotel/Motel Water Use

Data	Normalized Water Use (gal)		Source	Description
	(gal/occupied room/day)	(gal/ room/day)		
FY 2007-08 DWU Billing Data	86.8	52.0		
Literature	141, 149	n/a	Ref. 26	50th percentile value from field studies and audit data
	132-148		Ref. 32	"Satisfactory" water use for luxury full-service hotels in temperate climates
	108, 109		Ref. 26	25th percentile value from audit data and field studies
	92-108		Ref. 32	"Satisfactory" water use for mid-range full-service hotels in temperate climates
	53-55		Ref. 32	"Satisfactory" water use for small/budget full-service hotels in temperate climates
	n/a	132-159	Ref. 33	Average water consumption for Australian hotels
		83-108	Ref. 34	95% confidence interval from survey of 97 hotels in Colorado
		53-66	Ref. 33	Average water consumption for Australian motels

Table 5-15: Normalized Hospital Water Use

Data	Normalized Water Use (gal/bed/day)	Source	Description
FY 2007-08 DWU Billing Data[a]	445		Based on total beds
Literature	250-400	Ref. 35	Water use planning value
	346	Ref. 28	
	300	Ref. 36	Estimated average water use

[a] From inspection of the account owner names, accounts with the "hospital" premise type appear to include doctors' offices, clinics, animal hospitals, convalescent homes, and other facilities in addition to hospitals. Hospital water use should be identified and normalized on a case-by-case basis.

Total Commercial and Industrial Use

In 2008, the Dallas gross city product was $97 billion, Dallas employment was approximately 1,082,660 employees, and Dallas commercial space was 407 million square feet (Ref. 23). Therefore, FY 2007-08 commercial and industrial water use is estimated to be 56.7 gallons per employee per day or 0.151 gallons per square foot per day, and economic output is estimated to be $4.32 per gallon of water used for commercial and industrial purposes.[27]

Other Premise Types

Normalizing data such as those suggested in Table 5-3 were not identified for the other premise types; instead, water use was normalized by the number of customer accounts (Table 5-16). Until additional normalizing data become readily, available, normalizing by the number of accounts is the next best option for comparison with literature values. However, caution should be taken when comparing water use normalized by the number of accounts to literature values, since not every account within a premise type has similar water use.

For example, there are 214 unique accounts in the customer billing data base with the "hospital" premise type. Based on this figure, estimated FY 2007-08 hospital water use would be 14,134 gallons per hospital per day. However, as mentioned in a previous section, inspection of billing account owner names reveals that these accounts appear to include doctors' offices, clinics, animal hospitals, convalescent homes, and other facilities in addition to traditional hospitals. The consultant team identified twenty-three major hospitals in Dallas, which means that the average FY 2007-08 water use for the "hospital" premise type is likely to be much greater than the 14,134 gallons per hospital per day described above and could exceed 100,000 gallons per hospital per day. For comparison, a survey of 26 Florida hospitals revealed water use of 139,214 gallons per hospital per day (Ref. 37). From this example, it is clearly best to identify and normalize water use on an account-by-account basis.

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[27] The gross city product, employment, and commercial space figures are based on calendar year 2008, and the water use is based on fiscal year 2008. These data are slightly mismatched in time, but no better normalizing data were identified.

Table 5-16: FY 2007-08 Average Non-Residential Water Use by Premise Type and Number of Accounts

SAP Premise Type Description	Water Use (gal)	September 2008 Number of Accounts	Average Water Use (gal/acct/day)	Comparative Data[d] (gal/acct/day)
Predominantly Commercial				
Office Building	5,321,542,100	4,743	3,066	2,437
Other Business	2,453,597,400	5,757	1,164	
Park/Golf Courses	1,360,078,270	861	4,316	8,010[e]
Hotel/Motel	1,273,732,200	267	13,034	14,340
Restaurant	1,200,414,800	1,864	1,760	4,480
Hospital	1,107,062,200	214	14,134	8,211
Assumed To Be Commercial[a]	863,643,000	2,834	833	
Warehouse	842,732,400	2,173	1,060	
Shopping/Mall Centers	813,944,100	1,742	1,277	7,083
Portable Meter[b]	622,883,100	791	2,152	
Retail	616,329,800	2,142	786	
Church	560,477,400	1,743	879	2,353
Vehicle Servicing/Washing	462,109,800	1,410	895	2,302
Laundry	417,236,300	218	5,229	
Median Strip	368,194,800	611	1,646	
Automobile Dealers	112,150,500	283	1,083	
Cemetery/Agri Business	101,713,900	50	5,558	
Bar	95,613,400	320	816	
Parking Lot	54,253,900	166	893	
Vacant Land Or Raw Land	46,748,600	83	1,539	
Sandwich Shop	4,486,300	39	314	
Service Station[c]	1,322,800	5	723	1,682
Predominantly Industrial				
Factory/Manufacturer	3,434,403,200	650	14,436	
Food And Kindred Processing	1,573,927,400	168	25,597	
Predominantly Governmental				
Schools	1,294,471,200	820	4,313	4,492
Fire Station	23,271,000	78	815	

[a] Includes "Not assigned" premise type.

[b] Includes a correction to the February 2008 water use for portable meter account 100288894 from 99,900,000 gallons to 7,000 gallons, the average consumption during the other 16 months.

[c] New premise type as of February 2008.

[d] Comparative data obtained from a 1997 survey of industrial, commercial, and institutional customers of the Greater Vancouver (B.C.) Regional District (Ref. 36).

[e] Public golf courses only.

Key Findings about ICI Water Use

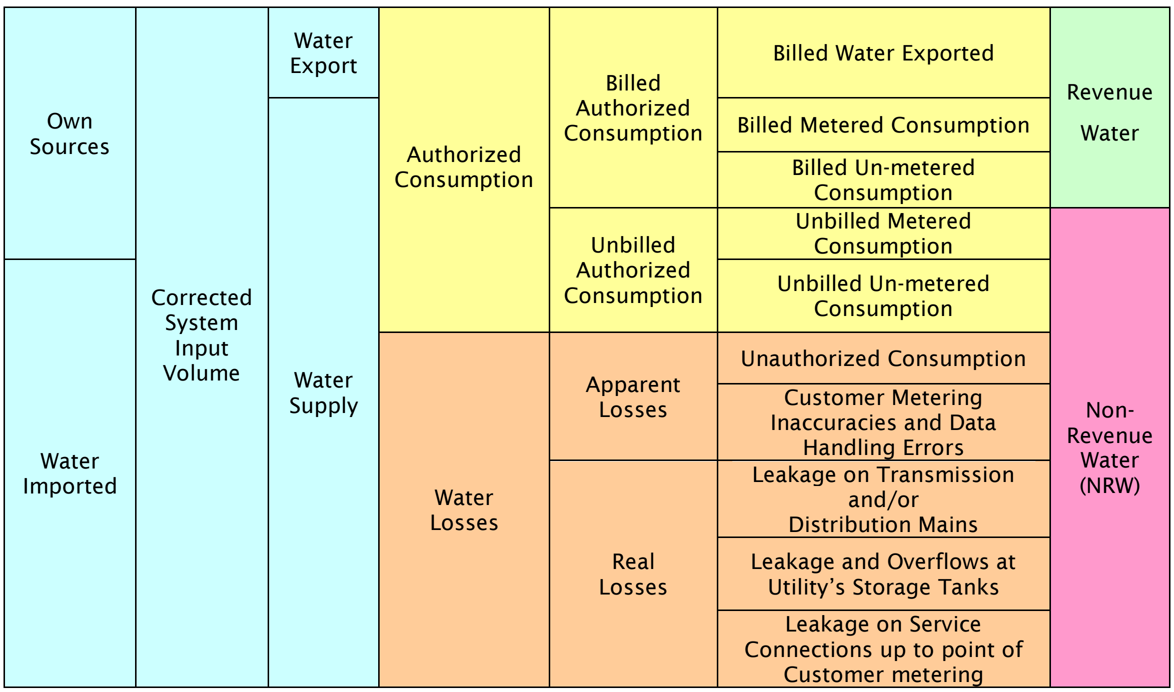
Key findings from the analysis of ICI water use between February 2008 and June 2009 are:

- Approximately fifty percent of Dallas's ICI water use is congregated among four premise types (Table 5-9):
  - Office Building (21.2 percent of ICI water use)
  - Factory/Manufacturer (12.9 percent)
  - Other Business (9.7 percent)
  - Park/Golf Course (6.5 percent)
- The top water-using ICI water customers should be a high priority for ICI conservation measures. The top one percent of ICI accounts used more than forty-four percent of the total ICI water demand, and the top ten percent of ICI accounts used almost eighty percent of the total ICI water demand (Figure 5-14).
- The bottom eighty percent of all ICI accounts in terms of water use are a low priority for conservation measures, because they use only ten percent of all ICI water (Figure 5-14). Public education and self-guided informational materials (perhaps downloadable from DWU's website) may be the most cost-effective conservation program activities for this group.
- Water use for some ICI premise types (e.g., Vacant Lot or Raw Land, Park/Golf Courses, Median Strip, and Cemetery/Agri Business) has at least a moderate correlation with monthly turf water deficit and average air temperature, suggesting significant irrigation water use. ICI premise types with high maximum month-to-average month ratios should be targeted for irrigation conservation measures, particularly the top users within these premise types.
- Large industrial customers, such as factories, manufacturers, and food processing, are high volume water users that could be strong candidates for onsite water reuse systems and other more efficient processing methods. Industry water efficiency benchmarks may exist for some manufactured products (e.g., computer chips), which could assist DWU in evaluating the water use efficiencies of specific sites or end uses at those sites.
- Office buildings and warehouses, particularly high use customers in these groups, are likely targets for cooling water efficiency measures, such as upgrades to inefficient cooling towers and single pass systems that may still be in use.
- Limited comparison of normalized water use with literature values suggest opportunities for ICI water use reduction, particularly in the Office Building and Hospital premise types (Tables 5-13 and 5-15).

5.6. Analysis of Water Losses

Figure 5-17 shows the standard American Water Works Association/International Water Association (AWWA/IWA) water balance. The TWDB uses this water balance as a model for its water audit reporting requirements. In addition, the AWWA has developed free Water Audit Software to allow standard recording and reporting of water loss data (Ref. 38). These standard categories have been used to record and analyze annual DWU water loss data for the Updated Strategic Plan.

Figure 5-17: Standard American Water Works Association/International Water Associations (AWWA/IWA) Water Balance



The AWWA methodology does not use unaccounted-for-water percentages and instead normalizes water losses by system characteristics (e.g., gallons per connection per day). These indicators are generally more robust and less susceptible to climatic changes from year to year. The standard method also estimates the financial value of the losses and allows more detailed targeting of resources to specific problem areas.

Results from the analysis of annual DWU water loss data are outlined in this section, and portions of the reporting worksheets from the AWWA software are shown in Appendix C. Reported DWU water use data were analyzed against production records and estimates of authorized uses and losses provided by the utility. The data were then entered into the AWWA water audit software to calculate performance indicators and establish trends. The water loss analysis and results are presented according to categories of water use shown in Figure 5-17.

The water audit was conducted on DWU retail usage only, as wholesale water use also has a loss component which is not accounted for within DWU water loss but should be accounted for in the water audits of the receiving customer cities themselves. Since the wholesale usage averaged 37.3 percent of total DWU water use between FY 2003-04 to FY 2007-08, this represents a significant component removed from the analysis.

DWU provided the following annualized data for FY 2002-03 through FY 2007-08.

- Corrected System Input Volume
- Authorized Consumption
    - Billed Authorized Consumption
    - Unbilled Authorized Consumption
        - Unbilled metered water uses included unbilled municipal water uses and ozone cooling water at the Elm Fork Water Treatment Plant.
        - Unbilled unmetered water uses included:
            - Distribution system flushing (mains, dead-end points, and fire hydrants)
            - Disinfection of new or reinstated mains
            - Firefighting and fire training
            - Fire Department flushing of mains
            - Process water at the Bachman Water Treatment Plant
            - Street sweeping/sewer cleaning
            - Meter testing

For each year, total water losses were calculated as the difference between corrected system input volume and authorized consumption. Using data and assumptions discussed in the following sections, water losses for FY 2002-03 through FY 2006-07 are summarized in Table 5-17.[28]

Table 5-17: Summary of Water Loss Estimates

Fiscal Year	Total Loss (gal/conn/day)	Infrastructure Leakage Index	Apparent Loss (gal/conn/day)
2002-03	100	4.6	32.0
2003-04	81	3.4	30.4
2004-05	118	6.0	29.3
2005-06	104	4.9	31.9
2006-07	104	5.2	27.5
AVERAGE	101	4.8	30.2

[28] DWU changed to a new billing system in FY 2007-08, causing uncertainties in some of the water use data. DWU is continuing to review and validate the data for FY 2007-08. Therefore, the FY 2007-08 data are not included in the evaluation in this report. Data were analyzed for the fiscal years from FY 2002-03 to FY 2006-07.

The following sections discuss the further division of total water losses into apparent and real water losses.

Apparent Losses

Apparent loss is water that is used but for which the utility does not receive revenue because of unauthorized consumption, inaccurate meters, and billing/systematic data handling errors.

Unauthorized Consumption

No estimates of DWU unauthorized consumption were available, so in each year, it was assumed to be 0.25 percent of the total water supplied to retail customers.[29] This value has been derived from a number of studies worldwide and is used as a default value in the AWWA Water Audit Software (Ref. 38).

Customer Meter Accuracy

Currently, small meters (less than 3 inches in diameter) are not analyzed for flow volume throughput. Therefore, the volume warranty limits are not being assessed, and some meters are beyond their recommended volume warranty limits. This is an area which may allow significant improvement in efficiency. As an example, Figure 5-18 shows four single-family residential accounts which have two-inch meters. This meter size typically has warranty limits of approximately three million gallons of flow. The four accounts in this figure passed this warranty limit in less than twelve months.

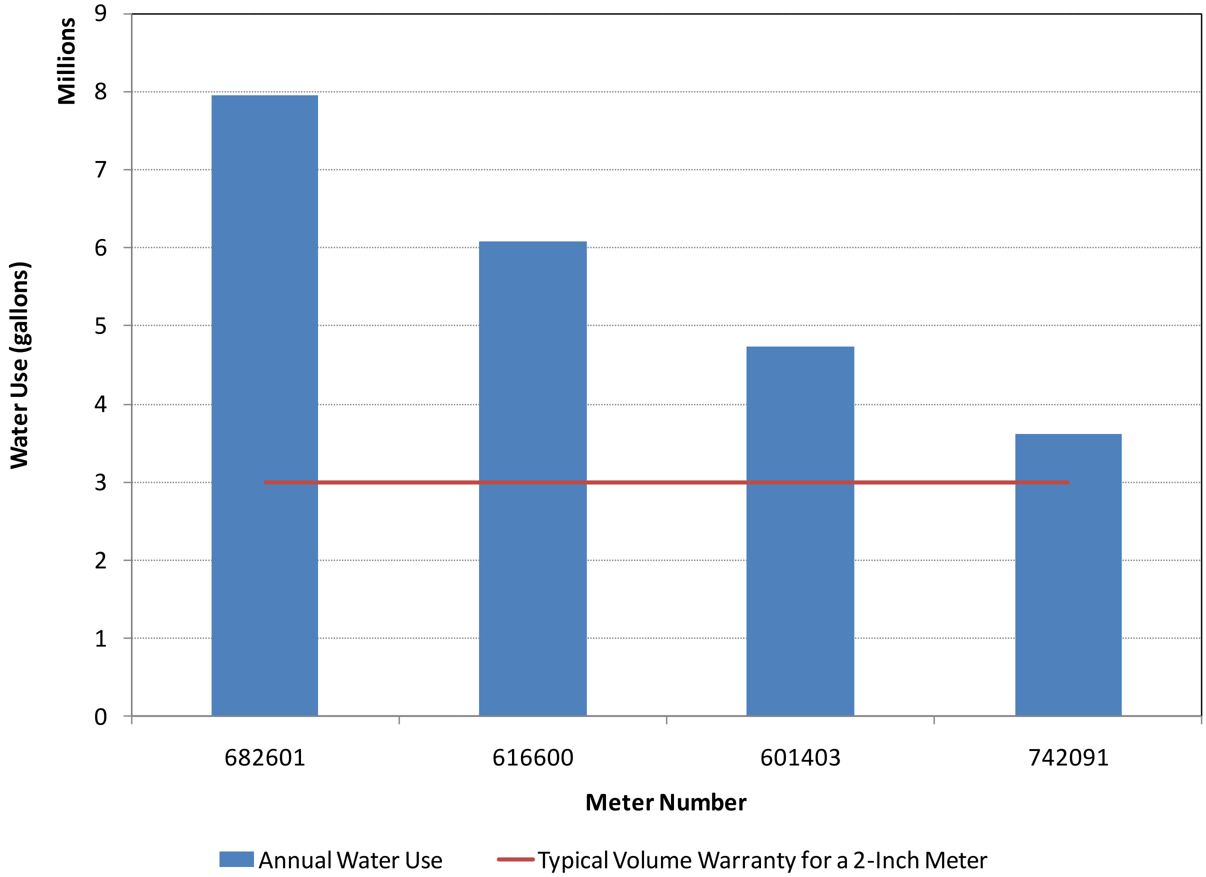
After discussion with staff from the Distribution Division Meter Section and considering the small meter volume inaccuracies, an overall estimate of 96% accuracy (4% inaccuracy) has been used in all the calculations of apparent loss due to meter inaccuracy.

Billing and Systematic Data Handling

Systematic data handling errors represent one of the most difficult losses to assess at the beginning of a comprehensive water audit. A cursory review has revealed a number of anomalies in the customer billing data, such as implausible meter reads; zero reads; accounts which have water service and no wastewater service; and misclassified accounts. Although no detailed assessment has been made, it is anticipated that there are a number of such items which can be analyzed further in the customer billing data.

[29] Corrected system input volume minus billed water exported (wholesale sales).

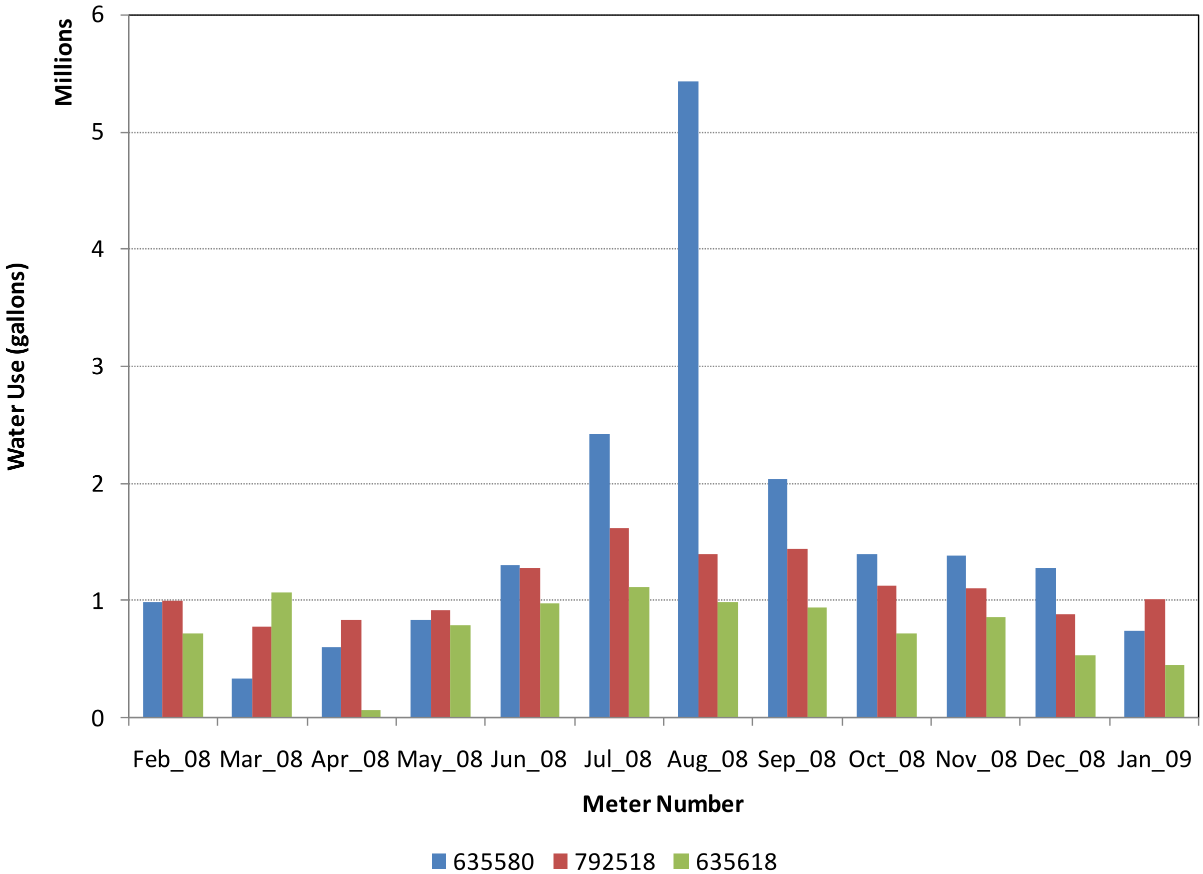
Figure 5-18: Example Single-Family Accounts with High Water Use Compared to Warranted Meter Limits, Calendar Year 2008



Possible examples of misclassified accounts include certain accounts currently classified as "firelines" or "vacant lot or raw land." Figure 5-19 shows three accounts categorized as firelines where there is significant, consistent use, in some cases more than one million gallons per month. If these accounts are valid and being billed, then the account should be changed to match the use, as these are apparently not being used as dedicated firelines. Much of the use is spread through the year with occasional summer peaks, suggesting either industrial or irrigation water uses.

In addition, within the database records there are users classified as "vacant lot or raw land." Some of these customers have high usage especially in the summer months. These accounts should be assessed to determine if they are classified incorrectly and the classification accordingly changed. Other areas to validate include meter roll-over issues, anomalous meter readings, and customers not billed for service. A separate study is necessary to research these issues properly and implement changes as the project progresses.

Figure 5-19: Incorrectly Classified Firelines



NOTE: Figure shows monthly data for three fireline meters.

Finally, Appendix A shows a cross-tabulation of retail water use from February 2008 through June 2009 by premise type and customer type. This table can be used to identify accounts with inappropriate combinations of premise type and customer type. Two possible examples include:

- Accounts with Park/Golf Course premise type and Residential customer type.
- Accounts with Hotel/Motel premise type and Industrial customer type.

Taking all of this into account, billing and systematic data handling issues have been assumed to be one billion gallons per year. This is a gross estimate, and additional, on-going work will likely provide a more accurate value.

Summary of Apparent Losses

While it is difficult to accurately assess losses on a monthly basis, due to the lag between production records and customer meter readings, some overall trends can be determined. The apparent losses calculated from FY 2002-03 through FY 2006-07 range from 27 to 32 gallons per connection per day (Table 5-17).

Real Losses

Real loss is water that is physically lost from the water system before it can be used. No specific field investigation to determine the level of real losses was conducted during development of the Updated Strategic Plan. Within the AWWA software accounting system, real losses are the remainder after all other water uses are estimated.[30] With this assumption, the annual real losses from FY 2002-03 through FY 2006-07 range from 51 to 89 gallons per connection per day (gal/conn/day).

The Infrastructure Leakage Index (ILI) is a dimensionless ratio of annual real losses to the Unavoidable Annual Real Losses (UARL). UARL is a function of the following variables:

- **Miles of pipe**. DWU has approximately 4,980 miles of water pipelines.
- **Number of connections**. The Distribution Division Meter Section estimated that the total number of connections (including inactive connections) was the same (413,000 connections) for each year during the period of analysis for this project.
- **Pressure in the system**. DWU staff reports that the average operating pressure is approximately sixty pounds per square inch (psi).
- **Length of customer service line**. DWU staff reports that the average length of customer service line is twenty-five feet.

The UARL is directly correlated with each of these variables – as they increase, so does the UARL. More details regarding calculation of the ILI can be found in AWWA Manual M36 (Ref. 39). From FY 2002-03 through FY 2006-07, DWU's estimated ILI varied between 3.4 and 6.0 (Table 5-17).

At this stage, the real loss data are not fully validated (this would involve field verification of estimated and calculated values), so further analysis is warranted to improve the measurement and estimation procedures for future years. Because of the assumption that real loss is the remainder after all other water uses are estimated, DWU should continue to review measurement and estimation procedures for all other water uses (including production meter accuracy) and leakage to better determine the true real loss situation.

Valuation of Water Losses

The value of the apparent and real water losses is discussed below.

Valuation of Apparent Losses

Apparent losses consist of water that has been used but for which the user has not paid the utility. Reducing apparent water losses would not reduce water use, but it would increase revenue by approximately $2.76 per thousand gallons of apparent loss reduction (Table 3-2).

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[30] Corrected system input volume minus authorized consumption minus apparent losses.

Valuation of Real Losses

Real losses consist of water that has been physically lost from the system before it could be used. Reduction of real water losses reduces water use and reduces expenses by approximately $634 per million gallons of real loss (this is the marginal O&M cost for water delivery from the FY 2009-10 budget).

5.7. High-Flow Plumbing Fixtures

The National Energy Policy Act of 1992 required certain performance standards for plumbing fixtures that were manufactured after January 1, 1994 (Table 5-18). Allowing time for retailers to sell their existing inventories after that date, it is assumed that the new, more efficient plumbing fixtures began to be installed as of 1995. In Texas, this legislation was recently superseded by HB 2667, which requires more restrictive performance standards by 2014 (Table 5-18).

Table 5-18: Performance Standards for Plumbing Fixtures

Plumbing Fixture	1992 National Energy Policy Act Performance Standard	2009 Texas HB 2667 Performance Standard	Units[a]	Range for New Fixtures Installed Since 1995	Range for Older Fixtures (Ref. 36)
Toilets	1.6	1.28	gpf	1.0 - 1.6	3.5 - 7
Urinals	1.0	0.5	gpf	0.0 - 1.0	1.5 - 5
Showerheads	2.5[b]	2.5[b]	gpm	1.5 - 2.5	2.75 - 8
Faucets	2.5[b]	2.2[c]	gpm	1.5 - 2.5	2.75 - 7

[a] "gpf" means gallons per flush, "gpm" means gallons per minute, and "psi" means pounds per square inch.
[b] Measured at 80 pounds per square inch (psi) of water pressure.
[c] Measured at 60 psi. A flow rate of 2.5 gpm at 80 psi is equivalent to a flow rate of 2.2 gpm at 60 psi.

It is important to the analysis of potential water savings for installation of low-flow plumbing fixtures to know the number of housing units that were constructed before 1995 (Table 5-19). These data can be used to estimate the number of high-flow plumbing fixtures that remain in use.

Approximately 51.7 percent of all Dallas housing units in 2000 were single-family housing units, and approximately 52.2 percent of all Dallas housing units in 1990 were single-family housing (Ref. 40).[31] Interpolating these numbers, it is estimated that approximately 232,502 single-family housing units and 215,047 multi-family housing units were constructed before 1995.[32]

[31] Including 1- and 2-unit structures, mobile homes, and RVs.

[32] Including structures with 3 or more units.

Table 5-19: Housing Units Constructed Before 1995

Time Period	Housing Units	Average Age (years)	Percentage	Cumulative Percentage
Built 1939 or earlier	27,698	>60	6.2%	6.2%
Built 1940-1959	111,145	60	24.8%	31.0%
Built 1960-1969	89,509	45	20.0%	51.0%
Built 1970-1979	97,504	35	21.8%	72.8%
Built 1980-1989	97,774	25	21.8%	94.7%
Built 1990-1994	23,920	18	5.3%	100.0%
TOTAL	447,550		100.0%	

Ref. 40

The housing units that contain older, high-flow plumbing fixtures were constructed before 1995 and are at least fifteen years old. The typical useful life of various plumbing fixtures is twenty-five to fifty years for toilets, ten to fifteen years for showerheads, and fifteen years for faucets (Ref. 36). Given the age of the older housing units (Table 5-19), it is likely that a significant portion of the older, high-flow plumbing fixtures have been replaced with more efficient fixtures since 1995.

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6. Recycling/Reuse of Treated Wastewater Effluent

Recycling/reuse of treated wastewater effluent is an important water efficiency strategy. DWU's plans for water recycling, its potential impact on water conservation, and other benefits of water recycling are presented in the following sections.

6.1. DWU Recycled Water Planning

In recent years, DWU has developed plans to recycle treated wastewater effluent for direct, non-potable uses and for indirect, potable uses. These plans are outlined in the following sections.

Recycled Water Implementation Plan

DWU developed a two-volume Recycled Water Implementation Plan in 2005. Volume I primarily focused on direct, non-potable recycling of treated wastewater effluent produced by DWU, including use of recycled water for irrigation and industrial applications (Ref. 14). One planned project is the Cedar Crest Golf Course pipeline extension, which is projected to be completed in 2011. The Cedar Crest Golf Course currently uses up to 0.5 million gallons per day (mgd) of recycled water for irrigation. Extension of the existing twenty-inch diameter pipeline will make recycled water available to the Dallas Zoo and other customers. Another planned project is the White Rock Pipeline Alternative project, which will provide recycled water from the Central WWTP to irrigation and industrial customers in the White Rock Creek Corridor. Combined, these recycled water projects are expected to provide an additional average supply of 18.25 mgd.

Volume II of the Recycled Water Implementation Plan (completed in 2007) focused on indirect recycling of the treated wastewater effluent, or augmentation of the potable water supply (Ref. 15). Conceptual conveyance alternatives were developed to augment Lake Ray Hubbard and Lewisville Lake with recycled water from Dallas WWTPs.

Exchange of Recycled Water with North Texas Municipal Water District

Since development of the Recycled Water Implementation Plan, DWU has agreed to an exchange of recycled water with the North Texas Municipal Water District (NTMWD). This exchange includes the following elements:

- DWU will use a portion of the recycled water discharged to Lewisville Lake from NTMWD-operated WWTPs in Frisco.
- Upon completion of a Main Stem Pump Station (approximately 2013), recycled water that originates from DWU WWTPs will be diverted from the main stem of the Trinity River to the NTMWD's East Fork Wetland.
- Upon completion of the Main Stem Pump Station, DWU will use recycled water discharged to Lake Ray Hubbard from NTMWD-operated WWTPs.

Other Return Flows

Dallas has also contracted with Flower Mound, Lewisville, Denton, and the Upper Trinity Regional Water District (UTRWD) to use the recycled water that these entities discharge to Dallas water supplies.

Summary of Projected Recycled Water Supplies

As a result of the recycled water exchange agreement with NTMWD, plans to augment Lewisville Lake and Lake Ray Hubbard with recycled water from Dallas WWTPs, as outlined in the Recycled Water Implementation Plan, are on hold.

Table 6-1 presents a summary of direct and indirect recycled water projects for DWU along with the projected water supply.

6.2. Water Conservation and Recycled Water

Recycled water projects are intended to help meet future water demands. DWU anticipates an increase in total raw water demand (wholesale and retail) from 558.3 mgd in the year 2010 to 883.0 mgd by the year 2060 (Ref. 3). Once fully implemented, the planned recycled water projects are projected to supply thirteen to fifteen percent of this raw water demand (Table 6-1).

Texas Water Code §11.002(8) defines conservation as "the development of water resources; and those practices, techniques, and technologies that will reduce the consumption of water, reduce the loss or waste of water, improve the efficiency in the use of water, or increase the recycling and reuse of water so that a water supply is made available for future alternative uses." Water recycling is a water conservation strategy that reduces demand for new raw water supplies, and this efficiency should be reflected in water use statistics. The Water Conservation Implementation Task Force recommended crediting indirect reuse diversion volumes against total diversion volumes for the purpose of calculating per capita water use for targets and goals (Ref. 2).[33]

To date, DWU has not taken credit for indirect reuse in its per capita water use estimates. DWU should follow this recommendation by developing water accounting procedures to track indirect reuse volumes and credit them against per capita water use. For example, it is projected (Row [J] in Table 6-1) that 4.8 percent of the DWU potable water supply in 2010 will consist of recycled water. Assuming that actual indirect reuse volumes confirm this projection, DWU retail per capita water use should be reduced by 4.8 percent for purposes of comparison to targets and goals.

[33] Water supplied for direct, non-potable reuse is not included in the total diversion volume, so no adjustments need to be made to account for direct, non-potable reuse projects.

Table 6-1: Summary of Recycled Water Projects for DWU

	Status	Type	Project Name	Projected Average Supply[a] (mgd)					
				2010	**2020**	**2030**	**2040**	**2050**	**2060**
[A]	Existing	Direct	Cedar Crest Golf Course	0.5	0.5	0.5	0.5	0.5	0.5
[B]	Existing/ Future	Indirect	Return Flows to DWU Reservoirs[b]	26.7	37.5	47.4	54.1	62.3	75.8
[C]	Future (2011)	Direct	Cedar Crest Pipeline Extension White Rock Pipeline Alternative	0.0	18.3	18.3	18.3	18.3	18.3
[D]	Future (2013)	Indirect	Main Stem Pump Station (Lake Ray Hubbard indirect reuse)	0.0	28.2	32.0	35.2	35.9	36.6
[E]	**Projected Total Reuse**			**27.2**	**84.5**	**98.2**	**108.1**	**117.0**	**131.2**
[F]	DWU Total Water Demand (Retail + Wholesale)			558.3	639.8	722.6	783.3	835.7	883.0
[G]	**Projected Total Reuse Percentage**			**4.9%**	**13.2%**	**13.6%**	**13.8%**	**14.0%**	**14.9%**
[H]	**Projected Indirect Reuse**			**26.7**	**65.7**	**79.4**	**89.3**	**98.2**	**112.4**
[I]	DWU Total Water Demand Minus Direct Reuse			557.8	621.1	703.9	764.6	817.0	864.3
[J]	**Projected Indirect Reuse Percentage**			**4.8%**	**10.6%**	**11.3%**	**11.7%**	**12.0%**	**13.0%**

[a] Projected average supplies from Ref. 4. Projected DWU total water demand from Ref. 3.

[b] Includes return flows from Flower Mound, Lewisville, Denton, NTMWD, and UTRWD.

[E] = [A] + [B] + [C] + [D]

[G] = [E]/[F]

[H] = [B] + [D]

[I] = [F] – [A] – [C]

[J] = [H]/[I]

6.3. Other Benefits

Other benefits of water recycling include:

- Since DWU provides raw and treated water to many wholesale customers, water recycling will broaden regional water efficiency efforts. Also, by implementing water recycling practices, the City of Dallas is leading by example and is encouraging water efficiency practices among its clients and customers and other regional entities.
- Water recycling can help the city avoid or defer costly potable water infrastructure expansion and will defer the need for new raw water supplies. Of the water management strategies for which costs have been developed in the 2011 Region C Initially Prepared Water Plan (Ref. 4), the two least expensive strategies are indirect and direct water recycling (Table 4-4).
- Direct, non-potable water recycling projects often use water for irrigation and cooling purposes, reducing peak demands for potable water.
- Unlike other raw water sources, the available recycled water supply increases with population growth and increased economic activity.

7. Description of the DWU Water Conservation Program

The goal of the 2005 Water Conservation Five-Year Strategic Plan (Ref. 1) was to reduce per capita water consumption by an average of one percent per year over five years through a phased approach of BMPs under the following major elements:

- City Leadership and Commitment
- Education and Outreach Initiatives
- Rebate and Incentive Programs

This chapter documents the water conservation measures implemented by DWU to date and the resulting water savings. Measure descriptions, the extent to which measures have been implemented, implementation costs, and water savings are discussed in the following sections.

7.1. Water Conservation Program History

DWU's water conservation efforts began in the early 1980s and have intensified since 2001. Beginning in 1981, DWU began adding bill inserts to encourage customers to conserve water. In 1984, DWU initiated a school education program that included textbook covers with a conservation message, poster contests, a regional science fair, curriculum aids, classroom presentations, and student tours of treatment facilities.

In the mid-1980s, DWU conservation efforts focused on media relations, speaking engagements, and special events and promotions. Media relations consisted of news coverage of conservation techniques and television and radio public service announcements. DWU staff spoke to professional and civic organizations and made classroom presentations on conservation. Special events and promotions included exhibits at fairs and community events, an annual Drinking Water Week poster contest that began in 1984, and water-upon-request promotions at local restaurants in 1985-86.

In 1987, DWU started a retrofit pilot program, fitting 2,025 homes with low-flow showerheads and toilet dams. Since the pilot program, DWU has provided ongoing public education about the benefits of retrofitting and ongoing distribution of retrofit devices upon request.

In 1988, DWU began promoting water-conservation landscapes with exhibits, brochures, and water-wise landscape seminars (in partnership with the Texas Agricultural Extension Service). In 1993, DWU installed a water-wise demonstration garden at the historic White Rock Pump Station and began sponsoring annual water-wise landscape recognition awards and a tour of homes with water-wise landscaping.

In the early 1990s, DWU sponsored the Pump House 5K Run and the Splash and Dash events, conducting water conservation seminars at the end of each event.

In October 2001, the Dallas City Council amended the city's water and wastewater ordinance to include conservation water rates and a prohibition of landscape water waste. The inverted block rate structure was amended so that residential customers using more than 15,000 gallons per month paid a higher unit rate for the additional water ($5.38 per thousand gallons effective October 1, 2009) and so that commercial customers using more than 10,000 gallons per month and using more than 1.4 times their annual average also pay a higher unit rate ($3.68 per thousand gallons effective October 1, 2009). In addition, the following wasteful practices were prohibited:

- Runoff from irrigation onto a street or other drainage area
- Irrigation of impervious areas
- Operation of an irrigation system with broken or missing sprinkler heads
- Irrigation during a precipitation event
- Irrigation between the hours of 10:00 a.m. and 6:00 p.m. from June 1 through September 30 of any year (except irrigation by hand and the use of soaker hoses)[34]

Finally, the amendment required all irrigation systems to be equipped with rain-sensing devices and freeze sensors by January 1, 2005. The amendment provided for warnings on a first violation of the ordinance and fines between $250 and $2,000 for subsequent violations.

In 2002, DWU initiated an extensive, ongoing multimedia Public Awareness Campaign to educate customers about wise landscape irrigation practices and new restrictions from the ordinance amendment. The campaign includes television ads on major stations, radio ads during peak traffic periods, billboards on heavily traveled thoroughfares, print ads in the Dallas Morning News and minority publications, transit boards, and internet promotions. The award-winning campaign is themed "Save Water. Nothing Can Replace It."

In 2003, DWU expanded its education efforts to include summer outreach programming in YMCAs and city recreation centers. In addition, DWU maintains a web site with information about its water conservation programs, water conservation tips, and answers to frequently asked water conservation questions (Ref. 41).

In 2005, Dallas Water Utilities developed the Strategic Plan to extend and expand its water conservation program. The goal of the Strategic Plan was to reduce per capita water use by one percent per year over five years. The following sections describe the water conservation strategies recommended in the Strategic Plan, the extent to which the measures have been implemented, the implementation costs, and the associated water savings.

7.2. City Leadership and Commitment Strategies

City leadership and commitment strategies are intended to demonstrate a strong commitment to water conservation, with the city "leading by example." Within this element of the Strategic

[34] The prohibition on irrigation between the hours of 10:00 a.m. and 6:00 p.m. has since been revised to be effective from April 1 through October 31.

Plan, the city has expanded its water conservation staff, expanded its water loss control program, revised its water conservation ordinance, and conducted retrofits at city-owned facilities. In addition, the city uses its web site to publicize its leadership, commitment, and conservation practices (Ref. 41). Moreover, Dallas was the first municipality in the North Texas area to adopt an ordinance prohibiting landscape water waste. The ordinance now serves as a model for many cities across the region.

Water Conservation Division Staff

DWU currently maintains 10.8 staff positions in the Water Conservation Division, up from 7 full-time employees in 2005. New staff members have included a water conservation analyst and two licensed irrigators. Staff members were added to analyze and track BMP programs, provide customer water audits, administer education programs, and facilitate retrofit programs.

Water Loss Control

DWU programs for reducing unauthorized consumption, improving meter accuracy, reducing systematic data handling errors, responding to reported leaks, performing active leakage control, and replacing pipelines are described in the next sections, followed by a discussion of current leak detection and repair facilities, staffing, and training.

Unauthorized Consumption

As unauthorized consumption situations are discovered, they are handled on an individual basis, and no performance indicators are recorded to determine the magnitude of the problem. DWU staff expects that unauthorized consumption is a small component of overall water losses. However, procedures are being evaluated within DWU to evaluate and reduce unauthorized uses.

Meter Accuracy

All production meters are calibrated and tested to American Water Works Association (AWWA) standards, and the master meter error adjustment is reported to be within those standard ranges.

Currently, DWU policy is to replace customer meters once they reach ten to fifteen years of age. As of August 2009, the average age of small meters in the system was reported to be 5.6 years. In FY 2008-09, approximately 11,690 meters were repaired and approximately 27,503 meters were replaced. This replacement rate is consistent with replacing meters when they are ten to fifteen years of age.

DWU conducts periodic testing of small retail meters. Recent samples provided by the Distribution Division Meter Section show that there are still some meters within the system with low measurement accuracies. Most problems occur in the low flow ranges, where meters may record only a small portion of the volume.

Large meters (three-inch diameter and larger) are tested at least annually, and the highest-use meters are tested as often as every three months. Large meters are generally flow tested in situ (without removing the customer meter) using a Sensus W1250 test rig, which is used to test flows up to approximately five hundred gallons per minute (gpm). Large meter replacement also continues. There are approximately 6,000 large meters, including 2,800 industrial meters and 3,000 detector check meters which allow priming of fire sprinkler systems while metering any low flows into that system.

Review of data from DWU and visits to the Distribution Division meter testing and repair facilities indicate that a significant amount of work is being completed to improve meter accuracies. DWU has meter testing facilities for large and small meters, an electronic catalogue of meters both in service and in the warehouse, and repair areas. Ten two-man crews work on the large meters, and sixty-five employees work on the small meters. Currently, all service work, meter replacements, and new installations are conducted by city staff. No staffing issues were reported by the Distribution Division Meter Section.

A number of programs have been put into place over the last ten years to improve meter accuracy in the DWU system. These include:

- Replacement of 7,300 commercial meters (2007);
- Initial review of 6,800 automatic meter reading (AMR) units in the Central Business District, South Dallas/Fair Park, and Deep Ellum areas; and
- A policy of meter replacement of any meter older than fifteen years.

Systematic Data Handling Errors

DWU has not specifically reported systematic data handling errors prior to this Updated Strategic Plan. Analysis of billing system data is routinely conducted to evaluate zero readings and anomalous readings. Work orders are generated for field verification and review of these anomalies.

Response Procedures for Reported Leaks

Water main leak repair procedures are an important component of any water utility and affect such performance areas as customer support, water outages, water loss, capital investment, and operational costs. Appendix D summarizes current procedures utilized by the Operations Division with respect to “reported” water main leak repairs for various types of leaks.

Active Leakage Control

The active leak detection program has the goal of surveying the entire water system and improving the integrity of the water system by identifying weaknesses in water pipelines before breaks develop. Recent program enhancements have lowered the target time to survey all water distribution pipes to 2.5 years. Detecting unknown/unreported leaks benefits the public by reducing water loss, reducing the utility costs, reducing the potential for property damage from pipeline breaks, improving public relations as a result of ongoing visibility and promotion of maintenance, and reducing disruption to customers with fewer unscheduled repairs resulting in fewer traffic and service interruptions. Small diameter pipelines (those two to twelve inches in diameter) make up eighty-five percent of the potable water system, while larger diameter pipelines with diameters greater than twelve inches make up the remaining fifteen percent.

Small diameter pipelines are surveyed with noise surveys or acoustic leak detection equipment. Noise surveys utilize a high frequency contact microphone on water services or fire hydrants to detect leaks in the system. Acoustic leak detection is done by field survey teams with acoustic correlation equipment that captures the sound of the leak as it radiates to a logger. The equipment consists of Permalog MK3 Leak Noise Loggers affixed to pipes and fittings and electronic leak listening devices used in conjunction with an AccuCorr 3000 Correlator to pinpoint the location of the leak. The advantage of this technology is that the leak locations may be marked and scheduled for repairs without excessive excavation.

Correlators used on smaller pipelines are typically less effective for determining the location of leaks on larger pipelines. For the Large Diameter Program, DWU established an agreement with Pressure Pipe Inspection Company in 2004 to survey larger pipelines using the Sahara technology. This technology is also an acoustic technology, but it uses a cable tethered to a sensor that travels through a pipeline and relays real-time data. The pipeline may be active while the technology is being utilized.

DWU added four staff members to its Leak Detection Program in FY 2004-05.[35] With additional funding of $50,000 in FY 2006-07, new equipment was added to expand coverage of the program. In FY 2008-09, the leak detection budget was increased by $652,000 to increase the number of leak detection crew members from eight to fourteen and to purchase additional leak detection equipment. Due to the FY 2008-09 budget increase, DWU’s real losses should decrease significantly over the next five years.

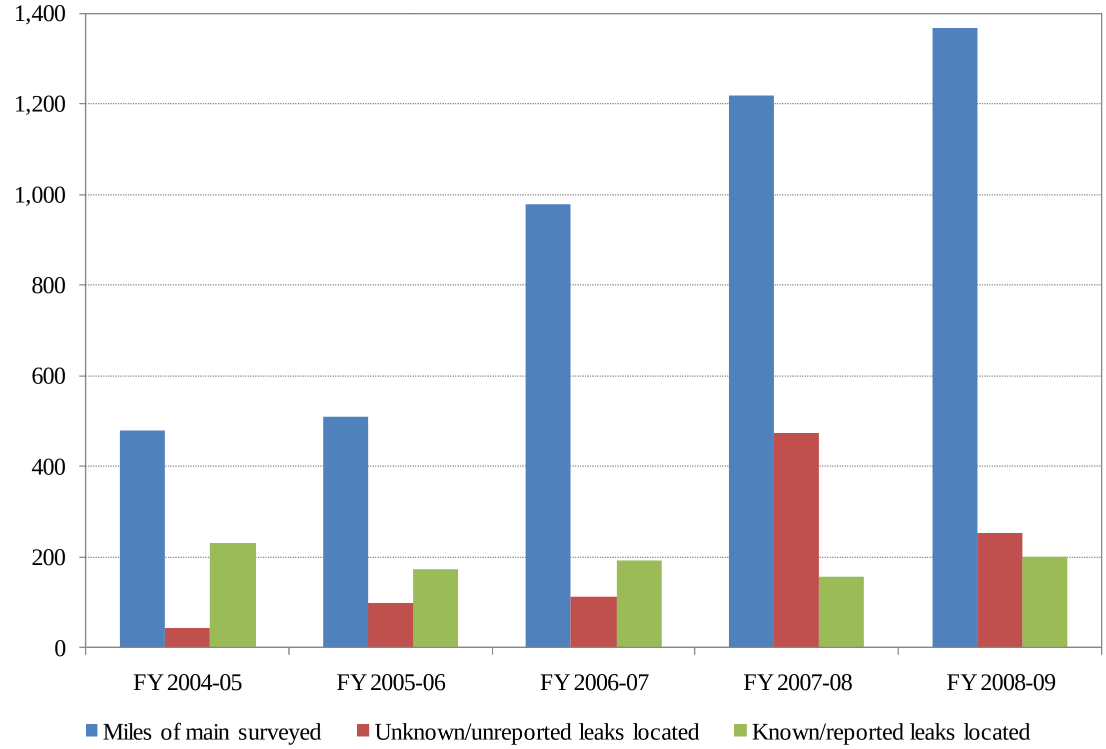
DWU’s in-house leak detection program for small-diameter pipes has surveyed more miles of pipe each year. The program should continue to accelerate its efforts to achieve its goal of surveying all small-diameter pipes every 2.5 years. Miles surveyed, unknown/unreported leaks located, and known/reported leaks located are presented in Figure 7-1. Approximately 2,000 main line leaks are found and repaired each year. Some of these are located proactively (Figure 7-1), and the rest are surfacing leaks reported by customers or DWU staff (not included in Figure 7-1). FY 2007-08 was the most active year in terms of leaks located.

Currently, DWU has an annual budget of $31.6 million for maintenance and repair of the distribution system. In calendar year 2008, DWU repaired 2,060 main breaks, 1,362 hydrant or valve leaks, and 1,817 service leaks.

Since 2005, targeted leak detection of 47.65 miles of high-risk large-diameter transmission main (with the Sahara technology) has been conducted, and 73 previously unreported leaks (1.53 leaks per mile) were identified. The city has not budgeted for an evaluation of the entire transmission system, but will continue to identify high-risk locations for targeted leak detection.

[35] The Leak Detection Program is operated by the Operations Division (not the Water Conservation Division).

Figure 7-1: DWU Small-Diameter Leak Detection Program Results



Pipeline Replacement

Pipeline replacement can reduce leakage, if targeted to problematic mains. Through active leakage detection and asset condition assessment, DWU has made a significant effort to target and locate poorly performing mains. In FY 2008-09, DWU completed 355,518 linear feet (approximately 70 miles) of main rehabilitation or replacement at a total cost of $69,613,709.

Current Facilities, Staffing, and Leak Detection Training

DWU has three Operations Division service centers. These centers provide all operational services, not just leak detection and repair. Current staffing levels with respect to leak detection and repair are as follows:

- Eight work sections, including six day shifts (Monday through Friday), one weekend shift (Friday through Sunday), and one weeknight shift (Monday through Thursday).
- Fourteen leak detection staff members.
- Twenty-three repair crews (four-man turn-key crews consisting of a repair truck, backhoe, dump truck), including sixteen day shifts, four weekend shifts, and three weeknight shifts.

- Five two-man fire hydrant crews on the day shift.

Leak detection training activities include internal workshops and field evaluations. Each leak detection staff member is tested annually in the field with the leak detection equipment. This training includes finding leaks that have been engineered for the purpose of testing operator skill.

Water Conservation Ordinance Revision

In 2006, the city revised its water conservation ordinance by extending time-of-day water restrictions from April 1 through October 31 (formerly June 1 through September 30) each year. The ordinance prohibits outdoor watering during the hours between 10:00 a.m. and 6:00 p.m., among other irrigation system maintenance measures

Retrofit of City-Owned Facilities

Retrofits of city facilities included replacement of plumbing fixtures and irrigation audits and corresponding improvements. The city also increased its public awareness efforts with campaigns publicizing improvements or retrofits at city-owned facilities. In FY 2005-06, a total of 152 indoor plumbing fixtures were installed as retrofits in twenty-five city facilities, with an estimated annual water savings of 2.7 million gallons.

DWU water conservation irrigators work with city departments on proper maintenance and operation of city irrigation systems. Three detailed irrigation audits were performed at city facilities in both FY 2005-06 and FY 2006-07. The city installed water-wise landscaping and redesigned the irrigation system at Kiest Park (estimated savings of more than 431,000 gallons per year) and installed an “earth-kind” rose garden with drip irrigation at the Samuell Grand Recreation Center. In addition, the city replaced pop-up spray heads in medians at Dallas City Hall with more efficient heads (expected to reduce irrigation water use by 30 to 40 percent annually).

In addition, funds were budgeted in FY 2008-09 for the Park and Recreation Department to install 183 independently controlled irrigation stations at Stevens Park Golf Course, replacing existing quick coupler irrigation heads with valve-in-head sprinkler assemblies operated by smart controllers and moisture sensors on eighteen golf course fairways. However, this project was not implemented in FY 2008-09 and will not be implemented in FY 2009-10, because the Stevens Park Golf Course is scheduled for renovation beginning in November 2010.

Finally, DWU’s City Leadership Grant Program makes funding for water conservation projects available to other city departments on a competitive basis. Dallas has made the following improvements through this initiative:

- Replaced eighty urinals at forty fire stations.
- Replaced 825 pop-up spray heads at the main entrance and adjacent north parking lot of the Dallas Zoo with new heads that provide more efficient and effective water usage. These improvements are expected to reduce irrigation water use at these locations by twenty-five percent annually.

7.3. Education and Outreach Initiatives

DWU has implemented a number of public education and outreach strategies including an expanded Public Awareness Campaign, the Environmental Education Initiative for K-12 students, a water conservation mascot, free irrigation system inspections, industrial-commercial-institutional cooling tower audits, water-wise landscape events, and other public education initiatives.

Expanded Public Awareness Campaign

The ongoing Public Awareness Campaign, themed “SAVE WATER. Nothing Can Replace It.” promotes water conservation with television ads on major stations, radio ads during peak traffic periods, billboards on heavily traveled thoroughfares, and print ads in the *Dallas Morning News* and minority publications. An updated web site featuring the “Save Water” logo contains information about water conservation programs, the water conservation ordinance restrictions, and various “green” events sponsored by the city (Ref. 41).

Although the Dallas-Fort Worth area receives water service from many different water providers, it is a single media market. As a result, the DWU Public Awareness Campaign delivers messages within other water service areas, and the DWU water service area receives water conservation messages from other water providers. In 2009, DWU partnered with the Tarrant Regional Water District (TRWD) to leverage its Public Awareness Campaign budget and to minimize the potential for customer confusion by providing uniform water conservation messages to the entire media market. The public awareness program budget has grown from $1,150,000 in FY 2003-04 to $1,380,000 in FY 2009-10. Through the partnership with TRWD, Dallas leveraged an additional $650,000 in media exposure in 2009.

Environmental Education Initiative for K-12 Students

DWU augmented its existing school education programs with an Environmental Education Initiative (EEI) through a collaborative effort with the Department of Sanitation to provide programs for grades kindergarten through twelve in the Dallas Independent School District and the Richardson Independent School District. The EEI web site is an online resource for teachers with links to videos on outdoor water use, indoor water use, watersheds, the power of many conserving, and surface-groundwater interactions (Ref. 42). The web site also has a description of recycling lessons and water lessons for kindergarten through fifth grade children. Teachers can also register for a free in-class presentation through this web site. To date, the EEI has held programs for more than forty-one thousand students, and over nine hundred teachers have participated in the staff development program. The annual EEI budget has increased from $171,000 in FY 2005-06 to $274,000 in FY 2009-10.

Water Conservation Mascot

In 2006, DISD students elected Dallas' official water conservation mascot. "DEW" debuted in July 2006, with a seven-day tour at seven recreation centers. Nearly seven hundred children participated. As part of the kick-off, DWU water conservation staff and local artists taught children about water conservation and provided comic strip drawing lessons, encouraging children to participate in the educational campaign by creating their own cartoons for a competition. The winner of the competition became a creative director for the animated DWU commercial based on her concept. The DEW commercial aired in 2007 in English and Spanish. The video "DEW Helps Kids Save Water" received the 2007 Watermark Award for Communications Excellence from the Texas Section of the AWWA and the Water Environment Association of Texas. DEW spots aired on Nickelodeon and the Cartoon Network in the summer of 2007, and DEW now has his own MySpace and Facebook web pages. DEW information can also be accessed through the "Kids Corner" link on the city's webpage (Ref. 41).

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DEW also introduces and narrates the Environmental Education Initiative videos. In summer 2009, the DWU held a "Create a Slogan for DEW" contest to augment its Public Awareness Campaign. Elementary and middle school students submitted 582 slogans to the contest, and the winning slogan was "You can't go green without going blue."

Free Irrigation System Inspections

DWU added two licensed irrigators to its water conservation division staff and began providing free irrigation system inspections in FY 2006-07. The inspectors serve residential and commercial customers and work with other city departments on proper maintenance and operation of city irrigation systems. The inspections include identification of potential system leaks, diagnosis of equipment malfunctions, and recommendations for equipment upgrades to enhance efficiency. As of March 2010, over one thousand inspections have been performed. These inspections are estimated to save more than thirty-one mg annually at city facilities alone.

ICI Cooling Tower Audits

The industrial-commercial-institutional (ICI) cooling tower audit program is an outreach effort by DWU to assist large users of cooling water in finding ways to operate more efficiently, save water and energy, and lower their costs. Water savings are realized as the ICI customers implement audit recommendations. The first ICI cooling tower audit was conducted in March 2007. To date, sixty audits have been performed. If all audit recommendations are implemented, the ICI cooling tower audit program is projected to save 242 mg per year. No data are available as to how many of the recommendations have been implemented.

Water-Wise Landscape Events

DWU's water-wise landscapes program is designed to raise public awareness and save water by publicizing demonstration gardens, recognizing water-wise award winners, and promoting the replacement of water-thirsty yards with landscaping that requires minimal water and maintenance.

The city has "water-wise" landscapes and demonstration gardens at the historic White Rock Lake Pump Station and Fair Park. DWU also promotes the use of water-wise landscaping with annual water-wise awards, tours of homes, and semi-annual water-wise seminars. Water-wise landscaping is also presented on DWU's water conservation web site, including a list of water-wise landscape locations and virtual tours (Ref. 41).

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During FY 2003-04 through FY 2007-08, DWU held ten water-wise events. It is difficult to quantify water savings achieved specifically from these events. However, these events heighten public awareness of the importance of water conservation and provide tools for landscape conversion and proper maintenance.

Water savings resulting from customer conversion to water-wise landscaping is not tracked by the city, but continued education events and potential water-wise landscape ordinances for future construction are expected to contribute to water use reduction over time.

Other Public Education

DWU also uses other approaches to public education, including water bill inserts, brochures, speaking engagements, special events and promotions, and conservation-oriented signs in city facilities.

7.4. Rebate and Incentive Programs

DWU has implemented the following rebate and incentive programs: the *New Throne for Your Home* toilet voucher program; the *Minor Plumbing Repair* program; and the ICI pre-rinse spray nozzle replacement program, *Spray to Save*. Each of these programs is described below. Water savings and costs by program are presented in Section 7.5.

New Throne for Your Home **Toilet Voucher/Rebate Program**

The *New Throne for Your Home* program, initiated in July 2007, offers vouchers of up to $90 for replacement of older, inefficient toilets with more efficient models. Voucher applicants must be DWU customers who own or rent a single- or multi-family residence built prior to 1992 and who do not already have water-efficient toilets. Residential vouchers are limited to two per household. Multi-family requests are handled on a first-come, first-served basis, as funding is limited. The program has been promoted in print and on the DWU water conservation web site.

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To date, more than 20,400 toilets have been replaced through the *New Throne for Your Home* program. These efficient toilets are projected to save 93.2 mg annually.

Minor Plumbing Repair **Program**

The *Minor Plumbing Repair* (MPR) program replaces inefficient water use fixtures such as toilets (up to two per household), faucet aerators, and showerheads with efficient water use fixtures. The program also includes minor repairs to leaking faucets, hose bib leaks, easily accessible pipe joint leaks, and water heaters. The MPR program assists low-income DWU customers at no cost to the customer.

The MPR program was initiated in FY 2005-06. To date, over 1,700 families have participated. Currently, measures implemented through the MPR program are projected to save 16.5 mg annually.

ICI Pre-Rinse Spray Nozzle Replacement Program

The *Spray to Save* program is a pre-rinse spray nozzle replacement initiative that provides efficient pre-rinse spray nozzles free to restaurants, cafeterias, and other commercial food service providers. By using these efficient nozzles, food service businesses may save up to $1,000 per year in energy, water, and wastewater costs. Eligible businesses are DWU customers with an existing, inefficient pre-rinse spray nozzle assembly.

The *Spray to Save* program was initiated in September 2007. Since inception, more than 8,500 fixtures have been replaced at more than 3,100 food service facilities, providing estimated annual savings of 475 mg per year.

7.5. Summary of Conservation Water Savings and Costs

DWU determines the extent of water conservation by compiling implementation data, monitoring water consumption, modeling water demand, and tracking water conservation costs. Projected conservation water savings and actual costs are discussed below.

Water Savings from Water Conservation Measures

DWU estimates the water savings due to its conservation efforts as the difference between actual water use and projected water demand if the water conservation program did not exist. To project what Dallas water demand would be in the absence of the water conservation program, DWU examined factors that influenced historical water use prior to the implementation of the water conservation ordinance and changes to the water rate structure (i.e., prior to FY 2001-02). As part of this process, DWU developed and calibrated an annual water demand model based on historical water consumption from FY 1978-79 through FY 2000-01 (Figure 7-2) (Ref. 43). Statistically significant predictor variables (i.e., factors that influenced water use) include an economic index, the number of days in each year where the high temperature was greater than 100 degrees, and rainfall volume.[36]

The difference between the water demand model projection and actual consumption is assumed to be water savings due to the water conservation program (Figure 7-2). Based on this analysis, it appears that DWU conserved a total of approximately 98 billion gallons (bg) from FY 2001-02 through FY 2008-09 (Table 7-1).

Water Conservation Costs

DWU provided historical budget information for the Water Conservation Division (Table 7-2). These budgets include salaries and benefits of Water Conservation Division staff, other operating expenses, consulting fees, fixture purchases, and performance contracts. To the extent possible, salaries and benefits have been allocated to individual programs. During the 5-year period from FY 2003-04 to FY 2007-08, DWU budgeted approximately $15.6 million for the Water Conservation Division.[37]

In other divisions, the city budgeted money for leak detection and repair, code enforcement, water rate studies, etc. A portion of these budgets were also used for water conservation, but these amounts have not been included in this report.

Unit Costs for Water Conservation Program

The unit cost is the total amount spent on water conservation divided by the total past, present, and future water savings to be realized from the implemented measures. Some of the information necessary for this calculation has been presented in previous sections (budgets/spending and total water savings to date), but an estimate of the future water savings due to implemented measures is also necessary. Estimated future water savings and resulting unit costs are discussed in the following sections.

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[36] Other variables considered include population, the number of days with high temperature greater than 90 degrees, the number of days with high temperature greater than 95 degrees, the number of rain days, and water price.

[37] These budgets will be compared to projected water savings in a later section. During the analysis, FY 2007-08 was the latest fiscal year for which complete projected water savings were available.

Figure 7-2: Estimated Consumption without Conservation vs. Actual Consumption

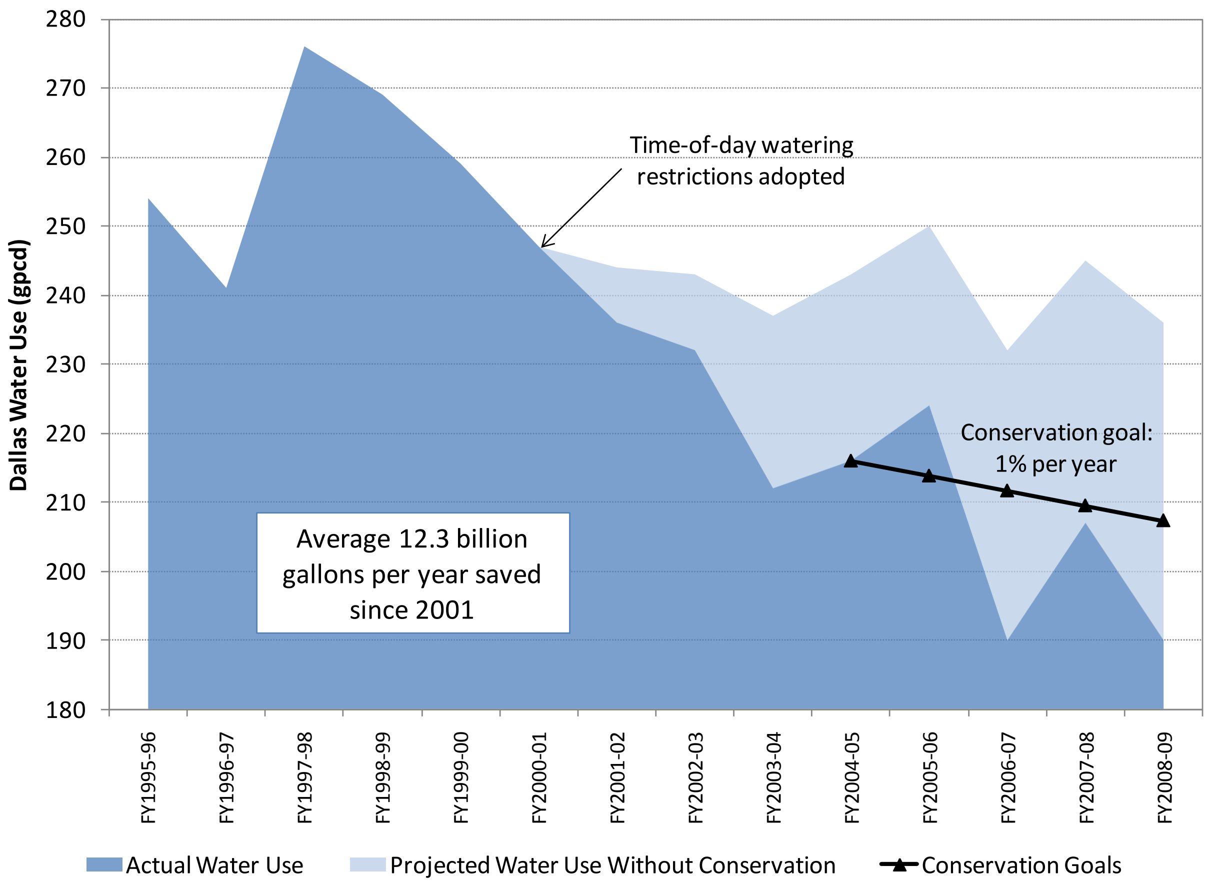

Table 7-1: DWU Total Projected Water Conservation Savings

Fiscal Year	Projected Conservation Savings		
	Annual		Cumulative
	(bg)	(% of Projected Consumption)	(bg)
2001-02	3.2	3.0%	3.2
2002-03	1.9	1.8%	5.2
2003-04	7.3	7.2%	12.4
2004-05	15.1	13.5%	27.6
2005-06	12.9	11.2%	40.5
2006-07	17.8	16.8%	58.3
2007-08	18.0	15.5%	76.4
2008-09	21.6	19.3%	98.0

Table 7-2: Itemized Water Conservation Division Budgets

Program	Fiscal Year					Five-Year Total
	2003-04	2004-05	2005-06	2006-07	2007-08	
Unallocated Salaries & Benefits[a]	$328,712	$378,658	$418,472	$386,096	$233,509	$1,745,447
Other Operating Expenses	$465,265	$220,495	$1,099,520	$349,355	$109,505	$2,244,140
Consulting Fees		$339,925	$195,000	$76,000		$610,925
Public Awareness Campaign	$1,253,638	$1,306,747	$1,489,949	$1,493,248	$1,496,645	$7,040,227
Rain/Freeze Sensor Rebate Program	$303,104	$100,000				$403,104
Minor Plumbing Repair Program			$245,792	$247,166	$448,581	$941,539
Environmental Education Initiative			$233,185	$235,050	$236,972	$705,207
Toilet Voucher Program				$348,417	$688,211	$1,036,628
Pre-rinse Spray Nozzle Program				$303,604	$202,022	$505,626
Irrigation System Check-up Program				$151,618	$214,367	$365,985
Cooling Tower Audit Program				$25,000	$25,000	$50,000
Total Budget	$2,350,719	$2,345,825	$3,681,918	$3,615,555	$3,654,812	$15,648,829

[a] Manager, support staff, and water analyst. Other salaries and benefits are allocated to individual programs.

Future Water Savings from Implemented Measures

Water conservation measures with an effective life that is longer than one year will yield future water savings at no additional cost to the utility. These measures include:

- Replacement of inefficient toilets with efficient toilets (estimated measure life of twenty-five years)
- Replacement of inefficient faucets/aerators with efficient faucets/aerators (ten years)
- Replacement of inefficient showerheads with efficient showerheads (ten years)
- Replacement of inefficient pre-rinse spray nozzles with efficient pre-rinse spray nozzles (three years)
- Irrigation audits (five years)
- ICI cooling tower audits (ten years)

The estimated future water savings from measures that have already been implemented are shown in Table 7-3.

Table 7-3: Estimated Future Water Savings for Implemented Water Conservation Measures with an Effective Life Longer Than One Year

Program	Estimated Future Water Savings[a] (bg)
New Throne for Your Home (SF)[b]	0.32
New Throne for Your Home (MF)[b]	0.25
Spray to Save	0.25
Minor Plumbing Repair	0.17
Irrigation Audits	0.21
ICI Cooling Tower Audits	2.00
Total	3.19

[a] For measures implemented through FY 2007-08. Savings estimated over the life of each measure.

[b] No adjustment has been made to account for freeriders or replacements that would have occurred naturally without the program. These adjustments would reduce the projected savings.

Unit Costs

The projected water savings from implemented measures for the last five years (FY 2003-04 through FY 2007-08) is approximately 74.3 bg (71.1 bg realized during the five years plus 3.2 bg in future savings). During the same period, DWU has spent approximately $15.6 million on water conservation through the Water Conservation Division (Table 7-2) and an unknown additional amount through other programs (e.g., leak detection and repair, code enforcement, rate studies, etc.). Therefore, the total unit cost of conservation for the last five years is at least $0.21 per thousand gallons.

Water conservation extends the life of raw water supplies; therefore, it is appropriate to compare the cost of conserving water to existing and projected future raw water costs. During the last five years, it appears that the cost of conserving water has been less than or comparable to the current average cost of raw water ($0.4744 per thousand gallons from Table 3-2) and less than the costs of most future sources of water supply (see Section 4.3).

Unit costs can also be estimated for programs where direct estimates of savings have been made (Table 7-4). The estimated unit costs for these programs, which are mostly rebate and incentive programs, range from $0.02 per thousand gallons (cooling tower audits) to $5.22 per thousand gallons (Minor Plumbing Repair). The estimated average unit cost for these programs is approximately $0.76 per thousand gallons. The unit costs in Table 7-4 do not include the portion of the manager, support staff, and water analyst salaries and benefits that were devoted to the individual programs.

Table 7-4: Estimated Unit Costs for Selected Water Conservation Programs, FY 2003-04 to FY 2007-08

Program	Estimated Total Water Savings (bg)	Estimated Expenditures[a] ($)	Estimated Unit Cost ($/1,000 gal)
New Throne for Your Home	0.59	$1,036,628	$1.77
Spray to Save	0.37	$505,626	$1.35
Minor Plumbing Repair	0.18	$941,539	$5.22
Irrigation Audits[b]	0.27	$365,985	$1.37
ICI Cooling Tower Audits[b]	2.42	$50,000	$0.02
Total	3.83	$2,899,778	$0.76

[a] Based on budget information in Table 7-2. Does not include the portion of the manager, support staff, and water analyst salaries and benefits that was expended for these programs.

[b] The estimated total water savings from the audit programs are based on the assumption that the facility owners have implemented all recommended improvements. If the owners do not implement a portion of the recommended improvements, then the estimated total water savings will decrease, and the estimated unit cost will increase proportionally. The estimated expenditures do not include private expenditures for implementation of the audit recommendations.

Although most of the programs in Table 7-4 (particularly the Minor Plumbing Repair program) have higher unit costs than the total water conservation unit cost and produce a relatively small proportion of the city's water conservation savings, these programs have ancillary benefits that are difficult to measure, such as aiding DWU's low-to-moderate income customer base and overall support in the community.

8. Identification and Screening of Potential Water Conservation Strategies

Potential water conservation strategies were identified from numerous sources. Screening criteria were developed from the City of Dallas water use profile (Chapter 5) to help determine which potential water conservation strategies would be most effective for Dallas during the next five years. DWU staff and the consultant team screened the potential strategies, selecting fifteen water conservation strategies for detailed evaluation of water savings, costs, benefits, staffing, and implementation issues.

8.1. Identification of Potential Water Conservation Strategies

Potential water conservation strategies were compiled from various sources, including recommendations by task forces and planning groups, literature sources, 2005 Strategic Plan recommendations that have not yet been implemented, and programs implemented in other cities that have successful water conservation efforts.

Water Conservation Implementation Task Force

The Water Conservation Implementation Task Force (described in detail in Section 2.3) was assigned several tasks, including identifying, evaluating, and selecting best management practices (BMPs) for municipal, industrial, and agricultural water uses and evaluating the cost and benefits of the selected BMPs. The Task Force developed TWDB Report 362, *Water Conservation Best Management Practices Guide* (Ref. 18). This guide, released in November 2004, included twenty-two BMPs for municipal water users, fifteen BMPs for industrial water users, and twenty BMPs for agricultural water users. In the BMP Guide, each BMP's characteristics are detailed in seven subsections of applicability, description, implementation, schedule, scope, documentation, determination of water savings, cost-effectiveness considerations, and references. Municipal and industrial BMPs were considered for inclusion in the Updated Strategic Plan.

Region C Water Planning Group Recommendations

The most recent water conservation recommendations of the Region C Water Planning Group are contained in the 2011 Region C Initially Prepared Water Plan (Ref. 4). For Dallas, the plan recommended three sets of water conservation strategies: the basic package, the expanded package, and the accelerated package. The conservation measures and projected water savings associated with each recommended water conservation package are described in detail in Section 2.2. These conservation measures were considered for inclusion in the Updated Strategic Plan.

The Initially Prepared Plan is a draft of the upcoming 2011 Region C Water Plan. DWU will work with the Region C Water Planning Group to coordinate the recommended water conservation strategies in the final 2011 Region C Water Plan with the recommendations of this Updated Strategic Plan.

Literature Reviewed for Water Conservation Strategies

Literature on water conservation measures and studies were reviewed to compile a list of strategies to screen for consideration in the Strategic Plan. Some of the more extensively reviewed publications are summarized below. A complete list of references is included at the end of the plan.

Amy Vickers, Handbook of Water Use and Conservation (Ref. 36)

The *Handbook of Water Use and Conservation* is an extensive treatise on water conservation strategies including discussions of applicability, efficiencies, benefits and costs, and basic steps to audit for incorporation. A number of water efficiency strategies or measures described in the handbook were included in the list of potential strategies including residential/domestic toilets, urinals, showerheads, faucets, clothes washers, and dishwashers; water-wise landscape, native and low-water turf and plants, practical turf areas, irrigation systems and devices, irrigation scheduling, soil improvements, mulches, efficient landscape maintenance, and water decorations and fountains; and ICI metering and submetering, cleaning and sanitation, process water uses, commercial kitchens and restaurants, laundries and laundromats, swimming pools and zoos, cooling and heating systems, leaks and water losses, and maintenance practices for ICI water efficiency.

Water Audits and Loss Control Programs, AWWA Manual M36 (Ref. 39)

Manual M36 presents best management practices that provide supervisory staff and operations staff with clear and concise procedures to follow to complete common water loss control tasks (Ref. 39). A review of industry best management practices for real water loss control is contained in Appendix E.

California Urban Water Conservation Council, Various Publications

The California Urban Water Conservation Council has produced several studies and reports on water conservation strategies including Programmatic BMP: Commercial, Industrial, and Institutional (Ref. 44) and Memorandum of Understanding Regarding Urban Water Conservation in California (Ref. 45).

U.S. Environmental Protection Agency, Water Conservation Plan Guidelines (Ref. 46)

In 1998, the U.S. Environmental Protection Agency published guidelines for water utilities to use in preparing a water conservation plan. This document is organized into basic, intermediate, and advanced guidelines, based on the population served by a water utility, and provides information about the nature and possible use of the strategies.

Pacific Institute, Waste Not, Want Not: The Potential for Urban Water Conservation in California (Ref. 47)

This report makes recommendations for water conservation in California include reducing water waste through cost-effective water saving technologies, revised economic policies, appropriate state and local regulation, and public education. It reviews the water savings potential in California from various indoor and outdoor residential and ICI conservation strategies.

Status of Previous Strategic Plan Recommendations

Many of the recommendations from the 2005 Strategic Plan have been implemented. Table 8-1 summarizes the status of Strategic Plan recommendations.

Review of Water Conservation Programs in Other Cities

An evaluation of six U.S. Southwestern cities' water utility conservation programs was conducted to learn from their program approaches and results with cutting-edge water saving technologies, strategies, and policies. The six Southwestern utilities are:

- Albuquerque Bernalillo County Water Utility Authority (Albuquerque, New Mexico)
- Austin Water Utility (Austin, Texas)
- Denver Water (Denver, Colorado)
- San Antonio Water System (San Antonio, Texas)
- San Diego County Water Authority (San Diego, California)
- Southern Nevada Water Authority (Las Vegas, Nevada)

A wealth of findings on program planning, implementation, and management; setting program priorities; program effectiveness; ordinance and policy initiatives; ordinance enforcement; public and school education; stakeholder involvement; and other topics are presented in Appendix F. Measures implemented by the six Southwestern cities were considered as potential conservation strategies for DWU.

Key findings related to screening of potential water conservation strategies are summarized below:

- Focus on customer-oriented measures that will realize measurable water savings, particularly hardware measures.
- Target ICI customers with sector-oriented programs. Restaurants, hotels, health clubs, large industrial facilities, and public schools are common program partners.
- Voluntary programs yield little water savings. Voluntary certification programs, such as those for certified water-efficient car wash operations and golf courses, have more public education value than measurable water savings.
- Weather-based irrigation controllers are starting to be installed, but there are concerns about the quality of the controllers and that some controllers may cause increased water use.

Table 8-1: Status of 2005 Strategic Plan Recommendations

No.	Description	Implemented? Yes	Partial	No	Recommended in Strategic Plan	Accomplished	Comments
1.0	**Element 1 - City Leadership and Commitment**						
1.1	Continue to fund personnel and provide resources for continuance of Water Conservation program	✓			Add Water Conservation Analyst, two Senior Coordinators, and six Coordinators over period of plan	WC staff expanded, including Water Conservation Analyst, two licensed irrigators, and an additional coordinator	New staff added as program has evolved and some outside contractors used for select programs
1.2	Inspect city facilities and retrofit inefficient plumbing fixtures with low-water use fixtures (toilets, shower heads, faucet aerators, etc.)	✓			Retrofit or change out indoor plumbing fixtures in city-owned or leased facilities to meet current plumbing codes for water-efficient devices	Plumbing upgrades at facilities. FY2006-07: Twenty-five fire stations, libraries and recreation centers, 152 indoor plumbing fixtures installed; FY2007-08: Eighty urinals installed at fire stations; FY 2008-09: 176 toilet retrofits	This will be a multi-year process due to the size and scope of properties owned and operated by the City of Dallas.
1.3	Convert appropriate sections of city-owned landscapes to water-wise landscapes; implement in conjunction with Item 1.4. May include additional demonstration sites at parks or other highly visible city properties, recommended beginning at water treatment plants and pump stations	✓			Install additional water-wise landscape at other city properties to expand beyond existing installations and demonstration gardens	Installed water-wise landscape at Kiest Park recreation center and Skyline Library; Fire Station 10 surveyed, and changes added to construction contract; Earth-kind roses and drip irrigation at Samuel Grand Park	This will be a multi-year process due to the size and scope of properties owned and operated by the City of Dallas.

Table 8-1 Continued: Status of 2005 Strategic Plan Recommendations

No.	Description	Implemented?			Recommended in Strategic Plan	Accomplished	Comments
		Yes	Partial	No			
1.4	Retrofit city-owned irrigated areas with high-efficiency sprinklers and weather-sensitive irrigation controllers	✓			Install water-efficient irrigation equipment at city facilities with older, less efficient systems	Dallas Zoo entrance and north parking lot drip irrigation complete; Fire Department training center altering irrigation areas and adding drip irrigation; installed irrigation upgrades at Kiest Park recreation center and Skyline Library	This will be a multi-year process due to the size and scope of properties owned and operated by the City of Dallas.
1.5	Review and revise city ordinances and codes to ensure water conservation principles are maintained. Consider adopting new codes/standards for further water conservation		✓		Improve utilization of codes and standards to promote water conservation and require water-efficient equipment	Extended time-of-day watering restriction period from April 1 through October 31; Green Dallas adopted for new buildings	See Appendix G
1.6	Improve water conservation code enforcement efforts so that customers practicing water conservation are encouraged to continue practices			✓	More training of Code Enforcement officers and possible staff addition	Water conservation staff trained Code Enforcement officers on water conservation ordinances, but efforts not expanded	
1.7	Further refine collection and analysis of DWU water use data and refine how effectiveness of water conservation program is measured	✓			Further define water use patterns, revise meter testing, reduce unauthorized water use, and enhance water loss management strategies	Hired Water Conservation Analyst and implemented an expanded Leak Detection Program	

Table 8-1 Continued: Status of 2005 Strategic Plan Recommendations

No.	Description	Implemented? Yes	Implemented? Partial	Implemented? No	Recommended in Strategic Plan	Accomplished	Comments
1.8	Expand implementation of the recycled water program			✓	Initiate Recycled Water Implementation Plan (Refs. 14 and 15) and include recycled water program in public awareness campaign	Adjusted indirect Recycled Water Implementation Plan (Ref. 15) by negotiating agreement with North Texas Municipal Water District to exchange recycled water. Cedar Crest pipeline extension under development.	
1.9	Implement a conservation rate structure to further reduce discretionary water use: consider two factors when evaluating rates - that water conservation pricing will save water and also decrease revenue from reduced sales			✓	Continue to evaluate water rate pricing structure and further develop water conservation pricing	Existing four-tier rate structure has not been expanded	Strategic Plan recommended to focus residential price increases on high water users and to consider separate irrigation meters for ICI and high user accounts
2.0	**Element 2 - Education and Outreach Initiatives**						
2.1	Continue to fund multi-media public awareness campaign	✓			Aggressive multi-media program recommended with Spanish and other language venues	Expanded campaign and coordinated with Tarrant Regional Water District	
2.2	Continue to fund new and expanded special water conservation promotional events	✓			Broaden reach of public awareness with special events and award programs	Mascot "DEW," videos, webpage, tours, and water-wise awards	

Table 8-1 Continued: Status of 2005 Strategic Plan Recommendations

No.	Description	Implemented?			Recommended in Strategic Plan	Accomplished	Comments
		Yes	Partial	No			
2.3	Augment existing school education program to include structured English and Spanish language K-12 curriculum	✓			Augment existing programs to include structured water conservation programs	Environmental Education Initiative, DEW mascot outreach	
2.4	Develop and implement a bilingual customer indoor/outdoor water conservation audit program		✓		Develop indoor/outdoor program with literature on water-wise landscape, but initially focus on high-water users	Implemented irrigation audit program, but not indoor program; City has bilingual staff available, but to date not requested	
2.5	Create an enhanced website, providing up-to-date information that promotes, encourages, and educates the public about water conservation	✓			Develop and maintain special website on water conservation with links to details of program and include both English and Spanish language components	Expanded website and developed "Save Water - Nothing Can Replace It" logo for savedallaswater.com site	
2.6	Take leadership role in promoting a regional approach to water conservation by creating stakeholder committees, task forces, or advisory groups to better define water conservation message and recruit allies to promote programs		✓		Utilize 2004 Water Conservation Advisory Committee to expand stakeholders, receive input on new programs and ordinances	See 2.7	

Table 8-1 Continued: Status of 2005 Strategic Plan Recommendations

No.	Description	Implemented?			Recommended in Strategic Plan	Accomplished	Comments
		Yes	Partial	No			
2.7	Continue to work with DWU customer cities and other municipalities on joint water conservation education efforts and encourage them to adopt like measures and initiatives	✓			Encourage customer cities to develop like programs, provide technical support to wholesale customers to advance conservation efforts	Joint education efforts with Tarrant Regional Water District (TRWD) & North Texas Municipal Water District (NTMWD)	
3.0	**Element 3 - Rebate and Incentive Programs**						
3.1	Implement a rain and freeze sensor rebate program	✓			Rebate programs in FY 2004-05 as incentive to comply with new ordinance	Prior to ordinance implementation, rebate for rain and freeze sensors	Program was offered for a limited time only. Ordinance now requires these devices on all working automatic irrigation systems.
3.2	Implement a faucet aerator and showerhead retrofit program	✓			Free fixtures for DWU customers (stand-alone program or in conjunction with toilet retrofit program)	Minor Plumbing Repair program implemented with low-flow device give-away and repair program	

Table 8-1 Continued: Status of 2005 Strategic Plan Recommendations

No.	Description	Implemented?			Recommended in Strategic Plan	Accomplished	Comments
		Yes	Partial	No			
3.3	Implement a toilet retrofit program to replace residential toilets installed prior to 1994: phase program to start with low income/elderly replacement program, then single-family and multi-family incentive programs, then ICI incentive program	✓			Low income/elderly replacement/repair program start with 325 home pilot program; two-year pilot program for single-family incentive, adding multi-family incentive program second year; eventually add ICI incentive program	Minor Plumbing Repair program has had more than 1,700 participants since 2005; New Throne for Your Home voucher program has replaced more than 20,400 toilets to date.	
3.4	Implement an ICI grant program for higher-use customers			✓	Promote grant program for installing both indoor and outdoor water conservation measures to ICI customers with high conservation potential through direct marketing/mail marketing	An ICI audit program was implemented in lieu of grant program. Sixty audits have been performed.	
3.5	Implement a water-efficient washing machine program			✓	Incentive program with power company partnership to provide rebates for installing high-efficiency washing machines (residential and commercial)	Not implemented.	

Table 8-1 Continued: Status of 2005 Strategic Plan Recommendations

No.	Description	Implemented?			Recommended in Strategic Plan	Accomplished	Comments
		Yes	Partial	No			
3.6	Implement a pre-rinse spray nozzle retrofit program for food service facilities	✓			Target commercial and institutional food service establishments for pre-rinse kitchen spray nozzle retrofit; research found approximately 4,000 nozzles could be replaced	Give-away program of nozzles and aerators to food service facilities began in FY 2007-08 as recommended; have replaced more than 8,500 fixtures at more than 3,100 service facilities	Program still ongoing; nozzles wear out and will need replacement over time
3.7	Consider additional rebate programs that extend beyond initial five year planning period: ▪ landscape conversions ▪ irrigation system upgrades ▪ rainwater harvesting ▪ graywater systems for new construction			✓	These programs were recommended to be considered for implementation after the five-year planning period	None of these programs have been initiated.	Consider these or other incentive programs as program evolves to meet changing conditions

- Consider banning turf on public medians and rights-of-way, since these are common water waste spots.
- Graywater can be problematic. A study in Perth, Australia found that houses which installed graywater systems increased their water demand an average of twenty gpcd. The reasons for this are not clear, but it is assumed that people feel they have a license to take longer showers or indulge in other excess water use.
- Austin's maximum two-day per week watering restrictions have yielded significant water savings since the ordinance was adopted in 2007. Increased public education, ordinance enforcement, and stiffer fines (up to $500) are cited as the reasons why most customers are complying with the restrictions. Estimated 2008 water savings were five to nine mgd on an average summer day, or about 2.5 percent less than projected 2008 summer consumption.

Potential Water Conservation Strategies

Potential water conservation strategies were compiled from various sources discussed previously in this chapter – recommendations by task forces and planning groups, literature sources, Strategic Plan recommendations that have not been implemented, and programs implemented in other cities that have successful water conservation programs. The list of potential water conservation strategies is presented in Appendix H. This comprehensive list of strategies was screened for applicability to Dallas and other factors, as described in Section 8.2.

8.2. Screening of Potential Water Conservation Strategies

This section discusses screening of potential water conservation strategies to generate a list of strategies for which a detailed evaluation will be performed (Chapter 9).

Screening Criteria

Based on the DWU water use profile developed in Chapter 5, screening criteria were developed to help identify new residential and ICI water conservation strategies and which new water loss reduction measures that should be evaluated in greater detail. The screening criteria are presented in the following sections.

Residential Strategy Screening Criteria

- Target the Single Family Residential and Apartment/Condo Master Metered premise types.
- Target the top twenty-five percent of water-using customers among all residential customers.
- Target outdoor water use. Focus on Single Family Residential accounts, since this premise type has the second highest summer-to-winter water use ratio (Table 5-5).
- Where possible, select water conservation measures with potential for regional cooperation.

- Consider implementation issues, potential water savings, potential for public acceptance, and anticipated effectiveness.

ICI Strategy Screening Criteria

- Target the top (highest one to ten percent) water-using customers among all ICI customers.
- Target the top (highest) water-using premise types among all ICI customers.
- Group program measure strategies by the largest water-using activities, such as cooling water use, industrial and food processing, irrigation, medical and dental equipment, and plumbing fixtures.
- Target high profile ICI properties for landscape and irrigation-related water conservation measures, such as city parks, golf courses, and large frontage properties with heavy irrigation. For example, the 488 active (mostly lawn irrigation) Median Strip accounts include many City of Dallas and homeowners' association (HOA) customers. While this premise type represents only about one percent of DWU's ICI demands, it has high public visibility along roadways and business areas. Native and drought-tolerant plantings and efficient irrigation methods at these sites offer significant public education benefits.
- Promote and/or require (through amended customer terms of services and/or ordinances) water conservation program measures that have the highest potential for large savings (e.g., industrial and commercial cooling water, process washing, irrigation, and plumbing fixtures and appliances). By requiring water efficiency measures to be installed at the point of new facility construction or renovation, future water savings are built in at little direct cost to DWU.
- Proven "hardware" measures (technologies) should have priority over conservation program activities that lack reliable water savings data. A water conservation measure under consideration should usually only be adopted into a plan and program if there are solid case examples and other data to support the utility's investment.
- Paybacks of two to five years for medium and large customers.
- Paybacks of less than one year for small customers.
- Opportunities for cost-sharing with other utilities, government programs, and industry programs where they are known to exist.

Water Loss Reduction Strategy Screening Criteria

- Level of capital investment: Current poor economic conditions make this an important factor in decision-making. Low capital input is preferred, especially to start a new program.
- Possibility for contracting: The city has expressed an interest in whether contractors can be utilized for new water conservation programs. This criterion outlines whether the project can be run by outside contractors.

- Return on investment and payback period: In the long term, financial return on investment and payback period are important factors.
- Possibility of outside funding: This criterion considers whether outside funding (federal, state, or private) may be available for the project in question.

Other Screening Criteria

- Applicability and practicability for the City of Dallas
- Frequency of implementation based on cities interviewed (Appendix F), water conservation literature, and experience of the consulting team.
- Results based on cities interviewed (Appendix F).
- Characteristics of individual strategies that are favorable or challenging for implementation in Dallas. These characteristics were developed as part of the 2005 Strategic Plan from the Water Conservation Implementation Task Force's Water Conservation Best Management Practices Guide (Ref. 18) and are presented in Appendix I.

Selection of Strategies for Detailed Evaluation

Based on the potential water conservation strategies and the screening criteria, DWU staff and the consultant team screened the potential strategies, selecting fifteen water conservation strategies for detailed evaluation of water savings, costs, benefits, staffing, and implementation issues, as described in the following sections.

Residential and ICI Strategies Selected for Detailed Evaluation

The selected residential and ICI strategies are defined in Table 8-2, and the corresponding customer types and water use types are shown in Table 8-3.

Table 8-2: Residential and ICI Water Conservation Strategies Selected for Detailed Evaluation

Strategy	Description
City Leadership & Commitment	
Water-Wise Landscape Design Requirements	Upon City Council approval and adoption, Dallas would revise its landscape ordinance to limit turf areas in all new landscapes and require low-water-use landscaping in other areas. Other requirements could include minimum soil depths, soil amendments, and turfgrass summer dormancy capability. Turfgrass requires more water than native grasses and low-water-use plants. Reducing the turfgrass area in new landscapes will reduce irrigation water use.
ICI Water-Efficient Equipment Rule	Upon City Council approval and adoption, Dallas would adopt an ordinance requiring certain water efficiency standards for new and newly-occupied ICI establishments. Example requirements could include repairing all leaks, retrofitting high-flow plumbing fixtures, and other equipment and service requirements, depending on the nature of the business. DWU would collaborate with the city's Building Inspection Office to verify installation of water efficiency measures prior to occupancy.
Education & Outreach Initiatives	
Voluntary Twice-Weekly Irrigation Schedule	Through its Public Awareness Campaign, DWU would encourage all customers to limit irrigation to a maximum of two days per week from April 1 through October 31. Twice-weekly irrigation limitation will reduce over-irrigation but will allow customers to meet plant needs.
ICI Customer Water Audits	A DWU auditor (or contractor) would visit an ICI establishment with the company's engineers or other employees knowledgeable about company water use, review all end uses of water, identify potential water-efficiency improvements and potential costs, directly install small, low-cost devices as appropriate, document the findings, inform the company of applicable DWU water conservation programs, and follow up with the company to track implementation of the recommendations. The ICI customer water audit would be conducted at no cost to the customer.

Table 8-2 Continued: Residential and ICI Water Conservation Strategies Selected for Detailed Evaluation

Strategy	Description
ICI Training Programs	DWU would develop, lead, and manage ongoing water efficiency training programs for: ▪ ICI facility managers for premise types that use the most water, and ▪ Irrigators, with a focus on EPA WaterSense programs. Topics would include industrial cooling and process, food processing, irrigation management, and leakage control. Bi-monthly or quarterly training programs would be recommended. As facility managers and irrigators become more aware of available water-efficient technologies and methods, they will begin to implement these measures. DWU should work with local businesses, green building organizations, and energy utilities to seek their input on the curriculum development and certification process. ICI training programs could increase participation in other water conservation programs.
ICI Business Partnership Program	DWU would establish an ongoing Business Partnership Task Force or work group for the purpose of engaging the ICI community in DWU's water conservation program, particularly business leaders who represent companies that are top water users. The Task Force would meet four to six times per year for discussion of water conservation practices, sharing of conservation success stories, and discussion of DWU ICI water conservation programs. Increased awareness of the value of ongoing water efficiency practices should lead to water savings for the participating customers.
ICI Hospitality Program	Water conservation staff would engage hotels, motels, and restaurants in the city's water conservation program and train hospitality staff on methods to reduce water use and waste. Measures would include water on request, reuse of towels and linens, etc. DWU would provide printed materials to encourage guest participation: table cards, door hangers, pillow cards, etc.
Rebate & Incentive Programs	
Residential Irrigation System Incentive	DWU would offer a rebate or other incentive to single- and multi-family residential customers that retrofit their existing irrigation systems with water-conserving equipment. Qualifying equipment may include: ▪ Drip irrigation equipment ▪ Spray heads with greater distribution uniformity ▪ Weather-based irrigation controllers ▪ Other devices

Table 8-2 Continued: Residential and ICI Water Conservation Strategies Selected for Detailed Evaluation

Strategy	Description
ICI Financial Incentives	DWU would implement a site-specific rebate program for ICI customers to promote water-efficient equipment installation and upgrades. Examples could include cooling processes, plumbing fixtures, laundry processing, medical/dental devices, landscape irrigation, rainwater harvesting, etc. Candidates could include office buildings, hotels/motels, restaurants, grocery stores, Laundromats, schools, manufacturers, food processing, and parks/golf courses. Customers would propose water-efficiency improvements and project the associated water savings and costs. After review of the proposal, DWU could agree to fund a portion of the cost (up to a maximum amount per customer) for water efficiency measures that meet certain water savings performance standards. The customer would install the approved water-efficiency measures. Upon confirmation of installation, DWU would rebate a portion of the measure costs. DWU could also establish financial partnerships with energy utilities and green building organizations.
Enhanced Residential Toilet Incentive	Expand the "New Throne for Your Home" program to replace additional existing single- and multi-family residential toilets that use 3.5 gallons per flush or more with HETs (1.28 gallons per flush or less).
Residential Clothes Washer Incentive	DWU would offer a rebate to single- and multi-family residential customers for replacing older, inefficient clothes washers with water-efficient models (modified energy factor of at least 1.8 and water factor of no more than 7.5). Efficient clothes washers use up to sixty percent less energy and up to forty percent less water than conventional machines.

Table 8-3: Customer and Water Use Types Addressed by Measures Selected for Detailed Evaluation

Measure	Customer Type				Water Use Type	
	SF	MF	ICI	Utility	Indoor	Outdoor
Enhanced Real Loss Reduction				✓	✓	
Enhanced Apparent Loss Reduction				✓	✓	✓
Water-Wise Landscape Design Requirements	✓	✓	✓			✓
ICI Water-Efficient Equipment Rule			✓		✓	
Twice-Weekly Irrigation Schedule	✓	✓	✓			✓
ICI Customer Water Audits			✓		✓	✓
ICI Training Programs			✓		✓	✓
ICI Business Partnership Program			✓		✓	✓
ICI Hospitality Program			✓		✓	✓
Residential Irrigation System Incentive	✓	✓				✓
ICI Financial Incentives			✓		✓	✓
Enhanced Residential Toilet Incentive	✓	✓			✓	
Residential Clothes Washer Incentive	✓	✓			✓	
Additional Savings – Existing Real Loss Program				✓	✓	
House Bill 2667 High-Efficiency Toilet Law	✓	✓	✓		✓	
TOTAL	6	6	9	3	12	9

SF = Single-family residential
MF = Multi-family residential
ICI = Industrial, commercial, and institutional

Water Loss Strategies Selected for Detailed Evaluation

The strategies for reducing real and apparent water losses that have been selected for detailed evaluation are outlined and explained below.

<u>Enhanced Real Water Loss Reduction</u>

As discussed below, there are six elements to the enhanced real water loss reduction strategy:

- Develop and track water loss performance indicators

  DWU would develop and track water loss performance indicators (Table 8-4) on a monthly basis. This could include automated monitoring of water audit data through software programming and third party review and reporting of data. The results would be used to target water loss resources (e.g., leak detection and repair crews).

Table 8-4: Suggested Water Loss Performance Indicators

DWU Area	Performance Indicator
Customer Service	▪ Number of zero reads per month ▪ Number of zero reads verified ▪ Number of zero reads determined incorrect ▪ Number of customers with water account, but no wastewater account ▪ Number of above customers verified ▪ Number of rollover meter reads ▪ Number of negative meter reads ▪ Number of estimated reads ▪ Number of frauds (meter removed/tampered) ▪ Estimate of volume used by Fire Department*
Financial	▪ Water Loss as a percentage of the total cost of operating the system ▪ Value of Real Losses ($) ▪ Value of Apparent Losses ($)
Meter Maintenance	▪ Number of meters above new meter volume warranty ▪ Number of meters above refurbished meter volume warranty ▪ Number of meters more than 10 years old ▪ Number of meters more than 15 years old ▪ Number of large meters tested (>3") ▪ Meter test results. Analysis and trending of average inaccuracy ▪ Total number of large meters (>3") ▪ Total number of active meters* ▪ Number of meter leaks
Operations	▪ Infrastructure Leakage Index ▪ Apparent Loss – Gallons per connection per day ▪ Real Loss – Gallons per connection per day ▪ Monthly footage of distribution system surveyed for leaks* ▪ Number of service leaks* ▪ Number of main leaks/breaks* ▪ Number of transmission main leaks/breaks (>24")* ▪ Number of hydrant leaks* ▪ Number of valve leaks ▪ Number of all leaks and breaks found by proactive methods (broken down by type of leak) ▪ Number of all leaks and breaks reported due to leak surfacing (broken down by type of leak) ▪ Cost of leaks (broken down by type of leak). This includes the cost to fix the leak and the estimate of lost water ▪ Estimate of volume of water used for flushing operations* ▪ Number of miles of main* ▪ Number of service connections* ▪ Average system pressure
Personnel	▪ Number of Distribution Division Meter Section staff per thousand meters ▪ Number of Customer Service staff per thousand connections/accounts ▪ Number of Operations staff per hundred miles of main
Treatment	▪ Volume of treatment plant water sent to sewer/consumed* ▪ Treatment cost per million gallons*

*Indicates that DWU currently tracks this performance indicator.

- Improve validation of water loss performance data

  Water use in some of the AWWA water balance categories (Figure 5-17) is difficult to estimate and should be validated through field testing where possible. Improvements in data validation could include:

  - Additional meter testing and analysis of meter test results (this could include all sizes of meters from residential to the production meters). It is particularly important to maintain calibration of the production meters and the largest commercial/industrial meters, as these will have the greatest impact on overall average meter accuracy if they are in error. Analysis of meter test results could be used to refine the meter accuracy assumption in the system water audit.
  - Conduct water loss audits on a pressure zone level. Since smaller district metered areas (DMAs) are not considered at this time, it is recommended that pressure zone water balances are conducted to improve the level of accuracy of the system water audit. Minimum flow characteristics would be analyzed and leakage estimated. Leakage detection surveys would be conducted on the pressure zone and evaluation and recording of reduction in real losses reported.
  - Review and evaluate the pressure reducing valve (PRV) maintenance and replacement program. Tasks could include more frequent monitoring of PRV vaults and continued trending and analysis of collected data.

- Assess and enhance performance of active leakage detection program

  Using performance indicators (Table 8-4), determine whether additional leak detection and repair crews are warranted. Add personnel and equipment and conduct additional training as necessary. Analyze the economic level of leakage, including a financial review of the costs of the leak detection and repair program and benefits from the reduction of leakage (e.g., reduced treatment and distribution costs, reduced number of emergency callouts and main breaks, etc.).

- Continue to plan, develop, and implement water loss recommendations from previous water audits and efficiency studies.

  Monitor and document milestones reached as the result of recommendations made in the Water Efficiency Study (Ref. 7), the internal City Auditor's Report (Ref. 8), and the Texas Water Development Board's Analysis of Water Loss (Ref. 9).

- Maximize advanced metering infrastructure (AMI) monitoring capabilities

  Plan, develop and implement methodologies to track long term consumption patterns of ICI financial rebate recipients.

- Leakage management software

  Evaluate, purchase, and implement leakage management software specifically designed to enhance leak detection efforts. Examples include ILMSS LEAKS Suite (Ref. 10) and Crowder Consulting's NETBASE Water Distribution Management Software (Ref. 11). This will improve cost-benefit analyses and targeting of leak detection and repair efforts and assist in pressure management.

<u>Enhance Apparent Loss Reduction</u>

Below are six elements of the enhanced apparent water loss reduction strategy:

- Dedicate water loss management analysts

  Dedicated water loss management analysts are important for the improved levels of review and data analysis necessary to find, trend, and correct discrepancies within the metering and billing systems.

- Evaluate meter volumes

  Improve meter accuracy by reviewing all residential meter volumes and changing out meters that have exceeded the warranty limits. There are a number of two-, 1.5-, one-, and ¾-inch meters with flow volumes in excess of the warranty limits (Figure 5-18). Target customers that use a volume of water that would exceed the meter warranty within five years for participation in DWU water conservation programs to help reduce their water use to within the normal range of the meter warranty. If this is not possible, conduct a meter-sizing analysis and replace the meter with a meter of appropriate size for the water use.

- Review accounts with either water or wastewater accounts

  Identify customers that are billed for water service and not for wastewater service (and vice versa), and verify that these customers do not receive both services. Correct any discrepancies that are identified. In a study conducted from 2004 to 2006 by Utility Revenue Management (Ref. 12), a number of accounts were found where customers were being billed for water, but not for wastewater.

- Evaluate misclassified accounts

  Evaluate and correct accounts with misclassified premise types. Update premise types as the water use associated with an account changes. One example would be to review the fireline classification, as more than fifty fireline accounts were found to have significant, regular monthly usage, which should not occur. These accounts should be reclassified, or the fireline meters should be removed and replaced with properly-sized retail meters. Another example would be to review the cross-tabulation of retail water use by premise type and customer type (Appendix A) for accounts with inappropriate combinations of premise type and customer type.

- Report on performance indicators

  Interface with all relevant DWU Divisions; collate, organize, and analyze all water loss data, including performance indicators (Table 8-4); and prepare performance reports that document water loss reduction.

- Identify unauthorized uses

  Conduct an analysis of theft of service and customers not currently receiving a correct bill. Initial review would include analysis of accounts that consistently read zero, identification of addresses with no service, etc.

Existing Strategies Selected for Evaluation of Additional Savings

Two water conservation strategies that have already been implemented are projected to lead to additional water savings during the next five years. Water savings from these measures have also been evaluated.

- DWU increased its leak detection budget by $652,000 in FY 2008-09 to increase the number of leak detection crew members from eight to fourteen and to purchase additional leak detection equipment.
- House Bill 2667 (Table 2-1) phases in a requirement by 2014 that all new toilets for sale in Texas be high-efficiency toilets (HETs) that use a maximum of 1.28 gallons per flush.

Existing Strategies Not Evaluated

In recent years, both the Texas Legislature and the federal government have promulgated significant water conservation legislation. A summary of recent Texas water conservation legislation is presented in Table 2-1. Examples of new federal rules include new standards for residential dishwasher and clothes washer water use.[38] With the exception of House Bill 2667, as discussed above, water savings from recent water conservation legislation have not been evaluated and are not included in the projected water savings in Chapter 9. However, it is expected that DWU will realize some additional water savings from the recent legislation.

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[38] The federal Energy Independence and Security Act of 2007 specified that "standard size" dishwashers manufactured on or after January 1, 2010 must not have water use of more than 6.5 gallons per cycle and that residential clothes washers manufactured on or after January 1, 2011 must not have water use of more than 9.5 gallons per cubic foot of washer capacity.

9. Detailed Evaluation of Selected Water Conservation Strategies

The detailed evaluation of the selected water conservation strategies considers DWU's water conservation goals for the next five years and probable water savings, benefits, costs, and feedback from wholesale customer cities and other stakeholders. Each of these topics is addressed in the following sections.

9.1. Water Conservation Goals

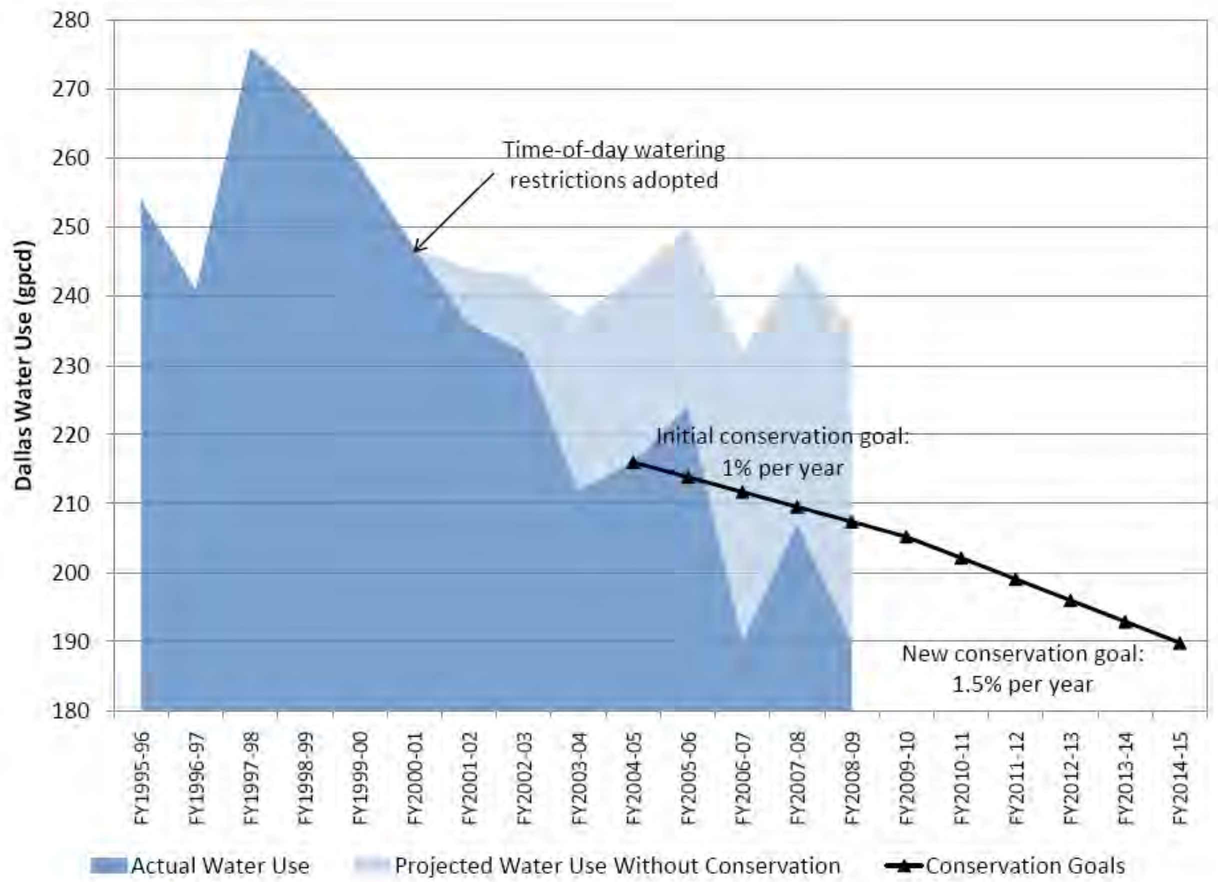
The goals of the Updated Strategic Plan are to:

- Develop and implement water conservation programs aimed at:
    - Reducing seasonal peak demands
    - Reducing water loss and waste
    - Decreasing per capita water use (gpcd)
- Continue a heightened public awareness of water conservation in Dallas and the North Texas region.
- Continue and enhance conservation practices that will maintain quality of life and allow economic growth and development.
- Continue to include broad-based public and private stakeholder groups (both English and Spanish- speaking) in new program development and implementation processes.
- Continue to lead by example by upgrading city facilities with water-efficient fixtures, landscapes, and irrigation systems wherever possible.
- Assist in facilitating regional conservation efforts among DWU wholesale customer cities and neighboring municipalities.
- Target an average 1.5 percent per year reduction in per capita consumption for the five-year planning period (Figure 9-1). This target is exclusive of any credit for indirect reuse diversion volumes (see Section 6.2).
- Establish the foundation for continuation of water savings targets for the following five-year period and succeeding five-year intervals.

With the exception of the per capita consumption goal, these were also the goals of the 2005 Strategic Plan.[39] The revised per capita consumption goal will affect the customer participation goals for the selected water conservation strategies, as discussed in the next sections.

[39] In the 2005 Strategic Plan, the per capita consumption goal was an average one percent per year reduction in overall per capita consumption for the five-year planning period.

Figure 9-1: Per Capita Water Consumption Goal, FY 2010-11 through FY 2014-15



9.2. Projected Water Savings

The water savings for the selected residential and ICI strategies and the water savings for selected water loss reduction strategies have been projected using different methods, as described below.

Projected Water Savings from Selected Residential and ICI Measures

The projected water savings for the selected residential and ICI strategies are based on water use for the target customers, the target customer market, the projected unit water savings, and other impacts. This information is presented in Table 9-1. Documentation for water savings assumptions and related impacts is presented in Appendix J.

Table 9-1: Target Customer Water Use, Target Customer Markets, and Projected Water Savings

Selected Water Conservation Strategies	Water Use: Indoor Water Use (gpad[a])	Water Use: Outdoor Water Use (gpad)	Target Market	Projected Water Savings: Indoor Savings (gpad)	Projected Water Savings: Outdoor Savings (gpad)	Projected Water Savings: Net Water Savings (gpad)	Impacts: Measure Life[b] (years)	Impacts: Annual Savings Decay[c]
Single-Family Residential Sector								
Voluntary Twice-Weekly Irrigation Schedule	188	98	All		2.0%	2.0	20	n/a
Water-Wise Landscape Design Requirements	188	98	New construction		25.0%	24.5	20	n/a
Residential Irrigation System Incentive	383	319	All, top 25 % priority		20.0%	63.8	10	5%
Enhanced Residential Toilet Incentive	188	98	Old toilets	22.0		22.0	25	n/a
Residential Clothes Washer Incentive	188	98	Old washers	19.3		19.3	12	0%
HB 2667 HET Law	188	98	All by 2014	8.4		8.4	25	n/a
Multi-Family Residential Sector								
Voluntary Twice-Weekly Irrigation Schedule	2,017	359	All		2.0%	7.2	20	n/a
Water-Wise Landscape Design Requirements	2,017	359	New construction		25.0%	89.8	20	n/a
Residential Irrigation System Incentive	7,780	1,417	All, top 25 % priority		20.0%	283.4	10	5%
Enhanced Residential Toilet Incentive	2,017	359	Old toilets	22.0		22.0	25	n/a
Residential Clothes Washer Incentive	2,017	359	Old washers	69.3		69.3	12	0%
HB 2667 HET Law	2,017	359	All by 2014	98.0		98.0	25	n/a
Industrial, Commercial, and Institutional (ICI) Sector								
Voluntary Twice-Weekly Irrigation Schedule	1,826	701	All		2.0%	12.6	20	n/a
ICI Water-Efficient Equipment Rule	1,826	701	New construction	15.0%		284.7	20	n/a
ICI Customer Water Audits	14,793	5,301	All, top 10% priority	15.0%	15.0%	3,014.1	10	15%
ICI Training Programs	14,793	5,301	All, top 10% priority	0.5%	0.5%	200.9	5	15%
ICI Business Partnership Program	70,627	39,661	Top 1%	0.5%	0.5%	1,102.9	5	15%
ICI Hospitality Program								
Hotels/Motels	9,685	4,045	All	4.0%		387.4	1	n/a
Restaurants	1,430	271	All	2.0%		28.6	1	n/a
ICI Financial Incentives								
Large Businesses	14,793	5,301	Top 10%	35.0%	35.0%	7,032.9	10	5%
Small-Medium Businesses	1,826	701	Small-medium	20.0%	20.0%	505.4	10	5%
Toilets	1,826	701	Old toilets	10.0%		189.8	25	n/a
HB 2667 HET Law	1,826	701	All by 2014	83.1		83.1	25	n/a

[a] gpad = gallons per account per day.

[b] Measure life is the number of years that the measure can be expected to yield water savings before it must be replaced due to normal product aging.

[c] Annual savings decay is the annual percentage of customers who are expected to remove a water-saving device or discontinue adherence to water efficiency practices.

Water Use and Unit Water Savings

In Table 9-1, the water use figures are the average indoor and outdoor water use by accounts in the target market. For example, the average indoor water use for all single-family residential accounts is 188 gallons per account per day (gpad). The twenty-five percent of single family accounts with the highest water demands have an average indoor water use of 383 gpad.

The projected water savings (Table 9-1) for each strategy are indoor and outdoor water savings goals for customer participants. The figures shown are based on the experience of other utilities and benchmark data. As such, they are estimates, and actual water savings will vary. Some customers will realize greater water savings, while others will realize less due to a number of variables that affect individual water use. Once each strategy is in operation, DWU staff should verify that customers are realizing the projected water savings. If they are not, the program should be reevaluated and revised goals should be established.

The net water savings (Table 9-1) are the water savings expected from the measure for customers that participate in the selected water conservation strategies. Most of the incentive-based and educational measures will apply to a relatively small number of customers who will be targeted for program participation according to their water savings potential.

Target Customer Markets

Most measures will be available to all customers, but some measures will be specifically targeted at high water users and new customers that have high water savings potential. For example, the Residential Irrigation System Incentive measure, which will provide an incentive for such measures as improved irrigation controllers and other irrigation system water efficiency improvements, will be available to all DWU customers. At the same time, water users in the top 25th percentile will be targeted more aggressively to engage their participation in the program because of their potential for higher water savings than the average customer. Similarly, high water-using customers are expected to be more interested in participating in the program since their potential for cost savings is also greater.

Several factors impact the projected water savings over time. Measure life is defined as the number of years that the measure can be expected to yield water savings before it must be replaced due to normal product aging (e.g., clothes washers typically last about twelve years before they are replaced). Annual savings decay refers to the annual percentage of customers who are expected to remove a water-saving device or discontinue adherence to water efficiency practices (e.g., removing a weather-based irrigation controller or no longer resetting an irrigation clock on a monthly basis as recommended during a customer audit).

Ordinances and rules have no decay adjustments because participation is mandatory. The water savings shown for these strategies incorporate the fact that there will not be full customer compliance. Annual savings decay factors are not shown for plumbing fixtures and appliances, because experience has shown virtually no removals due to customer dissatisfaction. Replacements of faulty equipment are assumed to have the same water use and efficiency features as the original product.

Program Participation

Program participants are DWU customers who can reasonably be expected to adopt the selected water conservation measures. Customer participation goals were set for each of the strategies based on a combination of factors, including:

- Participation levels achieved by other water utilities for similar programs,
- Net water savings per account for the strategy,
- The implementation schedule for each strategy,[40]
- Water savings required to meet the revised per capita consumption goal.

The projected number of customer participants must be achieved to realize the water savings projected for each measure (Table 9-2). The growing participation figures shown for the regulatory strategies (e.g., Water-Wise Landscape Design Requirements (new customers only), ICI Water-Efficient Equipment Rule (new customers only), and the HB 2667 HET Law (all new fixtures sold in Texas by 2014)) reflect phasing-in schedules associated with these strategies. The figures shown for other strategies represent the numbers of customers who must be successfully engaged by DWU to voluntarily adopt water efficiency strategies.

Participation goals for certain strategies were set in percentage terms and translated to numbers of accounts for Table 9-2. These participation goals vary by planning year and include the following ranges:

- Ten to thirty-five percent participation in the Voluntary Twice-Weekly Irrigation Schedule.
- Twenty-five to fifty percent participation associated with the Water-Wise Landscape Design Requirements and the ICI Water-Efficient Equipment Rule. This assumes phase-in of the requirements, along with customer education. This assumption will result in up to ninety-five percent compliance in later years (beyond the five-year planning period).
- Twenty to fifty percent participation in the ICI Hospitality Program by hotels, motels, and restaurants.

Lastly, the participation goals reflect the numbers of new customers and the numbers of existing customers who will add or replace toilets/urinals with high-efficiency fixtures in accordance with HB 2667.

[40] The recommended implementation schedule is presented in Chapter 10.

Table 9-2: Customer Participation Assumptions for Projected Water Savings

Selected Water Conservation Strategies	Projected Number of Participating Accounts/Incentives				
	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Single-Family Residential Sector					
Voluntary Twice-Weekly Irrigation Schedule	27,350	41,442	69,771	84,575	99,674
Water-Wise Landscape Design Requirements				709	1,432
Residential Irrigation System Incentive			125	900	2,000
Enhanced Residential Toilet Incentive	2,000	5,000	5,000	5,000	5,000
Residential Clothes Washer Incentive		188	367	500	1,100
HB 2667 HET Law	5,470	12,709	21,769	32,139	43,856
Multi-Family Residential Sector					
Voluntary Twice-Weekly Irrigation Schedule	2,419	3,665	6,170	7,480	8,815
Water-Wise Landscape Design Requirements				63	127
Residential Irrigation System Incentive			125	900	2,000
Enhanced Residential Toilet Incentive	2,000	6,000	6,000	6,000	6,000
Residential Clothes Washer Incentive		188	367	500	1,100
HB 2667 HET Law	484	1,124	1,925	2,842	3,878
Industrial, Commercial, and Institutional (ICI) Sector					
Voluntary Twice-Weekly Irrigation Schedule	2,849	4,317	7,268	8,810	10,383
ICI Water-Efficient Equipment Rule				74	149
ICI Customer Water Audits	49	75	100	100	100
ICI Training Programs			125	250	250
ICI Business Partnership Program		5	5	5	5
ICI Hospitality Program					
Hotels/Motels		51	78	105	132
Restaurants		368	557	751	948
ICI Financial Incentives					
Large Businesses		20	20	20	20
Small-Medium Businesses		50	75	75	75
Toilets		7,000	7,000	7,000	7,000
HB 2667 HET Law	1,425	2,302	4,652	7,342	10,383

[a] Participation for the ICI Business Partnership Strategy is shown in average number of meetings per year and not in numbers of accounts.

The number of participants shown in Table 9-2 does not contain adjustments for free riders or silent savers, due to the uncertainties in estimating their net effects. Free riders are customers who participate in an incentive-based water conservation strategy, such as the efficient clothes washer or HET rebate programs, but who would have purchased an efficient clothes washer or HET even if a rebate had not been available to defray the cost of the purchase. Silent savers are customers that adopt water efficiency measures but do not apply for available incentives. It is difficult to estimate reliably the number or percentage of free riders and silent savers for a given strategy. If free ridership is a significant concern for a particular measure, program participation rules can be tightened to minimize their impact.

Water Savings from Selected Residential and ICI Strategies

The projected water savings for the selected residential and ICI strategies (Table 9-3) are based on the unit water savings, target customer markets, program participation assumptions, measure life, and annual savings decay assumptions described in the previous sections.

Projected Water Savings from Selected Water Loss Measures

All of the projected water savings for the selected water loss measures will come from the Enhanced Real Loss Reduction strategy and from the increased capacity (due to the FY 2008-09 budget increase) of existing real loss reduction efforts. Although reduction of apparent losses recovers revenue for the utility, it does not reduce water use.

As discussed in Section 5.6, DWU's estimated ILI has varied between 3.4 and 6.0 (Table 5-17), with an average of 4.8. It is recommended that DWU maintain a maximum ILI of 3.0, as this is the maximum recommended ILI for municipalities with requirements for new sources in the near future (Ref. 48). Based on experience with other utilities, the consultant team projected the water savings from the selected water loss reduction strategies (Table 9-3). The projected real loss reduction of 12.45 mgd by FY 2014-15 corresponds to a reduction in ILI from 4.8 to 2.8.

Long-Term Implications of Projected Savings

The water savings from the selected strategies are expected to continue beyond the five-year implementation of the Updated Strategic Plan, even if no additional funding is provided for these strategies after FY 2014-15. The incentive-based and educational programs implemented during the five-year planning period will continue to produce water savings beyond FY 2014-15 for some additional years depending on the measure life (e.g., the water savings for the high efficiency clothes washer rebate program has a twelve year life for each washer that is installed) and the annual decay assumptions. In addition, water savings from ordinance-related measures will continue to grow along with the growing population. Assuming that all of the selected strategies are implemented as described in this chapter, it is projected that the measures implemented during the five-year planning period will save a total of approximately 99.6 billion gallons over the next twenty years (Appendix K).

Table 9-3: Projected Water Savings from Selected Strategies

Selected Water Conservation Strategies	Projected Water Savings (gal/day)				
	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Single-Family Residential Sector					
Voluntary Twice-Weekly Irrigation Schedule	53,606	81,225	136,751	165,768	195,360
Water-Wise Landscape Design Requirements				17,362	52,440
Residential Irrigation System Incentive			7,975	64,996	189,327
Enhanced Residential Toilet Incentive	43,930	153,755	263,580	373,405	483,230
Residential Clothes Washer Incentive		3,618	10,690	20,338	41,563
HB 2667 HET Law	46,003	106,881	183,074	270,286	368,833
Single-Family Residential Subtotal	***143,538***	***345,479***	***602,070***	***912,155***	***1,330,753***
Multi-Family Residential Sector					
Voluntary Twice-Weekly Irrigation Schedule	17,366	26,314	44,302	53,704	63,290
Water-Wise Landscape Design Requirements				5,625	16,989
Residential Irrigation System Incentive			35,425	288,714	840,990
Enhanced Residential Toilet Incentive	43,930	175,720	307,510	439,300	571,090
Residential Clothes Washer Incentive		13,002	38,416	73,087	149,364
HB 2667 HET Law	47,416	110,166	188,700	278,597	380,170
Multi-Family Residential Subtotal	***108,712***	***325,202***	***614,353***	***1,139,026***	***2,021,891***
Industrial, Commercial, and Institutional (ICI) Sector					
Voluntary Twice-Weekly Irrigation Schedule	39,944	60,524	101,897	123,522	145,571
ICI Water-Efficient Equipment Rule				20,220	40,851
ICI Customer Water Audits	147,691	351,595	596,943	797,079	952,003
ICI Training Programs			25,118	71,585	110,517
ICI Business Partnership Program		5,514	10,202	14,062	17,095
ICI Hospitality Program					
Hotels/Motels		19,912	30,101	40,600	51,137
Restaurants		10,519	15,942	21,473	27,113
ICI Financial Incentives					
Large Businesses		140,658	274,283	400,875	520,435
Small-Medium Businesses		25,270	61,912	96,658	129,509
Toilets		1,278,200	2,556,400	3,834,600	5,112,800
HB 2667 HET Law	118,437	191,422	386,727	610,414	863,251
ICI Subtotal	***306,072***	***2,083,614***	***4,059,524***	***6,031,087***	***7,970,281***

Table 9-3 Continued: Projected Water Savings from Selected Strategies

Selected Water Conservation Strategies	Projected Water Savings (gal/day)				
	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Enhanced Real Loss Reduction					
Develop and track water loss performance indicators	100,000	250,000	300,000	350,000	400,000
Improve validation of water loss performance data	100,000	100,000	200,000	300,000	400,000
Assess and enhance performance of active leakage detection program	700,000	1,200,000	1,800,000	3,300,000	5,850,000
Continue to plan, develop, and implement water loss recommendation from previous water audits and efficiency studies	n/a	n/a	n/a	n/a	n/a
Maximize advanced metering infrastructure (AMI) monitoring capabilities	n/a	n/a	n/a	n/a	n/a
Leakage management software	100,000	200,000	400,000	600,000	800,000
Enhanced Real Loss Reduction Subtotal	***1,000,000***	***1,750,000***	***2,700,000***	***4,550,000***	***7,450,000***
Additional Savings - Existing Real Loss Program	***2,000,000***	***2,500,000***	***3,500,000***	***4,500,000***	***5,000,000***
Total Projected Water Savings	**3,558,322**	**7,004,295**	**11,475,947**	**17,132,268**	**23,772,925**

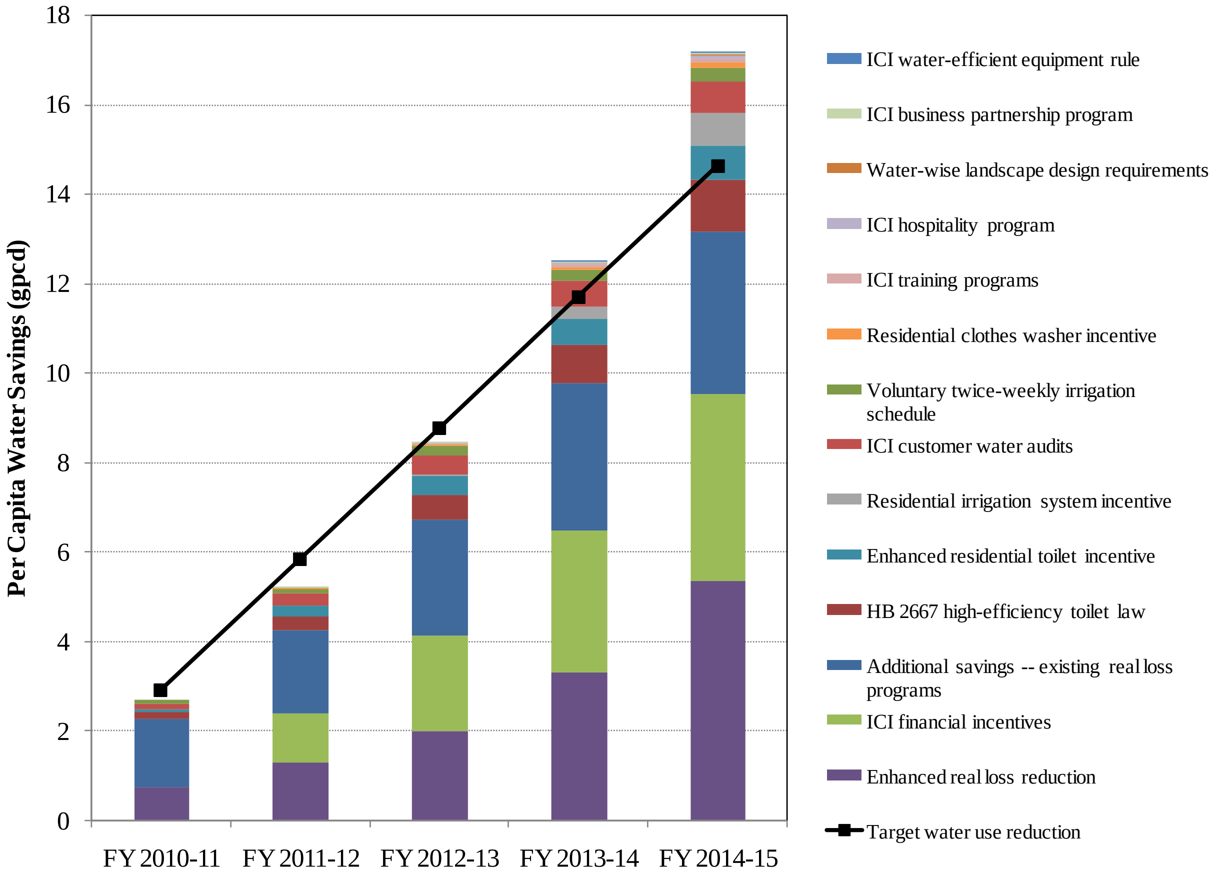
"N/a" means that savings were not projected for this component.

The projected water savings are based on the unit water savings, target customer markets, measure life, annual savings decay, and program participation assumptions described in Tables 9-1and 9-2.

Projected Per Capita Water Savings

Figure 9-2 shows the conversion of the projected savings in mgd (Table 9-3) to per capita water savings by selected water conservation strategy, ordered from greatest projected savings to least. The selected strategies are projected to achieve the target per capita water use reduction (an average of 1.5 percent per year) by the last two years of the planning period. The three most important strategies to achieving the savings goal are enhanced real loss reduction, ICI financial incentives, and additional savings from existing real loss programs.

Figure 9-2: Projected Per Capita Water Savings from Selected Strategies



The projected water savings are based on the unit water savings, target customer markets, measure life, annual savings decay, and program participation assumptions described in Tables 9-1and 9-2.

9.3. Probable Benefits

Water conservation has both economic and non-economic benefits. Water conservation:

- Extends the life of existing water supplies and delays the need to develop expensive future water supplies (Table 4-4). Costs associated with developing new water supplies (or purchasing new water) can include capital costs for construction of reservoirs, pumping facilities, pipelines, treatment plants, water storage, and related facilities; costs of obtaining water rights and permits; and operation and maintenance (O&M) costs such as labor, energy, and chemicals.

- Reduces peak requirements, extending the life of existing infrastructure. Water system infrastructure is sized to meet peak demands. When peak demands are reduced through water conservation, the need for infrastructure expansion is delayed.
- Lowers capital and operating costs of the existing system. Deferral of new water supply development or infrastructure expansion allows the utility to avoid associated capital costs. In addition, operational costs, such as power and chemicals, are reduced.
- Positions the city to obtain future water rights. In the Long Range Water Supply Plan (Ref. 3) and in the 2011 Region C Initially Prepared Plan (Ref. 4), Dallas has identified future water sources that would involve interbasin transfer of raw water. An interbasin transfer authorization requires that the applicant "has developed and implemented a water conservation plan that will result in the highest practicable levels of water conservation and efficiency achievable within the jurisdiction of the applicant" (Ref. 5).
- Other benefits include positive environmental effects, improved customer good will, continued growth and economic development, a reduction of Dallas's carbon footprint, and a positive image of Dallas.

Typically, capital costs are developed for specific projects in specific locations. However, probable water savings have been developed for the city as a whole and not for specific locations in the water system. Therefore, the avoided capital costs are difficult to quantify. In addition, other avoided capital costs are somewhat speculative, since not all decisions have been made about future water supplies for Dallas. Therefore, the benefit evaluation described in this section includes only avoided O&M costs.

According to DWU staff, the marginal O&M cost for water delivery is $634 per million gallons (mg), and the marginal O&M cost for wastewater service is $640 per mg.[41] Some strategies (e.g., residential irrigation system incentives) only reduce water O&M costs, because irrigation does not return flow to the wastewater system. Other strategies (e.g., enhanced residential toilet incentives) reduce both water and wastewater O&M costs.

For most of the selected strategies, the opinion of probable economic benefit for a given strategy is simply the projected water savings from Section 9.2 multiplied by the avoided O&M costs. The exception is the Enhanced Apparent Loss Reduction strategy, which does not reduce water usage. Instead, enhanced apparent loss reduction would enable the utility to generate revenue for water that has been used but for which the utility has not been compensated.

[41] 2010 dollars. Avoided O&M costs are assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). Historical average inflation rate calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

As discussed in Section 5.6, DWU's apparent losses have varied from 27 to 32 gal/conn/day in recent years (Table 5-17), with an average of 30.2 gal/conn/day. Based on experience with other utilities, the consultant team projected the additional billed water from each component of the Enhanced Apparent Loss Reduction strategy (Table 9-4). The additional billed water is projected to amount to 3.85 mgd by FY 2014-15, or 9.3 gal/conn/day. It was assumed that this water would be billed at an average rate of $2.76 per thousand gallons (Table 3-2).[42]

The opinion of probable economic benefit from the selected water conservation strategies is about $13 million per year by FY 2014-15 (Figure 9-3). The three measures that contribute the most benefits are enhanced apparent loss reduction, ICI financial incentives, and enhanced real loss reduction. Assuming that all of the selected strategies are implemented as described in this chapter, the opinion of probable economic benefit for the measures implemented during the five-year planning period is approximately $157.9 million over the next twenty years.

9.4. Probable Costs

In the following sections, unit cost assumptions are described and opinions of probable cost for the selected water conservation strategies are presented. Conservation strategy costs typically include:

- Marketing and public education materials and campaigns
- Hardware devices (e.g., giveaways or free installation of small retrofit devices, pre-rinse spray valves, hose shutoffs, etc.)
- Incentive fees for rebate and bill credit programs
- Staff or contractor labor
- Equipment, materials, and training (especially for leak detection and repair)

Unit Cost Assumptions for Selected Residential and ICI Strategies

Unit cost assumptions for the selected residential and water conservation strategies are presented in Table 9-5. Documentation for the unit cost assumptions is provided in Appendix L. The "Incentive/Audit" amount is the projected amount of the financial incentive to the customer for each measure (e.g., per toilet, per clothes washer, etc.). The "Labor" amount is the probable labor cost for each measure for either DWU staff or a contractor to provide the incentive, training, or audit.

The primary sources of information used to develop the unit costs include recent Water Conservation Division and Operations Division budgets, reported unit costs at other water utilities, and unit cost assumptions in the Alliance for Water Efficiency Water Conservation Tracking Tool (Ref. 6).

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[42] 2009 dollars. The average water rate is assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). Historical average inflation rate calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

Table 9-4: Projected Additional Billed Water Use from Enhanced Apparent Loss Reduction

Selected Water Conservation Strategies	Projected Additional Billed Water Use (gal/day)				
	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Dedicate water loss management analysts	100,000	250,000	500,000	1,500,000	2,500,000
Evaluate meter volumes	100,000	250,000	250,000	500,000	750,000
Review accounts with either water or wastewater accounts	100,000	100,000	100,000	100,000	100,000
Evaluate misclassified accounts	250,000	250,000	500,000	500,000	500,000
Report on performance indicators	n/a	n/a	n/a	n/a	n/a
Identify unauthorized uses	n/a	n/a	n/a	n/a	n/a
Total	**550,000**	**850,000**	**1,350,000**	**2,600,000**	**3,850,000**

"n/a" means that additional billed water was not projected for this component.

Figure 9-3: Opinions of Probable Economic Benefit from Selected Strategies

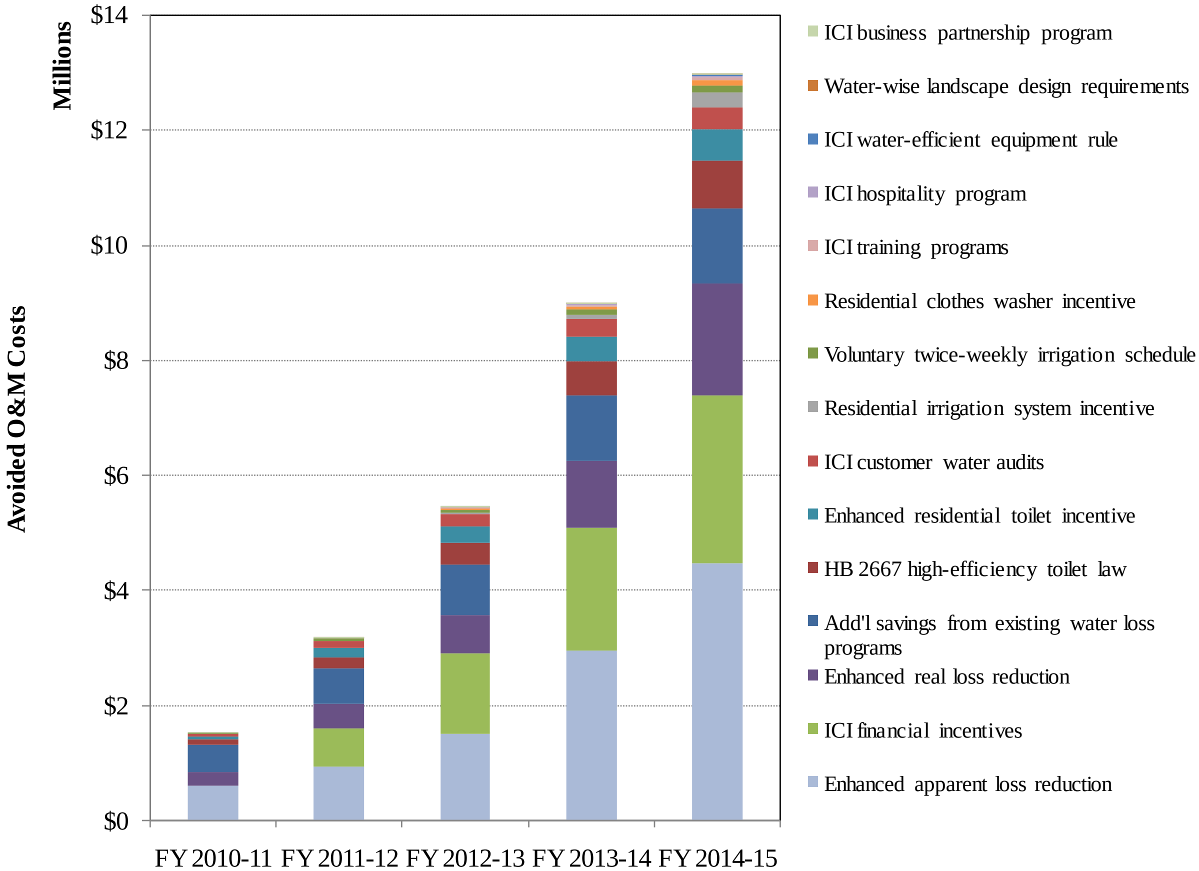


Table 9-5: Unit Cost Assumptions for Selected Residential and ICI Strategies

Selected Water Conservation Strategies	Unit Cost Assumptions ($/measure)		
	Incentive	**Labor**	**Combined**
Single-Family Residential			
Voluntary Twice-Weekly Irrigation Schedule	-	-	-
Water-Wise Landscape Design Requirements	-	-	-
Residential Irrigation System Incentive	$200	$106	$306
Enhanced Residential Toilet Incentive	$100	$30	$130
Residential Clothes Washer Incentive	$100	$20	$120
HB 2667 HET Law	-	-	-
Multi-Family Residential			
Voluntary Twice-Weekly Irrigation Schedule	-	-	-
Water-Wise Landscape Design Requirements	-	-	-
Residential Irrigation System Incentive	$200	$198	$398
Enhanced Residential Toilet Incentive	$100	$30	$130
Residential Clothes Washer Incentive	$250	$20	$270
HB 2667 HET Law	-	-	-
Industrial, Commercial, and Institutional (ICI)			
Voluntary Twice-Weekly Irrigation Schedule	-	-	-
ICI Water-Efficient Equipment Rule	-	-	-
ICI Customer Water Audits	-	$1,000	$1,000
ICI Training Programs	-	$5,000	$5,000
ICI Business Partnership Program	-	-	-
ICI Hospitality Program	-	-	-
Hotels/Motels	n/a	n/a	n/a
Restaurants	n/a	n/a	n/a
ICI Financial Incentives	-	-	-
Large Businesses	Up to $100,000 combined		Up to $100,000
Small-Medium Businesses	$500	$141	$641
Toilets	$100	$30	$130
HB 2667 HET Law	-	-	-

"n/a" means that no itemization of costs between rebates and labor was estimated.

"-" means that the measure will be implemented without cost to the utility or will be performed by existing Water Conservation Division staff.

Costs shown in 2010 dollars.

Probable Costs

Opinions of probable cost for the selected water conservation strategies are presented in Table 9-6. The opinions of probable cost for most of the residential and ICI strategies are based on the program participation assumptions (Table 9-2) and the unit cost assumptions (Table 9-5). Opinions of probable cost for other strategies were developed based on experience with other utilities. Opinions of probable cost were adjusted for inflation using the same rates as discussed in Section 9.3. By FY 2014-15, the total opinion of probable cost for the selected strategies is about $10.19 million per year.

Table 9-6: Opinions of Probable Cost for Selected Strategies

Selected Water Conservation Strategies	Opinion of Probable Cost				
	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Single-Family Residential Sector					
Voluntary Twice-Weekly Irrigation Schedule	-	-	-	-	-
Water-Wise Landscape Design Requirements	-	-	$45,200	$46,200	$47,300
Residential Irrigation System Incentive	-	$42,100	$41,000	$302,000	$686,900
Enhanced Residential Toilet Incentive[a]	$275,385	$686,300	$702,500	$719,000	$735,900
Residential Clothes Washer Incentive	-	$23,600	$47,200	$65,800	$148,300
HB 2667 HET Law	-	-	-	-	-
Single-Family Residential Subtotal	***$275,385***	***$752,000***	***$835,900***	***$1,133,000***	***$1,618,400***
Multi-Family Residential Sector					
Voluntary Twice-Weekly Irrigation Schedule	-	-	-	-	-
Water-Wise Landscape Design Requirements	-	-	$45,100	$46,200	$47,300
Residential Irrigation System Incentive	-	-	$53,300	$393,100	$894,000
Enhanced Residential Toilet Incentive[a]	$275,385	$822,000	$841,300	$861,100	$881,300
Residential Clothes Washer Incentive	-	$53,000	$106,100	$148,200	$333,600
HB 2667 HET Law	-	-	-	-	-
Multi-Family Residential Subtotal	***$275,385***	***$875,000***	***$1,045,800***	***$1,448,600***	***$2,156,200***
Industrial, Commercial, and Institutional (ICI) Sector					
Voluntary Twice-Weekly Irrigation Schedule	-	-	-	-	-
ICI Water-Efficient Equipment Rule	-	-	-	-	-
ICI Customer Water Audits[b]	$101,100	$104,800	$107,200	$109,700	$112,300
ICI Training Programs	$25,600	$26,200	$26,800	$27,400	$28,100
ICI Business Partnership Program	-	-	-	-	-
ICI Hospitality Program	$50,000	$102,400	$104,800	$107,200	$109,700
ICI Financial Incentives					
Large Businesses	$500,000	$2,000,000	$2,000,000	$2,000,000	$2,000,000
Small-Medium Businesses	-	$33,600	$51,600	$52,800	$54,000
Toilets	-	$949,600	$972,000	$994,800	$1,018,200
HB 2667 HET Law	-	-	-	-	-
ICI Subtotal	***$676,700***	***$3,216,600***	***$3,262,400***	***$3,291,900***	***$3,322,300***

Table 9-6 Continued: Opinions of Probable Cost for Selected Strategies

Selected Water Conservation Strategies	Opinion of Probable Cost				
	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Enhanced Real Loss Reduction					
Develop and track water loss performance indicators	$50,000	$51,200	$52,400	$53,600	$54,900
Improve validation of water loss performance data	$250,000	$511,800	$523,800	$536,100	$548,700
Assess and enhance performance of active leakage detection program					
▪ Field staff -- leak detection. Eight technicians by FY 2014-15 ($55,000 per FTE).	$110,000	$225,200	$230,500	$471,800	$482,900
▪ Training on new equipment, training updates	$40,000	$30,000	$30,000	$30,000	$30,000
▪ Field staff -- leak repairs. Four-man, turn-key repair crews for increased workload generated by enhanced leak detection program. Two crews by FY 2014-15 ($45,000 per FTE).	$45,000	$184,200	$235,700	$386,000	$395,100
▪ Additional equipment for new leak repair crews (including repair truck, dump truck, truck and trailer, backhoe tractor, air compressor, tools and materials). For each crew: initial equipment purchase: $400,000; initial stocking of materials and tools: $200,000.	$600,000	$70,000	$670,000	$140,000	$140,000
▪ Leak detection equipment: correlating loggers and associated equipment	-	$50,000	-	$50,000	-
▪ Leak detection equipment: ground microphones	-	-	$20,000	$20,000	-
▪ Leak detection equipment: correlator	-	-	$30,000	-	$30,000
▪ Additional equipment for new technicians as others become outdated (including vehicles, leak detection equipment, line locators, probe rods, tools, etc.).	-	-	-	$80,000	$104,000
Continue to plan, develop, and implement water loss recommendation from previous water audits and efficiency studies	$25,000	$25,600	$26,200	$26,800	$27,400
Maximize advanced metering infrastructure (AMI) monitoring capabilities	$100,000	$102,400	$104,800	$107,300	$109,800
Leakage management software	$15,000	$25,000	$35,000	$50,000	$50,000
Enhanced Real Loss Reduction Subtotal	***$1,235,000***	***$1,275,400***	***$1,958,400***	***$1,951,600***	***$1,972,800***
Additional Savings - Existing Real Loss Program [c]	***$683,000***	***$699,100***	***$715,500***	***$732,300***	***$749,600***

Table 9-6 Continued: Opinions of Probable Cost for Selected Strategies

Selected Water Conservation Strategies	Opinion of Probable Cost				
	FY 2010-11	**FY 2011-12**	**FY 2012-13**	**FY 2013-14**	**FY 2014-15**
Enhanced Apparent Loss Reduction					
Dedicate water loss management analysts ▪ Review accounts with either water or wastewater service ▪ Evaluate misclassified accounts ▪ Report on performance indicators ▪ Identify unauthorized uses ▪ Resolve billing data issues ▪ Other tasks	$95,000	$97,200	$99,500	$203,700	$208,500
Evaluate meter volumes	$150,000	$153,500	$157,100	$160,800	$164,600
Enhanced Apparent Loss Reduction Subtotal	***$245,000***	***$250,700***	***$256,600***	***$364,500***	***$373,100***
Total Opinion of Probable Cost	**$3,390,470**	**$7,068,800**	**$8,074,600**	**$8,921,900**	**$10,192,400**

[a] Selected strategy currently budgeted at $275,385 per year as part of the New Throne for Your Home program in the Water Conservation Division. Increased budget authorization will be necessary for amounts in excess of $275,385 per year (after adjustment for inflation).

[b] Selected strategy currently budgeted at approximately $75,510 per year as part of the Cooling Tower Audit program in the Water Conservation Division. Increased budget authorization will be necessary for amounts in excess of $75,510 per year (after adjustment for inflation).

[c] Selected strategy currently budgeted as part of the Leak Detection Program in the Operations Division. No increased budget authorization will be necessary for this selected strategy.

"-" means that the measure will be implemented without cost to the utility or will be performed by existing Water Conservation Division staff.

It is projected that if DWU does not spend the amounts shown in Table 9-6, then it will not realize the projected water savings shown in Table 9-3. However, there is an important difference between these opinions of probable cost and the recommended budgets presented in Section 10.4. Several of these strategies are already funded to a certain level in the existing DWU budget. To the degree to which they are currently funded, these strategies do not require an increased budget authorization. The strategies that are wholly or partially funded in the existing DWU budget are:

- The Enhanced Residential Toilet Incentive is currently budgeted at approximately $550,770 per year as part of the New Throne for Your Home program in the Water Conservation Division. In Table 9-6, this budget has been split equally between the single-family and multi-family residential sectors. Increased budget authorization will be necessary for amounts in excess of $550,770 per year (after adjustment for inflation).
- The ICI Customer Water Audit strategy is currently budgeted at approximately $75,510 per year as part of the Cooling Tower Audit program in the Water Conservation Division. Increased budget authorization will be necessary for amounts in excess of $75,510 per year (after adjustment for inflation).
- Costs associated with Additional Savings from the Existing Real Loss Program are currently budgeted as part of the Leak Detection Program in the Operations Division. No increased budget authorization will be necessary for this strategy.

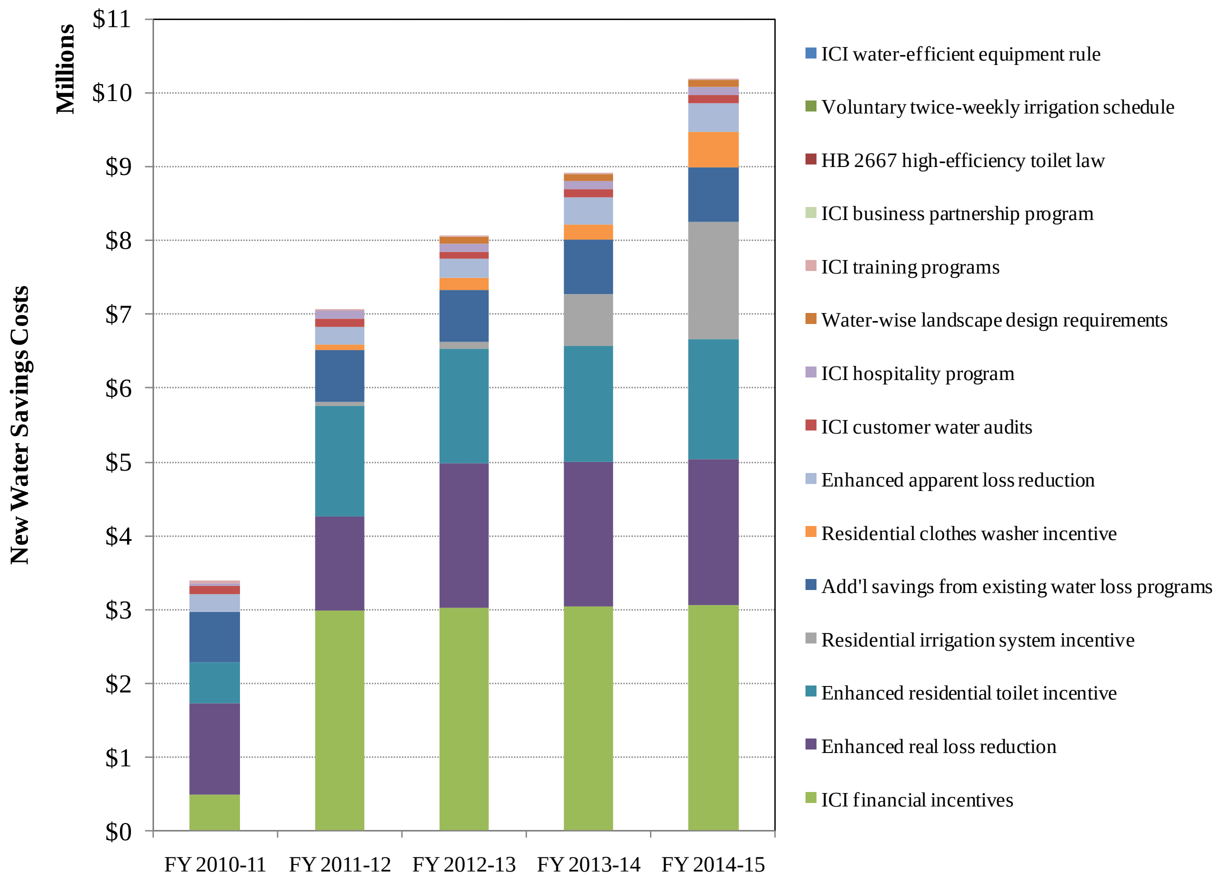
Each of the remaining selected strategies will require an increased budget authorization according to the opinions of probable cost shown in Table 9-6.

Some of the recommended water conservation strategies require no additional DWU labor (e.g., voluntary twice weekly irrigation schedule). However, some of the recommended measures will require staff time for employees of other city departments. For example, under the recommended ICI water-efficient equipment rule, DWU would collaborate with the city’s Building Inspection Office to verify installation of water efficiency measures prior to occupancy. Additional staff time for employees of city departments other than DWU is not included in the opinions of probable cost.

The opinions of probable cost are presented in Figure 9-4 in order of probable strategy costs, from greatest cost to least cost. By FY 2014-15, the measures with an opinion of probable cost greater than $1 million per year are ICI financial incentives, enhanced real loss reduction, the enhanced residential toilet incentive, and the residential irrigation system incentive.

Assuming that all of the selected strategies are implemented as described in this chapter, the opinion of probable cost over the next twenty years for the measures implemented during the five-year planning period is approximately $37.6 million (the costs would actually be incurred during the first five years). Comparing the twenty-year opinion of probable cost to the projected twenty-year water savings gives an opinion of probable unit cost for the water savings of about $0.38 per thousand gallons. If the HB 2667 HET Law is excluded from the unit cost analysis, the twenty-year opinion of probable unit cost is $0.53 per thousand gallons. These opinions of probable unit cost are less than the pre-amortized unit costs of raw water from the other potential water supplies for which unit costs are available (Table 4-4), even without accounting for water treatment and distribution costs or the probable benefits from the conserved water (Section 9.3).

Figure 9-4: Opinions of Probable Cost for Selected Strategies

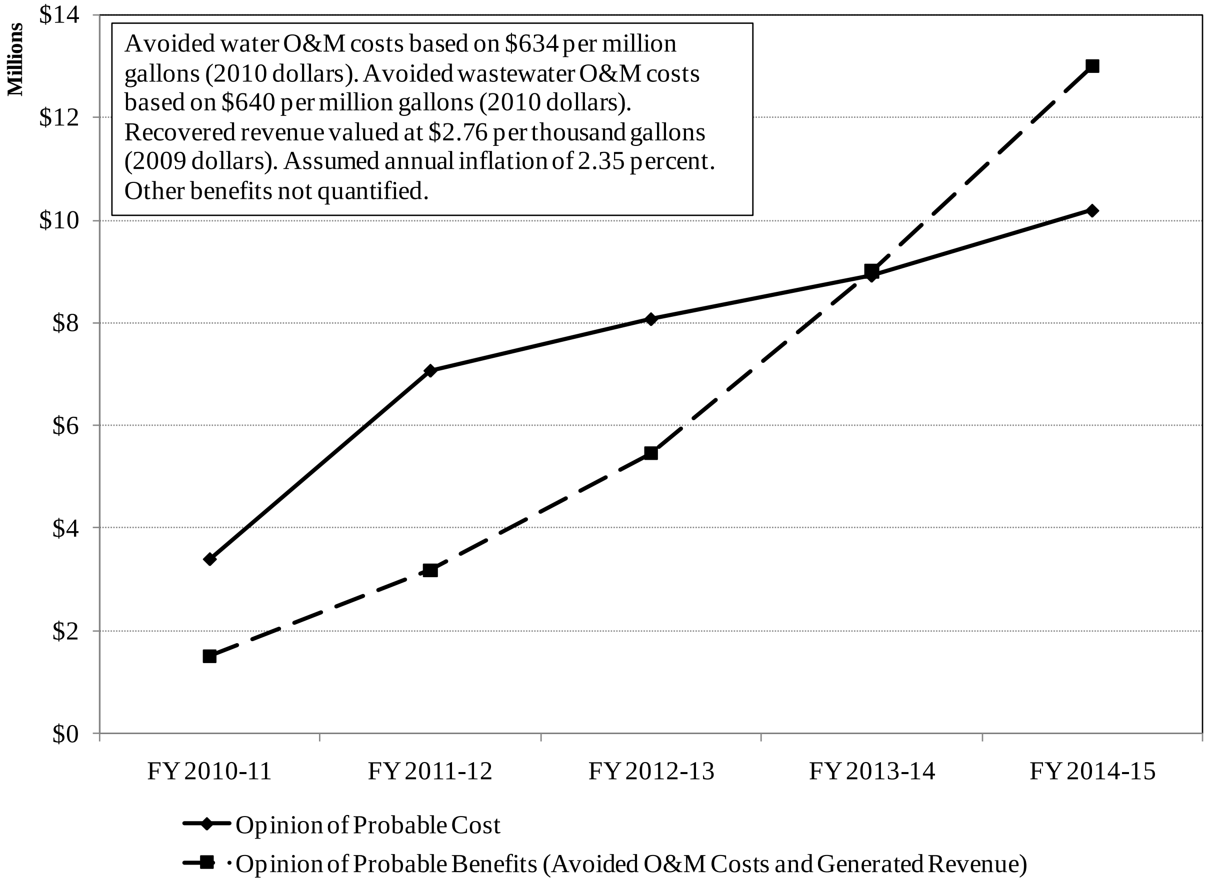


There is another potential cost to DWU customers. Without increasing water rates, the projected water conservation savings would cause DWU to lose revenue in the amount of the fixed costs associated with the saved water. Therefore, it may become necessary for DWU to increase water rates to pay for fixed water production costs. Analysis of this cost to the consumer would require a water rate study. Since no rate study was performed as part of the Updated Strategic Plan development, the impact of increasing water rates was not considered in the cost analysis.

9.5. Benefit-Cost Analysis

For the five-year planning period, probable benefits and probable costs are compared for the selected strategies in Figure 9-5. By FY 2013-14, the probable economic benefit from avoided O&M costs and from generated revenue is projected to exceed the probable cost of implementing the selected strategies.

Figure 9-5: Opinions of Probable Economic Benefit and Probable Cost for Selected Strategies



Assuming that all of the selected strategies are implemented as described in this chapter, the opinion of probable net economic benefit (probable economic benefit minus probable cost) is approximately $120.3 million over the next twenty years.

There may be additional benefits (e.g., avoided capital costs) and additional costs (e.g., increases in water rates) that have not been considered in the benefit-cost analysis.

9.6. Input from Wholesale Customer Cities and Stakeholders

Three public meetings were held during development of the Updated Strategic Plan to obtain input from wholesale customer cities and other stakeholders:

- Wholesale customer city meeting held on April 29, 2010,
- Dallas Sierra Club presentation held on May 11, 2010, and
- ICI customer meeting held on May 18, 2010.

These groups are expected to be an important part of the expanded water conservation efforts. Active stakeholder participation will help maintain relationships within the interest groups and encourage public participation in water conservation. The wholesale customers represent a significant portion of the DWU water system, and their share of overall water use is projected to increase over time to approximately fifty percent (Ref. 3). As summarized below, each group provided feedback that DWU will consider as part of implementation of the Updated Strategic Plan or for future updates to the Plan. Meeting notes and written feedback from meeting attendees are presented in Appendix M.

Stakeholder Meeting 1: Wholesale Customers

DWU invited all wholesale customers to this meeting, and representatives from twelve wholesale customers attended. DWU staff presented information about the Updated Strategic Plan and the state-required Water Conservation and Drought Contingency Plans.[43] Major elements of the presentation included:

- DWU water conservation accomplishments during the last five years
- Cooperative water conservation efforts with the wholesale customers
- Recommended new water conservation strategies
- Projected water savings and costs for the new strategies
- A timeline for completion of the Water Conservation Plan
- Potential changes to the Drought Contingency Plan

All wholesale customer comments and suggestions were related to the Drought Contingency Plan.

Stakeholder Meeting 2: Dallas Sierra Club

DWU staff made a presentation regarding the Updated Strategic Plan at a monthly meeting of the Dallas Sierra Club. Major elements of the presentation included:

- DWU water conservation accomplishments during the last five years
- Recommended new water conservation strategies
- Projected water savings, costs, budgets, and staffing for the new strategies

Dallas Sierra Club members asked several questions regarding Dallas water use, rebate programs, large water-using customers, and how to report irrigation water waste. One member suggested that DWU investigate limiting irrigation in neighborhoods that are governed by homeowner's associations.

Stakeholder Meeting 3: ICI Customers

DWU invited its top high-volume ICI customers to this meeting. Forty-nine people attended, representing thirty-six different entities. DWU staff made a presentation about the Updated

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[43] The state-required Water Conservation and Drought Contingency Plans are being updated contemporaneously with the Updated Strategic Plan.

Strategic Plan that was similar to the Dallas Sierra Club presentation. The attendees asked numerous questions about the reasons behind Dallas's declining water use, which conservation measure has had the greatest impact, how DWU is targeting outdoor water use, whether water rates will increase due to conservation measures, whether DWU has reuse plans, and other topics (see the meeting notes in Appendix M).

Ideas for improving the water conservation program included:

- Printing average water use by neighborhood on water bills
- Submetering (separate meters) for irrigation systems
- Recycling old toilets that have been replaced
- Integrated storm water management – the capture and use of storm water for irrigation
- Programs that have been successful in other cities: rebates and subsidies, irrigation controller exchange programs ("smart" for "dumb"), irrigation efficiency codes, auditing programs, and tracking services (monitoring a customer's irrigation use or providing an email with weekly irrigation needs)

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10. Recommended Implementation Plan, FY 2010-11 through FY 2014-15

The Updated Strategic Plan is designed to provide the next steps in a long-range, disciplined approach to water conservation. Benefits of this approach include extending the life of existing water supplies, reducing peak infrastructure requirements, avoiding certain capital and operating costs, encouraging citizens and customers to use water wisely, and positioning the city to obtain future water rights. The numerical goal of the Updated Strategic Plan is to reduce per capita consumption by an average of 1.5 percent per year during the five-year planning period (Figure 9-1).[44]

While significant analysis and efforts have gone into development of the Updated Strategic Plan, the Plan should be reassessed annually to make sure that Dallas is achieving its water conservation goals, to revamp programs if necessary, and to take advantage of new water conservation opportunities, such as federal or state funding for water conservation. The overall conservation program should be flexible, allowing strategies to be adjusted based on continued feasibility and support of goals, feedback from stakeholders and focus groups, and public participation or interest.

As described in the following sections, the recommended implementation plan consists of new or enhanced water conservation strategies, detailed action schedules, DWU staff increases, and budgets.

10.1. Recommended Water Conservation Strategies

Considering how effective DWU's water conservation program has been over the last several years (Figure 5-7), all of the water conservation strategies presently employed by DWU (described in Chapter 7) are recommended for continuation or enhancement under the Updated Strategic Plan.

In addition, it is recommended that DWU implement each of the strategies that were evaluated in detail (as described in Section 8.2 and Table 8-2) during the next five years. It is projected that these new or enhanced strategies will enable DWU to meet its water conservation goals, will be less expensive than other water supply alternatives, and will provide positive net economic benefits over the next twenty years. These strategies may be grouped into three major elements of the Plan:

- City Leadership and Commitment
- Education and Outreach Initiatives
- Rebate and Incentive Programs

[44] Other goals are presented in Section 9.1.

All elements are important for reaching the stated goals and have been designed to provide a well-balanced water conservation program.

Recommended water conservation strategies associated with each element are described below. Based on the selection criteria, the detailed evaluation of projected water savings and probable costs, and input from wholesale customers and stakeholder groups, the recommended strategies are the most suitable strategies for DWU implementation during the next five years. However, DWU should reconsider other strategies, such as those in Appendix H, during the next update to the Strategic Plan.

City Leadership and Commitment

Strategies within the City Leadership and Commitment element demonstrate a strong commitment to water conservation; in other words, the city "leads by example." The visible efforts and actions of the City of Dallas with respect to its own water use will be the best example of the city's commitment to water conservation. Positive efforts and actions conducted by the city will impact others and encourage like-mindedness in water conservation, not only by DWU customers, but also by others throughout the region. Water conservation leadership includes adopting and promoting water conservation practices at city facilities and continuing and enhancing water conservation-oriented ordinances and policies. Recommended water conservation strategies within the City Leadership and Commitment element are presented in Table 10-1. Projected water savings from the recommended City Leadership and Commitment strategies are presented in Table 9-3.

Education and Outreach Initiatives

The goal of Education and Outreach Initiatives is to maintain a heightened public awareness of water conservation in Dallas and the surrounding region and to reduce water use and waste by changing customer behavior. DWU should continue to aggressively pursue cooperation and input from stakeholder groups, brainstorm with stakeholders to develop and refine specific programs, and disseminate the message of water conservation to their particular constituencies.

The sustainability of an effective water conservation program is directly impacted by the cooperative spirit and active participation of all customers. Education of the public, especially school-age children, sets the groundwork for long-term water conservation awareness and wise water-use practices. Absent a continuous program of public awareness and outreach, any gains in water conservation will be eroded and over time will be substantially lost. The elements of education and outreach must be continued indefinitely in order to maintain long-term water savings. Recommended water conservation strategies within the Education and Outreach Initiatives element are presented in Table 10-2.

Table 10-1: Recommended Water Conservation Strategies: City Leadership and Commitment Element

Strategy	Description
Enhanced Real Loss Reduction	Enhanced real loss reduction includes several recommended elements, as described below. This strategy will help DWU meet or surpass its goals of surveying the entire distribution system for leaks every 2.5 years and reducing leakage so that the Infrastructure Leakage Index is less than or equal to three. ▪ Continue existing leak detection and repair efforts. ▪ Task 1: Develop and track water loss performance indicators (Table 8-4) on a monthly basis. This could include automated monitoring of water audit data through software programming and third party review and reporting of data. Use the results to target water loss resources (e.g., leak detection and repair crews). ▪ Task 2: Validate water use in the AWWA water balance categories (Figure 5-17) through field testing where possible. Improvements in data validation could include: o Perform additional meter testing and analysis of meter test results (this could include all sizes of meters from residential to production meters). Maintain calibration of the production meters and the largest commercial/industrial meters, as these will have the greatest impact on overall average meter accuracy if they are in error. Use the analysis of the meter testing results to refine the meter accuracy assumption in the system water audit. o Conduct water loss audits on a pressure zone level. Since smaller district metered areas (DMAs) are not considered at this time, conduct pressure zone water balances to improve the level of accuracy of the system water audit. Analyze minimum flow characteristics and estimate leakage. Conduct leakage detection surveys on the pressure zone and evaluate and record the reduction in real losses. o Review and evaluate the pressure reducing valve (PRV) maintenance and replacement program. Tasks could include more frequent monitoring of PRV vaults and continued trending and analysis of collected data.

Table 10-1 Continued: Recommended Water Conservation Strategies: City Leadership and Commitment Element

Strategy	Description
Enhanced Real Loss Reduction (Continued)	▪ Task 3: Add leak detection and repair personnel and equipment and conduct additional training. Analyze the economic level of leakage, including a financial review of the costs of the leak detection and repair program and benefits from the reduction of leakage (e.g., reduced treatment and distribution costs, reduced number of emergency callouts and main breaks, etc.). ▪ Task 4: Continue to plan, develop, and implement water loss recommendations from previous water audits and efficiency studies. Monitor and document milestones reached as the result of recommendations made in the Water Efficiency Study (Ref. 7), the internal City Auditor's Report (Ref. 8), and the Texas Water Development Board's Analysis of Water Loss (Ref. 9). ▪ Task 5: Maximize advanced metering infrastructure (AMI) monitoring capabilities. Use detailed water use monitoring capabilities in the downtown corridor to identify potential leakage on the customer side of the meters. Other uses could include monitoring and providing information on consumption patterns for ICI water users. ▪ Task 6: Evaluate, purchase, and implement leakage management software specifically designed to enhance leak detection efforts. Examples include ILMSS LEAKS Suite (Ref. 10) and Crowder Consulting's NETBASE Water Distribution Management Software (Ref. 11). This will improve cost-benefit analyses and targeting of leak detection and repair efforts and assist in pressure management.
Enhanced Apparent Loss Reduction	Enhanced apparent loss reduction includes several recommended components, as described below. This strategy will help DWU identify and correct apparent losses, generating additional revenue for the utility. ▪ Continue existing apparent loss reduction efforts.

Table 10-1 Continued: Recommended Water Conservation Strategies: City Leadership and Commitment Element

Strategy	Description
Enhanced Apparent Loss Reduction (Continued)	▪ Task 1: Dedicate water loss management analysts to find, trend, and correct discrepancies within the metering and billing systems. ▪ Task 2: Improve meter accuracy by reviewing all residential meter volumes and changing out meters that have exceeded the warranty limits. There are a number of two-, 1.5-, one-, and ¾-inch meters with flow volumes in excess of the warranty limits (Figure 5-18). Target customers that use a volume of water that would exceed the meter warranty within five years for participation in DWU water conservation programs to help reduce their water use to within the normal range of the meter warranty. If this is not possible, conduct a meter-sizing analysis and replace the meter with a meter of appropriate size for the water use. ▪ Task 3: Identify customers that are billed for water service and not for wastewater service (and vice versa), and verify that these customers do not receive both services. Correct any discrepancies that are identified. In a study conducted from 2004 to 2006 by Utility Revenue Management (Ref. 12), a number of accounts were found where customers were being billed for water, but not for wastewater. ▪ Task 4: Evaluate and correct accounts with misclassified premise types. Update premise types as the water use associated with an account changes. For example, review the fireline classification, as more than fifty fireline accounts were found to have significant, regular monthly usage, which should not occur. Reclassify these accounts or remove the fireline meters and replace them with properly-sized retail meters. As another example, review the cross-tabulation of total water use by premise type and customer type (Appendix A) for accounts with inappropriate combinations of premise type and customer type. ▪ Task 5: Interface with all relevant DWU Divisions; collate, organize, and analyze all water loss data, including performance indicators (Table 8-4); and prepare performance reports that document water loss reduction. ▪ Task 6: Conduct an analysis of unauthorized use and customers not currently receiving a correct bill. Initial review would include analysis of accounts that consistently read zero, identification of addresses with no water service, etc.

Table 10-1 Continued: Recommended Water Conservation Strategies: City Leadership and Commitment Element

Strategy	Description
Water-Wise Landscape Design Requirements	Upon City Council approval and adoption, revise the city's landscape ordinance to limit turf areas in all new landscapes and require low-water-use landscaping in other areas. Other requirements could include minimum soil depths, soil amendments, and turfgrass summer dormancy capability. Turfgrass requires more water than native grasses and low-water-use plants. Reducing the turfgrass area in new landscapes will reduce irrigation water use.
ICI Water-Efficient Equipment Rule	Upon City Council approval and adoption, adopt an ordinance requiring certain water efficiency standards for new and newly-occupied ICI establishments. Example requirements could include repairing all leaks, retrofitting high-flow plumbing fixtures, and other equipment and service requirements, depending on the nature of the business. Collaborate with the city's Building Inspection Office to verify installation of water efficiency measures prior to occupancy.
Recycled Water Projects	Continue efforts necessary to implement the Cedar Crest Pipeline Extension by 2011 to make recycled water available to the Dallas Zoo and other customers for non-potable uses. Continue development of the White Rock Pipeline Alternative project (which will provide recycled water from the Central WWTP to irrigation and industrial customers in the White Rock Creek Corridor) or other projects. Continue efforts necessary to complete the Main Stem Trinity River Pump Station by 2013; this will allow significant indirect reuse for potable purposes, as discussed in Section 6.1.

Table 10-2: Recommended Water Conservation Strategies: Education and Outreach Initiatives Element

Strategy	Description
Education & Outreach Initiatives	
Voluntary Twice-Weekly Irrigation Schedule	Through the Public Awareness Campaign, encourage all customers to limit irrigation to a maximum of two days per week from April 1 through October 31. Twice-weekly irrigation will reduce over-watering while also allowing customers to meet plant needs.
ICI Customer Water Audits	Visit an ICI establishment with the company's engineers or other employees knowledgeable about company water use; review all end uses of water; identify potential water-efficiency improvements and potential costs; directly install small, low-cost devices as appropriate; document the findings; inform the company of applicable DWU water conservation programs; and follow up with the company to track implementation of the recommendations. Complete the ICI customer water audit at no cost to the customer. Make the program available to all ICI customers but target the top ten percent of ICI customers in terms of water use.
ICI Training Programs	Develop, lead, and manage ongoing water efficiency training programs for: ▪ ICI facility managers for premise types that use the most water, and ▪ Irrigators, with a focus on EPA WaterSense programs. Topics will include industrial cooling and process, food processing, irrigation management, and leakage control. Bi-monthly or quarterly training programs are recommended. Make the program available to all ICI customers but target the top ten percent of ICI customers in terms of water use. Work with local businesses, green building organizations, and energy utilities to seek their input on the curriculum development and certification process. As facility managers and irrigators become more aware of available water-efficient technologies and methods, they will begin to implement these measures. ICI training programs could increase participation in other water conservation programs.

Table 10-2 Continued: Recommended Water Conservation Strategies: Education and Outreach Initiatives Element

Strategy	Description
ICI Business Partnership Program	Establish an ongoing Business Partnership Task Force or work group for the purpose of engaging the ICI community in DWU's water conservation program, particularly business leaders who represent companies that are top water users. Meet four to six times per year for discussion of water conservation practices, sharing of conservation success stories, and discussion of DWU ICI water conservation programs. Target the top one percent of ICI customers in terms of water use. Increased awareness of the value of ongoing water efficiency practices should lead to water savings for the participating customers.
ICI Hospitality Program	Engage hotels, motels, and restaurants in the city’s water conservation program and train hospitality staff on methods to reduce water use and waste. Measures would include water on request, reuse of towels and linens, etc. DWU would provide printed materials to encourage guest participation: table cards, door hangers, pillow cards, etc.

Target customer participation in the Education and Outreach Initiatives is shown in Table 9-2, and target customer markets are shown in Table 9-1. Opinions of probable unit cost for each measure are shown in Table 9-5. Projected water savings from the recommended Education and Outreach Initiatives are presented in Table 9-3.

Rebate and Incentive Programs

Rebate and incentive programs offer targeted customer groups financial motivation to conserve water. Recommended water conservation strategies within the Rebate and Incentive Programs element are presented in Table 10-3.

With the exception of the Enhanced Residential Toilet Incentive program, it is recommended that the incentive programs begin as pilot programs that would evolve to a full-scale program over the course of a year. The programs should include mechanisms for marketing and educating the public about the incentives and the potential water savings. The financial incentive should be set at a value that encourages customer participation and achieves water conservation savings at a reasonable price. Installation of rebated equipment should be confirmed,[45] and water savings should be estimated and tracked for each incentive program. The overall rebate program should be structured such that individual programs can be modified or phased-out as necessary to achieve the overall goals of the Updated Strategic Plan.

Target customer participation in the Rebate and Incentive Programs is shown in Table 9-2, and target customer markets are shown in Table 9-1. Opinions of probable unit cost for each measure are shown in Table 9-5. Projected water savings from the recommended Rebate and Incentive Programs are presented in Table 9-3.

10.2. Detailed Action Schedules

To maximize the success of the recommended water conservation strategies, DWU must prioritize implementation to allow for careful planning and development of ordinances, educational programs, and incentive programs, while still meeting the water conservation goals. The recommended implementation schedule (summarized in Table 10-4) is based on the following prioritization criteria:

- Implement measures with higher water savings early
- Implement measures with high community interest early
- Limit the number of programs to be planned/implemented each year
- Align strategies that have similarities/synergies
- Implement training programs in advance of rule changes, where applicable

[45] The exception is the Residential Clothes Washer Incentive. Due to the significant cost borne by the customer, it is reasonable to assume that virtually all rebated clothes washers will be installed.

Table 10-3: Recommended Water Conservation Strategies: Rebate and Incentive Programs Element

Strategy	Description
Residential Irrigation System Incentive	Offer a rebate or other incentive worth up to $200 to single- and multi-family residential customers that retrofit their existing irrigation systems with water-conserving equipment. Qualifying equipment may include: ▪ Drip irrigation equipment ▪ Spray heads with greater distribution uniformity ▪ Weather-based irrigation controllers ▪ Other devices Make the program available to all residential customers but target the top twenty-five percent of single- and multi-family residential customers in terms of water use.
ICI Financial Incentives	Implement a site-specific rebate program for ICI customers to promote water-efficient equipment installation and upgrades. Examples could include cooling processes, plumbing fixtures, laundry processing, medical/dental devices, landscape irrigation, rainwater harvesting, etc. Target the top ten percent of large ICI customers for two-thirds or more of the program resources and use the remainder to target small/medium businesses. Candidates could include office buildings, hotels/motels, restaurants, grocery stores, Laundromats, schools, manufacturers, food processing, and parks/golf courses. Customers propose water-efficiency improvements and project the associated water savings and costs. After review of the proposal, DWU decides whether to fund a portion of the cost (up to an anticipated maximum amount of $100,000 per customer) for water efficiency measures that meet certain water savings performance standards. The customer installs the approved water-efficiency measures. Upon confirmation of installation, DWU rebates a portion of the measure costs. DWU could also establish financial partnerships with energy utilities and green building organizations. Similar programs operated by Austin Water Utility and San Antonio Water System could serve as models during development of this strategy.
Enhanced Residential Toilet Incentive	Expand the “New Throne for Your Home” program to replace existing single- and multi-family residential toilets that use 3.5 gallons per flush or more with HETs (1.28 gallons per flush or less).

Table 10-3 Continued: Recommended Water Conservation Strategies: Rebate and Incentive Programs Element

Strategy	Description
Residential Clothes Washer Incentive	DWU would offer rebates worth up to $100 for single-family residential customers and worth up to $250 for multi-family residential customers for replacing older, inefficient clothes washers with water-efficient models (modified energy factor of at least 1.8 and water factor of no more than 7.5). Efficient clothes washers use up to sixty percent less energy and up to forty percent less water than conventional machines.

Table 10-4: Summary of Recommended Implementation Schedule

Program	Projected Water Savings Rank	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Additional savings -- existing real loss program	3	3				
HB 2667 high-efficiency toilet law	4	4				
Enhanced real loss reduction	1	1				
Enhanced apparent loss reduction	n/a	n/a				
Water-wise landscape design requirements	12			12		
ICI water-efficient equipment rule	13			13		
Recycled water projects	n/a	n/a				
Voluntary twice-weekly irrigation schedule	8	8				
ICI customer water audits	7	7				
ICI training programs	10	10				
ICI business partnership program	14	14				
ICI hospitality program	11	11				
Residential irrigation system incentive	6		6			
ICI financial incentives	2	2				
Enhanced residential toilet incentive	5	5				
Residential clothes washer incentive	9	9				

Savings Rank: lower numbers mean higher water savings

Strategy planning and development

Continue existing program/plan further implementation

Implementation

Notes:

1. Enhanced apparent loss reduction does not reduce water use but generates revenue for water that has been used but for which the utility has not been compensated
2. Recycled water projects were not included in the projected water savings rank.

In addition, there are several general steps to implementing a new water conservation strategy:

- Planning and development: Increase staff or hire a contractor as necessary to administer the program. Identify, research, and make decisions about key implementation issues (e.g., rebates versus vouchers, eligibility requirements, ordinance language, etc.). Identify methods for engaging the target customer market. Conduct pilot testing for a limited time to gain experience with the individual program. Planning and development typically occurs one or more years prior to full-scale implementation.
- Marketing and education: Conduct an aggressive campaign to solicit the participation of targeted customers. Educate customers about potential water savings expected from the particular program, how water is conserved, and other opportunities to save. This may involve meetings with stakeholder groups, multi-media advertising campaigns, or other communication methods. Marketing and education should begin a short time prior to full-scale implementation and should continue to some degree throughout the life of the strategy.
- Full-scale implementation: Depending on the individual strategy, conduct day-to-day operations necessary to enforce ordinance requirements, carry out individual education and outreach initiatives, or provide financial or other incentives to encourage customer participation.
- Verification/follow-up/data collection: Confirm the installation and implementation of relevant measures. For some strategies, this may involve site inspections. Record relevant data about the customer and the measure. Compare water use before and after installation. Verification/follow-up/data collection begins with full-scale implementation and continues until the individual strategy is discontinued.
- Savings/cost comparison: Estimate the water savings and the value of the water saved through the strategy. Estimate the cost to initiate and monitor the strategy throughout its life. Compare savings to costs in terms of a benefit-cost ratio or payback period. Savings/cost comparisons should be conducted annually to monitor the progress of the strategy toward meeting its goals. If the strategy is not meeting its goals, it should be reevaluated, and program parameters should be changed or revised goals should be established.

Taking these steps into account, detailed action schedules for the implementation of new water conservation strategies during the five-year implementation period are presented in Appendix N.

10.3. Recommended DWU Staff Increases

Some of the recommended water conservation strategies require no additional DWU labor (e.g., voluntary twice weekly irrigation schedule).[46] For others (e.g., residential clothes washer incentive), it is anticipated that DWU will hire a contractor to implement the strategy. The

[46] However, some of the recommended measures will require staff time for employees of other city departments. For example, under the recommended ICI water-efficient equipment rule, DWU would collaborate with the Building Inspection Office to verify installation of water efficiency measures prior to occupancy.

remaining recommended strategies will require increases in DWU staff, as summarized by strategy and fiscal year in Table 10-5.[47] In summary, it is recommended that DWU fund and create twenty-nine new full-time equivalents (FTEs) during the five-year implementation period, with sixteen FTEs in the Operations Division, eleven FTEs in the Water Conservation Division, and two FTEs shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

The recommended staff increases have been based on customer participation assumptions and staff time required for similar programs at other utilities. Each of the recommended water conservation strategies should be reviewed annually to verify that customer participation and the production capacity of the existing staff continue to warrant the recommended staff increases.

Recommended City Leadership and Commitment Staff Increases

To accomplish Enhanced Real Loss Reduction, eight additional field personnel are recommended for leak detection, and eight additional field personnel are recommended for leak repair. The field personnel for leak repair consist of two four-man crews. For each of the new repair crews, one position should be created one year before the other three positions are created. The employee in the first position, after gaining experience, will act as chief of the new crew.

Two management analyst FTEs are recommended for Enhanced Apparent Loss Reduction. Among other things, these employees will be responsible for finding, trending, and fixing discrepancies within the metering and billing systems. Because they will have to interface with several DWU Divisions to be effective, it is recommended that these positions be shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

The staffing recommendations for the Enhanced Real Loss Reduction and the Enhanced Apparent Loss Reduction strategies are consistent with the AWWA water loss control best management practices (Ref. 39, summarized in Appendix E).

Finally, the Water-Wise Landscape Design Requirements for new construction will require one FTE to evaluate landscaping plans, conduct site visits, and ensure construction compliance with the new regulations.

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[47] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

Table 10-5: Recommended DWU Staff Increases

Recommended Water Conservation Strategies[a]	Recommended DWU Staff Increases (FTEs) FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15	Five-Year Total	Division
City Leadership and Commitment							
Enhanced Real Loss Reduction							
- Field personnel (leak detection)	+2.00	+2.00		+4.00		+8.00	Operations
- Field personnel (leak repair)	+1.00	+3.00	+1.00	+3.00		+8.00	Operations
Enhanced Apparent Loss Reduction							
- Management analyst	+1.00			+1.00		+2.00	Shared[b]
Water-Wise Landscape Design Requirements							
- Plan evaluation, construction compliance			+1.00			+1.00	Water conservation
Education and Outreach Initiatives							
ICI Customer Water Audits							
- Site visits, analysis, reporting	+0.50					+0.50	Water conservation
ICI Training Programs							
- Outreach, development, training	+0.50					+0.50	Water conservation
ICI Hospitality Program							
- Outreach, development, operations	+0.50					+0.50	Water conservation
Rebate and Incentive Programs							
Residential Irrigation System Incentive							
- Site visits, analysis, verification		+0.50		+2.25	+3.00	+5.75	Water conservation
- Clerical				+0.75	+1.25	+2.00	Water conservation
ICI Financial Incentives							
- Clerical		+0.25				+0.25	Water conservation
- Site visits, analysis, verification	+0.25					+0.25	Water conservation
Enhanced Residential Toilet Incentive							
- Site visits, verification		+0.25				+0.25	Water conservation
Water Conservation Division Subtotal	***+1.75***	***+1.00***	***+1.00***	***+3.00***	***+4.25***	***+11.00***	
Operations Division Subtotal	***+3.00***	***+5.00***	***+1.00***	***+7.00***		***+16.00***	
Shared[b]	***+1.00***			***+1.00***		***+2.00***	
TOTAL	**+5.75**	**+6.00**	**+2.00**	**+11.00**	**+4.25**	**+29.00**	

[a] Some recommended water conservation strategies/tasks not shown. Either they require no additional labor or it is anticipated that DWU will hire contractors to execute them.
[b] Shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

Recommended Education and Outreach Initiatives Staff Increases

The three Education and Outreach Initiatives listed in Table 10-5 will each require a half-time FTE for implementation. It is recommended that the half-time ICI Customer Water Audits and ICI Training Programs positions be combined to form one full-time FTE that is shared between the two strategies. This employee will work with an ICI contractor for one to two years, conducting site visits, analyzing water use and the potential for water savings, and reporting the audit findings. As this employee gains experience, he or she will gradually begin to conduct a portion of the ICI customer water audits. During the first two years, this employee will also research and develop the training programs, conduct outreach to targeted ICI customers, and teach the training programs.

For the ICI Hospitality Program, DWU should devote 0.50 FTE to researching and developing the program; conducting outreach to hotels, motels, and restaurants; educating hospitality staff in ways to reduce water use and referring them to other ICI water conservation programs as necessary; developing printed program materials (e.g., table cards, door hangers, pillow cards, etc.), and managing the distribution of these materials.

Recommended Rebate and Incentive Programs Staff Increases

It is recommended that the majority of the positions created in the Water Conservation Division be devoted to the Residential Irrigation System Incentive strategy, which expands upon the existing Irrigation System Check-up Program. There are two types of positions for this program. The first type will be field personnel responsible for site visits, inspection of irrigation systems, identification of potential system improvements, estimation of associated water savings and probable costs, and installation verification (5.75 FTEs). The second type will be office personnel responsible for reviewing incentive applications for eligibility, scheduling field appointments, processing incentives, and implementation tracking (2.00 FTEs).

Two quarter-time FTEs are recommended for specific tasks associated with the ICI Financial Incentives program. The first 0.25 FTE will be office personnel responsible for reviewing incentive applications for completeness/eligibility, scheduling field appointments, processing incentives, recordkeeping, and other clerical tasks. It is also anticipated that the ICI Financial Incentives program will distribute a substantial number of high-efficiency toilets to ICI customers, most likely with the assistance of a contractor. The second 0.25 FTE will conduct site visits and verify installation of approximately ten percent of the toilets for which incentives are given.

Similarly, although it is anticipated that DWU will hire a contractor to implement the Enhanced Residential Toilet Incentive program, it is recommended that DWU devote 0.5 FTE to conducting site visits and verifying installation of approximately ten percent of the toilets for which incentives are given.

10.4. *Recommended Water Conservation Budgets and Budget Items*

As discussed in Section 9.4, the opinions of probable cost for the recommended water conservation strategies are the probable amounts that DWU must spend on each strategy (Table 9-6) to achieve the projected water savings (Table 9-3). However, several of the strategies are already funded at some level in the existing DWU budget. To the degree to which they are currently funded, these strategies do not require an increased budget authorization. The discussion in Section 9.4 provides further details. In this section, the opinions of probable cost from Section 9.4 are reconciled into recommended budget items. Additional detail is provided in Appendix O.

Water Conservation Division Budget

The recommended water conservation strategies for the Updated Strategic Plan have been scheduled for implementation over a five-year period. A five-year budget for the Water Conservation Division was developed in conjunction with the conservation strategy recommendations (Table 10-6). Existing water conservation programs should continue to be funded at existing levels (adjusted for inflation). Additional funding is recommended to enhance two existing programs (the Enhanced ICI Customer Audits program expands upon the Cooling Tower Water Audits program, and the Enhanced Residential Toilet Incentive program expands upon the *New Throne for Your Home* program), and additional funding is recommended for five other recommended water conservation strategies (Table 10-6). Recommended Water Conservation Division budgets over the next five fiscal years range from about $5.2 million to $11.5 million. These budgets include operating costs (labor, incentives, etc.) but do not include major capital expenditures for recycled water pipelines or pipeline replacement costs.

Operations Division Budget Items

Table 10-7 shows recommended Operations Division budget items by fiscal year.[48] The existing real loss programs should continue to be funded at existing levels (adjusted for inflation); in particular, Table 10-7 emphasizes maintaining funding from the FY 2008-09 budget increase for additional leak detection. New budget items are recommended for Enhanced Real Loss Reduction and Enhanced Apparent Loss Reduction. Based on these items, recommended new budget items for the Operations Division over the next five years range from about $1.39 million to about $2.14 million.

[48] Table 10-7 does not represent the full Operations Division budget, only items discussed in the Updated Strategic Plan.

Table 10-6: Recommended Water Conservation Division Budgets by Fiscal Year

Budget Item	Status	Recommended Water Conservation Division Budgets[a]				
		FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Salaries and Benefits	Existing	$608,523	$622,800	$637,400	$652,400	$667,700
Other Operating Expenses	Existing	$1,060,505	$1,085,400	$1,110,900	$1,137,000	$1,163,700
Public Awareness Campaign	Existing	$1,380,000	$1,412,400	$1,445,600	$1,479,600	$1,514,400
Minor Plumbing Repair Program	Existing	$400,000	$409,400	$419,000	$428,900	$439,000
Environmental Education Initiative	Existing	$274,000	$280,400	$287,000	$293,700	$300,600
Pre-Rinse Spray Nozzle Program	Existing	$290,250	$297,100	$304,100	$311,200	$318,500
New Throne for Your Home	Existing	$550,770	$563,700	$577,000	$590,600	$604,500
Cooling Tower Audits	Existing	$75,510	$77,300	$79,100	$81,000	$82,900
Existing Budget Items Subtotal		***$4,639,558***	***$4,748,500***	***$4,860,100***	***$4,974,400***	***$5,091,300***
Water-Wise Landscape Design Reqs.	Additional	$0	$0	$90,300	$92,400	$94,600
ICI Customer Water Audits[b]	Additional	$25,600	$27,500	$28,100	$28,800	$29,500
ICI Training Programs	Additional	$25,600	$26,200	$26,800	$27,400	$28,100
ICI Hospitality Program	Additional	$50,000	$102,400	$104,800	$107,200	$109,700
Residential Irrigation System Incentive	Additional	$0	$42,100	$94,300	$695,100	$1,581,000
ICI Financial Incentives	Additional	$500,000	$2,983,200	$3,023,500	$3,047,600	$3,072,200
Enhanced Residential Toilet Incentive[c]	Additional	$0	$944,600	$966,800	$989,500	$1,012,800
Residential Clothes Washer Incentive	Additional	$0	$76,600	$153,300	$214,000	$481,900
Next Update to the Strategic Plan	Additional	$0	$0	$0	$699,100	$0
Additional Budget Items Subtotal		***$601,200***	***$4,202,600***	***$4,487,900***	***$5,901,100***	***$6,409,800***
Recommended Total Budget		**$5,240,758**	**$8,951,100**	**$ 9,348,000**	**$10,875,500**	**$11,501,100**

[a] The existing budget is assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[b] Extension of the Cooling Tower Audit program. Probable additional costs only.

[c] Extension of the New Throne for Your Home program. Probable additional costs only.

Table 10-7: Recommended Operations Division Budget Items by Fiscal Year

Recommended Water Conservation Strategy	Status	Recommended Operations Division Budget Items[a] FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Additional Savings – Existing Real Loss Program[b]	Existing	$683,000	$699,100	$715,500	$732,300	$749,600
Existing Budget Item Total		**$683,000**	**$699,100**	**$715,500**	**$732,300**	**$749,600**
Enhanced Real Loss Reduction						
Develop and track water loss performance indicators	Additional	$50,000	$51,200	$52,400	$53,600	$54,900
Improve validation of water loss performance data	Additional	$250,000	$511,800	$523,800	$536,100	$548,700
Assess and enhance performance of active leakage detection program						
▪ Field staff -- leak detection. Eight technicians by FY 2014-15 ($55,000 per FTE).	Additional	$110,000	$225,200	$230,500	$471,800	$482,900
▪ Training on new equipment, training updates	Additional	$40,000	$30,000	$30,000	$30,000	$30,000
▪ Field staff -- leak repairs. Four-man, turn-key repair crews for increased workload generated by enhanced leak detection program. Two crews by FY 2014-15 ($45,000 per FTE).	Additional	$45,000	$184,200	$235,700	$386,000	$395,100
▪ Additional equipment for new leak repair crews (including repair truck, dump truck, truck and trailer, backhoe tractor, air compressor, tools and materials). For each crew: initial equipment purchase: $400,000; initial stocking of materials and tools: $200,000.	Additional	$600,000	$70,000	$670,000	$140,000	$140,000
▪ Leak detection equipment: correlating loggers and associated equipment	Additional		$50,000		$50,000	
▪ Leak detection equipment: ground microphones	Additional			$20,000	$20,000	
▪ Leak detection equipment: correlator	Additional			$30,000		$30,000
▪ Additional equipment for new technicians as others become outdated (including vehicles, leak detection equipment, line locators, probe rods, tools, etc.).	Additional				$80,000	$104,000
Continue to plan, develop, and implement water loss recommendation from previous water audits and efficiency studies	Additional	$25,000	$25,600	$26,200	$26,800	$27,400
Maximize advanced metering infrastructure (AMI) monitoring capabilities	Additional	$100,000	$102,400	$104,800	$107,300	$109,800
Leakage management software	Additional	$15,000	$25,000	$35,000	$50,000	$50,000

Table 10-7 Continued: Recommended Operations Division Budget Items by Fiscal Year

Recommended Water Conservation Strategy	Status	Recommended Operations Division Budget Items[a]				
		FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Enhanced Apparent Loss Reduction						
Evaluate meter volumes	Additional	$150,000	$153,500	$157,100	$160,800	$164,600
Additional Budget Items Total[c]		**$1,385,000**	**$1,428,900**	**$2,115,500**	**$2,112,400**	**$2,137,400**

[a] Does not represent the full Operations Division budget, only items discussed in the Updated Strategic Plan. Existing budget items are assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[b] Included in the existing Operations Division Budget. Reflects the FY 2008-09 budget increase for leak detection. It is assumed that future Operations Division budgets will maintain this level of funding (adjusted for inflation).

[c] Sum of the Enhanced Real Loss Reduction and Enhanced Apparent Loss Reduction budget items.

Shared Budget Item

Table 10-8 shows the recommended shared budget item by fiscal year.[49] It is anticipated that this budget item will be shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section. A new budget item is recommended for management analysts as part of the Enhanced Apparent Loss Reduction strategy. The recommended budget for this shared item over the next five years ranges from $95,000 to $208,500.

Recycled Water Projects Budget

Although it is recommended that DWU proceed with implementation of recycled water projects to increase water efficiency, recycled water planning has been conducted separately from water conservation planning, and no budget recommendations for recycled water projects have been developed as part of the Updated Strategic Plan.

Reconciliation of Probable Costs and Recommended Budgets

Individual line items from the opinions of probable cost table (Table 9-6) have been totaled by strategy and placed into the recommended budget tables (Tables 10-6 through 10-8). The sum of the following budget items equals the total opinion of probable costs in Table 9-6:[50]

- Existing *New Throne for Your Home* budget (Table 10-6);
- Existing Cooling Tower Audits budget (Table 10-6);
- The sum of the "additional" budget items in Table 10-6, with the exception of the "Next Update to the Strategic Plan" item;
- Existing Budget Item Total (Table 10-7);
- Additional Budget Items Total (Table 10-7); and
- Additional Budget Items Total (Table 10-8).

The only budget items that do not appear in the opinions of probable cost for the recommended water conservation strategies (Table 9-6) are the "Next Update to the Strategic Plan" budget item and the following existing Water Conservation Division budget items:

- Salaries and Benefits
- Other Operating Expenses
- Public Awareness Campaign
- Minor Plumbing Repair Program
- Environmental Education Initiative
- Pre-Rinse Spray Nozzle Program

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[49] Table 10-8 does not represent the full budget of any Division, only items discussed in the Updated Strategic Plan. Recommended budget assumed to be shared between Planning, Financial, and Rate Services; Customer Account Services; and the Meter Section of the Distribution Division.

[50] Within a rounding error of a few hundred dollars.

Table 10-8: Recommended Additional Shared Budget Items by Fiscal Year

Recommended Water Conservation Strategy	Status	Recommended Shared Budget Items[a]				
		FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15
Enhanced Apparent Loss Reduction						
Management analysts	Additional	$95,000	$97,200	$99,500	$203,700	$208,500
Additional Budget Items Total		**$95,000**	**$97,200**	**$99,500**	**$203,700**	**$208,500**

[a] Does not represent the full budget of any Division, only items discussed in the Updated Strategic Plan. Recommended budget assumed to be shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

10.5. Measuring the Effectiveness of the Updated Strategic Plan

Measuring the effectiveness of the Updated Strategic Plan should include annual updates to the water use analysis in Chapter 5. The updated water use analysis should consider the following metrics and trends:

- Total annual water use (all customers)
- Annual and monthly water use by customer class
- Annual unbilled (or non-revenue) water
- Total per capita water use (gpcd)
- Residential per capita water use (gpcd)
- Usage trends in ICI accounts or groups of accounts, including normalization by factors that influence commercial water use, as appropriate[51]
- Estimations of indoor and outdoor water use
- Other data, such as numbers of accounts, meteorological data, etc.

To gain a global sense of the Updated Strategic Plan's effectiveness, statistical analyses of these data may be compared to similar analyses of water use data from a previous year or years. Many of the mechanisms are presently in place to make global year-to-year comparisons. However, refinements of these data are recommended to better differentiate how and where water is used. For example, water use for each premise type should be monitored and the results used to target customers for water conservation programs.

In addition to comparing water use from year to year, DWU should continue to track the number of water conservation measures implemented and use these data to estimate water savings from each water conservation program where possible.

10.6. General Recommendations

During development of the Updated Strategic Plan, a number of issues and ideas emerged regarding water use data analysis, ordinances and ordinance enforcement, and wholesale customer and stakeholder outreach. General recommendations on these topics are presented in the following sections.

Water Use Analysis

DWU typically tracks multi-family residential water use under the General Service classification, which primarily consists of commercial water users. However, DWU can identify multi-family residential water use using premise types and the customer billing data. DWU currently produces a "Multi Family Apartment Report," but the consumption volumes in this report do not appear to match the sum of the customer billing data by premise type. To allow better analysis of the water

[51] Example normalization units are presented in Table 5-3. DWU should conduct research as necessary to identify additional normalization units and to quantify the normalization units (e.g., number of hospital beds for a given account or for the Hospital premise type).

use data, DWU should refine its multi-family residential water use report and consistently track multi-family residential water use. As part of this effort, DWU should consider subdividing the Residential customer type in the customer billing database into Single-Family Residential and Multi-Family Residential and assigning the accounts to this classification accordingly.

Instances remain in the customer billing data where the recorded water use for a given month is unrealistically high (see discussion in Appendix B). In these cases, it appears unlikely that customers were actually charged for the recorded water use. In cases where the recorded water use is adjusted for meter reading errors or other data issues prior to customer billing, DWU should maintain a separate database of corrected billed usage. This database of corrected billed usage, in combination with the customer billing database, will allow more accurate estimation of actual customer water use.

During data analysis, the monthly sum of the reported summary water use data across all categories (Residential + GS + OGS + Municipal) was compared to the sum of all customer billing data. Although these sums should be identical, they are not (Figure B-1). Moving forward, DWU should identify the cause of these discrepancies and assign/reassign fields in the customer billing database or revise data queries as necessary so that the sum of the customer billing data exactly matches the reported water use by category. This will result in more consistent water accounting throughout the utility.

The Water Conservation Implementation Task Force recommended crediting indirect reuse diversion volumes against total diversion volumes for the purpose of calculating per capita water use for targets and goals. DWU should follow this recommendation by developing water accounting procedures to track indirect reuse volumes and should credit them against per capita water use. For example, it is projected (Row [J] in Table 6-1) that 4.8 percent of the DWU potable water supply in 2010 will consist of recycled water. Assuming that actual indirect reuse volumes confirm this projection, DWU retail per capita water use should be reduced by 4.8 percent for purposes of comparison to targets and goals.

Ordinances and Ordinance Enforcement

In the Strategic Plan (Ref. 1), it was recommended that Dallas should "review and revise existing City ordinances, codes, and standards as necessary to ensure that water-conserving principles are maintained. Consider adoption of new codes and standards that will further advance water conservation." This recommendation is renewed in the Updated Strategic Plan. For example, the consultant team has developed extensive recommendations for revisions to Dallas's landscape ordinance (Ref. 49) that would improve landscape water conservation and irrigation water use efficiency. These recommendations are presented in Appendix G.

It was also recommended in the Strategic Plan that DWU should "improve water conservation code enforcement efforts." This recommendation is also renewed in the Updated Strategic Plan. One idea for improving code enforcement efforts was identified during an interview with a representative of the Southern Nevada Water Authority. Currently DWU uses an "ordinance" enforcement model, where a representative from the Department of Code Compliance issues a citation to a violator, and the fine is pursued through the court system as necessary. Under “service rule” enforcement, modeled after the Southern Nevada Water Authority’s enforcement efforts (see discussion in Appendix F), DWU would include certain water conservation rules as part of its conditions for water service. The enforcement agent (whether operating from the Department of Code Compliance or the Water Conservation Division) would document violations with digital photography and/or video, and fines would be assessed as part of the violator’s water bill. The documentation would be made available to the customer in electronic form. The benefits of the “service rule” enforcement approach include avoiding the court system, reducing enforcement costs per violation, and the potential for greater water savings. Before DWU commits to the “service rule” enforcement model, it should assess the potential for greater water savings, design a documentation and fine process, and explore relevant legal issues.

Wholesale Customer and Stakeholder Outreach

Another recommendation from the Strategic Plan is also renewed in the Updated Strategic plan: DWU should “continue to work with … customer cities and other municipalities on joint water conservation education efforts and encourage them to adopt like measures and initiatives…” The wholesale customers represent a significant portion of the DWU water system, and their share of overall water use is projected to increase over time to approximately fifty percent (Ref. 3). Active participation of the customer cities is important to conserve the existing water supply and to postpone the need for new water supply reservoirs as long as possible. The city should continue to provide technical support to its wholesale customers to advance water conservation efforts. Efforts should include workshops, special events, and information and resource sharing (such as sharing of brochures, and advertisements).

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11. References

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Appendix A:
Cross-Tabulation of DWU Water Use by Premise Type and Customer Type

Table A-1: Total Water Use by Premise Type and Customer Type, February 2008 through June 2009

Premise Type	Total Water Use by Customer Type (gallons)			
	Commercial	Governmental	Industrial	Residential
Apartment # Individual Metered	96,175,700			267,380,770
Apartment/Condo Master Metered	25,840,653,910	14,593,200		570,800
Assumed To Be Commercial	1,220,722,437	11,938,600	6,747,600	268,100
Automobile Dealers	170,922,300			
Bar	138,088,100			
Cemetery/Agri Business	144,973,300	979,000		
Church	884,236,037	0		57,600
Duplex - Individual Metered	96,200			832,978,706
Duplex - Master Metered	10,687,700			144,290,741
Factory/Manufacturer	914,092,809		3,613,663,290	
Fire Station	846,100	34,541,300		15,700
Food And Kindred Processing	467,843,097	1,397,100	1,628,811,400	
Hospital	1,378,503,679	205,597,100	14,446,000	
Hotel/Motel	1,739,465,129	383,200	5,837,100	
Laundry	593,242,900		3,100	
Median Strip	327,781,831	150,486,035		44,171,300
Mobile Home - Individual Metered	102,000			30,659,900
Mobile Home - Master Metered	434,966,700			
Multi-Family/Townhome - Master Metered	1,142,615,524	44,179,000	58,000	1,256,800
Not assigned	6,500			
Office Building	6,216,607,942	946,261,200	261,422,109	6,400
Other Business	3,077,628,994	300,757,583	9,270,700	221,300
Park/Golf Courses	1,346,706,447	898,740,163	34,695,700	1,200
Parking Lot	72,175,300	3,502,500	8,100	
Portable Meter	493,691,884	2,711,400		
Restaurant	1,656,799,479			
Retail	878,152,137	3,978,200	7,972,900	102,400
Sandwich Shop	5,886,500			
Schools	613,778,538	1,286,075,917		
Service Station	2,450,500			61,000
Shopping/Mall Centers	1,189,141,351	1,093,900	130,000	
Single Family Residential	2,234,200			37,538,633,328
Unknown	24,985,500			
Vacant Lot or Raw Land	44,895,500	10,938,500		1,446,500
Vehicle Servicing/Washing	597,843,271	36,006,900	5,353,100	
VLNDRESI	961,500			4,474,200
Warehouse	1,430,682,348	25,274,100	70,891,500	203,900
TOTAL	53,160,643,343	3,979,434,898	5,659,310,599	38,866,800,645

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Appendix B:
Data Quality Control

B. Data Quality Control

Prior to providing the CIABS customer billing data to APAI, DWU's conservation analyst identified 27 instances where monthly usage for a single meter was reported to be greater than 900,000,000 gallons per month. These instances represented obvious errors, and the conservation analyst changed these monthly usage values to zero gallons.

In nine instances, monthly water use greater than 95 million gallons for a single residential meter was reported. Since this is highly unlikely to be correct, these monthly entries were also changed to zero gallons. However, other instances remain in the customer billing data where the recorded water use for a given month is unrealistically high. To give one example, the recorded October 2008 water use for account number 100322255 with premise type F (Apartment/Condo Master Metered) was about 84.9 million gallons.[52] The recorded water use for the other active months ranged between 2.19 million gallons and 4.92 million gallons. This may be a meter reading error, usage calculation error, or large leak, and it appears unlikely that this customer was actually charged for 84.9 million gallons of water use in one month. In cases where the recorded water use is adjusted for meter reading or other data issues prior to customer billing, DWU should maintain a separate database of corrected billed usage so that actual customer water use can be more accurately estimated. Because such adjusted use figures were not available, the consultant team made no additional corrections to the customer billing data before analysis of historical DWU water use.[53]

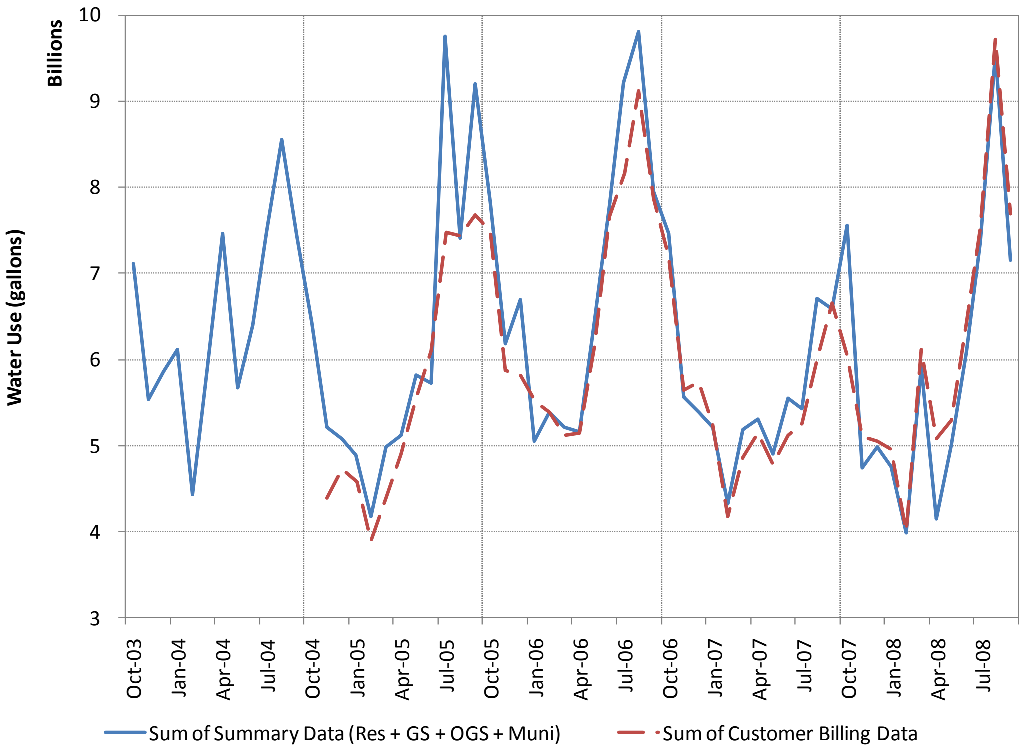
The monthly sum of the reported summary water use data across all categories (Residential + GS + OGS + Municipal) was compared to the sum of all customer billing data. Although these sums should be identical, they are not (Figure B-1). From November 2004 through September 2008, the cumulative reported summary data totals 288.9 billion gallons, while the cumulative customer billing data totals only 279.2 billion gallons. In general, the customer billing data from the CIABS database (November 2004 through January 2008) does not contain as much water as the reported summary data, and the customer billing data from the SAP database (February 2008), contains more water than the reported summary data. Moving forward, DWU should identify the cause of these discrepancies and resolve them so that water accounting is consistent throughout the utility.

The reported summary data were also compared to the customer billing data for each customer type. Ideally, the sums of the monthly customer billing data by the relevant customer types would match the summary data to the gallon, but this was not the case for any customer type. DWU should assign/reassign fields in the customer billing database or revise data queries as necessary so that the sum of the customer billing data exactly matches the reported water use by category.

[52] Total water use for this account is the sum of 16 records.

[53] Beyond the 36 instances discussed above.

Figure B-1: Overall Comparison of Reported Summary Data and Customer Billing Data



In a few instances, the reported summary data were significantly less than the sums of the customer billing data and were inconsistent with summary data from other years. These cases are:

- April 2008 for residential water use (Figure B-2),
- August 2006 and November 2007 for multi-family GS water use (Figure B-3), and
- December 2006 for municipal water use (Figure B-4).

In these cases, the reported summary data were replaced with the sum of the customer billing data for the relevant customer or premise types.

Figure B-4 shows the sum of customer billing data only through January 2008, because municipal water use is not broken out as a customer type in the SAP billing software.

In other cases, spikes in the data suggested that meter readings included water use over a period longer than one month (Figures B-5 and B-6). Averaging was performed to adjust monthly OGS data for June and July 2005, February and March 2008, and July and August 2008. A large number of municipal meters are read on a quarterly basis, so a three-month running average was used to adjust the reported municipal water use for the entire period to more accurately reflect actual monthly water use.

Figure B-2: Comparison of Reported Residential Data

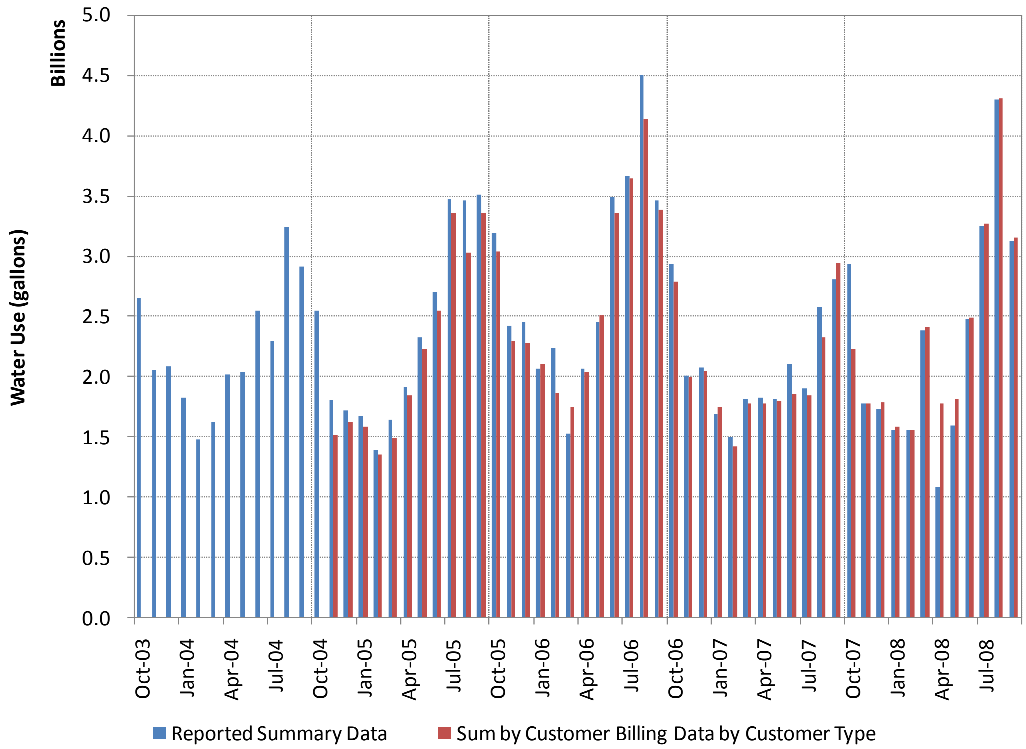


Figure B-3: Comparison of Reported Multi-Family GS Data

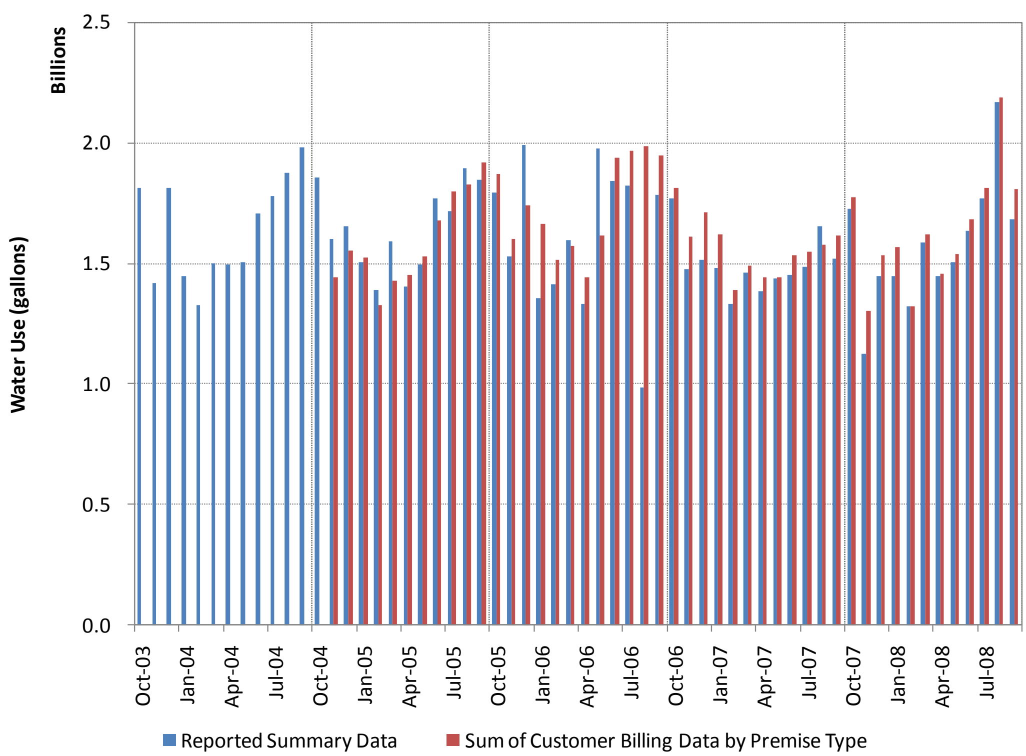


Figure B-4: Comparison of Reported Municipal Data

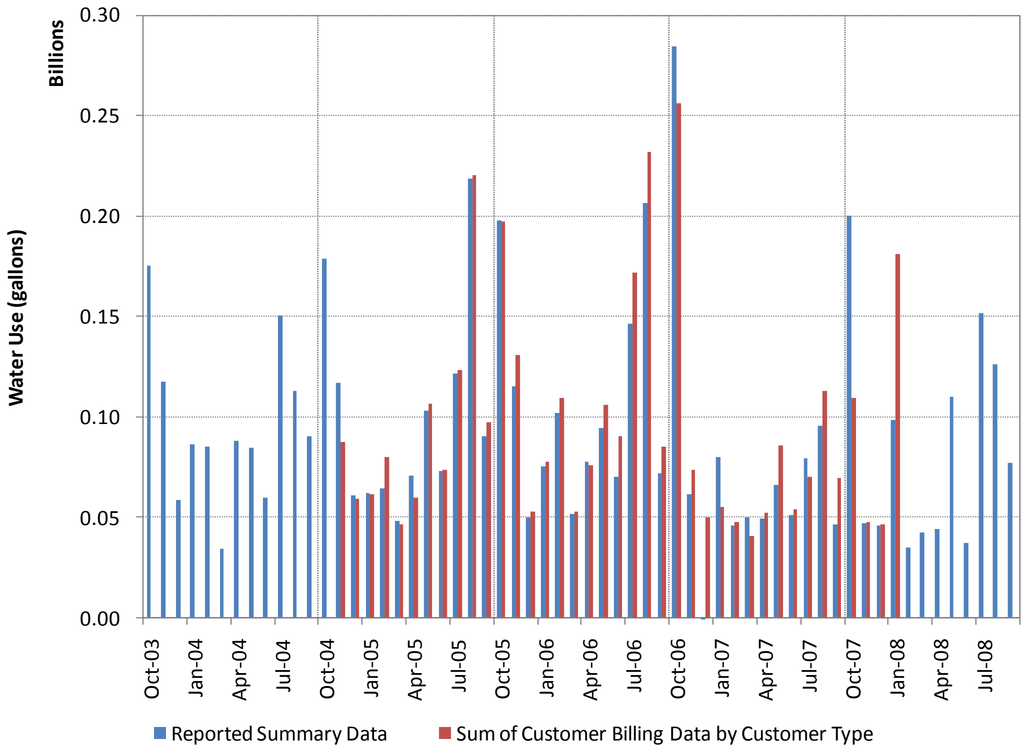


Figure B-5: Spikes in Reported OGS Data

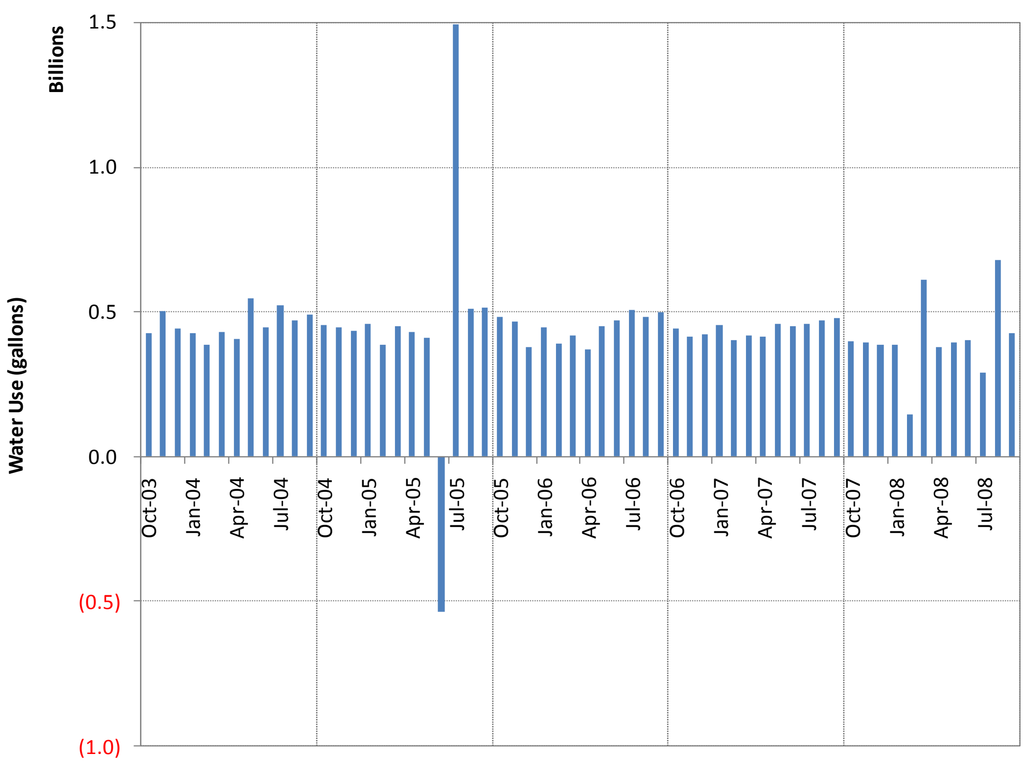
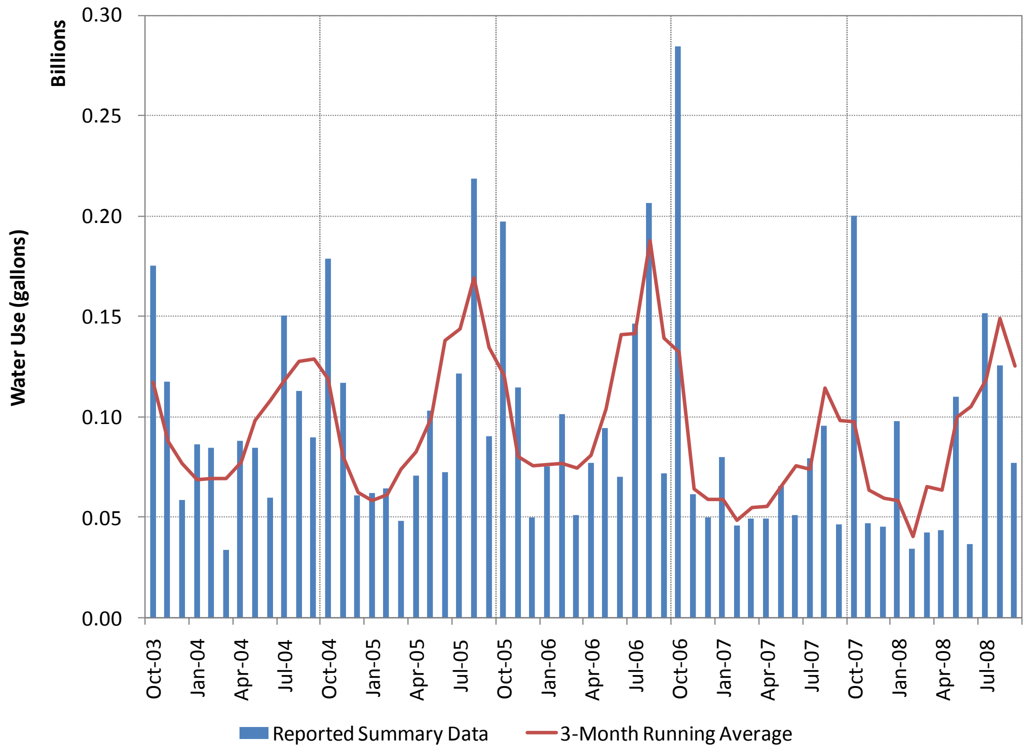


Figure B-6: Averaging of Reported Municipal Data

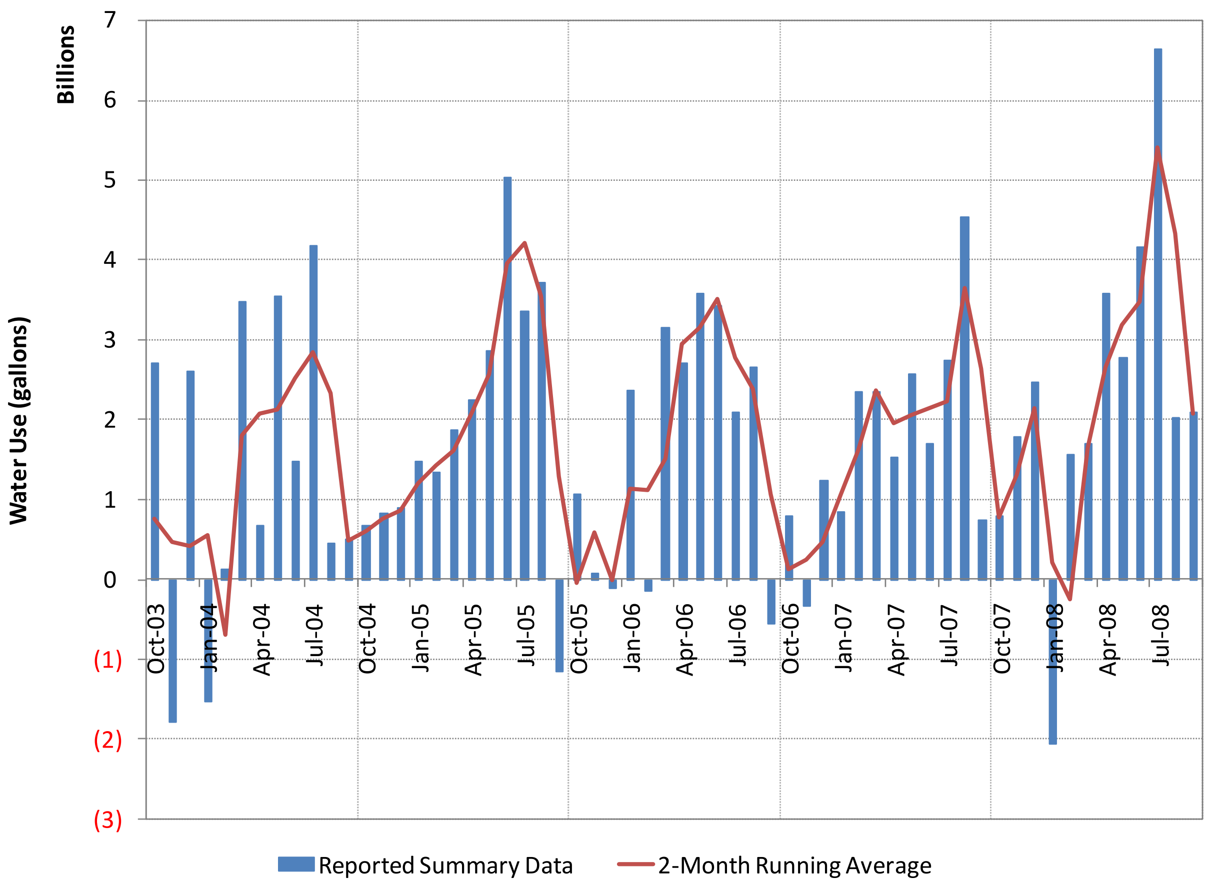


Potentially, the adjusted municipal data could be improved by identifying accounts where meters were read on a periodic basis and distributing the recorded water use for a given month evenly over the period since the last meter reading (instead of assuming that all water use occurred during the month of the meter reading). Because this would be a labor-intensive effort, the municipal water use is a small fraction of the overall water use, and it is uncertain how much the quality of the adjusted data would be improved, the consultant team did not perform this additional analysis.

Non-revenue water is the difference between produced water and billed authorized consumption. Ideally, non-revenue water would be estimated from production meter readings and customer meter readings that occurred at the same time; however, given the large number of customer meters, this is not possible. Customer meters are read on multiple dates throughout the month, while production meters may be read on a single day. As a result, the average date of customer meter readings for a given period may lag the production meter reading date by as much as fifteen days.

To explain this, consider a hypothetical case where non-revenue water is estimated for the month of September: suppose that produced water is calculated based on production meter readings taken on September 1 and October 1 and that billed metered water is calculated from customer meter readings that occur (on average) on September 15 and October 15. If significant changes in customer water use occur between October 1 and October 15, then error is introduced into the September non-revenue water estimate. To address this problem, the non-revenue water data were adjusted using a two-month running average (Figure B-7). This significantly reduces the occurrence of negative non-revenue water amounts and emphasizes the summer peaking pattern for the non-revenue water.

Figure B-7: Averaging of Reported Non-Revenue Data



In summary, the reported summary data (showing monthly water use by water user category) were adjusted as described above.

Appendix C:
Analysis of Annual DWU Water Loss Data

AWWA WLCC Free Water Audit Software: Reporting Worksheet

WAS v4.1

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Water Audit Report for: Dallas Water Utilities
Reporting Year: 2002-03 10/2002 - 9/2003

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

<< Enter grading in column 'E'

Volume from own sources:	154,175.300	Million gallons (US)/yr (MG/Yr)
Master meter error adjustment (enter positive value):		MG/Yr
Water imported:		MG/Yr
Water exported:	51,544.300	MG/Yr
WATER SUPPLIED:	102,631.000	MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

			Pcnt:	Value:
Billed metered:	82,860.100	MG/Yr		
Billed unmetered:		MG/Yr		
Unbilled metered:	2,759.500	MG/Yr		
Unbilled unmetered:	1,997.700	MG/Yr		1,997.700
AUTHORIZED CONSUMPTION:	87,617.300	MG/Yr		

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption)

15,013.700 MG/Yr

Apparent Losses

			Pcnt:	Value:
Unauthorized consumption:	256.578	MG/Yr	0.25%	

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

			Pcnt:	Value:
Customer metering inaccuracies:	3,567.483	MG/Yr	4.00%	
Systematic data handling errors:	1,000.000	MG/Yr		
Apparent Losses:	4,824.061			

Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	10,189.639	MG/Yr
WATER LOSSES:	15,013.700	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 19,770.900 MG/Yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	4,600.0	miles
Number of active AND inactive service connections:	413,000	
Connection density:	90	conn./mile main
Average length of customer service line:	25.0	ft (pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	60.0	psi

PERFORMANCE INDICATORS

Operational Efficiency Indicators

Apparent Losses per service connection per day:	32.00	gallons/connection/day
Real Losses per service connection per day*:	67.60	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	1.13	gallons/connection/day/psi
Unavoidable Annual Real Losses (UARL):	2,222.90	million gallons/year
From Above, Real Losses = Current Annual Real Losses (CARL):	10,189.64	million gallons/year
Infrastructure Leakage Index (ILI) [CARL/UARL]:	4.58	

* only the most applicable of these two indicators will be calculated

AWWA WLCC Free Water Audit Software: Reporting Worksheet

 WAS v4.1

Back to Instructions

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Water Audit Report for: Dallas Water Utilities
Reporting Year: 2003-04 10/2003 - 9/2004

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED << Enter grading in column 'E'

Volume from own sources:	150,016.500	Million gallons (US)/yr (MG/Yr)
Master meter error adjustment (enter positive value):		MG/Yr
Water imported:		MG/Yr
Water exported:	55,614.300	MG/Yr
WATER SUPPLIED:	94,402.200	MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

			Pcnt:	Value:
Billed metered:	77,945.500	MG/Yr		
Billed unmetered:		MG/Yr		
Unbilled metered:	2,407.900	MG/Yr		
Unbilled unmetered:	1,842.800	MG/Yr		1,842.800
AUTHORIZED CONSUMPTION:	82,196.200	MG/Yr		

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption) 12,206.000 MG/Yr

Apparent Losses

			Pcnt:	Value:
Unauthorized consumption:	236.006	MG/Yr	0.25%	

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	3,348.058	MG/Yr	4.00%	
Systematic data handling errors:	1,000.000	MG/Yr		
Apparent Losses:	4,584.064			

Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	7,621.936	MG/Yr
WATER LOSSES:	12,206.000	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 16,456.700 MG/Yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	4,600.0	miles
Number of active AND inactive service connections:	413,000	
Connection density:	90	conn./mile main
Average length of customer service line:	25.0	ft (pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	60.0	psi

PERFORMANCE INDICATORS

Operational Efficiency Indicators

Apparent Losses per service connection per day:	30.41	gallons/connection/day
Real Losses per service connection per day*:	50.56	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	0.84	gallons/connection/day/psi
Unavoidable Annual Real Losses (UARL):	2,222.90	million gallons/year
From Above, Real Losses = Current Annual Real Losses (CARL):	7,621.94	million gallons/year
Infrastructure Leakage Index (ILI) [CARL/UARL]:	3.43	

* only the most applicable of these two indicators will be calculated

AWWA WLCC Free Water Audit Software: Reporting Worksheet

WAS v4.1

Back to Instructions

? Click to access definition

Water Audit Report for: Dallas Water Utilities
Reporting Year: 2004-05 | 10/2004 - 9/2005

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED << Enter grading in column 'E'

Volume from own sources:	152,083.900	Million gallons (US)/yr (MG/Yr)
Master meter error adjustment (enter positive value):		MG/Yr
Water imported:		MG/Yr
Water exported:	55,146.700	MG/Yr
WATER SUPPLIED:	96,937.200	MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

			Pcnt:	Value:
Billed metered:	73,760.300	MG/Yr		
Billed unmetered:		MG/Yr		
Unbilled metered:	2,400.700	MG/Yr		
Unbilled unmetered:	2,983.500	MG/Yr		2,983.500
AUTHORIZED CONSUMPTION:	79,144.500	MG/Yr		

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption) 17,792.700 MG/Yr

Apparent Losses

			Pcnt:	Value:
Unauthorized consumption:	242.343	MG/Yr	0.25%	

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	3,173.375	MG/Yr	4.00%	
Systematic data handling errors:	1,000.000	MG/Yr		
Apparent Losses:	4,415.718			

Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	13,376.982	MG/Yr
WATER LOSSES:	17,792.700	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 23,176.900 MG/Yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	4,600.0	miles
Number of active AND inactive service connections:	413,000	
Connection density:	90	conn./mile main
Average length of customer service line:	25.0	ft (pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	60.0	psi

PERFORMANCE INDICATORS

Operational Efficiency Indicators

Apparent Losses per service connection per day:	29.29	gallons/connection/day
Real Losses per service connection per day*:	88.74	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	1.48	gallons/connection/day/psi
Unavoidable Annual Real Losses (UARL):	2,222.90	million gallons/year
From Above, Real Losses = Current Annual Real Losses (CARL):	13,376.98	million gallons/year
Infrastructure Leakage Index (ILI) [CARL/UARL]:	6.02	

* only the most applicable of these two indicators will be calculated

AWWA WLCC Free Water Audit Software: Reporting Worksheet

 WAS v4.1

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? Click to access definition

Water Audit Report for: Dallas Water Utilities
Reporting Year: 2005-06 | 10/2005 - 9/2006

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED << Enter grading in column 'E'

Volume from own sources:	170,436.900	Million gallons (US)/yr (MG/Yr)
Master meter error adjustment (enter positive value):		MG/Yr
Water imported:		MG/Yr
Water exported:	67,398.200	MG/Yr
WATER SUPPLIED:	103,038.700	MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

			Pcnt:	Value:
Billed metered:	82,718.200	MG/Yr		
Billed unmetered:		MG/Yr		
Unbilled metered:	2,406.500	MG/Yr		
Unbilled unmetered:	2,218.000	MG/Yr		2,218.000
AUTHORIZED CONSUMPTION:	87,342.700	MG/Yr		

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption) 15,696.000 MG/Yr

Apparent Losses

			Pcnt:	Value:
Unauthorized consumption:	257.597	MG/Yr	0.25%	

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	3,546.863	MG/Yr	4.00%	
Systematic data handling errors:	1,000.000	MG/Yr		
Apparent Losses:	4,804.459			

Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	10,891.541	MG/Yr
WATER LOSSES:	15,696.000	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 20,320.500 MG/Yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	4,639.0	miles
Number of active AND inactive service connections:	413,000	
Connection density:	89	conn./mile main
Average length of customer service line:	25.0	ft (pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	60.0	psi

PERFORMANCE INDICATORS

Operational Efficiency Indicators

Apparent Losses per service connection per day:	31.87	gallons/connection/day
Real Losses per service connection per day*:	72.25	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	1.20	gallons/connection/day/psi
Unavoidable Annual Real Losses (UARL):	2,227.52	million gallons/year
From Above, Real Losses = Current Annual Real Losses (CARL):	10,891.54	million gallons/year
Infrastructure Leakage Index (ILI) [CARL/UARL]:	4.89	

* only the most applicable of these two indicators will be calculated

AWWA WLCC Free Water Audit Software: Reporting Worksheet

 WAS v4.1

Back to Instructions

? Click to access definition

Water Audit Report for: Dallas Water Utilities
Reporting Year: 2006-07 10/2006 - 9/2007

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

WATER SUPPLIED

<< Enter grading in column 'E'

Volume from own sources:	141,767.598	Million gallons (US)/yr (MG/Yr)
Master meter error adjustment (enter positive value):		MG/Yr
Water imported:		MG/Yr
Water exported:	53,063.045	MG/Yr
WATER SUPPLIED:	88,704.553	MG/Yr

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

			Pcnt:	Value:
Billed metered:	67,597.972	MG/Yr		
Billed unmetered:		MG/Yr		
Unbilled metered:	2,600.100	MG/Yr		
Unbilled unmetered:	2,776.800	MG/Yr		2,776.800
AUTHORIZED CONSUMPTION:	72,974.872	MG/Yr		

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption)

15,729.681 MG/Yr

Apparent Losses

			Pcnt:	Value:
Unauthorized consumption:	221.761	MG/Yr	0.25%	

Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed

Customer metering inaccuracies:	2,924.920	MG/Yr	4.00%	
Systematic data handling errors:	1,000.000	MG/Yr		
Apparent Losses:	4,146.681			

Choose this option to enter a percentage of billed metered consumption. This is NOT a default value

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:	11,583.000	MG/Yr
WATER LOSSES:	15,729.681	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: 21,106.581 MG/Yr

= Total Water Loss + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	4,639.0	miles
Number of active AND inactive service connections:	413,000	
Connection density:	89	conn./mile main
Average length of customer service line:	25.0	ft (pipe length between curbstop and customer meter or property boundary)
Average operating pressure:	60.0	psi

PERFORMANCE INDICATORS

Operational Efficiency Indicators

Apparent Losses per service connection per day:	27.51	gallons/connection/day
Real Losses per service connection per day*:	76.84	gallons/connection/day
Real Losses per length of main per day*:	N/A	
Real Losses per service connection per day per psi pressure:	1.28	gallons/connection/day/psi
Unavoidable Annual Real Losses (UARL):	2,227.52	million gallons/year
From Above, Real Losses = Current Annual Real Losses (CARL):	11,583.00	million gallons/year
Infrastructure Leakage Index (ILI) [CARL/UARL]:	5.20	

* only the most applicable of these two indicators will be calculated

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Appendix D:
DWU Reported Leak Awareness, Location, and Repair Procedures

Table D-1: DWU Reported Leak Awareness Procedures

Type of Leak	Procedure
Water Main Break	Operations staff members become aware of a possible emergency water main break from calls received from customers, businesses, staff, or other City services groups such as transit, fire department, waste collection, etc. The procedure is for dispatch to assign a First Responder to the scene for assessment. First Responders are available twenty-four hours per day/seven days per week. The normal response time for emergency leaks is within one hour, and often the water main leak is isolated or throttled by the First Responder.
Service Leak – Utility Side	Same as for a Water Main Break.
Service Leak – Private Side	Same as for Water Main Breaks and Service Leaks on the Utility Side. The First Responder will immediately notify the owner of the private leak and advise that it should be repaired. Subsequent notices are sometimes sent for delinquent repairs.
Valve & Hydrant Leaks	Awareness, if no water surfacing, is normally due to maintenance activities. If the leak is reported, a First Responder is sent within one hour. If deemed necessary, leaks are isolated or throttled by the First Responder.

Table D-2: DWU Reported Leak Location Procedures

Type of Leak	Procedure
Water Main Break	Most of the time the leak location is beneath the surfacing water, and specific leak location activities are unwarranted. If the First Responder is unsure of the leak location, standard practice is to have water operations drill test holes to locate the leak. If unsuccessful, a DWU leak detection crew is contacted.
Service Leak – Utility Side	Most of the time the leak location is beneath the surfacing water, and specific leak location activities are unwarranted. If the First Responder is unsure of the leak location, the DWU leak detection crew is contacted.
Valve & Hydrant Leaks	Leaks are easily confirmed on these appurtenances. Leak location is most often confirmed by the First Responder or Operations Staff by noise survey or probing method.

Table D-3: DWU Reported Leak Repair Procedures

Type of Leak	Procedure
Emergency Water Main Break	First Responder will secure location, isolate or throttle leak, and arrange for emergency utility locates. On average, emergency utility locates are provided within two hours depending on availability. Once locates are provided, repair is completed, on average, within four to six hours.
Water Main Break	First Responder will create a water main break activity code and secure the site. Dispatch will arrange for utility locates to be provided on a non-emergency basis. On average, utility locates are provided within two to seven days depending on availability and method used. Personnel will monitor leak to verify its status. Once locates are provided, repair is completed, on average, within ten days.
Emergency Service Leak – Utility Side	First Responder will remain on-site until utility repair crews arrive and will arrange for emergency utility locates to be provided. Once leaks are located, the repair is completed, on average, within four to six hours.
Service Leak – Utility Side	First Responder will either create a service leak repair work order or a service line replacement work order. For service leak repairs, dispatch will arrange for utility locates to be provided on a non-emergency basis. On average, utility locates are provided within two to seven days depending on availability and method used. Once leaks are located, the repair is completed, on average, within fourteen days.
Emergency Service Leak – Private Side	The leak is isolated, and the owner is responsible for the repair.
Service Leak – Private Side	The owner is responsible for the repair. When necessary, City Code Enforcement department is contacted for action.
Valve & Hydrant Leaks	A work order is generated, and repairs are scheduled according to a priority list. Generally, repairs are completed within ten days.

Appendix E:
Real Water Loss Best Management Practices

E. Real Water Loss Best Management Practices

The new M36 manual published by AWWA (Ref. 39) should be used as a primary resource to plan and determine best practices. The M36 can be purchased from the AWWA bookstore. Another resource is the Canadian National Guide to Sustainable Municipal Infrastructure (Ref. 50), available for free download. The best management practices discussed in this Appendix are based on material in these references.

Water main and service line failures are unavoidable. Factors that affect water main and service failures include but are not limited to:

- Pipe and fitting material;
- Pipe and fitting manufacturing and quality control;
- Pipe and fitting handling and storing;
- Design and installation practices;
- Traffic loading and vibrations;
- Soil and groundwater environment and corrosion;
- System pressure and transients;
- Operational practices and maintenance;
- Water quality and chemical characteristics; and
- Proximity to and activities associated with construction, operation, or repair of other utility infrastructure.

To reduce water loss associated with the failures and drivers listed above, the approaches in the following subsections should be considered as best practices.

The volume of water lost from a leak depends on the runtime of a leak. The runtime is comprised of three components – awareness, location and repair. Methods for reducing these components are addressed in the following sections.

E.1. Leak Awareness Time

Leak awareness time is the time from the occurrence of the leak until the utility becomes aware of the leak. The leak awareness time is greatly affected by whether the leak is reported to the utility or is an unreported leak.

Reduction of Leak Awareness Time for Reported Leaks

Methods to become more responsive and vigilant in the identification of reported leaks include:

- Work with local media to inform the public about your initiative to reduce water leakage and improve customer service.
- Encourage residents to report any signs of possible leakage to the utility.
- Provide literature educating the public on the delivery of water and include information on how to spot the signs of water leakage. This may be done through the water bill.

- Display information on how to report signs of potential leakage on city vehicles, websites, and advertisements. Information should include the appropriate contact information (e-mail, phone, fax, etc.).
- Educate and train not only water utility staff but other city staff (Parks, Inspections, Fire, Police, Wastewater, Solid Waste, etc.) to identify the signs of possible water leaks and make sure they are aware of the proper reporting contacts.
- Engage other groups such as taxi drivers, private security patrols, watch groups, delivery companies, and others to participate in reporting possible leakage.

Overall, reducing the awareness time of reported leakage involves educating and engaging the public and other city staff in assisting the utility at being more responsive to water leaks.

Reduction of Leak Awareness Time for Unreported Leaks

Many leaks can go undetected for very long periods. The AWWA recommends that if no active leakage control programs are in place, the average awareness time of unreported leakage be considered at 2 years. Appropriate methods to quantify the actual cost-benefit of various reduction measures can be difficult to assess. Nonetheless, utility management staff must evaluate the level of and need for active leakage control. All systems should have basic active leakage control programs and adjust these as necessary to control or reduce leakage.

Water balances and component analysis, acoustic leak detection surveys, permanent noise logging systems, and district metered areas can be used to assess the level of unreported leakage and assist in the identification of these leaks. These methods are described in the following sections.

Water Balances

By completing the standard AWWA/IWA Water Balance annually through use of the AWWA water audit software, the volume of real losses within a distribution system or sector can be established. The real loss level can be analyzed and compared to the level of loss from a detailed component analysis using standard background and reported leakage values for the particular utility to assess the level of unreported leakage. Excessive levels of unreported leakage would indicate the need to increase active leakage activities.

Acoustic Leak Detection Surveys

Routine leak detection surveys using electronic acoustic equipment is the most fundamental and most recommended basic level of active leakage control. Staff is deployed with acoustic equipment to listen for leak noise on available water main fittings such as hydrants, valves and curb stops. All leak noises are logged and categorized and forwarded to the leak detection location crews for further evaluation and pinpointing. Acoustic leak detection surveys are probably the most effective method to find unreported leaks in most situations.

Permanent Noise Logging Systems

Acoustic noise loggers are permanently or semi-permanently placed in the distribution system and surveyed periodically for the presence of possible leak noises. Any leak noise is forwarded to the leak detection location crews for investigation and pinpointing. The electronic equipment is used in difficult locations and where regular acoustic surveys may not be effective.

District Metered Areas (DMAs)

DMAs are discrete areas of a distribution system that are continuously metered and monitored for demand. The minimum night flow is recorded and evaluated for signs of potential leakage in the area. Efforts dealing with leak pinpointing can therefore be prioritized area by area, and unreported leakage is identified in a more proactive manner.

E.2. Location Response Time

The location response time is the amount of time taken to pinpoint the location of a water main after the utility has been made aware of the presence of a leak. All water main leaks should be properly assessed and located prior to commencing any excavation in order to mitigate the probability of a dry hole.

The location response time will vary depending on the severity, location, availability of staff, and backlog of work orders; however, it is important that all leaks be scheduled for location and repair.

The following recommendations are provided to reduce leak location times:

- Use a centralized, consistent tracking system to record and prioritize all reported leakage.
- Train and assign dedicated staff to leak location duties.
- Use the latest available leak detection equipment including but not limited to leak noise correlators, electronic acoustic rods and ground microphones, and leak noise loggers.
- Ensure that leak locating personnel have the latest infrastructure and mapping information including asset information.
- Prepare and record a detailed leak location report for each leak located indicating the severity level of leak.
- Ensure that all required utility locates have been requested.
- Assess the most probable type of leak to ensure repair crews have all necessary equipment and repair fittings.
- Develop monitoring procedures and performance measures to determine progress. Simple analysis of the average time to find and fix leaks should suffice, with monitoring and review to make sure that this improves annually.
- Assess the location with respect to customer type and critical users to determine and coordinate required communication efforts.

- Assess and identify required line valves that may need to be isolated to complete the repair.

It is current best practice to complete a leak location activity for all types of leaks, whether large reported main break or small hydrant leaks. A proper leak location assessment will help prioritize and reduce repair costs.

E.2. Repair Response Time

The repair response time is the amount of time taken to coordinate and dispatch a repair crew and to complete the actual repair. A successful and speedy repair scheduling protocol is an effective work order management system that enables the utility to identify the most cost-effective repair schedule based on type, severity, and location. A clear and concise general repair methodology and flow chart will ensure that a quality repair is made. Proper data collection and recording of failure type, repair times, and water isolation and restoration will enable utility staff to track and record water loss and asset condition information for future analysis.

Appendix F:
Review of Water Conservation Programs in Other Cities

F. Review of Water Conservation Programs in Other Cities

An evaluation of the water utility conservation programs in six U.S. Southwestern cities was conducted to learn from their program approaches and results with cutting-edge water saving technologies, strategies, and policies. Each of the cities evaluated has pursued innovative program approaches that have realized beneficial results and offer potential promise for implementation by DWU.

F.1. Criteria for Selection of Water Conservation Programs for Evaluation

More than a dozen water utility water conservation programs were considered for evaluation. The selection criteria for the utilities evaluated included their having similar institutional, service area, and water demand and supply characteristics and experience as DWU, such as:

- Water utility is both a large wholesale and retail water provider
- Serves over one million people in a fast growing region
- Diverse customer demographics and water use characteristics
- Long-term need for a prominent if not aggressive water conservation program
- High irrigation and outdoor water demands
- Active industrial, commercial, and institutional (ICI) water savings program
- Mature (more than ten years old) water conservation program has historical perspective as well as a forward-looking approach on program effectiveness
- Similar climatic characteristics
- Based in the Southwestern United States

Based on the above selection criteria, and in consultation with Ms. Carole Davis, Manager of Water Conservation for DWU, a final group of six water utilities was selected for evaluation:

- Albuquerque Bernalillo County Water Utility Authority (Albuquerque, New Mexico)
- Austin Water Utility (Austin, Texas)
- Denver Water (Denver, Colorado)
- San Antonio Water System (San Antonio, Texas)
- San Diego County Water Authority (San Diego, California)
- Southern Nevada Water Authority (Las Vegas, Nevada)

F.2. Overview of Six Southwestern Cities' Water Conservation Programs

Background information on each of the six water conservation programs was collected from the programs' websites as well as telephone interviews with each program manager. Each of the managers interviewed was very helpful.

Water Saving Goals, Budget and Staffing

A summary of the water savings goals, reported savings, and program budget and staffing for the six cities is provided in Table F-1. Several themes and features stand out:

- Per Capita Water Use Goals. All six systems evaluated reported progress in realizing water savings as a result of their long-term water conservation program. Five of the six utilities have set gallons per capita per day (gpcd) reduction goals. These goals vary from a low of 116 gpcd for the San Antonio Water System (SAWS) to a high of 199 for the Southern Nevada Water Authority (SNWA). The gpcd goals set by the five utilities are not completely comparable, however, for several reasons. First, the year set for reaching the goal is different for each system. Second, each system's demand characteristics (e.g., ratio of residential to nonresidential usage), while similar in some respects, are not identical. Thus, dividing total system water demand by population to yield a gpcd factor does not render city-to-city gpcd figures exactly comparable. Third, reclaimed water is available in some but not all service areas of the six systems. Utilities with greater reclaimed capacities may be more likely to report lower outdoor demands for potable water, thereby reducing their average gpcd figure and also their gpcd goals. Conversely, systems with limited reclaimed supplies may report higher gpcd figures and less ambitious gpcd reduction goals.
- System Leaks and Losses. System water losses and leaks or unaccounted-for-water (UFW), as reported in percentages by the utilities, appears relatively low for most of the systems, with Austin and SAWS slightly above the ten percent figure that is generally considered to be acceptable. Austin also reported their figures based on the newer AWWA/IWA water loss reporting methodology where its infrastructure leakage index (ILI) is within the acceptable range.
- Program Budgets. The budgets for the six programs vary considerably. The budgets are sometimes but not always based on water saving goals for the programs and estimates of program costs to reach those goals. Cost-effectiveness analysis of program elements was performed on some but not all programs; most managers have revised their programs over time and thus the return on investment (ROI) for measures in their programs is not always known or consistent from year-to-year.
- Program Staff and Consultants. All six programs utilize both permanent (utility) staff and paid consultants on an ongoing basis. Most staff are permanently employed by the utility, as shown under "Staffing (Utility & Contractor)" on Table F-1. Program staffing is highest with the more aggressive programs and lower with those systems that are close to reaching their water saving goals (e.g., Albuquerque and San Diego). Utility staff are often in charge of program management, ongoing program reporting, and most educational program development and outreach. Landscape and ICI audit responsibilities are often contracted out for some or the majority of audits, with all six systems employing at least a few utility staff who can conduct customer audits.
- Years in Existence. All of the programs have been in existence for at least ten years. The City of Austin's program, started in about 1983, is one of the oldest.

Table F-1: Water Conservation Program Goals, Budget, and Staff for Six U.S. Southwestern Cities

Water Conservation Program	Water Savings Achieved	Goals for Water Savings	System Unaccounted-for Water (UFW), Leaks and Apparent Losses	Program Budget (2009)	Staffing (Utility & Contractors)
Texas					
Austin Water Utility	6.4 to 10.4 mgd peak day as of FY08	Reduce peak demand by 1% per year (25 mgd savings by FY2017)	7.7% real losses or 9.8 mgd; ILI = 2.6 (FY2007, most recent)	$6.3 million	20 full-time
San Antonio Water System (SAWS)	Since 1980, SAWS has reduced its per capita demand by 39%.	116 gpcd (normal year basis) by 2016. Avg. 139 gpcd in 2008. Avg. 124 in 2009 (Jan-July).	12% (2008)	$6.5 million plus $2 to $3 million from commercial meter revenues. Additional dedicated program revenue from top tier rate users varies by year.	24 full -time staff, 5 part-time enforcement officers, and several summer temps and student interns (outdoor audit and irrigation programs)
New Mexico					
Albuquerque Bernalillo County Water Utility Authority	Average per capita reductions have been achieved since 1995 when program began.	150 gpcd by 2014. Avg. 159 gpcd 2009. Goal tied to state permit requirements for San Juan-Chama Project.	12.5% or 3.7 bg/year (2007)g	Appx. $3 million	5 full-time plus 2 (winter) to 6 (summer) ordinance enforcement officers. Contractors hired for landscape classes and school education programs.
Colorado					
Denver Water	Avg. 168 gpcd in 2009, a 43 gpcd reduction from avg. 211 gpcd in prior pre-drought period.	165 gpcd, or a 22% total demand reduction by 2016 (based on pre-drought period, average of 1993-2001).	6%	$10 million	18 full-time plus 12 contracted employees who provide ordinance enforcement, irrigation audits and soil ordinance checks.
Nevada					
Southern Nevada Water Authority	Avg. 245 gpcd in 2009. Program begun in 1990s reports steady progress toward per capita use reduction goal.	199 gpcd by 2035. Avg. 245 gpcd in 2009.	5% (two-thirds of pipes less than 20 years old)	$34 million ($50 million 2008). Budget spent primarily on customer incentives (rebates).	28 full-time.
California					
San Diego Water Authority	Avg. 9% total system demand reduction in first 6 months of 2009 compared to same period in 2008. Avg. 177 gpcd in 2008.	170 gpcd by 2020 (based on recent 10-year avg.), but goal may be cut even further.	1% difference between wholesale supplier and SDCWA; SDCWA wholesale customers' UFW figures reported separately.	$10 million plus $1.5 million from local gas/electric program partner and grants from Met. Water Dist. So. Calif. and U.S. Bureau of Reclamation.	8 full-time.

F.3. Overview of Conservation Program Components

Brief descriptions of program components for each of the six cities are provided in Table F-2. Program features of note are highlighted in bold.

F.4. Key Findings from Interviews with Water Conservation Managers

There were a number of "lessons learned" and helpful insights about water conservation program effectiveness gleaned from the interviews with the six water conservation program managers. Specific program features or comments are identified for some utilities; where they are not, more than one manager repeated the information. The key findings from these programs and interviews are summarized as follows.

Program Planning and Management

- Budget matters. The amount of water conservation program funding makes all the difference on what a program can achieve. Demand reductions through water conservation are just as valuable as new water supply capacity.
- Dedicated revenue streams, such as impact fees and revenues from top user rate tiers, help provide water conservation programs with significant and dedicated funding (SAWS).
- Innovate. Effective program innovations and creative approaches occur when staff members are given flexibility to change existing programs and try new initiatives, even if it strays from the original plan.

Priorities: Effective Program Strategies to Realize Significant Water Savings

- Hardware Measures. Put program money into customer-oriented measures that will realize measurable water savings. For example, if a particular rebate program is popular among customers but is not achieving the participation levels and water savings for which it was created, action is required: the program should be updated to meet its goals, it should be reduced in effort and expense, or it should be eliminated. Similarly, educational materials and outreach strategies are essential tools to educate customers and create incentives for them to adopt water saving measures, but they should be targeted to prompt customers to be participants in specific program offerings, such as turf replacement rebates and home audits.

Table F-2: Water Conservation Program Components for Six U.S. Southwestern Cities

Water Conservation Program	Residential/Domestic Measures				
	Home Audit & Retrofit Devices; Plumbing Repair	*Toilet Installations: HET 1.28 gallon per flush (gpf) and Low-volume 1.6 gpf*	*Clothes Washers*	*Hot Water on Demand*	*Other*
Texas					
Austin Water Utility		$200 rebate for pre-1996 toilets, $50 rebate for 1.6 gpf toilets and new construction (max. 3 per dwelling). WaterSense-labeled toilets only. Additional $60 rebate for licensed plumber installation. ICI: $175 rebate also available for pre-1992 flush-valve toilets.	$150 rebate ($100 water and $50 energy) per washer. MF: $250 rebate per washer.		$100 rebate for Pressure Regulating Valve (PRV).MF: Max/ $500 rebate (parts and labor)
San Antonio Water System (SAWS)	Free SF home audits. Includes leak repair and installation of low-volume showerhead and aerators.	Free HET toilets (max. 2 per household) for pre-1992 fixtures ("Kick the Can" program).	$100 rebate per household (credited on customer water bill). CEE Tier 3 washers only (updated monthly).	$150 rebate.	
New Mexico					
Albuquerque Bernalillo County Water Authority	Free SF home audits. Includes review of home water use history, toilet leak check and simple repairs, and installation of low-volume showerhead, aerators and automatic shutoff hoses. Includes outdoor landscape and sprinkler evaluation.	1) $200 rebate for 1.28 gpf HET fixtures that replace conventional high-volume toilets. 2) $100 rebate for HETs that replace 1.6 gpf low-volume fixtures.	$100 rebate (credit on water bill).	$100 rebate (credit on water bill).	
Colorado					
Denver Water		$125 HET rebate or $25 low-flow/1.6 gpf rebate. **Rebates also apply to new construction.**	$150 rebate.		$40 rebate for each submeter installed in a multi-family unit.
Nevada					
Southern Nevada Water Authority	Indoor Water Audit and Retrofit Kit (one per household) provided free.				
California					
San Diego Water Authority	Free	$100 rebate for high-volume toilets.	Rebates start at $135 with energy utility program cost-sharing.		

Table F-2 Continued: Water Conservation Program Components for Six U.S. Southwestern Cities

Water Conservation Program	Landscape & Outdoor Measures (Residential & Commercial)						
	Irrigation Audit	*Turf & Plant Retrofit*	*Weather-based Irrigation Controllers; Rain-Moisture Sensors*	*Rainwater Harvesting*	*Golf*	*Reclaimed Water Program*	*Other*
Texas							
Austin Water Utility	1) Free on-site audit for residential underground sprinkler systems using more than 25,000 gal/mo (summer).			1) $30 rebate per rain barrel. 2) Maximum $500 rebate for large (>300 gallon) capacity RWH system.		Yes	
San Antonio Water System (SAWS)	Free SF home (indoor and outdoor) audits.	1) Max $525 rebate per qualified property (requirements include max. 50% turf, specified turf and plant materials, min 4" soil depth, other). 2) **Additional max. $400 "Water Saving Bonus" for sustaining low water use over time.** 3) $100 gift certificate to a local participating nursery.			"Golf Fore SA" Program no longer active-all but 1 course on reclaimed.	Yes	
New Mexico							
Albuquerque Bernalillo County Water Authority	Free SF home (indoor and outdoor) audits.	1) Xeriscape Rebate Program offers $0.75 square foot rebate (bill credit) up to 2000 sq. ft. 2) $01.50 square foot rebate offered for min. 500 sq. ft and up to 2000 sq. ft area irrigated by RWH. 3) 25% rebate (max. $50) off the cost of renting grass removal equipment for participants in the Xeriscape Rebate Program.	1) 25% rebate off the cost of a multi-setting sprinkler controller. 2) $25 rebate for purchase of a rain sensor.	1) $25 up to $150 rebates for rainwater harvesting system (amount based on storage volume). 2) Additional rebates based on area covered by RWH and related changes (see "Turf & Plant Retrofit").		Yes	1) $2 rebates per multi-stream sprinkler rotor heads. 2) 25% off compost (max. $100) for participants in the Xeriscape Rebate Program. 3) Irrigation only accounts (appx. 1300) must agree to follow a budget set by ABCWA.
Colorado							
Denver Water			25% rebate off the cost of a WBIC.				1) $25 rain sensor rebate ($50 for wireless). 2) $5 per nozzle rebate (min. $20) for irrigation rotary nozzles.
Nevada							
Southern Nevada Water Authority	Multi-family Property Irrigation Review.	**$1.50 sq. ft (max 5000 sq. ft) rebate for grass removal and desert landscape plant material replacement; $1 sqft rebate provided over 5,000 sq. ft. (max. $300,000 per property).**	1) WBIC rebate max $200 or 50% of purchase price. 2) Rain sensor rebate max. $50 or 25% purchase price.		**Rebates for aggressive golf course conversion program.**	Yes (golf courses and public parks only).	**1) Pool cover rebate max $50 or 50% purchase price; permanent mechanical pool cover rebate max $200 or 50% of purchase price.**
California							
San Diego Water Authority	1) Free outdoor audits. 2) New GIS/Sat. customized landscape budget program starting in 2009.	Rebates for synthetic turf on Single Family properties.	1) Rebates start at $230 for WBICs. 2) Rebates for rotating nozzles on Single Family properties.			Yes	"A Better Way to Beautiful" water-smart landscape program theme incorporates fresh approaches.

Table F-2 Continued: Water Conservation Program Components for Six U.S. Southwestern Cities

Water Conservation Program	Industrial, Commercial and Institutional (ICI) Measures							
	ICI Audit	*Toilets & Urinals*	*Rebates and Retrofits*	*Clothes Washers*	*Cooling Towers and Process*	*Restaurants and Food Service*	*ICI Car Washes*	*Commercial Laundries*
Texas								
Austin Water Utility	Free.	1) See "HET Toilets." 2) Free flush-valve toilets (ADA and elongated models $45 extra). Additional $30 rebate for installation by a licensed plumber.	Free irrigation audits and $1000 max rebates for equipment and plant material upgrades.	$250 rebate ($150 water, $100 gas energy) per washer. Energy rebate partner: Texas Gas Service.	Maximum $100,000 rebates for new equipment and processes, including: single-pass cooling replacement, condensate and rainwater reuse for irrigation or cooling tower makeup and rinse water reuse. Property and/or sales tax exemptions may also apply.			1) Maximum $40,000 rebate for ozone and water reuse laundering equipment. Rebate based on water saved per day or half the equipment cost, whichever is less. 2) State of Texas sales and property tax exemptions also apply.
San Antonio Water System (SAWS)	Free audits for Cooling Towers	Free HET toilets for pre-1992 toilets.	Large-scale Retrofit Rebate Program: max. 50% rebate for equipment changes, including air-cooled equipment, process water reclamation, AC condensate reuse, industrial process, cooling tower modification,medical/dental, laundry, and cleaning systems.		Free cooling tower audits. See also Retrofits and Rebates.	"Restaurant Certified WaterSaver Program" participants receive: 1) Free 1.6 gpm PRSV and installation of PRSV; 2) Free 1.6 gpf toilets, and 3) 50% rebate on air-cooled ice machines.	BMP and certification program for "Recognized WaterSaver Partner." Charity carwashes allowed at permanent carwash facilities only.	See also Retrofits and Rebates.
New Mexico								
Albuquerque Bernalillo County Water Authority	Free.	1) $200 rebate for 1.28 gpf HET fixtures that replace conventional high-volume toilets. 2) $100 rebate for HETs that replace 1.6 gpf low-volume fixtures.						
Colorado								
Denver Water	Free	1) $150 rebate for HET toilet. 2) $125 for HET flush valve and bowl. 3) $75 rebate for 1.6 gpf toilets. 4) $50 rebate for HET urinal.	1) $40 rebate for each submeter installed on a CII property. 2) **$21.50 per 1000 gal/year (min. 100,000 gal/year) rebates for replacement of a variety water-cooled and other equipment with high-efficiency and air-based cooling systems**. Max. $40,000 rebate.	$150 rebate per machine for coin-op laundry equipment.	1) $500 rebate per cooling tower conductivity controller installed. 2) $50 rebate per for meter installed to monitor cooling tower make-up and bleed-off.	1) $350 rebate for boilerless steamers.	Certified Car Wash Equipment program offers 1) $1 rebate per high-efficiency nozzle (max. $300/year). 2) $100 rebate for weep management system to control weather system bleed.	*Yes–see "Rebates and Retrofits."*
Nevada								
Southern Nevada Water Authority	Free	*Yes–see "Rebates and Retrofits."*	Menu of pre-approved water saving technologies offer range of rebates for HET toilets, HET urinals, waterless urinals, showerheads, cooling tower drift reducers, conductivity controllers and air-based ice makers.		*Yes–see "Rebates and Retrofits."*	1) Rebates for air-cooled ice makers. 2) **"Water Upon Request" stickers provided free to participating restaurants.**	**"Water Smart Car Wash" certifies recycled only sites and provides the public with online discount coupons.**	**"Linen Exchange Program" for hotels and resorts; free cards and mirror clings provided.**
California								
San Diego Water Authority				Rebates start at $135 with energy utility program cost-sharing.				

Table F-2 Continued: Water Conservation Program Components for Six U.S. Southwestern Cities

Water Conservation Program	Public Outreach & Education; Stakeholder Involvement	Pricing	Conservation Ordinances				
			Water Waste	*Residential/ Domestic*	*Watering Restrictions*	*Landscape*	*ICI*
Texas							
Austin Water Utility	Seminars, school programs, **website-based do-it-yourself audit instructions** and resources, and "Water Wise Newsletter." **Website features most recent total daily water demands.**	Conservation rates in effect.	Yes–leaks, broken sprinkler systems, and runoff.		**Maximum 2 days/week watering allowed for automatic irrigation systems (Residential, Multifamily and Commercial properties).** No restrictions on Residential Oct 1 - April 30th. Fines for violations up to $500. Year-round: No automatic system irrigation between 10 a.m. and 7 p.m. May 1 - Sept. 30: Hand-held watering allowed anytime.		
San Antonio Water System (SAWS)	1) "WaterSaver Lane" Low-Water-Use Landscape and Lawn exhibit at the San Antonio Botanical Garden; 2) SAWS WaterSaver weekly eNewsletter with tips-outdoor emphasis; 3) online SAWS Conservation events weekly listings; 4) SAWS website tips include rebate application downloads. 5) "Season to Save Community Challenge" program for non-profit and community groups.	Conservation rates in effect.	Yes–controllable leaks and runoff.	Mission Verde ordinance (2009) requires high-efficiency plumbing fixtures in new construction.	Year-round restrictions in effect when aquifer level is below 660 feet. Automatic irrigation allowed any day but not between 10 a.m. and 8 p.m. Hand-held watering allowed anytime.	Conservation Ordinance specifies 1) Allowable drought-tolerant grass varieties for commercial and residential builders; 2) Rains sensors; 3) Annual irrigation check-up report required for sites 5 acres and larger; 4) Charity car wash restrictions; 5) Power washers registration program.	
New Mexico							
Albuquerque Bernalillo County Water Authority	**1) Free monthly classes: "Watering the Lawn Water Smart!" "Basics of Drip Irrigation Systems," "Do-It-Yourself Leak Detection," and "Xeriscape & Landscape Conversion Seminar." $20 rebate (credit) on water bill for attending lawn watering class. Most print materials available in Spanish. 2) Schools program. 3) Children's Water Festival. 4) Publications and videos.**	Flat rate structure with summer surcharge based on winter usage.	Yes–any water other than precipitation that flows from a property to a public right-of-way or adjacent property.		Time-of-day watering restrictions in effect April 1 to Oct. 31. No lawn sprinkling, car washing and pool draining between 11 a.m. and 7 p.m. Exemptions include hand watering, drip irrigation and bubblers, dust control, and first 30 days of newly sodded lawns and landscaping. Fines for 1st offense is $20 and can go up to $2000 for additional violations. **Voluntary "Water by the Numbers" ("1-2-3-2-1") program recommends number of days per month to water.**		
Colorado							
Denver Water	1) "Use only what you need" program theme. 2) Denver Water's Xeriscape Garden.	Conservation rates in effect.	Yes–runoff and other water waste onto pavement.		Time-of-day watering restrictions in effect May 1 to Oct. 1. No lawn sprinkling, car washing and pool draining between 10 a.m. and 6 p.m. **No watering allowed during rain or strong winds. Fines $50 to $300 (3rd violation). Note: persistent violators may have their water service shut off.**	**1) Soil amendment and compost requirements on all new properties (water meter will not be installed until certified). 2) Decorative water features must recirculate all water used. (Denver Ord. 14.04)**	**1) All commercial car wash operations must use recycled water systems. 2) Commercial and other car fleets must be washed in approved vehicle washing facilities. 3) Commercial power washing equipment must use a max. 1.6 gpm and be certified by Denver Water. (Denver Ord. 14.03.4). 4) All cooling condensate water must be reused or recycled before discharge into a sewer drain. (Denver Ord. 14.03.3)**
Nevada							
Southern Nevada Water Authority	**1) Rebate coupons available online. 2) e-mail newsletters.**	Conservation rates in effect.	Yes–leaks, broken sprinkler systems, runoff, and failure to discharge pool or spa drainage into a public sanitary sewer (if available).		1) Time-of-day watering restrictions in effect May 1 to Oct. 1. No lawn sprinkling between 11 a.m. and 7 p.m. 2) **Number of days watering is allowed during winter (1 day/week), spring/fall (3 days/week) and summer (any day).**	**Area allowed for new turf subject to limits (rules vary by five retail service areas).**	
California							
San Diego Water Authority	"A Better Way to Beautiful" water-smart landscape program theme incorporates fresh approaches, including outreach to HOAs and MF managers.	Conservation rates in effect.					

- Top Users. Focus on top users for each sector. The largest savings are often here; these customers are often well known in the community and when they adopt water conservation measures and realize big savings many people will hear about it and become inspired to do the same. Examples of top user targets are:
    - Top one percent of users (whole system)
    - Top one hundred or two hundred ICI users (update annually)
    - Irrigation-only and large irrigation accounts

- Industrial, Commercial, and Institutional (ICI) Users – Target Specific End Use Groups. Target ICI users with sector-oriented programs (e.g., restaurants and hotels) in annual or multi-year campaigns. Enlist ICI sector leaders who are actively working in their respective industries to participate in citizen or stakeholder group meetings and outreach efforts and put those people to work in helping with your program. Restaurants, hotels, health clubs, large industrial facilities, and public schools are common program partners.
    - "Cold call" letters to all ICI users to engage them in your program are not effective. Target top users, call them, and make appointments to meet with them to arrange an audit and follow-up. Engage your stakeholder members to help contact these customers if you have trouble getting in the door.
    - Use utility buildings for ICI demonstration projects. Denver Water changed the conventional chemical treatment on the cooling towers of one of its buildings, boosting the cycles of concentration from about eight to over forty. This is helping to show other building managers that what the utility is promoting is a new but proven technology.
    - Instead of telling contractors what kind of programs they should run, use a performance-base system. Tell them your water saving targets and have them figure out how they can best realize your goals (San Diego).
- Lawn Irrigation Class $20 Bill Credit Program (Albuquerque). "Very successful" and popular program realized an estimated average eighteen percent water savings among class attendees one year after they attended the class. Water savings estimate is based on customers' water bills one year before and one year after they attended the class for the program's first year only. Over eight thousand residential customers have participated since 2006. Mostly single-family homeowners attend; multi-family building managers receive a $20 bill credit for each building they manage. Cost is approximately $600 for each one-hour class (contractor and room rental).
- Homeowner Associations (HOA). Getting HOAs to convert to drip systems is an effective tactic that will save water even if their irrigation system is poorly designed and they water too frequently (SNWA).
    - Rebates for HOA properties have a five-year contract provision that require water savings goals to be met for the rebate to be paid annually over that same time period. A weather adjustment factor is included in the contract. For example, during a drought year a higher amount of irrigation water use that is above the contract allotment may be allowed. The volume allowed for the weather

adjustment varies by year depending on local rainfall and related climactic conditions (Denver).

- Turf rebate program participants must sign deed restrictions that prohibit anything but drought-tolerant plant material in the future. Starting in 2009, at least two of the utility conservation programs will give rebates only to customers who agree to amend their property deeds such that they and no future owner can plant high-volume plant material on property areas that previously received a rebate. These programs are new as of summer 2009 and thus program compliance and enforcement results have not yet been reported (SAWS and SNWA).
- Turf removal rebate programs save more water when appropriate changes are also made to the landscape's irrigation system. A high-volume irrigation system will still waste water even if it is being use on water-thrifty plants.
    - Estimated thirty gallons per square foot per year savings realized with turf rebates (Albuquerque).
    - The San Antonio WaterSaver Landscape Rebate Program also provides a $100 bonus gift certificate to customers who meet their ten percent water savings budget for the year. About seventy percent of program participant customers meet that goal. The water savings are verified by a conservation field staff consultant who checks customers' water use records as well as their evapotranspiration values and landscape sizes to make sure they are reducing their irrigation demands as planned. During the first half of 2009, SAWS paid out about $4,100 on rebates and $5,500 on the gift certificates to about one hundred customer participants. SAWS has budgeted $27,000 for the 2010 rebates.
    - Keep in touch with turf rebate program participants for at least a year after turf conversion. Web-based and "e-mail pal" strategies are low-cost ways to send customer reminders about water smart irrigation practices (SAWS).
- Place restrictions (ordinance) on new turf installed for new developments if you have a turf rebate program, otherwise the utility is sending a mixed message to the public ("If you already live here you shouldn't have grass, but if you are moving here it's okay to have grass with your new home").
- Irrigation audits conducted during the warm months are more effective in reducing customer water demands than audits provided off-season.
- "Water by the Numbers 12321" monthly watering schedule program has been "hugely successful," with estimated savings of five hundred million gallons in 2008 compared to 2006, the most recent normal rainfall year (Albuquerque).
- Active ongoing evaluation of lawn and landscaped areas is helpful to track trends in outdoor water use. SNWA is using GIS, aerial photography, and other imagery data to monitor ordinance compliance, make sure turf rebate customers have not reinstalled turf, track pool cover usage and rebate sites, and estimate the amount of irrigated area. The annual cost of the aerial imagery (resolution of six inches per pixel), including several layers for a five hundred square mile area, costs SNWA about $250,000 annually. This budget includes flight photography and related imagery processing and correction.

- Soil amendment requirement on all new properties has excellent compliance, probably because a meter will not be installed until compliance is verified (Denver).

Less Effective Program Strategies for Water Savings

- Voluntary programs yield few water savings. Voluntary certification programs, such as those for certified water-efficient car wash operations and golf courses, have more public education value than measurable water saving results.
    - Residential do-it-yourself outdoor audit download instruction sheet has had unknown impacts (Austin).
- Small water users produce small water savings. Make top users a priority.
- Avoid giving simple water saving tips to the public. People will tend to adopt the easy measures, such as turning off the tap while brushing their teeth, and ignore the more important ones, such as removing high-volume turf (SNWA).
- Weather-based Irrigation Controllers (WBICs) are starting to get installed but there are concerns about the quality of the controllers and that some may cause increased water use.
- High efficiency toilet (HET) rebates for 1.28 gpf toilets in new construction are offered to boost adoption of HETs although some developers might have installed them anyway (Denver).

Program Cost-Effectiveness and Customer Incentives

- The cost of new water "capacity" realized from water savings is less than what the utility would otherwise pay to develop new sources of supply.
- Cost-effectiveness analysis on total program and its components is spotty, perhaps because program investments and results vary from year-to-year.
    - Cost of new supply is about $8,800 per acre-foot per year for SNWA; right now it costs about $6,000 per acre-foot per year for conservation-generated water supplies (SNWA).
    - Hardware savings cost-effectiveness are measured based on ten years and landscape program measures are based on three years, but those baselines may be changing (SAWS).
    - Turf rebate program return on investment is approximately $700 per acre-foot (SAWS).
    - Return on investment for non-turf conservation programs ranges from about $200 to $300 per acre-foot (SAWS).
    - Condensate recycling project at one site had a return on investment of $50 per acre-foot (SAWS).

- Golf course turf removal rebates are $1.50 per square foot ($1.00 per square foot after the first fifty thousand square feet), but the actual removal cost is about $0.80 per square foot (SNWA).

- Incentive (rebate or bill credit) dollar values are often based on what is believed to be an attractive amount rather than cost-effectiveness analysis.
- Water pricing: "Not sure what rates would stop" some affluent customers who use a lot of water.
- A tiered rebate structure for ICI and large user (e.g., irrigator) customers is yielding more program participants (Denver).

Ordinance and Policy Initiatives

Ordinance and policy initiatives for San Antonio and Austin are described below.

San Antonio

A new ordinance, known as "Mission Verde," becomes effective January 1, 2010 and includes these requirements for both landscapes and plumbing fixtures:

- Landscape
    - Newly installed irrigation systems on one- and two-family properties may cover a maximum of ten thousand square feet of irrigation with spray or rotor heads. Micro-spray and drip irrigation may be used on additional area upon SAWS approval of a landscape plan.
    - Irrigation installers for newly installed irrigation systems shall provide system owner with a recommended seasonal irrigation schedule and instructions on how to operate the system and set the controller. The irrigation schedule must be affixed to the controller or adjacent wall. The SAWS water conservation manager must approve seasonal schedules.
    - Annual irrigation checkup reports are required for athletic fields, golf courses, large properties, and large users. At present reporting is on the honor system. SAWS has the authority to issue violation tickets but thus far it has not done so with this new program. Property owners who do not turn in their annual report in the future may receive a fine on their water bill.
    - Newly installed irrigation systems using pop-ups or rotors shall not be used in small landscape areas, i.e., less than five feet in length and/or width and impervious surfaces along two or more perimeters.
    - Where allowed, pop-ups and rotor heads must direct flows away from impervious surfaces and shall not be placed within four inches of such surfaces.
    - SAWS and CPS Energy shall work together to coordinate and promote water and energy incentive and rebate programs in "one-stop" venues to ease citizen and business participation in programs.

- Plumbing Fixtures
    - EPA WaterSense® water efficiency standards for plumbing fixtures are required in all new construction:
        - Gravity toilets shall use a maximum of 1.28 gallons per flush (gpf)
        - Urinals shall use a maximum of 0.5 gallons per flush (gpf)
        - Showerheads shall use a maximum of 2.0 gallons per minute (gpm)
        - Faucet aerators in bathrooms shall use a maximum of 1.5 gallons per minute (gpm)
    - Coin-operated Washing Machines that are newly installed in public laundry rooms, apartment houses, dorms and other sites shall meet or exceed the Consortium for Energy Efficiency (CEE) most current Tier 2 water and energy standards.

Austin

This city's maximum two-day per week watering restrictions has yielded significant water savings since the ordinance was adopted in 2007. Increased public education, ordinance enforcement, and stiffer fines (up to $500) are cited as the reasons why most customers are complying with the restrictions. Estimated 2008 water savings were five to nine mgd on an average summer day and approximately 6.16 mgd on the peak day. The average cost per year for a ten-year planning period is $187,500, or about $0.30 per gallon total cost.

Voluntary restrictions in the past were not found to be effective.

Ordinance Enforcement

- Enforcement works when it is done right.
    - Chronic offender commercial water sites are saving about ten thousand gallons per month after compliance (SAWS).
    - Chronic offender residential water sites are saving about two hundred to three hundred gallons per month after compliance (SAWS).
- Utility condition of service terms. SNWA has focused more on revising its Condition of Service Terms to promote enforcement of its water conservation policies instead of enacting ordinances and may be achieving better compliance as a result. For example, if a homeowner waters their landscape during hours that are prohibited (as written in SNWA's "condition of service terms" for all its customers), the homeowner is assessed a fee directly on their water bill. This avoids collection problems. Few customers challenge violation fees because of SNWA's unique documentation system. The Las Vegas Valley Water District, a member agency of the SNWA, posts their conservation-related customer service rules online and may be accessed at the following URL:

  http://www.lvvwd.com/assets/pdf/serv_rules_section12.pdf

- Videotape violations. SNWA enforcement officers videotape all observed violations and show the video to any customer who challenges the violation. Still pictures are not as effective because they don't always show irrigation sprays well and they cannot capture the duration of the violation. This documentation method is particularly effective with repeat offenders.
- Stiff fees work. Most enforcement programs provide an educational warning on the first violation for a property. SNWA doubles its fees for violations and uses a three-year cycle (like car violations).

- Ban turf on public medians and rights-of-way. These are common water waste spots (SNWA).
- Vary enforcement surveillance and target problem neighborhoods.

Public and School Education

- Avoid too many messages to the public. SNWA's strategy is two core messages: 1) "Do something" campaign that promotes participation in specific programs and 2) "The ethic" campaign which reinforces why water conservation is important.
- Customers are "worried about what their neighbors think" and are more likely to engage in a turf rebate program after someone else on their block has done so (SNWA).
- New water billing system will include monthly water conservation messages. This is a virtually free way to communicate with your customers (Denver).
- Water conservation education curriculum for school children is now being designed for each grade level in Albuquerque. Some children who have received Project WET materials have seen the same materials three to four times during their elementary school years. New public education staff employed by the utility are developing this program.

Stakeholder Involvement

- Stakeholder groups are critical to program success. This is typically comprised of representative wholesale and large retail customers served by the regional supplier. The stakeholder process is a critical part of making a program successful. Target each sector and subsector of water users to be part of the group. Engage these members to help devise and pre-flight new water conservation programs. They are also critical outreach agents and can help persuade large building facility managers to accept onsite audits.
  - Each year identify a short list of top water-using customer groups that need focused attention. Task the group to help with program outreach and work directly with top users to get their water demands down.
  - The chairperson of the stakeholder group is often someone who comes from an industry or sector that is a target priority for that year.
  - Meet monthly. Use the meeting to report on program progress, new ideas, problems, etc. Give your wholesale customers advance warning about large

rebates that may be planned in their service area (e.g., turf removal at a golf course that will lower local utility revenues).

  - Have broad representation on the group, such as AARP, the Scouts, HOAs, and members of the arts community.
  - Ad hoc groups that serve a temporary purpose help get new programs started and keep the group fresh. Disband them with their work is done.

- As a regional wholesaler, offer rebates to both your local wholesale and retail customers. This will boost program participation. Alternatively, require your local wholesale and retail suppliers to offer their own rebate and other conservation programs.
- Shared programs with other utilities (e.g., energy) are usually only worthwhile when both partners have an equal stake in the program outcome. Consider sharing mailing envelopes (and postage costs) for direct customer program appeals even if they are not cooperative programs.

Miscellaneous Observations

- Graywater can be problematic. A study in Perth, Australia found that houses which installed graywater systems increased their water demand an average of twenty gpcd. The reasons for this are not clear, but it is assumed that people feel they have a license to take longer showers or indulge in other excess water use.
- Most water conservation program staff should be out in the field working directly with customers.
- Hire contract staff to do most of the outdoor audits. Cool season months are not a good time to do audits – customers are less likely to implement then or later – and thus you usually don't need to have these staff in the office all year.
- High bill complaints are increasingly associated with homes that have water features such as fountains and ponds (Denver).

F.5. References

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Appendix G:
Recommendations to Amend the Dallas Landscape Ordinance

G. Recommendations to Amend the Dallas Landscape Ordinance

This appendix presents a review of the City of Dallas's existing Landscape Ordinance (Ref. 49). The purpose of this review is to identify opportunities in the ordinance where, with revision, the city could realize improved landscape water conservation and irrigation water use efficiency.

For this task, the following city ordinances as well as proposed statewide policies and U.S. EPA draft WaterSense® Program specifications were also reviewed and are included in the comments and recommendations:

- City of Dallas Irrigation Ordinance – "Standards for Designing, Installing and Maintaining Landscape Irrigation Systems." (Ref. 51)
- City of Dallas Water Conservation Ordinance – "Conservation Measures Relating to Lawn and Landscape Irrigation." (Ref. 52)
- City of Dallas Green Building Ordinance – "Green Building Program Ordinance (alternate)." (Ref. 53). Phase 1 took effect on October 1, 2009, and Phase 2 will take effect October 1, 2011.
- City of Dallas weed ordinances (Refs. 54 and 55).
- State of Texas, House Bill No. 4299 – "An Act relating to rainwater harvesting and other water conservation initiatives." (Ref. 56)
- College Station, Texas, proposed "Natural Landscape Ordinance." (Ref. 57)
- U.S. EPA WaterSense. "Revised Draft Inspection Guidelines for WaterSense® Labeled New Homes." (Ref. 58)

In addition to the above documents, references to relevant water conservation and landscape ordinances in other U.S. cities and water utility jurisdictions are also provided in this review.

G.1. Review of City of Dallas Landscape Ordinance

Dallas's current Landscape Ordinance (also referred to as the "Tree Ordinance") provides a set of standards and requirements that are designed primarily for the purposes of urban beautification, protection of property values, and preservation of large trees. When the ordinance was adopted fifteen years ago, it likely served those objectives. Today, however, Dallas's Landscape Ordinance is limited in terms of what is commonly included in a water conservation-oriented landscape ordinance: requirements for landscape design, installation, and maintenance that promote water efficiency, including but not limited to specifications for soil, turf, plants, trees, and irrigation technology, maintenance, and operation.

Despite the Landscape Ordinance's limits with respect to promotion of water-thrifty landscapes, one of its strengths is that the subjects covered under most of its sections are similar to those typically found in conservation-oriented landscape ordinances. For example, sections covering plant materials, soil, and irrigation requirements are already included in the Landscape

Ordinance, even though they mostly pertain to trees. Thus, future water efficiency-oriented revisions to the ordinance in many cases will fall under existing topic areas, and thus an entirely new chapter in the Dallas City Code will likely not be needed.

Comments and Recommendations by Section

The following are recommendations for revisions to the Landscape Ordinance:

- Amend and expand the "Purpose" section (Sec. 51A-10.102) to broaden the ordinance's scope by adding: To conserve water; To promote native and drought-adaptive noninvasive vegetation that thrive on natural rainfall after plant establishment; and To promote efficient irrigation. This change would be consistent with other elements in the Purpose section that include "ground-water recharge" and "To conserve energy."
- Amend and expand the "Acceptable Plant Materials" section (Sec. 51A-10.103) to: Require some if not all native or adaptive drought-tolerant noninvasive plant materials in new and renovated landscapes; limit the area allowed for high-volume plant materials such as turfgrass; select plants from approved plant material lists only; and delist "bad" weeds that are beneficial and used as native plant choices. Several jurisdictions have incorporated acceptable turf and plant lists into their water conservation ordinances and policies. For example, the San Antonio Water System's ordinance for drought-tolerant grass identifies approved turfgrass varieties to assist residents and builders. Revisions to the Landscape Ordinance could also adopt or establish a similar approved list of acceptable plants. If added, it is recommended that an existing regional or state list be incorporated by reference. Such a list should also clarify when weeds are acceptable, such as those used for medicinal (e.g., dandelions) or aesthetic purposes. Thus, native plant and weed-related revisions to the Landscape Ordinance will need to be cross-referenced to the city's weed rules so that the latter are also updated. The College Station, Texas, proposed "Natural Landscape Ordinance" provides helpful model ordinance language pertaining to native vegetation, including clarifying standards for wildflower and weed-dominated landscapes that are intentional versus neglectful. Lastly, this section of the ordinance may be a good place to specify plant hydrozones (low-, medium- and high-water using areas) as well as space limits for high-water-using plants. The landscape and irrigation ordinance for Pasco County, Florida requires that turf, annual flowers, and vegetable gardens must be on separate irrigation zones from shrub and ground cover areas. The U.S. EPA WaterSense program, in its May 8, 2009 "Revised Draft Inspection Guidelines for WaterSense® Labeled New Homes" has proposed that a maximum of forty percent of a site's landscapable area be high-water-volume turf.
- Amend and expand the "Soil Planting Area Requirements" section (Sec. 51A-10.104) to: Specify minimum depth for topsoil; preserve topsoil quality; and create mulching requirements for soil moisture retention. Soil quality can play a significant role in the future water needs of a landscape. Ensuring that newly planted landscapes are supported by healthy soil could yield long-term outdoor water savings for the city. Examples of the type of specifications to add to this section of the Landscape Ordinance include: (a) require a site's original topsoil to be preserved and stockpiled during building construction and restored after building completion; (b) require a minimum of 6 to 8 inches of high quality topsoil be installed on new and renovated landscapes; and (c)

require mulching of newly planted plants, trees, and shrubs to improve soil moisture retention. For example, six yards of organic amendment for each thousand square feet of topsoil are required in new landscapes by the City of Santa Cruz, California in their "Water Efficient Landscape Ordinance." Consider requiring at least annual mulching of existing plant materials that are irrigated so as to promote continued good soil moisture retention.

- Amend and expand the "Irrigation Requirements" section (Sec. 51A-10.106) to specify water-efficiency technologies and irrigation system requirements that are consistent with state law and the city's Irrigation Ordinance. At present this section is very short (five sentences) and only addresses irrigation of plant materials used for screening; it also requires that they must be irrigated by an automatic irrigation system. Established native and drought-tolerant plants used for screening may not require automatic irrigation systems (manual watering might be sufficient) or scheduled irrigations during normal weather conditions, because they thrive on Dallas's local rainfall patterns to which they are naturally adapted. This section should also cross-reference the city's new Irrigation Ordinance; in some instances new or refined specifications may be needed for irrigation system design, certification, operation, and maintenance. For example, this section (and/or the Irrigation Ordinance) should be broadened to incorporate new irrigation efficiency technologies (e.g., soil moisture sensors and weather-based irrigation controllers), appropriate use of irrigation (i.e., no irrigation in narrow medians), and related irrigation design, installation, and maintenance requirements. This section could also specify that selected irrigation system types (e.g., spray, rotor, drip, microspray, etc.) be based on plant hydrozones for low-, medium- and high-water using plants and turf. Similarly, this section could set rules on the maximum allowable volume or inches of water applied per irrigation run or per week. For example, Chatham County, North Carolina allows a maximum of one inch of irrigation water to be applied per week as part of its year-round conservation ordinance.

- Amend and expand the "General Maintenance" section (Sec. 51A-10.108) to include requirements for prompt irrigation system leak repair, replacement of broken sprinkler heads, seasonal resetting of irrigation controllers, and related requirements. Water utility landscape irrigation audit programs commonly find that neglect plays a large role in irrigation system water waste. In addition to leak and sprinkler head repair and controller resetting, other provisions to consider adding to this section include: irrigation system testing and certification which also verifies that required rain/freeze sensors are not only installed but working (roughly every 2-3 years); and allowing watering-in of chemicals only within 24 hours of application, among other provisions.

- Amend and expand the "Landscape Plan" sections (Sec. 51A-10.123 through Sec. 51A-10.128) to incorporate: Water conservation landscape design and related irrigation components; and water efficiency training needs for city landscape plan reviewers and site inspectors. These sections of the Landscape Ordinance cover the key topic areas for design, installation, and inspection of landscapes, but they are focused primarily on trees and street landscape aesthetics only, not water efficiency. Each of the sections pertaining to landscape planning and design should be evaluated and revised where appropriate to specify water conservation requirements. There are too many items to address here, but one example of a section ("Mandatory Landscaping Requirements" Sec. 51A-10.125) needing revision includes: “any portion of the buffer strip in the front yard and adjacent to the side lot line need not exceed 10 percent of the lot width.” This requirement could force small lot owners to put in narrow buffer strips that are nearly impossible to irrigate efficiently, resulting in overspray onto a neighbor’s driveway or other hardscape. In another example, the Enforcement section (Sec. 51A-10.128) pertains only to building officials. Effective enforcement will have to involve DWU, which may include empowering DWU “water cops” or other trained staff to perform irrigation inspections and cite violations when necessary. Similarly, the current ordinance requires a city building inspector to approve a landscape plan submission. Under a revised water conservation-oriented Landscape Ordinance, this task might be better performed by DWU staff and/or building inspectors who have been fully trained to evaluate and inspect the water efficiency components of landscape plan submissions.

- Amend and expand the “Fines” section (Sec. 51A-10.139) to include non-tree plant materials and irrigation systems. The current Landscape Ordinance mostly addresses trees. A more comprehensive and tiered system for fines will be needed for violations to non-tree and irrigation system ordinance requirements.
- Amend and expand the “Landscape Checklist” (City of Dallas Ordinance No. 22053, updated 5/18/06 and adopted under Article X) to include non-tree plant materials and irrigation systems. This is a useful feature of the Landscape Ordinance, but it needs major revision to incorporate updated plant and irrigation water efficiency requirements. Revising this checklist may be one of the last tasks in the revision process. Once the final set of new water efficiency provisions that will be added to the ordinance is certain, they can be added to the inspection checklist. Note that some of the items to be added to the checklist can already be found in existing city ordinances, so existing city ordinances should be reviewed to capture their requirements in the checklist. For example:
    - The city’s Water Conservation Ordinance requires the installation of rain and freeze sensors, and broken or missing sprinkler heads are prohibited (these should be checked for installation at new sites);
    - The city’s Irrigation Ordinance, based on state law, includes several provisions that also belong on the checklist, such as: “Provide the irrigation system’s owner or owner’s representative a copy of the irrigation plan indicating the actual system’s installation;”
    - The city’s new Green Building Ordinance has outdoor water use efficiency standards (i.e., “Utilize drip irrigation emitters for all bedding areas of the landscape plan”); and
    - The EPA’s new “Revised Draft Irrigation Audit Guidelines for WaterSense® Labeled New Homes” (May 8, 2009) contains a site inspection audit guide that may be useful in revising the city’s checklist.

In sum, relevant elements of the above ordinances and proposed standards should be reviewed carefully for incorporation into Dallas’s Landscape Ordinance checklist. Doing so will ensure that the city’s landscape plan and inspection approvals meet the requirements of all of its existing ordinances and city codes.

G.2. Conclusions and Recommendations

DWU's landscape water conservation and irrigation water use efficiency goals for the city need to be incorporated as practical standards and specifications into the city's revised Landscape Ordinance. As discussed above, a comprehensive revision of the Landscape Ordinance is recommended to include and compliment the various existing City of Dallas, State of Texas, and federal ordinance and standards for landscape and irrigation water efficiency that already exist.

Below are concluding suggestions for conducting the ordinance revision process, including additional features that merit consideration under the revised Landscape Ordinance:

- Collaborate with the Dallas Urban Forest Advisory Committee (UFAC) to incorporate water conservation requirements into the Landscape Ordinance. DWU will likely need to provide ongoing guidance to UFAC in the revision process for tasks such as consolidating and specifying standards, fine-tuning revised language, and ensuring consistency and compliance with other existing city and state water efficiency rules as well as federal WaterSense® and U.S. Green Building Council LEED® standards that are applicable.
- Incorporate rainwater harvesting and alternative supplies into the Landscape Ordinance. Texas is a national leader in promoting the use of rainwater harvesting (RWH), both for irrigation and also indoor use. A comprehensive RWH and alternative water sources bill is now pending before the Texas legislature; if passed, the bill will promote and in some cases require RWH systems in new buildings with roof areas exceeding ten thousand square feet. This bill is a sign that RWH and alternative water supplies for irrigation are fast becoming permanent sources for irrigation water in the future. Thus, it is suggested that revisions to the Landscape Ordinance include provisions for rainwater and other alternative water supplies.
- Consider adoption of a permanent lawn and landscape watering schedule for automatic irrigation systems. A future water conservation-oriented Landscape Ordinance will help serve Dallas's long-term outdoor water efficiency goals, but it is also true that even with the best landscape designs and latest weather-based irrigation controller and related technologies, some of the largest outdoor water savings are still achieved by simply limiting the number of days per week that lawns and landscapes can be irrigated. Here are the recommended core features of such a rule:
    - Establish a maximum two-day-per-week schedule. This should apply to automatic irrigation systems only. A maximum three-day-per-week schedule is an option, but three-day schedules sometime result in increased water use. While there may be initial resistance to a two-day schedule, many people easily adapt to two-day schedules over time and not just during drought. For example, residents in Austin, Central Florida and other regions with mandatory two-day schedules generally have adapted well.
    - Allow hand watering with a hose or container on any day during normal (non-drought) conditions. Many who initially oppose a two-day schedule are later content that they can hand water their lawn or gardens whenever they want.

- Limit the maximum amount of water to be applied to turf per day by setting volume limits (e.g., one inch) or by setting time limits (e.g., number of minutes per day). Properties with high use or especially dry conditions that may need extra water will have the option of hand watering whenever necessary.

- Review Dallas-based homeowner's association (HOA) rules that may conflict with DWU's landscape water efficiency goals and revise the Landscape Ordinance accordingly. HOAs commonly have landscape and irrigation requirements designed to preserve community aesthetic standards. However, HOA rules are also commonly found to conflict with local water conservation goals or ordinances. As part of the Landscape Ordinance revision process, existing HOA rules in the DWU service area should be evaluated so that the city and not HOAs have the final authority on landscape water use and irrigation practices.

- Add ornamental water features (fountains, ponds, etc) to the Landscape Ordinance. Ornamental water features are a fast-growing component of home and commercial landscapes, and some of them use thousands of gallons of water per day. These outdoor water-using products should be addressed in the ordinance to control common water waste problems, such as overspray, leakage, high evaporative losses, and excessive water dumping. Preliminary ideas for recommended standards or best management practices include:

    - Use recirculating, not once-through, water only. Use recycled water if it is available.
    - Limit hours of operation. Residential customers may operate water features for a maximum of twelve hours per day. Commercial customers and government facilities may operate water features during business hours only but not between midnight and 6:00 a.m.
    - Minimize water losses due to evaporation and wind by installing water features in areas that are not in direct sun and protected from wind. Similarly, use a shadecloth to minimize water losses to high temperatures, evaporation and wind.
    - Spray nozzles should not overspray beyond the water feature.
    - Repair leaks within forty-eight hours.
    - Do not operate water features during a drought or unusually high temperatures.

Appendix H:
Potential Water Conservation Strategies

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Potential Water Conservation Strategies

Strategy Name	Description	Strategy Type						Targeted Water Use Categories					
		Regulations/ Policies	Rebates/ Incentives/ Vouchers	Utility/ Government Programs	Public Education/ Outreach	Alternative Water Sources	Other	Indoor	Outdoor/ Seasonal	SF	MF	ICI	Municipal/ Utility
Annual irrigation system analyses/plans for large properties		x							x	x	x	x	
Athletic field conservation		x	x						x			x	x
Boiler and steam systems	Same as boilerless steamers cooking equipment?		x		x			x				x	
Business Partnership Program	Similar to SAWS and SNWA ICI program models.	x	x		x			x	x			x	
Car wash	Fundraisers at commercial facilities only	x										x	
Car wash	Restrictions	x						x				x	
Car Wash	Equipment upgrades: water reuse equipment, nozzle upgrades		x					x				x	
Central cooling (other than cooling towers) incentives and/or requirements		x	x						x			x	
City/utility-wide water efficiency	Water efficiency SOPs, checklist and reporting for all city/utility departments	x											x
Clothes washers/commercial laundry	Rebates (with multiple tiers based on efficiency) or requirements. Could apply to SF. On the commercial side, could apply to industrial laundry (hotel, hospital), coin-op, and MF.	x	x					x		x	x	x	
Clothes washers/commercial laundry	Federal energy standards for residential clothes washers	x					x	x		x			
Clothes washers/commercial laundry	Local/state clothes washer standards	x						x		x	x	x	
Collecting fuel cell vapor		x										x	
Commercial power washer registration		x										x	
Commercial Food Service & Restaurants	Equipment rebates or requirements (food steamers, cookers, ice makers, dipper wells, dish and ware washing, etc.). Removal of garbage disposals or flow restrictors for garbage disposals.	x	x					x				x	x
Commercial Food Service & Restaurants	Spray valve incentives/distribution. NOTE: Texas Health and Safety Code 372.005 specifies commercial pre-rinse spray valve performance standards (maximum 1.6 gpm), effective January 1, 2006.		x					x				x	
Commercial Medical/Dental/Hospital	X-ray/digital, sterilizers, HVAC, appliances, dry vacuum, food service, maintenance		x					x				x	x
Commercial & Govt Office Buildings	Cooling, plumbing, food service, maintenance, alternative sources							x				x	x
Condensate	Collect and reuse air-conditioning condensate	x				x			x	x	x	x	x
Conservation coordinator				x									
Conservation planning	Conservation Potential Assessment using computer modeling (e.g., Seattle)			x									x
Conservation water rate structures	Tiered blocks, water budgeting, peak rates, etc.	x		x				x	x	x	x	x	
Cooling towers incentives and/or requirements	Cooling tower minimum cycles; new towers have conductivity controllers, make-up and blowdown meters; green chemical treatments.	x	x						x			x	
Dedicated irrigation meters	Dedicated irrigation meters required for new ICI accounts, over 10,000 sq. ft., etc.	x		x					x			x	
Dedicated revenue stream for conservation programs	Establish impact and user fees; add tier to water rates.	x						x	x	x	x	x	
Desalination						x		x	x	x	x	x	x
Dishwasher incentives	Residential (see Commercial Food Service for ICI)		x					x		x	x		
Drip irrigation incentives			x						x	x	x	x	

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Energy and water conservation	Partnerships with energy providers, etc.						x					x	x
Enforcement of existing regulations		x							x	x	x	x	x
Enhanced water waste ordinance; move Stage 2 elements to Stage 1		x							x	x	x	x	
Evaporative AC replacement rebates			x						x	x			
Garbage disposals		x	x					x				x	
Flushometer bowl and valve retrofits		x	x					x				x	x
General ICI rebate (boiler and steam systems, landscape, refrigeration, rinsing/cleaning, water waste reduction, site-specific program, etc.)			x					x	x			x	
Golf course conservation	Similar to SAWS Golf Fore SA program	x	x						x			x	x
Graywater	Requirements for new construction.	x				x			x	x	x	x	
Graywater	Recycling incentives for existing homes					x			x	x	x	x	
Graywater	Recycling incentives for new construction					x			x	x	x	x	
Green building ordinance		x						x	x			x	x
HOA rules - prohibit restrictive covenants that prevent conservation in landscaping and irrigation systems/practices	State law?	x							x	x			
Hose nozzle distribution	EBMUD								x	x			
Hot water on demand			x					x		x	x	x	
Hotels and Motels	Cooling, plumbing, food service, pool, laundry, landscape design, irrigation, maintenance, alternative sources							x	x			x	x
ICI Commercial Equipment Rule	Groups items otherwise described under clothes washers/commercial laundry, commercial food service & restaurants, cooling tower incentives and requirements, replace water-cooled equipment with air-cooled/more efficient equipment, and other measures.	x						x	x			x	
Increasing water prices	Elasticity of demand as raw water prices increase			x			x						
Irrigation system design requirements	System requirements per HB2914/30 TAC 344, rain shutoff devices, minimum irrigation areas, flow direction, zones, ET controllers, biennial system audits, drip irrigation in parkway strips, distribution uniformity, soil moisture sensors, etc.	x							x	x	x	x	
Landscape irrigation systems incentives and/or requirements	Rotary nozzles, etc.	x	x						x	x	x	x	
Leak detection kit distribution			x					x		x	x		
Leak detection/repair program for low-income			x					x	x	x			
LEED certification	Construction of new city facilities	x											x
Low-flow plumbing fixture laws	1992 National Energy Policy Act, 2009 HB 2667	x						x		x	x	x	x
Parks conservation		x	x						x				x
Performance contracting for wider deployment of rebate/incentive programs			x					x	x	x	x	x	
Positive shutoffs on spray rinse wands	Does state law address this?	x						x				x	
Pressure reducing valve incentives and/or requirements		x	x					x	x	x	x	x	
Process water	Industrial water treatment					x		x				x	
Process water	Reuse of process water					x		x				x	

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Public and school education (audits/water waste reduction)	Cooling towers				x				x			x	
Public and school education (audits/water waste reduction)	Irrigation systems -- irrigation audits				x				x	x	x	x	
Public and school education (audits/water waste reduction)	Industrial (indoor/outdoor)				x			x	x			x	
Public and school education (audits/water waste reduction)	Multi-family (indoor/outdoor)				x			x	x		x		
Public and school education (audits/water waste reduction)	Municipal/Utility (indoor/outdoor)				x			x	x				x
Public and school education (audits/water waste reduction)	Single-family (indoor/outdoor)				x			x	x	x			
Public and school education (audits/water waste reduction)	Self-audit (indoor/outdoor)				x			x	x	x	x	x	
Public and school education (certification/training/coordination with professional associations)	Car wash certification		x		x			x				x	
Public and school education (certification/training/coordination with professional associations)	Cooling tower certification		x		x				x			x	
Public and school education (certification/training/coordination with professional associations)	ICI management and employee programs				x			x	x			x	
Public and school education (certification/training/coordination with professional associations)	Professional irrigators' training course				x			x	x	x	x	x	
Public and school education (certification/training/coordination with professional associations)	Restaurant certification (spray valves, toilets, signage)/Waterwise restaurant program		x		x			x				x	
Public and school education (certification/training/coordination with professional associations)	Swimming pool maintenance, use				x				x	x	x		
Public and school education (certification/training/coordination with professional associations)	Waterwise hotel/motel program				x			x	x			x	
Public and school education (implementation projects-tied to school capital rehab budget)	Cooling, plumbing, food service, pool, laundry, landscape design, irrigation, maintenance, alternative sources				x			x	x			x	
Public and school education (demonstration projects)	Model efficient homes				x			x	x	x	x	x	
Public and school education (demonstration projects)	Rainwater harvesting				x			x	x	x	x	x	
Public and school education (demonstration projects)	Xeriscaping				x			x	x	x	x	x	
Public and school education (general)	Additional FTE, professional marketing staff				x			x	x	x	x	x	
Public and school education (general)	Advertisements/program marketing				x			x	x	x	x	x	
Public and school education (general)	Aggressive, sustained public education program; perhaps contract with professional PR firm				x			x	x	x	x	x	
Public and school education (general)	Block leader program				x			x	x	x	x		
Public and school education (general)	Conservation awards				x			x	x	x	x	x	

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Public and school education (general)	Electronic newsletter				x			x	x	x	x	x	
Public and school education (general)	Education-in-schools program				x			x	x	x	x		
Public and school education (general)	ICI newsletter				x			x	x			x	
Public and school education (general)	Peak day management campaign				x				x	x	x	x	
Public and school education (general)	Promotional program (free car)				x			x	x	x			
Public and school education (general)	Videos and other publications				x			x	x	x	x	x	
Public and school education (general)	Web page				x			x	x	x	x	x	
Public and school education (general)	Workshops, presentations, outreach				x			x	x	x	x	x	
Public and school education (irrigation)	Irrigation (scheduling, ET requirements, ET/weather data, irrigation calculator)	x			x				x	x	x	x	
Public and school education (irrigation)	Customized water budgets for high users				x				x	x	x	x	x
Public and school education (irrigation)	Soil depth initiative				x				x	x	x	x	
Public and school education (irrigation)	Composting initiative				x				x	x		x	x
Rain/freeze shutoff device distribution/incentives/requirements		x	x						x	x	x	x	
Rainwater	Rain barrel rebates and distribution		x			x			x	x	x	x	x
Rainwater	Rainwater harvesting (new construction, retrofits, etc.)	x	x			x			x	x	x	x	x
Reclaimed water	Require reclaimed water (if available) for cooling towers, irrigation, central cooling plants, etc.	x				x		x	x			x	x
Reclaimed water	Decentralized reclaimed water production facilities					x		x	x			x	x
Reclaimed water	Reuse of treated effluent					x		x	x			x	x
Regional cooperation	Explore opportunities for leveraging of budgets, cost-sharing, common program administration, increased buying power, etc.			x				x	x	x	x	x	x
Replace water-cooled equipment with air-cooled/more efficient equipment	Air compressors, ice machines, refrigeration condensers, x-ray processing equipment, vacuum pumps, hydraulic equipment, etc.	x	x					x				x	
Shower heads, faucet aerators, toilet flappers distribution/replacement/incentives			x					x		x	x	x	
Soil sensor incentives and/or requirements		x	x						x	x	x	x	
Storm water	Storm water harvesting	x	x						x	x	x	x	x
Submetered billing incentives and/or requirements	Multi-family (submetered common areas and no allocated billing on this water), industrial	x	x					x			x	x	
Swimming pool cover incentives or requirements		x	x						x	x	x	x	
Swimming pool filter rebates			x						x	x	x	x	
Swimming pool retrofit incentives			x						x	x	x	x	x
Toilet/urinal incentives/distribution/requirements	HETs, dual-flush, retrofit on resale, retrofit kits, direct install, low-flush bags, etc. Texas Health and Safety Code 372.002 specifies toilet and urinal performance standards (maximum 1.6 gpf for toilets and 1.0 gpf for urinals) for new equipment, effective January 1, 1992. New HB2667 requires phase-in or 1.28 gpf toilets by 2014.	x	x					x		x	x	x	
Use pressure zone analyses to identify areas to focus on for customer assistance (EBMUD)			x	x				x		x	x	x	
Utility/municipal leadership	Apply measures to city/utility facilities			x				x	x				x
Water broom rebates	EBMUD		x						x			x	
Water conservation plan for large customers		x									x	x	x

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Water loss analysis/prevention	Annual water audit and tracking of performance indicators. Texas Water Code 16.0121(b) says, "Every five years, a retail public utility providing potable water shall perform and file with the board a water audit computing the utility's most recent annual system water loss."			x									x
Water loss analysis/prevention	Water audit data validation			x				x	x	x	x	x	x
Water loss analysis/prevention	Universal metering	x		x				x	x	x	x	x	x
Water loss analysis/prevention (apparent loss)	Management analyst(s) conduct billing system analysis: identify and resolve billing system data errors, improper classifications, unbilled accounts, etc.			x				x	x	x	x	x	x
Water loss analysis/prevention (apparent loss)	Calibration of master meters			x				x	x	x	x	x	x
Water loss analysis/prevention (apparent loss)	Calibration/replacement of customer meters. Priority on largest water users and meters with high volume. Look at meter types and sizing based on user profile.			x				x	x	x	x	x	x
Water loss analysis/prevention (apparent loss)	Identification and prevention of water theft			x				x	x	x	x	x	x
Water loss analysis/prevention (apparent loss)	Advanced metering: automatic metering infrastructure (AMR or AMI) that detects continuous flow (SNWA/LVVWD)			x				x		x	x	x	
Water loss analysis/prevention (real loss)	Billing leak detection			x				x	x	x	x	x	
Water loss analysis/prevention (real loss)	Leak detection and repair: active leak detection, district metered areas, night flow monitoring, passive listening with noise logging systems, etc. Refine procedures to reduce times for leak awareness, location, and repair. Add staff, conduct training.			x									x
Water loss analysis/prevention (real loss)	Continue to implement previous recommendations			x									x
Water loss analysis/prevention (real loss)	Leakage management software			x									x
Water loss analysis/prevention (real loss)	Pressure control			x						x	x	x	x
Water loss analysis/prevention (real loss)	Main replacement program (ductile iron)			x				x	x	x	x	x	x
WaterSense certification for new homes		x	x							x	x		
Water waste prohibition	Restricted watering days; limited watering hours (irrigation system, hand watering); maximum runoff distance (50 ft?); prohibit broken/misadjusted irrigation components; athletic field, golf course restrictions; no unattended hoses; no ponding on hard surfaces; no watering during precipitation event or freezing temperatures	x							x	x	x	x	x
Water waste prohibition	No once-through cooling (cooling equipment, ice machines, etc.)	x	x						x			x	
Water waste prohibition	Restrictions on filling swimming pools (no fill valves, no fill, etc.)	x							x	x	x	x	
Water waste prohibition	Fountain restrictions	x							x	x	x	x	
Water waste prohibition	Hotels reduce laundry	x						x				x	
Water waste prohibition	Hydrant and sewer flushing on emergency basis only	x											x
Water waste prohibition	No construction watering unless reclaimed water	x				x			x			x	
Water waste prohibition	No misters	x							x				
Water waste prohibition	No new connections (with some exceptions)	x								x	x	x	x
Water waste prohibition	No new landscapes	x							x	x	x	x	
Water waste prohibition	Pavement washing restrictions	x							x	x	x	x	

Appendix H
Potential Water Conservation Strategies

Strategy Name	Description	Strategy Type						Targeted Water Use Categories					
		Regulations/ Policies	Rebates/ Incentives/ Vouchers	Utility/ Government Programs	Public Education/ Outreach	Alternative Water Sources	Other	Indoor	Outdoor/ Seasonal	SF	MF	ICI	Municipal/ Utility
Water waste prohibition	Nursery water restrictions	x							x			x	
Water waste prohibition	Ordinance variances suspended	x											x
Water waste prohibition	Restaurant water on request only	x						x				x	
Water waste prohibition	Restricted foundation watering	x							x	x	x	x	
Water waste prohibition	Unrepaired leaks	x							x	x	x	x	
Water waste prohibition	Vehicle washing restrictions (none, some, hand only, etc.)	x							x	x	x	x	
Water waste prohibition	Water for power production voluntarily reduced	x										x	
Water waste prohibition	Wholesale customers encouraged to comply, reduce leaks, stabilize pressure	x											x
Water wise landscape conversion programs	Convert turf to native plants, etc.		x						x	x	x	x	
Water wise landscape design requirements	(X% native plants, Y% max turf, Z minimum soil depth, soil amendment, turfgrass dormancy, etc.)	x							x	x	x	x	
Weather-based smart controller incentives and/or requirements	Remote control, etc.	x	x						x	x	x	x	x
Wholesale agency assistance programs				x									
Wholesale customer contracts	Institute conservation rate structures, practices, programs with wholesale customers upon contract renewal			x					x				x
Xeriscape option from homebuilders	Xeriscape is outmoded landscape design concept; See EPA's New Single Family Home specs for guidelines.	x							x	x			
Xeriscape option on new homes required		x							x	x			

Appendix I:
Water Conservation Strategy Considerations

Table I-1: Water Conservation Strategy Considerations (Adapted from Ref. 18)

Water Conservation Strategy	Characteristics Favorable for Implementation	Characteristics Unfavorable for Implementation
System Water Audit and Water Loss	• Reduce "Unaccounted For" water • Can revise meter testing and repair practices from results • Can determine if unmetered uses are impacting revenues • Can help determine if leak reduction program needed	• Need to have extensive billing, meter, leak, and repair data to perform audit accurately • If the utility has a high infrastructure leakage index, it may take several years to address minor leaks
Water Conservation Pricing	• Discourage inefficient water use • Can reduce water use peaks with inverted block pricing or seasonal rates • Develop long term consumption patterns consistent with cost • Could serve as a revenue stream to fund conservation programs • Customer costs better tracked to usage and small users not subsidizing large users as much • Should provide customers with more detailed bill statements to encourage water conservation	• Public education needed about new rate structure and customer class uses • More complex billing structure • Unit cost per water produced may be higher with water conservation
Prohibition of Wasting Water	• Reduce water waste • Satisfy cooperative customers who are concerned about waste • Reduce peak usage • More efficient use of water	• Consumer education needed on rule • Staffing needed for enforcement and administration • Makes water utility a regulatory body for unwilling customers
Showerhead, Aerator, and Toilet Flapper Retrofit	• Reduce water usage in older construction • May be instituted with kit distribution or ordinance • Relatively inexpensive program	• Applicable to pre-1995 construction – need to determine target areas • Savings would eventually be realized by natural replacement • Need to develop education program and means of distribution • If change-of-ownership ordinance used, must educate realtors and have tracking plan
Residential Toilet Replacement Programs	• Reduce water use in major water use fixture • May institute with rebate, replacement unit, or by ordinance • Relatively inexpensive change • Admin and inspection costs lower for multi-family retrofits	• Need to determine pre-1995 construction and target areas • Savings would eventually be realized by natural replacement • Program must be marketed • Requires warehouse space if retrofit units offered • Staff time needed to administer, and labor cost for installation verification if applicable

Table I-1 Continued: Water Conservation Strategy Considerations (Adapted from Ref. 18)

Water Conservation Strategy	Characteristics Favorable for Implementation	Characteristics Unfavorable for Implementation
Residential Toilet Replacement Programs	• Reduce water use in major water use fixture • May institute with rebate, replacement unit, or by ordinance • Relatively inexpensive change • Admin and inspection costs lower for multi-family retrofits	• Need to determine pre-1995 construction and target areas • Savings would eventually be realized by natural replacement • Program must be marketed • Requires warehouse space if retrofit units offered • Staff time needed to administer, and labor cost for installation verification if applicable
Residential Clothes Washer Incentive Program	• Reduces water use in frequently used appliance • Good for water providers with large percentage of residential • Can offer rebate in conjunction with power utility rebate	• Relatively expensive appliance, even with rebate – rebate needs to be set at level to be incentive to more than high end customer • Need to educate public and rebate to increase participation
Hot Water on Demand – Loop Point of Use	• Reduces water waste while waiting for hot water to warm pipes	• Requires retrofit of building with electrical outlets at point of use or recirculation piping • Energy costs may increase
Residential Dishwasher (replace with water-efficient models)	• Reduces water use with more efficient appliance • Requires less energy to use	• Need large market penetration to have influence • Savings may eventually be realized by unit replacement over time • Cost of unit may be twice as much as conventional units
Residential Swimming Pools	• Conserves water through more efficient practices and use of cover	• Need customer base • Cover may be costly add-on to installation • Ordinance enforcement
School Education	• Relatively inexpensive program once designed • Will generate long term behavioral changes • Children can influence family water usage • Can include showerhead/faucet kit distribution in program	• Need good market penetration to have influence • Requires utility staff oversight and outreach efforts • Have to develop expertise and engaging programs that are age appropriate
Water Surveys for Single-Family and Multi-Family Customers	• Reduce water waste and make water use more efficient • Targets indoor and outdoor uses • Target highest users first	• Requires extensive staff time • Volunteer program • Associated costs for water-efficient plumbing fixtures distributed during surveys
Landscape Irrigation Conservation and Incentives	• More efficient landscape watering and long-term reduction in peak water use • Potential change to water-efficient vegetation	• Requires substantial customer base with irrigation systems • Comprehensive irrigation audits require staff or hired contractor • Devices and upgrades may be costly
Water Wise Landscape Design and Conservation Programs	• Reduce peak water usage long-term • Raise awareness • Saves customers time and money	• Education program needed to inform public about designs and market program • Rebate incentive needed to encourage

Table I-1 Continued: Water Conservation Strategy Considerations (Adapted from Ref. 18)

Water Conservation Strategy	Characteristics Favorable for Implementation	Characteristics Unfavorable for Implementation
Athletic Field Conservation	• Reduce daytime water demand and perception of excessive use • Parks and Schools good constituency • Two approaches – incentive/voluntary or ordinance	• Need customer base with irrigated athletic fields • Need stakeholder group to increase participation • Water audits/surveys needed • Need staff or contractor expertise
Golf Course Conservation	• Reduce water use and reduce peak demand • Incentive for course owners since large water demand • Two approaches as above – incentive/voluntary or ordinance • Could offer recycled water as alternative	• Need customer base • Need stakeholder group to increase participation • Water audits/surveys needed • Need staff or contractor expertise
Metering of all new connections and retrofitting of existing connections	• Method to account for all water usage • Increase revenue • Create equity among customers	• Requires proper installation and meter size • Retrofit of some multi-unit customers to separate meters • Staff time for installation and testing
Wholesale agency assistance programs	• Large percentage of water used by wholesale agencies • Providing assistance to agencies will increase water savings • Extend water conservation programs/education further	• Requires stakeholder groups and cooperative participation • Requires staff and administration and possibly additional costs for support
Conservation Coordinator	• Dedicated employee to oversee conservation programs • Efficiency through ongoing analyses • Enhance public image of utility	• Require versatile employee with power or management support to alter program • Support staff may be necessary • May require or need to manage consultants or contractors
Water Reuse	• Utilizes reclaimed water for beneficial use • Reduces potable water use • May be able to permanently remove some customer accounts from potable water base • Recycled water can be used for many applications including landscape, some industrial, and uses where potable is not required	• Requires reclaimed water production • Requires infrastructure for delivery • Stakeholder group needed to encourage participation • Marketing and public education needed • May require more stringent effluent limits
Public Information	• Effective means of educating public and promoting conservation • Reduce water use and waste • Behavioral changes may result in short and long term water savings • Important component with other BMPs	• Need market penetration for water saving results • May need several programs to target specific users • Stakeholder groups needed for effective program • Continued funding commitment needed to maintain water savings
Rainwater Harvesting and Condensate Reuse	• Reduce outdoor irrigation water usage • Encourages efficient use of water outdoors or in processes	• Condensate reuse is typically more beneficial to ICI buildings than residential • May have limited appeal • Depends on climatic factors • Could be costly for existing facilities

Table I-1 Continued: Water Conservation Strategy Considerations (Adapted from Ref. 18)

Water Conservation Strategy	Characteristics Favorable for Implementation	Characteristics Unfavorable for Implementation
Park Conservation	• Reduce water use and reduce peak demand • Incentive for park owners since large water demand • Two approaches – incentive/voluntary or ordinance • Could offer recycled water as alternative	• Need customer base • Need stakeholder group to increase participation • Water audits/surveys needed • Need staff or contractor expertise
Conservation Programs for ICI	• Reduce water use for high water use customer • Targeted program • Customer may gain revenue benefit through conservation • Potential beneficial marketing through award program if offered	• Need customer base • Need stakeholder group to increase participation • Water audits/surveys needed • Rebate cost if offered
Industrial Water Audit	• Increase water use efficiency • Separate water use metering if applicable for processes and grounds • Targets large water users	• Requires extensive staff time • Volunteer program • Requires proactive or cooperative participation from users
Industrial Water Waste Reduction	• Increase water use efficiency • Separate water use metering if applicable for processes and grounds for efficiency • Targets large water users	• Requires extensive staff time • Volunteer program • Requires proactive or cooperative participation from users
Industrial Submetering	• Reduce water waste • Assists large customers in determining where to implement water use reduction strategies • Saves customers money	• Need to determine applicable customers • Market to customers • Staff time for audits and recommendations
Cleaning/Sanitation	• Reduce water use by improving efficiency of practices • Customer decrease water cost with efficiency	• Requires customer base • May not be significant use of water in Dallas • Volunteer program
Rinsing/Cleaning (especially commercial kitchens)	• Reduce water use by improving efficiency of processes • Customer decrease water cost with efficiency • Raise awareness	• Requires customer base (restaurants) • Staff time for audits and education • Volunteer program • Possible contractor administration needed
Commercial Laundries and Laundromats	• Reduce water use with more efficient appliances • Reduce cost to customers	• Requires staff time for audits and education • Market to customers • Volunteer program • Possible contractor administration needed
Swimming Pools and Zoos	• Reduce water waste with limits on filling or require covers • Reduce cost to customers with water use reduction strategies • Zoos may use recycle water for some applications	• May require audits • Requires change in practices • May need ordinance enforcement

Table I-1 Continued: Water Conservation Strategy Considerations (Adapted from Ref. 18)

Water Conservation Strategy	Characteristics Favorable for Implementation	Characteristics Unfavorable for Implementation
Water Fountains	• Reduce water use through efficient use or restrictions • Could use recycled water • Customer decrease water cost with efficient fountains • Public perception of water conservation with restrictions	• May not be significant user • Need to determine applicable customers • May need ordinance enforcement
Cooling Towers	• Reduce water use in large water use equipment • Reduce costs to customers from water and energy savings	• Need to determine applicable customers • Market to customers • Staff time for surveys
Cooling Systems (other than Cooling Towers)	• Reduce water waste by eliminating single-pass cooling systems • May be able to use alternative water source such as recycle	• Requires customer base • May not be significant use of water in Dallas • Volunteer program
Industrial Alternative Sources and Reuse of Process Water	• Reduce potable water use by process changes or recycling process water • May be able to use alternative water source such as recycle or graywater or other	• Requires customer base • May not be significant use of water in Dallas • Volunteer program
Industrial Water Treatment	• Reduce water waste with more efficient processes • May be able to use alternate water source	• Requires customer base • Need stakeholder group • Volunteer program
Boiler and Steam Systems	• Reduce water waste • Lowers customers' cost	• Requires customer base • May not be significant use of water in Dallas • Volunteer program
Refrigeration (including Chilled Water)	• Reduce water waste • Could target with incentive program	• Requires customer base • Need stakeholder group and cooperative participation
Once-Through Cooling	• Reduce water waste	• Requires customer base
Management and Employee Programs	• Can supplement other BMPs • Employee involvement can increase effectiveness of programs • Minimal cost	• Requires customer base • Need stakeholder group • Volunteer program
Industrial Landscape	• Reduce water use and peak demand • Lower water bills	• Need stakeholder group increase participation • Could be costly to implement
Industrial Site Specific Conservation	• Reduce water waste • May involve grant or other incentive program • May be eligible for award program	• May require site audit • Need stakeholder group to increase participation • Volunteer program • Requires a long-term commitment

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Appendix J:
Documentation for Water Conservation Savings Assumptions

Table J-1: Documentation for Water Conservation Savings Assumptions

Water Conservation Strategy	Documentation
HB 2667 High-Efficiency Toilet (HET) Law	Customers replace toilets at the end of their useful lives or during remodeling projects. The HB 2667 HET law mandates that, by 2014, all toilets for sale must be 1.28 gallons per flush (gpf) models. This law will affect all toilets that are replaced (both high-flow and low-flow fixtures). AWWARF's "Residential End Uses of Water" cites an average toilet flush of 2.13 gpf for all toilets (not just high-flow toilets) (Ref. J1). Therefore, replacement of an average toilet with a 1.28 gpf toilet would save 0.85 gpf'. The natural replacement rate for toilets is about 4 percent per year (Ref. J2). Single-Family Sector: Multiplying 0.85 gpf by 5.2 flushes per day and 2.84 persons per single-family household and a 0.67 adjustment factor would yield estimated water savings of 8.4 gallons per day per account (gpad). The adjustment factor assumes one toilet replacement per house, with the HET used predominately (two-thirds of flushes). Multi-Family Sector: Multiplying 0.85 gpf by 5.2 flushes per day and 2.52 persons per multi-family unit and 8.8 multi-family units per account yields estimated water savings of 98 gallons per day per multi-family account. Industrial, Commercial, and Institutional (ICI) Sector: The 1992 National Energy Policy Act required 1.0 gpf urinals, and installation of a 0.5 urinal would save at least 0.5 gpf. Assume 38.4 employees per ICI account, based on July 2008 employment of 1,082,660 (from Dallas Office of Economic Development) and 28,101 active ICI accounts. Assume 3 toilet flushes per day for female employees and 0.8 toilet flushes and 2.2 urinal flushes per day for male employees (Ref. J3). Estimate of savings: 19.2 females/account * 3 flush/female/day * 0.85 gpf + 19.2 males/account * 0.8 toilet flush/male/day * 0.85 gpf + 19.2 males/account *2.2 urinal flush/male/day * 0.5 gpf = 83.1 gal/day/account.
Enhanced Real Loss Reduction and Additional Savings – Existing Real Loss Programs	Estimate based on reducing average infrastructure leakage index (ILI) from 4.8 to 2.8.
Water-Wise Landscape Design Requirements	Estimated 25 percent savings from the average account outdoor water use corresponds to 24.5 gpad for single-family residential accounts and 89.8 gpad for multi-family residential accounts. The U. S. EPA estimates that a reduction of turfgrass from about 80 percent in a typical yard to 40 percent in a water-efficient landscape results in a water savings of approximately 25 percent (Ref. J4).
ICI Water-Efficient Equipment Rule	Estimated 15 percent savings from the average ICI account indoor water usage of 1,826 gallons per day, or 284.7 gallons per account per day. A survey of water conservation measures for small-medium sized ICI establishments at the Alliance for Water Efficiency Resource Library found a range of water savings (Ref. J5). For example: from a low of approximately 102 gallons per day (gpd) for a commercial ice maker, 170 gpd for a new pre-rinse spray valve in a restaurant, up to 894 gpd for a new two-compartment boilerless steamer in a restaurant, 1,243 gpd for a new medical/dental steam sterilizer, and up to 2,742 gpd for an x-ray film processing unit.

Table J-1 Continued: Documentation for Water Conservation Savings Assumptions

Water Conservation Strategy	Documentation
Voluntary Twice-Weekly Irrigation Schedule	Estimate. Lack of data on long-term effect of voluntary twice-weekly irrigation schedule.
ICI Customer Water Audits	The 15 percent estimated savings is a conservative estimate adjusted from DWU's estimated 11,918 gallon per day per site savings expected from the cooling tower audit program.
ICI Hospitality Program	Marriott International found that its linen reuse program saves 11 to 17 percent on its hot water and sewer costs, and the Southwest Florida Water Management District estimates that its Water Conservation Hotel and Motel Program, a towel and linen reuse program, saves 17 gallons per occupied room per day (which is 19.6 percent of the current Dallas hotel/motel water use in Table 5-14) (Refs. J6, J7). However, many hotels already have such programs, and current Dallas hotel/motel water use includes water savings from existing programs. The American Hotel & Lodging Association, in survey responses from 217 member hotels, found that 88 percent of hotels have a linen reuse program in place and 83.5 percent of hotels have a towel reuse program in place for guests who stay multiple nights (Ref. J8). In addition, the effectiveness of the program will partially depend on whether guests opt in or opt out of the program. Taking all of this into account, and recognizing that the hospitality program will also include hotel/motel staff training, it is estimated that water savings will be 4 percent of indoor water use for hotels/motels. The hospitality program will also encourage water-conserving behavior in restaurants. Changes will include items such as serving water on request only, presoaking utensils and dishes in basins of water rather than running water, washing only full loads in dishwashers, turning off food preparation faucets that are not in use, and other modified behaviors. No statistics on savings associated with these changes in behavior were identified. Based on this information, it is estimated that water savings will be 2 percent of indoor water use for restaurants.
ICI Training Programs	Estimate.
ICI Business Partnership Program	Estimate.
Enhanced Residential Toilet Incentive	Water savings based on replacement of high-volume 3.5+ gpf toilets with 1.28 gpf toilets. Water savings of 22.0 gpad assume 2.22 gpf savings multiplied by 5.2 flushes per day and 2.84 persons per household and a 0.67 adjustment factor. The adjustment factor assumes one toilet replacement per house, with the HET used predominately (two-thirds of flushes). For high-efficiency toilet rebates, the Alliance for Water Efficiency (AWE) Water Conservation Tracking Tool assumes savings of 10,391 gallons per year per single-family unit, or 28.5 gpad, and 15,777 gallons per year per multi-family unit, or 43.2 gpad (Ref. J2).

Table J-1 Continued: Documentation for Water Conservation Savings Assumptions

Water Conservation Strategy	Documentation
ICI Financial Incentives	
Large Businesses	Estimated 35 percent water savings among the top 10 percent of large ICI customers. LEED silver and gold projects often exceed 40 percent water savings.
Small-Medium Businesses	Estimated 20 percent water savings. The target customer is a small-medium ICI customer who can implement relatively simple, low-cost measures. Actual savings may be higher based on a survey of water conservation measures at the AWE Resource Library.[J5] The Dallas Green Building Program contains water efficiency elements with indoor water use reduction goals of 20 and 30 percent for new construction (Ref. J9). The EPA's WaterSense labeling program recognizes water-efficient products that are 20 percent more water-efficient than average products for a given category (Ref. J10).
Toilets	Estimated 10 percent savings from the average ICI account indoor water usage of 1,826 gallons per day, or 182.6 gallons per account per day. Water savings based on replacement of high-volume 3.5+ gallons per flush (gpf) toilets with 1.28 gpf toilets (savings of 2.22 gpf) and replacement of 1.0 gpf urinals with 0.5 gpf urinals (savings of 0.5 gpf). Estimate is commensurate with a calculation similar to that shown above for the HB 2667 HET law: 19.2 females/account * 3 flushes/female/day * 2.22 gpf + 19.2 males/account * 0.8 toilet flushes/male/day * 2.22 gpf + 19.2 males/account *2.2 urinal flushes/male/day * 0.5 gpf = 183.1 gal/day/account.
Residential Irrigation System Incentive	Estimated 20 percent savings from the average outdoor water use of the top 25 percent of accounts corresponds to 63.8 gpad for single-family residential accounts and 283.4 gpad for multi-family residential accounts. The EPA's WaterSense labeling program recognizes water-efficient products that are 20 percent more water-efficient than average products for a given category (Ref. J10). Acequia, a landscape irrigation company in Austin, has sustained more than a 20 percent reduction in its commercial clients' irrigation water use for at least five years (Ref. J11). Similar principles can be applied on the residential side.
Residential Clothes Washer Incentive	Estimated savings of 19.3 gpad for single-family washers and 69.3 gpad for multi-family washers (Ref. J2).

Appendix J References

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Appendix K:
Projected Water Savings from Recommended Strategies, FY 2010-11 through FY 2029-30

Appendix K
Projected Water Savings, FY 2010-11 through FY 2029-2030

Strategy	Projected Water Savings (gallons per day)											
	FY 2010-11	FY 2011-12	FY 2012-13	FY 2013-14	FY 2014-15	FY 2015-16	FY 2016-17	FY 2017-18	FY 2018-19	FY 2019-20	FY 2020-21	FY 2021-22
Additional savings -- existing real loss programs	2,000,000	2,500,000	3,500,000	4,500,000	5,000,000	3,333,333	1,666,667	0	0	0	0	0
HB 2667 high-efficiency toilet law	211,856	408,468	758,501	1,159,297	1,612,253	2,074,290	2,545,573	3,026,174	3,516,332	4,016,110	4,525,677	4,887,712
Enhanced real loss reduction	1,000,000	1,750,000	2,700,000	4,550,000	7,450,000	4,966,667	2,483,333	0	0	0	0	0
Water-wise landscape design requirements	0	0	0	22,987	69,428	139,798	229,838	320,793	389,684	436,054	459,439	416,953
ICI water-efficient equipment rule	0	0	0	20,220	40,851	61,899	79,201	80,006	80,818	81,639	82,469	41,829
Voluntary twice-weekly irrigation schedule	110,916	168,064	282,951	342,993	404,221	408,326	412,475	416,663	420,897	425,173	429,492	431,638
ICI customer water audits	147,691	351,595	596,943	797,079	952,003	809,203	687,823	584,649	496,952	422,409	359,048	305,191
ICI hospitality program	0	30,431	46,043	62,072	78,250	0	0	0	0	0	0	0
ICI training programs	0	0	25,118	71,585	110,517	93,939	79,849	67,871	57,691	49,037	0	0
ICI business partnership program	0	5,514	10,202	14,062	17,095	14,530	12,351	10,498	8,924	7,585	0	0
Enhanced residential toilet incentive	87,860	329,475	571,090	812,705	1,054,320	1,054,320	1,054,320	1,054,320	1,054,320	1,054,320	1,054,320	1,054,320
ICI financial incentives	0	1,444,128	2,892,595	4,332,133	5,762,743	5,730,246	5,699,374	5,670,045	5,642,183	5,615,714	5,590,568	5,566,680
Residential irrigation system incentive	0	0	43,400	353,710	1,030,316	978,800	929,860	883,367	839,199	797,239	757,377	719,508
Residential clothes washer incentive	0	16,620	49,106	93,425	190,927	190,927	190,927	190,927	190,927	190,927	190,927	190,927

Total (million gallons per day)	3.56	7.00	11.48	17.13	23.77	19.86	16.07	12.31	12.70	13.10	13.45	13.61
Total (billion gallons per year)	1.30	2.56	4.19	6.25	8.68	7.25	5.87	4.49	4.63	4.78	4.91	4.97
Cumulative Total (billion gallons)	1.30	3.86	8.04	14.30	22.97	30.22	36.09	40.58	45.21	49.99	54.90	59.87

NOTES:

The water savings from the selected strategies are expected to continue beyond the five-year implementation of the Updated Strategic Plan (FY 2010-11 through FY 2014-15), even if no additional funding is provided for these strategies after FY 2014-15. The incentive-based and educational programs implemented during the five-year planning period will continue to produce water savings beyond FY 2014-15 for some additional years depending on the measure life (e.g., the water savings for the high efficiency clothes washer rebate program has a twelve year life for each washer that is installed) and the annual decay assumptions discussed in Chapter 9. In addition, water savings from ordinance-related measures will continue to grow along with the growing population. This table shows projected water savings from these strategies for the next twenty years, a total of approximately 99.6 billion gallons.

Appendix K
Projected Water Savings, FY 2010-11 through FY 2029-2030

Strategy	Projected Water Savings (gallons per day)							
	FY 2022-23	FY 2023-24	FY 2024-25	FY 2025-26	FY 2026-27	FY 2027-28	FY 2028-29	FY 2029-30
Additional savings -- existing real loss programs	0	0	0	0	0	0	0	0
HB 2667 high-efficiency toilet law	5,120,931	5,356,359	5,594,014	5,833,911	6,076,068	6,320,500	6,567,225	6,816,259
Enhanced real loss reduction	0	0	0	0	0	0	0	0
Water-wise landscape design requirements	373,794	329,955	285,428	240,205	241,430	242,661	243,899	245,143
ICI water-efficient equipment rule	42,042	42,257	42,472	42,689	42,907	43,126	43,346	43,567
Voluntary twice-weekly irrigation schedule	433,796	435,965	438,145	440,335	442,537	444,750	446,973	449,208
ICI customer water audits	259,412	220,500	187,425	0	0	0	0	0
ICI hospitality program	0	0	0	0	0	0	0	0
ICI training programs	0	0	0	0	0	0	0	0
ICI business partnership program	0	0	0	0	0	0	0	0
Enhanced residential toilet incentive	1,054,320	1,054,320	1,054,320	1,054,320	1,054,320	1,054,320	1,054,320	1,054,320
ICI financial incentives	5,543,986	5,522,426	5,501,945	5,408,823	5,394,022	5,379,961	5,366,603	5,353,913
Residential irrigation system incentive	683,533	649,356	616,888	0	0	0	0	0
Residential clothes washer incentive	190,927	174,307	125,202	31,777	0	0	0	0
Total (million gallons per day)	13.70	13.79	13.85	13.05	13.25	13.49	13.72	13.96
Total (billion gallons per year)	5.00	5.03	5.05	4.76	4.84	4.92	5.01	5.10
Cumulative Total (billion gallons)	64.87	69.91	74.96	79.72	84.56	89.48	94.49	99.59

Appendix L:
Documentation for Unit Cost Assumptions

Table L-1: Documentation for Unit Cost Assumptions

Water Conservation Strategy	Documentation
ICI Customer Water Audits	Estimated contractor cost of $1,000 per audit. Current cost of cooling tower water audits is approximately $833 per audit. Includes site visit and reporting of potential water conservation measures, savings, and costs.
ICI Training Programs	Estimated cost of $5,000 per program to research, develop, lead, and manage ongoing water efficiency training programs. Assumed 5 programs per year.
Enhanced Residential Toilet Incentive	Although the breakdown of the estimated costs for each toilet incentive ($100 incentive and $30 labor/contractor fee) is slightly different than current DWU toilet incentive costs ($90 incentive, $39.50 contractor fee), the totals are similar. Limited research suggests that DWU could potentially reduce its labor/contractor costs. Labor costs for the following entities are reported to be: ▪ Jordan Water Conservancy, Utah: $11.86 per rebate (Ref. L1). ▪ Aurora, Colorado: $7.87 per rebate for "staff salary and administrative costs" (Ref. L2). ▪ Marin Municipal Water District, California: Master plan assumes a 0.45 full-time equivalent (FTE) for 1,000 rebates (Ref. L3). At a total compensation of $60,000 per year for an FTE, this corresponds to $27 per rebate. ▪ Contra Costa Water District, California: $16.61 per rebate during October 2009 through December 2009. Does not include inspection of installations (Ref. L4). Austin Water Utility and Albuquerque Bernalillo County Water Authority offer $200 rebates for replacement of high-volume 3.5+ gallons per flush (gpf) fixtures (Refs. L5, L6).
ICI Financial Incentives	
Large Businesses	The unit cost for this strategy is intended to be flexible to cover all types of site-specific water conservation improvements. It is anticipated that the maximum combined incentive and labor cost for a given measure would be up to $100,000. During the implementation phase, DWU will determine a maximum unit cost (e.g., dollars per thousand gallons) that it will pay for water savings, and this will influence the actual incentive amount for a given site-specific project.

Table L-1 Continued: Documentation for Unit Cost Assumptions

Water Conservation Strategy	Documentation
Small-Medium Businesses	The $500 average incentive unit cost is intended to prompt on a small-medium ICI customer to implement relatively simple, low-cost measures. The actual rebate amount for a given customer will depend on the measures implemented. Potential measures include high-efficiency commercial dishwashers, clothes washers, food steamers, ice machines, sterilizers, etc. Additional measures are listed in the Alliance for Water Efficiency (AWE) Resource Library (Ref. L7). The Metropolitan Water District of Southern California (MWDSC) has developed a menu of rebates offered to ICI customers that includes connectionless food steamers ($485 per compartment), air-cooled ice machines ($300 each), dry vacuum pumps ($125 per 0.5 horsepower, up to a maximum of $500), cooling tower conductivity controllers ($625 each), and other water-conserving equipment (Ref. L8). The Marin Municipal Water District provides rebates for commercial dishwashers at a rate of $9 per hundred cubic feet of annual water savings, up to a maximum of $500 per customers (Ref. L9). The $141 average labor unit cost represents approximately 2.5 hours of field staff time and 1 hour of clerical staff time to review applications, conduct site visits, process incentives, and keep records. It is assumed that an initial site visit will be performed as part of an ICI customer water audit. For comparison, City of Santa Rosa (CA) Utilities Department staff members typically spend 2 to 4 hours to visit a small-medium commercial site (Ref. L10).
Toilets	Same assumptions as for Enhanced Residential Toilet Incentive program.
Residential Irrigation System Incentive	The $200 average incentive unit cost is similar to rebates offered for weather-based irrigation controllers by the Southern Nevada Water Authority (half of purchase price, up to a maximum incentive of $200) and the San Diego County Water Authority ($230) (Refs. L11, L12). The actual rebate amount for a given customer will depend on the measures implemented. Potential measures include weather-based irrigation controllers, rotating nozzles for pop-up spray heads, drip irrigation equipment, and other devices. The $106 average labor unit cost for single-family residential sites represents approximately 1.9 hours of field staff time and 0.75 hour of clerical staff time to review applications, conduct pre- and post-installation site visits, process incentives, and keep records. For comparison, City of Santa Rosa (CA) Utilities Department staff members generally spend 30 minutes to 1 hour per site visit at single-family residential sites (Ref. L10). The $198 average labor unit cost for multi-family residential sites represents approximately 3.75 hours of field staff time and 1 hour of clerical staff time to review applications, conduct pre- and post-installation site visits, process incentives, and keep records. For comparison, City of Santa Rosa (CA) Utilities Department staff members may spend up to 4 hours per site visit at commercial sites, depending on the landscape size (Ref. L10).

Table L-1 Continued: Documentation for Unit Cost Assumptions

Water Conservation Strategy	Documentation
Residential Clothes Washer Incentive	The incentive unit costs of $100 per single-family clothes washer and $250 for multi-family clothes washer are similar to rebates offered by Denver Water ($150), Austin Water Utility (maximum of $100 for single-family and $250 for multi-family), Albuquerque Bernalillo County Water Authority ($100), and San Antonio Water System ($100) (Refs. L13, L5, L6, L14) The $20 contractor unit cost represents a fee paid to a contractor to review applications, process incentives, and keep records. Labor/contractor costs for the following entities are reported to be: ▪ Aurora, Colorado: $10.32 per rebate for “staff salary and administrative costs” (Ref. L2). ▪ Seattle Public Utilities, Washington: less than $12.50 administrative cost per rebate (Ref. L15). ▪ Bay Area Water Supply & Conservation Agency, California: reported a decrease from $15.52 to $8.77 in administrative costs per rebate from FY 2001-02 to FY 2007-08 (Ref. L16). ▪ Contra Costa Water District, California: $20 per rebate (Ref. L4). CCWD has joined with several other cities to retain PG&E (the power company) to process joint water and energy conservation rebates for high-efficiency clothes washers.

Appendix L References

L1. Western Resource Advocates, Smart Savings Water Conservation Measures that Make ¢ents: 2008.

L2. Reidy, K. and Tejral, J., 2008 Water Conservation Annual Report: prepared for Aurora Water, Aurora, Colorado, 2009.

L3. Marin Municipal Water District, 2007 Conservation Master Plan: June 20, 2007.

L4. Chris Dundon, Water Conservation Supervisor, Contra Costa Water District, personal communication, January 5, 2010.

L5. Drema Gross, Environmental Program Manager, Conservation Division, Austin Water Utility, City of Austin, Texas, personal communication, August 5, 2009.

L6. Katherine Yuhas, Water Conservation Officer, Albuquerque Bernalillo County Water Authority, personal communication, July 29, 2009.

L7. Alliance for Water Efficiency, AWE Resource Library Commercial, Institutional, and Industrial Water Users: URL: http://www.a4we.org/Commercial_Institutional_and_Industrial_Library_Content_Listing.aspx.

L8. Metropolitan Water District of Southern California, Save Water, Save a Buck Water Saving Technologies: June 1, 2010. URL: http://www.mwdsaveabuck.com/pdf/MWD_PRODUCTS.pdf.

L9. Alliance for Water Efficiency, Water Conservation Tracking Tool Version 1.1 User Guide: September 16, 2009.

L10. Dan Muelrath, Water Conservation Coordinator, City of Santa Rosa Utilities Department, Santa Rosa, California, personal communication, January 5, 2010.

L11. Doug Bennett, Conservation Manager, Southern Nevada Water Authority, Las Vegas, Nevada, personal communication, July 28, 2009.

L12. Bill Rose, Water Conservation Program Executive, and Jeff Stephenson, Senior Water Resources Specialist, San Diego County Water Authority, personal communication, July 31, 2009.

L13. Melissa Essex Elliott, Manager of Water Conservation, Denver Water, Denver, Colorado, personal communication, July 31, 2009.

L14. Karen Guz, Director, Conservation Department, San Antonio Water System, San Antonio, Texas, personal communication, July 31, 2009.

L15. Seattle Public Utilities, Management Responses to Auditor's Report on Water Conservation Financial Controls: June 8, 2001.

L16. Bay Area Water Supply & Conservation Agency, Water Conservation Programs Annual Report FY2007/08: August 2008.

Appendix M:
Stakeholder Meeting Notes

DALLAS WATER UTILITIES AND WHOLESALE CUSTOMERS

MEETING AGENDA CONCERNING
DALLAS' WATER CONSERVATION AND DROUGHT CONTINGENCY PLAN UPDATES
APRIL 29, 2010
ELM FORK WATER TREATMENT PLANT
1440 WHITLOCK LN., CARROLLTON, TX
2 P.M. – 4 P.M.

1.	**Opening Remarks**	Jody Puckett
2.	**Water Conservation Five-year Strategic Plan/ State Conservation Plan Updates**	Carole Davis
3.	**Drought Contingency Plan Update**	Denis Qualls
4.	**Discussion/Comments**	All
5.	**Next Steps**	Jody Puckett

City of Dallas Update to Strategic Plan on Water Conservation	**Meeting Memorandum** **Meeting Date: April 29, 2010** **Meeting Location: DWU – Elm Fork Water Plant** **APAI Project No: 0356-018-01**

Leader/Facilitator:	C. Davis	Recorder:	T. Noack

Attendees:	Representatives of DWU wholesale customer cities, DWU
Agenda:	N/A

Purpose: Wholesale Customer Stakeholder Meeting

Carole Davis provided a presentation covering the draft Update of the Five Year Strategic Plan on Water Conservation as well as a description of what will be included in the Water Conservation Plan to be submitted to TCEQ. Denis Qualls also provided a presentation on the work that has been performed on the update to the Drought Contingency Plan (DCP). After the presentations, Carole, Denis and Jodie Puckett sought feedback from the attendees. Comments recorded are as follows:

1. One commenter suggested DWU to consider 3 drought stages: voluntary, mandatory and prohibitions.
2. One commenter had a concern about no ornamental fountains in Drought Stage I.
3. One comment received via email after the meeting encouraged DWU to continue with a 4-stage DCP with mandatory measures.

Action Items:

The following action items were developed from attendee requests:

1. Email the drought contingency plan comparative matrix to meeting attendees. (Denis Qualls/Chris Schmid – within 2 weeks of meeting, May 14)
2. Email pdf of the presentation to attendees (Carole Davis)

Next Meeting: Sierra Club Stakeholder Meeting

Next Meeting Date

May 11, 2010

City of Dallas Update to Strategic Plan on Water Conservation	**Meeting Memorandum** **Meeting Date: May 11, 2010** **Meeting Location: Center for Spiritual Living** **APAI Project No: 0356-018-01**

Leader/Facilitator: C. Davis (DWU) Recorder: B. McDonald (APAI)

Attendees: Dallas Sierra Club, DWU, APAI

Agenda: N/A

Purpose: Dallas Sierra Club Stakeholder Meeting

Carole Davis provided a presentation covering the draft Update of the Five Year Strategic Plan on Water Conservation. After the presentation, Carole sought feedback from the attendees. Carole received several questions from attendees. The questions and her answers are summarized below:

1. How much water does the average Dallas resident use? TWDB statistics for 2007 show that average residential use in Dallas is 92 gallons per capita per day (gpcd).
2. How does Dallas water use compare to that in other cities? DWU prefers to compare to itself over time. There are a number of issues that affect the comparison of water use between cities, including the amount and types of industrial customers.
3. Many homeowners' associations (HOAs) require irrigation – can the City limit irrigation in HOA neighborhoods? The questioner also described the City's conservation goal as "modest." The City's authority to address homeowner deed covenants is not clear.
4. Does DWU offer clothes washer rebates? No, but they are planned for Year 2 of the five-year planning period.
5. Will DWU give toilet rebates to multi-family and industrial customers? DWU already offers toilet rebates to multi-family customers and has high interest from multi-family customers.
6. Who is DWU's largest single customer? An industrial customer in the computer chip-making business.
7. How can we report irrigation water waste? How is the water waste prohibition enforced? Call 311 to report irrigation water waste. A number of city employees, including code compliance officers, licensed irrigators (water conservation staff), and meter readers watch for violations during the course of their duties.

Action Items: No action items were developed from the attendee questions.

Next Meeting: ICI Stakeholder Meeting

Next Meeting Date

May 18, 2010

From: kirkmiller@juno.com [mailto:kirkmiller@juno.com]
Sent: Wednesday, May 12, 2010 8:22 AM
To: Davis, Carole
Cc: kirkmiller@juno.com
Subject: Water Conservation Feedback

Carole:

Thank you for speaking at the Sierra Club last night. You presentation was very good and was well received. Regarding feedback that you asked for: Addressing the largest ICI water users probably gives you the best bang for your buck. On the residential side, I would like to see financial incentives, such as rebates for efficient washing machines and toilets. I know that budgets are tight, but providing financial incentives would be a one-time expenditure that would pay off for many, many years (during the life of the water-efficient washer / toilet).

You have two staff members who perform irrigation inspections, which is good. I suggest that you create a program that offers in-home inspections to educate customers of other improvements for saving water. For instance, energy audits are available to tell people how to save money on heating and air conditioning. Creating similar audits of water usage could recommend how people can save water in their homes: toilets, washers, low-flow shower heads and faucets, hose end nozzles, how to detect leaks, etc. If individual inspections are not feasible, perhaps you could offer seminars to groups of people, giving them recommendations on how to save water in their homes.

The City of Richardson offers indoor and outdoor water conservation kits to residents. Perhaps you could do something similar for Dallas residents. Here is a link to Richardson's conservation kits.
http://www.cor.net/WaterConserve.aspx?id=5542

Again, thanks for talking at the Sierra Club.

Kirk Miller
The best way to predict the future is to help create it.

Water Conservation Stakeholders Meeting

AGENDA

May 18, 2010

9:00 a.m.

Dallas City Hall

- Opening Remarks
- Water Conservation Program Update
- Open Discussion

SAVE WATER
NOTHING CAN REPLACE IT
Dallas Water Utilities

City of Dallas
Update to Strategic Plan on Water Conservation

Meeting Memorandum
Meeting Date: May 18, 2010
Meeting Location: Dallas City Hall
APAI Project No: 0356-018-01

Leader/Facilitator: C. Davis (DWU)   Recorder: B. McDonald (APAI)

Attendees: Dallas ICI Customers, DWU, APAI
Agenda: Agenda and Sign-in Sheets attached

Purpose: Dallas ICI Customer Stakeholder Meeting

Carole Davis provided a presentation covering the draft Update of the Five Year Strategic Plan on Water Conservation. After the presentation, Carole sought feedback from the attendees. Carole received several questions from attendees. The questions and her answers are summarized below:

1. Mike Brasovan, THG Energy Solutions: Is the 2.8 percent per year decrease in per capita water use or overall water use – how much of the change is due to the economy and the weather? The 2.8 percent per year decrease is in per capita water use.
2. Catherine Horsey, Green Building Task Force: What conservation measure has had the most impact? Has overall water use increased due to increasing population? The time-of-day watering restriction has been very successful and has reduced peak water demand. On balance, the decrease in per capita water use has outweighed the increase in population, so overall water use has also been declining (B. McDonald). Population has increased nine percent, and per capita water use has decreased twenty-one percent (C. Davis).
3. (Did not hear identification): Have you considered printing average water use by neighborhood on water bills? Water use depends on property size, house size, and other factors. DWU will consider this.
4. Alan Hoffman, Builder: Outdoor water use makes up seventy percent of water use, so outdoor water use looks like "low-hanging fruit" for water conservation – how is DWU targeting outdoor water use. One measure that targets outdoor water use is an ordinance amendment that requires water-wise landscaping.
5. Michael Brown, Dallas Independent School District: Who should DISD contact to schedule cooling tower audits? DWU is currently awarding a new contract for the cooling tower audits. When this program is ready to resume audits, DWU will contact Mr. Brown.
6. Amanda Griffin, Dallas Irrigation Association: The irrigation audit program appears successful – do you have pre- and post-audit water use statistics? Have you considered submetering for irrigation systems? DWU has the data and can examine water use before and after irrigation system inspections. Submetering of irrigation systems is on the "big list" of measures for the future, but the proposed measures appear to offer more savings over the next five years (B. McDonald). In addition to better quantification of irrigation use, submetering would also reduce sewer bills.
7. Dan Mergen, Parkland Hospital: There are eighty to ninety hospitals in Dallas, all of whom are

subject to an emergency response requirement of ninety-six hours of water supply – has the city looked at ways to help hospitals meet this requirement? No, DWU would need to study this requirement and response measures.

8. Julie Schaar, Dallas Sierra Club: Does DWU recycle the old toilets that are replaced? DWU has been looking for responsible ways to recycle the old toilets, such as grinding them and using the material in paving projects – unfortunately such projects are not always available (Art Torres, DWU).
9. Jon Radtke, Coca Cola North America: Decreasing water use causes DWU to receive less income from water sales – does this mean that rates will increase? Are there any plans for "purple pipe" (water recycling) projects? DWU views the costs associated with water conservation as the purchase of a water supply. Conservation is inexpensive compared to other new supply sources. DWU currently supplies recycled water for irrigation at the Cedar Crest Golf Course and there are plans to extend this project to other customers.
10. (Did not hear identification): Will there be tax incentives offered for rainwater harvesting? Have you considered integrated storm water management – the capture and use of storm water for irrigation? DWU will consider funding a portion of a rainwater harvesting project under the new ICI Financial Incentive program. Projects considered under this program would have to demonstrate significant water savings and would be site-specific. DWU would have to discuss a particular project with an applicant.
11. Jack Jenkins, CNC Investments: Who is the specific contact for multi-family water conservation programs? Art Torres at DWU.
12. Brad Barton, (did not hear affiliation): We have replaced six thousand multi-family toilets in Austin and San Antonio -- is there a cap on the number of multi-family toilets that a single customer can receive? Also want to comment that it is difficult for us to quantify our irrigation use and that submetering would help. Yes there is a limit, it is currently two hundred toilets per year.
13. Brodie Bruner, Weathermatic: We have worked with other cities and we see that the following water conservation programs have been successful: rebates and subsidies, irrigation controller exchange programs ("smart" for "dumb"), irrigation efficiency codes, auditing programs, and tracking services (monitoring a customer's irrigation use or providing an email with weekly irrigation needs).
14. Tony Thomas, Hilton Anatole Hotel: The Anatole is looking at changing laundry equipment and the cost would be about $250,000 -- will there be an incentive to improve the water efficiency of large laundry facilities? This would be a candidate for the ICI Financial Incentives program. The proposed cap for this program is $100,000 per customer.
15. (Did not hear identification): When will more information be available about these programs? Are there barriers to submetering now? DWU will need about a year to hire contractors and develop program specifics. Currently, the only barrier to submetering is the additional cost, primarily installing another meter.
16. Brad Barton, (did not hear affiliation): Changing irrigation equipment at our multi-family locations has reduced irrigation water use by fifty percent and saved us $25,000.
17. Amanda Childress, U.S. Green Building Council North Texas: In these times of budget deficits and cuts, how will you protect the water conservation budget? The city views the cost of water conservation as the cost of purchasing a water supply. The city is committed to providing water to its customers, and it is committed to water conservation.
18. (Did not hear identification): What is the overall water use in gallons rather than gallons per capita per day? Did not bring those data to the meeting (B. McDonald). Has DWU considered electronic

bill delivery? DWU is working to make its billing system as efficient as possible, but this must be done in stages.
Action Items: No action items were developed from the attendee questions.
Next Meeting: ICI Stakeholder Meeting

Next Meeting Date
May 18, 2010

Appendix N:
Detailed Action Schedules, FY 2010-11 through FY 2014-15

Table N-1: Detailed Action Schedule: FY 2010-11

Strategy	Recommended Actions
City Leadership & Commitment	
Enhanced Real Loss Reduction	▪ Create and staff 2 FTEs for leak detection. Provide leak detection training as necessary. Conduct additional leak detection. ▪ Create and staff 1 FTE for leak repair. Provide leak repair training as necessary. Rotate this FTE among existing leak repair crews to gain experience. ▪ Purchase additional equipment for new leak repair crew (including repair truck, dump truck, truck and trailer, backhoe tractor, air compressor, tools and materials). ▪ Develop and track water loss performance indicators. ▪ Improve validation of water loss performance data. Actions to include a combination of: o Conducting additional meter testing and analysis to meter testing results. o Conducting water loss audits on pressure zone level. o Conducting more frequent monitoring of pressure-reducing valve (PRV) vaults. ▪ Continue to plan, develop, and implement water loss recommendation from previous water audits and efficiency studies. ▪ Develop and maximize advanced metering infrastructure (AMI) monitoring capabilities for water loss reduction. ▪ Evaluate, purchase, and implement leakage management software. ▪ Achieve target ILI of 4.3.
Enhanced Apparent Loss Reduction	▪ Create and staff 1 FTE as a management analyst. Find, trend, and fix discrepancies within the metering and billing systems. ▪ Evaluate meter volumes. Change out meters with excessive "mileage." ▪ Verify that customers billed for a single service (water or wastewater) do not receive both services. ▪ Evaluate and correct accounts with misclassified premise types. ▪ Interface with all relevant DWU Divisions to collate, organize, and analyze all water loss data, including performance indicators ▪ Identify and correct unauthorized uses, including investigating accounts that consistently read zero, addresses with no service, etc. ▪ Achieve target apparent loss of 28.9 gallons per connection per day.
Water-Wise Landscape Design Requirements	▪ No actions.

Table N-1 Continued: Detailed Action Schedule: FY 2010-11

Strategy	Recommended Actions
ICI Water-Efficient Equipment Rule	▪ No actions.
Recycled Water Projects	▪ Continue development of the Cedar Crest Pipeline Extension. ▪ Continue development of the Main Stem Trinity River Pump Station. ▪ Continue development of the White Rock Pipeline Alternative.
Education & Outreach Initiatives	
Voluntary Twice-Weekly Irrigation Schedule	▪ Develop a voluntary irrigation schedule for all customers that limits irrigation to a maximum of twice per week from April 1 through October 31. ▪ Conduct public education and outreach regarding the new voluntary irrigation schedule and plants' watering needs.
ICI Customer Water Audits	▪ Create and staff 0.50 FTE to administer ICI customer water audit program. ▪ Hire ICI contractor to conduct ICI customer water audits. ▪ ICI contractor conducts site visits, analyzing water use and the potential for water savings, and reporting the audit findings to the customer. Target forty-nine ICI customer water audits from top ten percent of ICI customers. ▪ DWU employee works with ICI contractor on site visits to gain experience with water audits. ▪ Follow up with customers to confirm installation of recommended measures. ▪ Track recommendations, installations, and projected water savings. Verify savings with before and after water use records.
ICI Training Programs	▪ Create and staff 0.50 FTE to administer ICI training programs. It is anticipated that this position would be combined with the 0.50 FTE described above for ICI customer water audits. ▪ Research and develop training programs designed for ICI facility managers for premise types that use the most water and/or for licensed irrigators. ▪ Research and develop training programs for licensed irrigators.
ICI Business Partnership Program	▪ Identify and contact potential participants from the top one percent of ICI customers to develop an ICI business partnership stakeholder group.

Table N-1 Continued: Detailed Action Schedule: FY 2010-11

Strategy	Recommended Actions
ICI Hospitality Program	▪ Create and staff 0.50 FTE to administer the ICI hospitality program. ▪ Research and develop printed materials that encourage hotel, motel, and restaurant guests to conserve water. ▪ Research and develop training programs for hotel, motel, and restaurant employees that teach water-conserving practices. ▪ Begin to conduct outreach to hotel, motel, and restaurant customers to engage their participation.
Rebate & Incentive Programs	
Residential Irrigation System Incentive	▪ No actions.
ICI Financial Incentives	▪ Research similar programs at other utilities. ▪ Determine minimum projected water savings per rebate dollar for site-specific rebates. ▪ Develop menu of potential improvements at small/medium businesses and associated rebate amounts. ▪ Determine maximum incentive amount per customer. ▪ Define eligibility requirements. ▪ Work with ICI contractor to evaluate ICI financial incentive program applications, review estimated water savings from proposed improvements, conduct site visits, and verify installation of proposed improvements. ▪ Create and staff 0.25 FTE to review incentive applications for completeness/eligibility, schedule field appointments, process incentives, track implementation, and other clerical tasks. ▪ Publicize upcoming ICI financial incentives program within the ICI community.
Enhanced Residential Toilet Incentive	▪ Hire a contractor to administer the Enhanced Residential Toilet Incentive program. It is anticipated that the Enhanced Residential Toilet Incentive would have the same eligibility conditions and incentive amounts as the *New Throne for Your Home* program. ▪ Target installation of two thousand HETs for single-family residential accounts and two thousand HETs for multi-family residential accounts. ▪ Continue to publicize the residential toilet incentive program.

Table N-1 Continued: Detailed Action Schedule: FY 2010-11

Strategy	Recommended Actions
Residential Clothes Washer Incentive	▪ Research similar programs at other utilities. ▪ Define structure of program (rebates versus vouchers, etc.). ▪ Define incentive amount (planning figures based on incentive worth up to $100 per single-family incentive and $250 per multi-family incentive). ▪ Define eligibility requirements. ▪ Hire contractor or train existing staff to administer the Residential Clothes Washer Incentive program.

Table N-2: Detailed Action Schedule: FY 2011-12

Strategy	Recommended Actions
City Leadership & Commitment	
Enhanced Real Loss Reduction	▪ Create and staff 2 FTEs for leak detection. Provide leak detection training as necessary. Conduct active leak detection operations. ▪ Purchase additional leak detection equipment (correlating loggers and associated equipment) ▪ Create and staff 3 FTEs for leak repair. Provide leak repair training as necessary. With the FTE created in FY 2010-11 as crew chief, form new four-man leak repair crew. Conduct active leak repair operations. ▪ Purchase additional leak repair tools, equipment, and materials as necessary. ▪ Refine and continue to track water loss performance indicators. Target leak detection and repair resources according to findings. ▪ Continue to improve validation of water loss performance data. Actions to include a combination of: o Conducting additional meter testing and analysis to meter testing results. o Conducting water loss audits on pressure zone level. o Conducting more frequent monitoring of pressure-reducing valve (PRV) vaults. ▪ Continue to plan, develop, and implement water loss recommendation from previous water audits and efficiency studies. ▪ Continue to develop and maximize AMI monitoring capabilities for water loss reduction. ▪ Continue to use leakage management software to target leak detection and repair efforts and assist in pressure management. ▪ Achieve target ILI of 4.1.

Table N-2 Continued: Detailed Action Schedule: FY 2011-12

Strategy	Recommended Actions
Enhanced Apparent Loss Reduction	▪ Management analyst continues to find, trend, and fix discrepancies within the metering and billing systems. ▪ Continue to evaluate meter volumes and change out meters with excessive "mileage." ▪ Continue to verify that customers billed for a single service (water or wastewater) do not receive both services. ▪ Continue to evaluate and correct accounts with misclassified premise types. ▪ Continue to interface with all relevant DWU Divisions to collate, organize, and analyze all water loss data, including performance indicators. ▪ Continue to identify and correct unauthorized uses, including investigating accounts that consistently read zero, addresses with no service, etc. ▪ Achieve target apparent loss of 28.1 gallons per connection per day.
Water-Wise Landscape Design Requirements	▪ No actions.
ICI Water-Efficient Equipment Rule	▪ No actions.
Recycled Water Projects	▪ Complete the Cedar Crest Pipeline Extension. ▪ Continue development of the Main Stem Trinity River Pump Station. ▪ Continue development of the White Rock Pipeline Alternative.
Education & Outreach Initiatives	
Voluntary Twice-Weekly Irrigation Schedule	▪ Continue public education and outreach regarding the voluntary irrigation schedule and plant water needs.
ICI Customer Water Audits	▪ ICI contractor continues to conduct site visits, analyzing water use and the potential for water savings, and reporting the audit findings. Target seventy-five ICI customer water audits from top ten percent of ICI customers. ▪ Employee continues to trail ICI contractor on site visits to gain experience with water audits. ▪ Continue to follow up with customers to confirm installation of recommended measures. ▪ Continue to track recommendations, installations, and projected water savings. Continue to verify savings with before and after water use records.

Table N-2 Continued: Detailed Action Schedule: FY 2011-12

Strategy	Recommended Actions
ICI Training Programs	▪ Continue to research and develop training programs designed for ICI facility managers for premise types that use the most water and/or for irrigators. ▪ Continue to research and develop training programs for irrigators. ▪ Publicize upcoming training programs within the ICI community.
ICI Business Partnership Program	▪ Continue to identify and contact potential participants from the top one percent of ICI customers as necessary to maintain an ICI business partnership stakeholder group. ▪ Conduct four to six meetings per year. Discuss water conservation practices, DWU water conservation programs, water savings opportunities, and successful ICI water conservation projects.
ICI Hospitality Program	▪ Manage printing and distribution of printed materials to hotels, motels, and restaurants. ▪ Conduct training programs for hotel, motel, and restaurant employees to teach water-conserving practices. ▪ Target participation of twenty percent of hotels, motels, and restaurants. ▪ Continue to refine printed materials and training programs. ▪ Continue to conduct outreach to hotel, motel, and restaurant customers to engage their participation.
Rebate & Incentive Programs	
Residential Irrigation System Incentive	▪ Create and staff 0.50 FTE to administer residential irrigation system incentive. ▪ Research similar programs at other utilities. ▪ Define structure of program (rebates versus vouchers, etc.). ▪ Define incentive amount for different irrigation system improvements (planning figures based on incentive worth up to $200 per single- and multi-family customers). ▪ Define eligibility requirements.

Table N-2 Continued: Detailed Action Schedule: FY 2011-12

Strategy	Recommended Actions
ICI Financial Incentives	▪ Review incentive applications for completeness/eligibility, schedule field appointments, process incentives, track implementation, and other clerical tasks. ▪ Evaluate ICI financial incentive program applications, review estimated water savings from proposed improvements, conduct site visits, and verify installation of proposed improvements. ▪ Conduct pilot testing of the ICI financial incentives program and modify program terms based on findings. Target improvements for top ten percent of ICI customers worth up to $2 million in incentives. ▪ Target fifty incentives for small/medium businesses. ▪ Compare projected water savings with actual savings, based on before and after water use data. Refine the program conditions as necessary to increase water savings. ▪ Hire a contractor to administer the high-efficiency toilet (HET) portion of the ICI Financial Incentives Program. It is anticipated that the same contractor would administer the Enhanced Residential Toilet Incentive program. ▪ Create and staff 0.25 FTE to conduct site visits and verify installation of HETs. ▪ Continue to publicize upcoming ICI financial incentives program within the ICI community.
Enhanced Residential Toilet Incentive	▪ Administer contract with contractor. ▪ Create and staff 0.25 FTE to conduct site visits and verify HET installations for approximately ten percent of measures. ▪ Target installation of five thousand HETs for single-family residential accounts and six thousand HETs for multi-family residential accounts. ▪ Continue to publicize the enhanced residential toilet incentive program.
Residential Clothes Washer Incentive	▪ Administer contract with contractor. ▪ Conduct pilot testing of residential clothes washer incentive program and modify program terms based on findings. Target participation of 188 single-family residential accounts and 188 multi-family residential accounts. ▪ Publicize upcoming residential clothes washer incentive.

Table N-3: Detailed Action Schedule: FY 2012-13

Strategy	Recommended Actions
City Leadership & Commitment	
Enhanced Real Loss Reduction	▪ Provide leak detection training as necessary. ▪ Purchase additional leak detection equipment (ground microphones, correlator) ▪ Create and staff 1 FTE for leak repair. Provide leak repair training as necessary. Rotate this FTE among existing leak repair crews to gain experience. ▪ Purchase additional equipment for new leak repair crew (including repair truck, dump truck, truck and trailer, backhoe tractor, air compressor, tools and materials). ▪ Refine and continue to track water loss performance indicators. Target leak detection and repair resources according to findings. ▪ Continue to improve validation of water loss performance data. Actions to include a combination of: o Conducting additional meter testing and analysis to meter testing results. o Conducting water loss audits on pressure zone level. o Conducting more frequent monitoring of pressure-reducing valve (PRV) vaults. ▪ Continue to plan, develop, and implement water loss recommendation from previous water audits and efficiency studies. ▪ Continue to develop and maximize AMI monitoring capabilities for water loss reduction. ▪ Continue to use leakage management software to target leak detection and repair efforts and assist in pressure management. ▪ Achieve target ILI of 3.8.

Table N-3 Continued: Detailed Action Schedule: FY 2012-13

Strategy	Recommended Actions
Enhanced Apparent Loss Reduction	▪ Management analyst continues to find, trend, and fix discrepancies within the metering and billing systems. ▪ Continue to evaluate meter volumes and change out meters with excessive "mileage." ▪ Continue to verify that customers billed for a single service (water or wastewater) do not receive both services. ▪ Continue to evaluate and correct accounts with misclassified premise types. ▪ Continue to interface with all relevant DWU Divisions to collate, organize, and analyze all water loss data, including performance indicators. ▪ Continue to identify and correct unauthorized uses, including investigating accounts that consistently read zero, addresses with no service, etc. ▪ Achieve target apparent loss of 26.9 gallons per connection per day.
Water-Wise Landscape Design Requirements	▪ Create and staff 1 FTE to administer water-wise landscape design requirements. ▪ Draft water-wise landscape requirements for new construction, including enforcement plan. ▪ Gather stakeholder and administration input. ▪ City Council adopts ordinance on water-wise landscape design requirements for new construction. ▪ Conduct outreach to educate builders, developers, contractors, and the public about the new water-wise landscape design requirements.
ICI Water-Efficient Equipment Rule	▪ Draft ICI water-efficient equipment rules for new and newly-occupied commercial establishments. ▪ Coordinate with Building Inspection Office to development enforcement plan. ▪ Gather stakeholder and administration input. ▪ City Council adopts ordinance on ICI water-efficient equipment requirements for new and newly-occupied commercial establishments. ▪ Conduct outreach to educate builders, developers, contractors, and the ICI community about the new ICI water-efficient equipment requirements.
Recycled Water Projects	▪ Continue development of the Main Stem Trinity River Pump Station. ▪ Continue development of the White Rock Pipeline Alternative.
Education & Outreach Initiatives	
Voluntary Twice-Weekly Irrigation Schedule	▪ Continue public education and outreach regarding the voluntary irrigation schedule and plant water needs.

Table N-3 Continued: Detailed Action Schedule: FY 2012-13

Strategy	Recommended Actions
ICI Customer Water Audits	▪ ICI contractor continues to conduct a portion of the site visits, analyzing water use and the potential for water savings, and reporting the audit findings. ▪ Employee conducts a portion of the site visits, analyzing water use and the potential for water savings, and reporting the audit findings. ▪ Target one hundred ICI customer water audits from top ten percent of ICI customers. ▪ Continue to follow up with customers to confirm installation of recommended measures. ▪ Continue to track recommendations, installations, and projected water savings. Continue to verify savings with before and after water use records.
ICI Training Programs	▪ Conduct training programs designed for ICI facility managers for premise types that use the most water and/or for irrigators. Target training for 125 ICI facility managers from top ten percent of ICI customers. ▪ Conduct training programs for irrigators. ▪ Continue to publicize upcoming training programs within the ICI community. ▪ Refine existing training programs and research and develop new programs as appropriate.
ICI Business Partnership Program	▪ Continue to identify and contact potential participants from the top one percent of ICI customers as necessary to maintain an ICI business partnership stakeholder group. ▪ Continue to conduct four to six meetings per year. Discuss water conservation practices, DWU water conservation programs, water savings opportunities, and successful ICI water conservation projects.
ICI Hospitality Program	▪ Continue to manage printing and distribution of printed materials to hotels, motels, and restaurants. ▪ Continue to conduct training programs for hotel, motel, and restaurant employees to teach water-conserving practices. ▪ Target participation of thirty percent of hotels, motels, and restaurants. ▪ Continue to refine printed materials and training programs. ▪ Continue to conduct outreach to hotel, motel, and restaurant customers to engage their participation.
Rebate & Incentive Programs	
Residential Irrigation System Incentive	▪ Conduct pilot testing of residential irrigation incentive program and modify program terms based on findings. Target participation of 125 single-family residential accounts and 125 multi-family residential accounts. ▪ Publicize upcoming residential irrigation system incentive program.

Table N-3 Continued: Detailed Action Schedule: FY 2012-13

Strategy	Recommended Actions
ICI Financial Incentives	▪ Continue to review incentive applications for completeness/eligibility, schedule field appointments, process incentives, track implementation, and other clerical tasks. ▪ Continue to evaluate ICI financial incentive program applications, review estimated water savings from proposed improvements, conduct site visits, and verify installation of proposed improvements. ▪ Target improvements for top ten percent of ICI customers worth $2 million in incentives. ▪ Target seventy-five incentives for small/medium businesses. ▪ Target installation of seven thousand HETs. ▪ Continue to compare projected water savings with actual savings, based on before and after water use data. Continue to refine the program conditions as necessary to increase water savings. ▪ Continue to publicize upcoming ICI financial incentives program within the ICI community.
Enhanced Residential Toilet Incentive	▪ Administer contract with contractor. ▪ Continue to conduct site visits and verify HET installations for approximately ten percent of measures. ▪ Target installation of five thousand HETs for single-family residential accounts and six thousand HETs for multi-family residential accounts. ▪ Continue to publicize the enhanced residential toilet incentive program.
Residential Clothes Washer Incentive	▪ Administer contract with contractor. ▪ Target participation of 367 single-family residential accounts and 367 multi-family residential accounts. ▪ Publicize upcoming residential clothes washer incentive.

Table N-4: Detailed Action Schedule: FY 2013-14

Strategy	Recommended Actions
City Leadership & Commitment	
Enhanced Real Loss Reduction	▪ Create and staff 4 FTEs for leak detection. Provide leak detection training as necessary. Conduct active leak detection operations. ▪ Purchase additional leak detection equipment (correlating loggers and associated equipment, ground microphones) ▪ Replace leak detection equipment as it becomes outdated (including vehicles, leak detection equipment, line locators, probe rods, tools, etc.). ▪ Create and staff 3 FTEs for leak repair. Provide leak repair training as necessary. With the FTE created in FY 2012-13 as crew chief, form new four-man leak repair crew. Conduct active leak repair operations. ▪ Purchase additional leak repair tools, equipment, and materials as necessary. ▪ Refine and continue to track water loss performance indicators. Target leak detection and repair resources according to findings. ▪ Continue to improve validation of water loss performance data. Actions to include a combination of: o Conducting additional meter testing and analysis to meter testing results. o Conducting water loss audits on pressure zone level. o Conducting more frequent monitoring of pressure-reducing valve (PRV) vaults. ▪ Continue to plan, develop, and implement water loss recommendation from previous water audits and efficiency studies. ▪ Continue to develop and maximize AMI monitoring capabilities for water loss reduction. ▪ Continue to use leakage management software to target leak detection and repair efforts and assist in pressure management. ▪ Achieve target ILI of 3.3.

Table N-4 Continued: Detailed Action Schedule: FY 2013-14

Strategy	Recommended Actions
Enhanced Apparent Loss Reduction	▪ Create and staff 1 FTE as a management analyst. Management analysts continue to find, trend, and fix discrepancies within the metering and billing systems. ▪ Continue to evaluate meter volumes and change out meters with excessive "mileage." ▪ Continue to verify that customers billed for a single service (water or wastewater) do not receive both services. ▪ Continue to evaluate and correct accounts with misclassified premise types. ▪ Continue to interface with all relevant DWU Divisions to collate, organize, and analyze all water loss data, including performance indicators. ▪ Continue to identify and correct unauthorized uses, including investigating accounts that consistently read zero, addresses with no service, etc. ▪ Achieve target apparent loss of 23.9 gallons per connection per day.
Water-Wise Landscape Design Requirements	▪ Evaluate landscape plans for compliance with regulations. ▪ Conduct site visits to ensure construction compliance. Pursue enforcement actions as necessary. ▪ Continue to educate builders, developers, contractors, and the public about the water-wise landscape design requirements.
ICI Water-Efficient Equipment Rule	▪ Building Inspection Office (BIO) personnel conduct site visits to ensure construction compliance. BIO pursues enforcement actions as necessary. ▪ Continue to educate builders, developers, contractors, and the ICI community about the ICI water-efficient equipment requirements.
Recycled Water Projects	▪ Complete the Main Stem Trinity River Pump Station. ▪ Continue development of the White Rock Pipeline Alternative.
Education & Outreach Initiatives	
Voluntary Twice-Weekly Irrigation Schedule	▪ Continue public education and outreach regarding the voluntary irrigation schedule and plant water needs.

Table N-4 Continued: Detailed Action Schedule: FY 2013-14

Strategy	Recommended Actions
ICI Customer Water Audits	▪ ICI contractor continues to conduct a portion of the site visits, analyzing water use and the potential for water savings, and reporting the audit findings. ▪ Employee conducts a portion of the site visits, analyzing water use and the potential for water savings, and reporting the audit findings. ▪ Target one hundred ICI customer water audits from top ten percent of ICI customers. ▪ Continue to follow up with customers to confirm installation of recommended measures. ▪ Continue to track recommendations, installations, and projected water savings. Continue to verify savings with before and after water use records.
ICI Training Programs	▪ Continue to conduct training programs designed for ICI facility managers for premise types that use the most water and/or for irrigators. Target training for 250 ICI facility managers from top ten percent of ICI customers. ▪ Continue to conduct training programs for irrigators. ▪ Continue to publicize upcoming training programs within the ICI community. ▪ Continue to refine existing training programs and research and develop new programs as appropriate.
ICI Business Partnership Program	▪ Continue to identify and contact potential participants from the top one percent of ICI customers as necessary to maintain an ICI business partnership stakeholder group. ▪ Continue to conduct four to six meetings per year. Discuss water conservation practices, DWU water conservation programs, water savings opportunities, and successful ICI water conservation projects.
ICI Hospitality Program	▪ Continue to manage printing and distribution of printed materials to hotels, motels, and restaurants. ▪ Continue to conduct training programs for hotel, motel, and restaurant employees to teach water-conserving practices. ▪ Target participation of forty percent of hotels, motels, and restaurants. ▪ Continue to refine printed materials and training programs. ▪ Continue to conduct outreach to hotel, motel, and restaurant customers to engage their participation.

Table N-4 Continued: Detailed Action Schedule: FY 2013-14

Strategy	Recommended Actions
Rebate & Incentive Programs	
Residential Irrigation System Incentive	▪ Create and staff 2.25 FTEs to conduct site visits, inspect irrigation systems, identify potential system improvements, estimate associated water savings, and verify installation. ▪ Create and staff 0.75 FTEs to review incentive applications for eligibility, schedule field appointments, process incentives, and track implementation. ▪ Target participation of nine hundred single-family residential accounts and nine hundred multi-family residential accounts. ▪ Continue to publicize residential irrigation system incentive program.
ICI Financial Incentives	▪ Continue to review incentive applications for completeness/eligibility, schedule field appointments, process incentives, track implementation, and other clerical tasks. ▪ Continue to evaluate ICI financial incentive program applications, review estimated water savings from proposed improvements, conduct site visits, and verify installation of proposed improvements. ▪ Target improvements for top ten percent of ICI customers worth $2 million in incentives. ▪ Target seventy-five incentives for small/medium businesses. ▪ Target installation of seven thousand HETs. ▪ Continue to compare projected water savings with actual savings, based on before and after water use data. Continue to refine the program conditions as necessary to increase water savings. ▪ Continue to publicize upcoming ICI financial incentives program within the ICI community.
Enhanced Residential Toilet Incentive	▪ Administer contract with contractor. ▪ Continue to conduct site visits and verify HET installations for approximately ten percent of measures. ▪ Target installation of five thousand HETs for single-family residential accounts and six thousand HETs for multi-family residential accounts. ▪ Continue to publicize the enhanced residential toilet incentive program.
Residential Clothes Washer Incentive	▪ Administer contract with contractor. ▪ Target participation of five hundred single-family residential accounts and five hundred multi-family residential accounts. ▪ Publicize upcoming residential clothes washer incentive.

Table N-5: Detailed Action Schedule: FY 2014-15

Strategy	Recommended Actions
City Leadership & Commitment	
Enhanced Real Loss Reduction	▪ Conduct active leak detection operations. ▪ Provide leak detection training as necessary. ▪ Purchase additional leak detection equipment (correlator) ▪ Replace leak detection equipment as it becomes outdated (including vehicles, leak detection equipment, line locators, probe rods, tools, etc.). ▪ Conduct active leak repair operations. ▪ Purchase additional leak repair tools, equipment, and materials as necessary. ▪ Refine and continue to track water loss performance indicators. Target leak detection and repair resources according to findings. ▪ Continue to improve validation of water loss performance data. Actions to include a combination of: o Conducting additional meter testing and analysis to meter testing results. o Conducting water loss audits on pressure zone level. o Conducting more frequent monitoring of pressure-reducing valve (PRV) vaults. ▪ Continue to plan, develop, and implement water loss recommendation from previous water audits and efficiency studies. ▪ Continue to develop and maximize AMI monitoring capabilities for water loss reduction. ▪ Continue to use leakage management software to target leak detection and repair efforts and assist in pressure management. ▪ Achieve target ILI of 2.8.

Table N-5 Continued: Detailed Action Schedule: FY 2014-15

Strategy	Recommended Actions
Enhanced Apparent Loss Reduction	▪ Management analysts continue to find, trend, and fix discrepancies within the metering and billing systems. ▪ Continue to evaluate meter volumes and change out meters with excessive “mileage.” ▪ Continue to verify that customers billed for a single service (water or wastewater) do not receive both services. ▪ Continue to evaluate and correct accounts with misclassified premise types. ▪ Continue to interface with all relevant DWU Divisions to collate, organize, and analyze all water loss data, including performance indicators. ▪ Continue to identify and correct unauthorized uses, including investigating accounts that consistently read zero, addresses with no service, etc. ▪ Achieve target apparent loss of 20.9 gallons per connection per day.
Water-Wise Landscape Design Requirements	▪ Evaluate landscape plans for compliance with regulations. ▪ Conduct site visits to ensure construction compliance. Pursue enforcement actions as necessary. ▪ Continue to educate builders, developers, contractors, and the public about the water-wise landscape design requirements.
ICI Water-Efficient Equipment Rule	▪ Building Inspection Office (BIO) personnel conduct site visits to ensure construction compliance. BIO pursues enforcement actions as necessary. ▪ Continue to educate builders, developers, contractors, and the ICI community about the ICI water-efficient equipment requirements.
Recycled Water Projects	▪ Continue development of the White Rock Pipeline Alternative.
Education & Outreach Initiatives	
Voluntary Twice-Weekly Irrigation Schedule	▪ Continue public education and outreach regarding the voluntary irrigation schedule and plant water needs.

Table N-5 Continued: Detailed Action Schedule: FY 2014-15

Strategy	Recommended Actions
ICI Customer Water Audits	▪ ICI contractor continues to conduct a portion of the site visits, analyzing water use and the potential for water savings, and reporting the audit findings. ▪ Employee conducts a portion of the site visits, analyzing water use and the potential for water savings, and reporting the audit findings. ▪ Target one hundred ICI customer water audits from top ten percent of ICI customers. ▪ Continue to follow up with customers to confirm installation of recommended measures. ▪ Continue to track recommendations, installations, and projected water savings. Continue to verify savings with before and after water use records.
ICI Training Programs	▪ Continue to conduct training programs designed for ICI facility managers for premise types that use the most water and/or for irrigators. Target training for 250 ICI facility managers from top ten percent of ICI customers. ▪ Continue to conduct training programs for irrigators. ▪ Continue to publicize upcoming training programs within the ICI community. ▪ Continue to refine existing training programs and research and develop new programs as appropriate.
ICI Business Partnership Program	▪ Continue to identify and contact potential participants from the top one percent of ICI customers as necessary to maintain an ICI business partnership stakeholder group. ▪ Continue to conduct four to six meetings per year. Discuss water conservation practices, DWU water conservation programs, water savings opportunities, and successful ICI water conservation projects.
ICI Hospitality Program	▪ Continue to manage printing and distribution of printed materials to hotels, motels, and restaurants. ▪ Continue to conduct training programs for hotel, motel, and restaurant employees to teach water-conserving practices. ▪ Target participation of fifty percent of hotels, motels, and restaurants. ▪ Continue to refine printed materials and training programs. ▪ Continue to conduct outreach to hotel, motel, and restaurant customers to engage their participation.

Table N-5 Continued: Detailed Action Schedule: FY 2014-15

Strategy	Recommended Actions
Rebate & Incentive Programs	
Residential Irrigation System Incentive	▪ Create and staff 3 FTEs for field personnel. ▪ Create and staff 1.25 FTEs for clerical personnel. ▪ Continue conduct site visits, inspect irrigation systems, identify potential system improvements, estimate associated water savings, and verify installation. ▪ Continue to review incentive applications for eligibility, schedule field appointments, process incentives, and track implementation. ▪ Target participation of two thousand single-family residential accounts and two thousand multi-family residential accounts. ▪ Continue to publicize residential irrigation system incentive program.
ICI Financial Incentives	▪ Continue to review incentive applications for completeness/eligibility, schedule field appointments, process incentives, track implementation, and other clerical tasks. ▪ Continue to evaluate ICI financial incentive program applications, review estimated water savings from proposed improvements, conduct site visits, and verify installation of proposed improvements. ▪ Target improvements for top ten percent of ICI customers worth $2 million in incentives. ▪ Target seventy-five incentives for small/medium businesses. ▪ Target installation of seven thousand HETs. ▪ Continue to compare projected water savings with actual savings, based on before and after water use data. Continue to refine the program conditions as necessary to increase water savings. ▪ Continue to publicize upcoming ICI financial incentives program within the ICI community.
Enhanced Residential Toilet Incentive	▪ Administer contract with contractor. ▪ Continue to conduct site visits and verify HET installations for approximately ten percent of measures. ▪ Target installation of five thousand HETs for single-family residential accounts and six thousand HETs for multi-family residential accounts. ▪ Continue to publicize the enhanced residential toilet incentive program.

Table N-5 Continued: Detailed Action Schedule: FY 2014-15

Strategy	Recommended Actions
Residential Clothes Washer Incentive	▪ Administer contract with contractor. ▪ Target participation of 1,100 single-family residential accounts and 1,100 multi-family residential accounts. ▪ Publicize upcoming residential clothes washer incentive.

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Appendix O:
Recommended Budgets and Budget Items by Fiscal Year:
FY 2010-11 through FY2014-15

TABLE O-1

YEAR 1 OF 5 (FY 2010-11)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED WATER CONSERVATION DIVISION MEASURES AND BUDGET

ELEMENT	Staff		Budget		
	Existing Staff (FTE)	New Staff (FTE)	Labor[a] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain existing water conservation programs[b]					
a. **Existing** staff from FY 2009-10, with overhead	10.80		$608,523	$0	$608,523
b. **Existing** operating expenses from FY 2009-10			$0	$1,060,505	$1,060,505
New City Leadership & Commitment Efforts for FY 2010-11					
1. None					
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**10.80**	**0.00**	**$608,523**	**$1,060,505**	**$1,669,028**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. Public Awareness Campaign			$0	$1,380,000	$1,380,000
2. Environmental Education Initiative			$0	$274,000	$274,000
3. Cooling tower audits			$0	$75,510	$75,510
New Education & Outreach Initiatives for FY 2010-11					
1. Voluntary twice-weekly irrigation schedule			$0	$0	$0
2. ICI customer water audits[c]		0.50	$25,600	$0	$25,600
3. ICI training programs		0.50	$25,600	$0	$25,600
4. ICI hospitality program		0.50	$25,600	$24,400	$50,000
5. ICI business partnership program			$0	$0	$0
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**1.50**	**$76,800**	**$1,753,910**	**$1,830,710**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. Minor Plumbing Repair Program			$0	$400,000	$400,000
2. Pre-Rinse Spray Nozzle Program			$0	$290,250	$290,250
3. New Throne for Your Home Program			$0	$550,770	$550,770
New Rebate & Incentive Programs for FY 2010-11					
1. ICI financial incentives (with new coordinator)		0.25	$21,000	$479,000	$500,000
2. Enhanced residential toilet incentive[d]			$0	$0	$0
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.25**	**$21,000**	**$1,720,020**	**$1,741,020**
TOTAL (ALL MEASURES)	**10.80**	**1.75**	**$706,323**	**$4,534,435**	**$5,240,758**

[a] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[b] The existing budget is assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[c] Extension of the Cooling Tower Audit program. Projected additional costs only.

[d] Extension of the New Throne for Your Home program. Projected additional costs only.

TABLE O-2

YEAR 2 OF 5 (FY 2011-12)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED WATER CONSERVATION DIVISION MEASURES AND BUDGET

ELEMENT	Staff		Budget		
	Existing Staff (FTE)	New Staff (FTE)	Labor[a] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain existing water conservation programs[b]					
a. **Existing** staff from FY 2009-10, with overhead	10.80		$622,800	$0	$622,800
b. **Existing** operating expenses from FY 2009-10			$0	$1,085,400	$1,085,400
New City Leadership & Commitment Efforts for FY 2011-12					
1. None					
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**10.80**	**0.00**	**$622,800**	**$1,085,400**	**$1,708,200**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. Public Awareness Campaign			$0	$1,412,400	$1,412,400
2. Environmental Education Initiative			$0	$280,400	$280,400
3. Cooling tower audits			$0	$77,300	$77,300
4. Voluntary twice-weekly irrigation schedule			$0	$0	$0
5. ICI customer water audits[c]	0.50		$27,500	$0	$27,500
6. ICI training programs	0.50		$26,200	$0	$26,200
7. ICI hospitality program	0.50		$26,200	$76,200	$102,400
8. ICI business partnership program			$0	$0	$0
New Education & Outreach Initiatives for FY 2011-12					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**1.50**	**0.00**	**$79,900**	**$1,846,300**	**$1,926,200**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. Minor Plumbing Repair Program			$0	$409,400	$409,400
2. Pre-Rinse Spray Nozzle Program			$0	$297,100	$297,100
3. New Throne for Your Home Program			$0	$563,700	$563,700
4. ICI financial incentives (with new clerical staff)	0.25	0.25	$38,100	$2,945,100	$2,983,200
5. Enhanced residential toilet incentive[d]		0.25	$16,000	$928,600	$944,600
New Rebate & Incentive Programs for FY 2011-12					
1. Residential irrigation system incentive (with new coordinator)		0.50	$40,712	$1,388	$42,100
2. Residential clothes washer incentive			$0	$76,600	$76,600
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.25**	**1.00**	**$94,812**	**$5,221,888**	**$5,316,700**
TOTAL (ALL MEASURES)	**12.55**	**1.00**	**$797,512**	**$8,153,588**	**$8,951,100**

[a] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[b] The existing budget is assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[c] Extension of the Cooling Tower Audit program. Projected additional costs only.

[d] Extension of the New Throne for Your Home program. Projected additional costs only.

TABLE O-3

YEAR 3 OF 5 (FY 2012-13)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED WATER CONSERVATION DIVISION MEASURES AND BUDGET

ELEMENT	Staff		Budget		
	Existing Staff (FTE)	New Staff (FTE)	Labor[a] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain existing water conservation programs[b]					
a. **Existing** staff from FY 2009-10, with overhead	10.80		$637,400	$0	$637,400
b. **Existing** operating expenses from FY 2009-10			$0	$1,110,900	$1,110,900
New City Leadership & Commitment Efforts for FY 2012-13					
1. Water-wise landscape design requirements		1.00	$90,300	$0	$90,300
2. ICI water-efficient equipment rule			$0	$0	$0
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**10.80**	**1.00**	**$727,700**	**$1,110,900**	**$1,838,600**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. Public Awareness Campaign			$0	$1,445,600	$1,445,600
2. Environmental Education Initiative			$0	$287,000	$287,000
3. Cooling tower audits			$0	$79,100	$79,100
4. Voluntary twice-weekly irrigation schedule			$0	$0	$0
5. ICI customer water audits[c]	0.50		$28,100	$0	$28,100
6. ICI training programs	0.50		$26,800	$0	$26,800
7. ICI hospitality program	0.50		$26,800	$78,000	$104,800
8. ICI business partnership program			$0	$0	$0
New Education & Outreach Initiatives for FY 2012-13					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**1.50**	**0.00**	**$81,700**	**$1,889,700**	**$1,971,400**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. Minor Plumbing Repair Program			$0	$419,000	$419,000
2. Pre-Rinse Spray Nozzle Program			$0	$304,100	$304,100
3. New Throne for Your Home Program			$0	$577,000	$577,000
4. ICI financial incentives	0.50		$39,000	$2,984,500	$3,023,500
5. Enhanced residential toilet incentive[d]	0.25		$16,400	$950,400	$966,800
6. Residential clothes washer incentive			$0	$153,300	$153,300
7. Residential irrigation system incentive	0.50		$40,712	$53,588	$94,300
New Rebate & Incentive Programs for FY 2012-13					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**1.25**	**0.00**	**$96,112**	**$5,441,888**	**$5,538,000**
TOTAL (ALL MEASURES)	**13.55**	**1.00**	**$905,512**	**$8,442,488**	**$9,348,000**

[a] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[b] The existing budget is assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[c] Extension of the Cooling Tower Audit program. Projected additional costs only.

[d] Extension of the New Throne for Your Home program. Projected additional costs only.

TABLE O-4

YEAR 4 OF 5 (FY 2013-14)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED WATER CONSERVATION DIVISION MEASURES AND BUDGET

ELEMENT	Staff		Budget		
	Existing Staff (FTE)	New Staff (FTE)	Labor[a] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain existing water conservation programs[b]					
a. **Existing** staff from FY 2009-10, with overhead	10.80		$652,400	$0	$652,400
b. **Existing** operating expenses from FY 2009-10			$0	$1,137,000	$1,137,000
2. Water-wise landscape design requirements	1.00		$92,400	$0	$92,400
3. ICI water-efficient equipment rule			$0	$0	$0
New City Leadership & Commitment Efforts for FY 2012-13					
1. Next update to the Strategic Plan			$0	$699,100	$699,100
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**11.80**	**0.00**	**$744,800**	**$1,836,100**	**$2,580,900**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. Public Awareness Campaign			$0	$1,479,600	$1,479,600
2. Environmental Education Initiative			$0	$293,700	$293,700
3. Cooling tower audits			$0	$81,000	$81,000
4. Voluntary twice-weekly irrigation schedule			$0	$0	$0
5. ICI customer water audits[c]	0.50		$28,800	$0	$28,800
6. ICI training programs	0.50		$27,400	$0	$27,400
7. ICI hospitality program	0.50		$27,400	$79,800	$107,200
8. ICI business partnership program			$0	$0	$0
New Education & Outreach Initiatives for FY 2012-13					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**1.50**	**0.00**	**$83,600**	**$1,934,100**	**$2,017,700**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. Minor Plumbing Repair Program			$0	$428,900	$428,900
2. Pre-Rinse Spray Nozzle Program			$0	$311,200	$311,200
3. New Throne for Your Home Program			$0	$590,600	$590,600
4. ICI financial incentives	0.50		$39,900	$3,007,700	$3,047,600
5. Enhanced residential toilet incentive[d]	0.25		$16,800	$972,700	$989,500
6. Residential clothes washer incentive			$0	$214,000	$214,000
7. Residential irrigation system incentive	0.50	3.00	$304,400	$390,700	$695,100
(with 2.25 FTEs **new** field staff and 0.75 FTEs **new** clerical staff)					
New Rebate & Incentive Programs for FY 2012-13					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**1.25**	**3.00**	**$361,100**	**$5,915,800**	**$6,276,900**
TOTAL (ALL MEASURES)	**14.55**	**3.00**	**$1,189,500**	**$9,686,000**	**$10,875,500**

[a] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[b] The existing budget is assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[c] Extension of the Cooling Tower Audit program. Projected additional costs only.

[d] Extension of the New Throne for Your Home program. Projected additional costs only.

TABLE O-5

YEAR 5 OF 5 (FY 2014-15)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED WATER CONSERVATION DIVISION MEASURES AND BUDGET

ELEMENT	Staff		Budget		
	Existing Staff (FTE)	New Staff (FTE)	Labor[a] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain existing water conservation programs[b]					
a. **Existing** staff from FY 2009-10, with overhead	10.80		$667,700	$0	$667,700
b. **Existing** operating expenses from FY 2009-10			$0	$1,163,700	$1,163,700
2. Water-wise landscape design requirements	1.00		$94,600	$0	$94,600
3. ICI water-efficient equipment rule			$0	$0	$0
4. Next update to the Strategic Plan			$0	$0	$0
New City Leadership & Commitment Efforts for FY 2012-13					
1. None					
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**11.80**	**0.00**	**$762,300**	**$1,163,700**	**$1,926,000**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. Public Awareness Campaign			$0	$1,514,400	$1,514,400
2. Environmental Education Initiative			$0	$300,600	$300,600
3. Cooling tower audits			$0	$82,900	$82,900
4. Voluntary twice-weekly irrigation schedule			$0	$0	$0
5. ICI customer water audits[c]	0.50		$29,500	$0	$29,500
6. ICI training programs	0.50		$28,100	$0	$28,100
7. ICI hospitality program	0.50		$28,100	$81,600	$109,700
8. ICI business partnership program			$0	$0	$0
New Education & Outreach Initiatives for FY 2012-13					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**1.50**	**0.00**	**$85,700**	**$1,979,500**	**$2,065,200**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. Minor Plumbing Repair Program			$0	$439,000	$439,000
2. Pre-Rinse Spray Nozzle Program			$0	$318,500	$318,500
3. New Throne for Your Home Program			$0	$604,500	$604,500
4. ICI financial incentives	0.50		$40,800	$3,031,400	$3,072,200
5. Enhanced residential toilet incentive[d]	0.25		$17,200	$995,600	$1,012,800
6. Residential clothes washer incentive			$0	$481,900	$481,900
7. Residential irrigation system incentive	3.50	4.25	$681,200	$899,800	$1,581,000
(with 3.00 FTEs **new** field staff and 1.25 FTEs **new** clerical staff)					
New Rebate & Incentive Programs for FY 2012-13					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**4.25**	**4.25**	**$739,200**	**$6,770,700**	**$7,509,900**
TOTAL (ALL MEASURES)	**17.55**	**4.25**	**$1,587,200**	**$9,913,900**	**$11,501,100**

[a] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[b] The existing budget is assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[c] Extension of the Cooling Tower Audit program. Projected additional costs only.

[d] Extension of the New Throne for Your Home program. Projected additional costs only.

TABLE O-6

YEAR 1 OF 5 (FY 2010-11)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED OPERATIONS DIVISION MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain **existing** leak detection and repair staff and operating expenses from FY 2008-09 budget increase[c]	6.00		$330,000	$353,000	$683,000
New City Leadership & Commitment Efforts for FY 2010-11					
1. Enhanced real loss reduction					
a. Develop and track water loss performance indicators			$0	$50,000	$50,000
b. Improve validation of water loss performance data			$0	$250,000	$250,000
c. Assess and enhance performance of active leakage detection program					
▪ Field staff -- leak detection.		2.00	$110,000	$0	$110,000
▪ Training on new equipment, training updates			$0	$40,000	$40,000
▪ Field staff -- leak repairs.		1.00	$45,000	$0	$45,000
▪ Additional equipment for new leak repair crews			$0	$600,000	$600,000
▪ Leak detection equipment: correlating loggers and associated equipment			$0	$0	$0
▪ Leak detection equipment: ground microphones			$0	$0	$0
▪ Leak detection equipment: correlator			$0	$0	$0
▪ Additional equipment for new technicians as others become outdated.			$0	$0	$0
e. Continue to plan, develop, and implement water loss recommendation from previous water audits/efficiency studies			$0	$25,000	$25,000
f. Maximize advanced metering infrastructure (AMI) monitoring capabilities			$0	$100,000	$100,000
g. Leakage management software			$0	$15,000	$15,000
2. Enhanced apparent loss reduction (evaluate meter volumes)			$0	$150,000	$150,000
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**6.00**	**3.00**	**$485,000**	**$1,583,000**	**$2,068,000**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2010-11					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2010-11					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**6.00**	**3.00**	**$485,000**	**$1,583,000**	**$2,068,000**

[a] Does not represent the full Operations Division budget, only items discussed in the Updated Strategic Plan. Existing budget items are assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[c] Included in the existing Operations Division Budget. Reflects the FY 2008-09 budget increase for leak detection. It is assumed that future Operations Division budgets will maintain this level of funding (adjusted for inflation).

TABLE O-7

YEAR 2 OF 5 (FY 2011-12)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED OPERATIONS DIVISION MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain **existing** leak detection and repair staff and operating expenses from FY 2008-09 budget increase[c]	6.00		$337,800	$361,300	$699,100
2. Enhanced real loss reduction					
a. Develop and track water loss performance indicators			$0	$51,200	$51,200
b. Improve validation of water loss performance data			$0	$511,800	$511,800
c. Assess and enhance performance of active leakage detection program					
▪ Field staff -- leak detection.	2.00	2.00	$225,200	$0	$225,200
▪ Training on new equipment, training updates			$0	$30,000	$30,000
▪ Field staff -- leak repairs.	1.00	3.00	$184,200	$0	$184,200
▪ Additional equipment for new leak repair crews			$0	$70,000	$70,000
▪ Leak detection equipment: correlating loggers and associated equipment			$0	$50,000	$50,000
▪ Leak detection equipment: ground microphones			$0	$0	$0
▪ Leak detection equipment: correlator			$0	$0	$0
▪ Additional equipment for new technicians as others become outdated.			$0	$0	$0
e. Continue to plan, develop, and implement water loss recommendation from previous water audits/efficiency studies			$0	$25,600	$25,600
f. Maximize advanced metering infrastructure (AMI) monitoring capabilities			$0	$102,400	$102,400
g. Leakage management software			$0	$25,000	$25,000
3. Enhanced apparent loss reduction (evaluate meter volumes)			$0	$153,500	$153,500
New City Leadership & Commitment Efforts for FY 2011-12					
1. None					
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**9.00**	**5.00**	**$747,200**	**$1,380,800**	**$2,128,000**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2011-12					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2011-12					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**9.00**	**5.00**	**$747,200**	**$1,380,800**	**$2,128,000**

[a] Does not represent the full Operations Division budget, only items discussed in the Updated Strategic Plan. Existing budget items are assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[c] Included in the existing Operations Division Budget. Reflects the FY 2008-09 budget increase for leak detection. It is assumed that future Operations Division budgets will maintain this level of funding (adjusted for inflation).

TABLE O-8

YEAR 3 OF 5 (FY 2012-13)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED OPERATIONS DIVISION MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain **existing** leak detection and repair staff and operating expenses from FY 2008-09 budget increase[c]	6.00		$345,750	$369,750	$715,500
2. Enhanced real loss reduction					
a. Develop and track water loss performance indicators			$0	$52,400	$52,400
b. Improve validation of water loss performance data			$0	$523,800	$523,800
c. Assess and enhance performance of active leakage detection program					
▪ Field staff -- leak detection.	4.00		$230,500	$0	$230,500
▪ Training on new equipment, training updates			$0	$30,000	$30,000
▪ Field staff -- leak repairs.	4.00	1.00	$235,700	$0	$235,700
▪ Additional equipment for new leak repair crews			$0	$670,000	$670,000
▪ Leak detection equipment: correlating loggers and associated equipment			$0	$0	$0
▪ Leak detection equipment: ground microphones			$0	$20,000	$20,000
▪ Leak detection equipment: correlator			$0	$30,000	$30,000
▪ Additional equipment for new technicians as others become outdated.			$0	$0	$0
e. Continue to plan, develop, and implement water loss recommendation from previous water audits/efficiency studies			$0	$26,200	$26,200
f. Maximize advanced metering infrastructure (AMI) monitoring capabilities			$0	$104,800	$104,800
g. Leakage management software			$0	$35,000	$35,000
3. Enhanced apparent loss reduction (evaluate meter volumes)			$0	$157,100	$157,100
New City Leadership & Commitment Efforts for FY 2012-13					
1. None					
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**14.00**	**1.00**	**$811,950**	**$2,019,050**	**$2,831,000**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2012-13					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2012-13					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**14.00**	**1.00**	**$811,950**	**$2,019,050**	**$2,831,000**

[a] Does not represent the full Operations Division budget, only items discussed in the Updated Strategic Plan. Existing budget items are assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[c] Included in the existing Operations Division Budget. Reflects the FY 2008-09 budget increase for leak detection. It is assumed that future Operations Division budgets will maintain this level of funding (adjusted for inflation).

TABLE O-9

YEAR 4 OF 5 (FY 2013-14)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED OPERATIONS DIVISION MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain **existing** leak detection and repair staff and operating expenses from FY 2008-09 budget increase[c]	6.00		$353,850	$378,450	$732,300
2. Enhanced real loss reduction					
a. Develop and track water loss performance indicators			$0	$53,600	$53,600
b. Improve validation of water loss performance data			$0	$536,100	$536,100
c. Assess and enhance performance of active leakage detection program					
▪ Field staff -- leak detection.	4.00	4.00	$471,800	$0	$471,800
▪ Training on new equipment, training updates			$0	$30,000	$30,000
▪ Field staff -- leak repairs.	5.00	3.00	$386,000	$0	$386,000
▪ Additional equipment for new leak repair crews			$0	$140,000	$140,000
▪ Leak detection equipment: correlating loggers and associated equipment			$0	$50,000	$50,000
▪ Leak detection equipment: ground microphones			$0	$20,000	$20,000
▪ Leak detection equipment: correlator			$0	$0	$0
▪ Additional equipment for new technicians as others become outdated.			$0	$80,000	$80,000
e. Continue to plan, develop, and implement water loss recommendation from previous water audits/efficiency studies			$0	$26,800	$26,800
f. Maximize advanced metering infrastructure (AMI) monitoring capabilities			$0	$107,300	$107,300
g. Leakage management software			$0	$50,000	$50,000
3. Enhanced apparent loss reduction (evaluate meter volumes)			$0	$160,800	$160,800
New City Leadership & Commitment Efforts for FY 2013-14					
1. None					
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**15.00**	**7.00**	**$1,211,650**	**$1,633,050**	**$2,844,700**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2013-14					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2013-14					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**15.00**	**7.00**	**$1,211,650**	**$1,633,050**	**$2,844,700**

[a] Does not represent the full Operations Division budget, only items discussed in the Updated Strategic Plan. Existing budget items are assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[c] Included in the existing Operations Division Budget. Reflects the FY 2008-09 budget increase for leak detection. It is assumed that future Operations Division budgets will maintain this level of funding (adjusted for inflation).

TABLE O-10

YEAR 5 OF 5 (FY 2014-15)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED OPERATIONS DIVISION MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. Maintain **existing** leak detection and repair staff and operating expenses from FY 2008-09 budget increase[c]	6.00		$362,175	$387,425	$749,600
2. Enhanced real loss reduction					
a. Develop and track water loss performance indicators			$0	$54,900	$54,900
b. Improve validation of water loss performance data			$0	$548,700	$548,700
c. Assess and enhance performance of active leakage detection program					
▪ Field staff -- leak detection.	8.00		$482,900	$0	$482,900
▪ Training on new equipment, training updates			$0	$30,000	$30,000
▪ Field staff -- leak repairs.	8.00		$395,100	$0	$395,100
▪ Additional equipment for new leak repair crews			$0	$140,000	$140,000
▪ Leak detection equipment: correlating loggers and associated equipment			$0	$0	$0
▪ Leak detection equipment: ground microphones			$0	$0	$0
▪ Leak detection equipment: correlator			$0	$30,000	$30,000
▪ Additional equipment for new technicians as others become outdated.			$0	$104,000	$104,000
e. Continue to plan, develop, and implement water loss recommendation from previous water audits/efficiency studies			$0	$27,400	$27,400
f. Maximize advanced metering infrastructure (AMI) monitoring capabilities			$0	$109,800	$109,800
g. Leakage management software			$0	$50,000	$50,000
3. Enhanced apparent loss reduction (evaluate meter volumes)			$0	$164,600	$164,600
New City Leadership & Commitment Efforts for FY 2014-15					
1. None					
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**22.00**	**0.00**	**$1,240,175**	**$1,646,825**	**$2,887,000**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2014-15					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2014-15					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**22.00**	**0.00**	**$1,240,175**	**$1,646,825**	**$2,887,000**

[a] Does not represent the full Operations Division budget, only items discussed in the Updated Strategic Plan. Existing budget items are assumed to increase at an annual inflation rate equal to the historical average inflation rate from 1990 through 2010 (2.35 percent per year). The historical average inflation rate was calculated from the Dallas Federal Reserve Bank trimmed mean personal consumption expenditures inflation rate (Ref. 13).

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

[c] Included in the existing Operations Division Budget. Reflects the FY 2008-09 budget increase for leak detection. It is assumed that future Operations Division budgets will maintain this level of funding (adjusted for inflation).

TABLE O-11

YEAR 1 OF 5 (FY 2010-11)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED SHARED MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. None			$0	$0	$0
New City Leadership & Commitment Efforts for FY 2010-11					
1. Enhanced apparent loss reduction (management analysts)		1.00	$95,000	$0	$95,000
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**0.00**	**1.00**	**$95,000**	**$0**	**$95,000**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2010-11					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2010-11					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**0.00**	**1.00**	**$95,000**	**$0**	**$95,000**

[a] Does not represent the full budget of any Division, only items discussed in the Updated Strategic Plan. Recommended budget assumed to be shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

TABLE O-12

YEAR 2 OF 5 (FY 2011-12)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED SHARED MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. None			$0	$0	$0
New City Leadership & Commitment Efforts for FY 2011-12					
1. Enhanced apparent loss reduction (management analysts)	1.00		$97,200	$0	$97,200
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**1.00**	**0.00**	**$97,200**	**$0**	**$97,200**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2011-12					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2011-12					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**1.00**	**0.00**	**$97,200**	**$0**	**$97,200**

[a] Does not represent the full budget of any Division, only items discussed in the Updated Strategic Plan. Recommended budget assumed to be shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

TABLE O-13

YEAR 3 OF 5 (FY 2012-13)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED SHARED MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. None			$0	$0	$0
New City Leadership & Commitment Efforts for FY 2012-13					
1. Enhanced apparent loss reduction (management analysts)	1.00		$99,500	$0	$99,500
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**1.00**	**0.00**	**$99,500**	**$0**	**$99,500**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2012-13					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2012-13					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**1.00**	**0.00**	**$99,500**	**$0**	**$99,500**

[a] Does not represent the full budget of any Division, only items discussed in the Updated Strategic Plan. Recommended budget assumed to be shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

TABLE O-14

YEAR 4 OF 5 (FY 2013-14)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED SHARED MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. None			$0	$0	$0
New City Leadership & Commitment Efforts for FY 2013-14					
1. Enhanced apparent loss reduction (management analysts)	1.00	1.00	$203,700	$0	$203,700
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**1.00**	**1.00**	**$203,700**	**$0**	**$203,700**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2013-14					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2013-14					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**1.00**	**1.00**	**$203,700**	**$0**	**$203,700**

[a] Does not represent the full budget of any Division, only items discussed in the Updated Strategic Plan. Recommended budget assumed to be shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.

TABLE O-15

YEAR 5 OF 5 (FY 2014-15)

CITY OF DALLAS - UPDATED WATER CONSERVATION FIVE-YEAR STRATEGIC PLAN

PROPOSED SHARED MEASURES AND BUDGET ITEMS

ELEMENT	Staff		Budget[a]		
	Existing Staff (FTE)	New Staff (FTE)	Labor[b] ($)	Expenses ($)	Total ($)
A. CITY LEADERSHIP & COMMITMENT					
Existing City Leadership & Commitment Efforts					
1. None			$0	$0	$0
New City Leadership & Commitment Efforts for FY 2014-15					
1. Enhanced apparent loss reduction (management analysts)	2.00		$208,500	$0	$208,500
SUBTOTAL - CITY LEADERSHIP & COMMITMENT	**2.00**	**0.00**	**$208,500**	**$0**	**$208,500**
B. EDUCATION & OUTREACH INITIATIVES					
Existing Education & Outreach Initiatives					
1. None					
New Education & Outreach Initiatives for FY 2014-15					
1. None					
SUBTOTAL - EDUCATION & OUTREACH INITIATIVES	**0.00**	**0.00**	**$0**	**$0**	**$0**
C. REBATES & INCENTIVE PROGRAMS					
Existing Rebate & Incentive Programs					
1. None					
New Rebate & Incentive Programs for FY 2014-15					
1. None					
SUBTOTAL - REBATES & INCENTIVE PROGRAMS	**0.00**	**0.00**	**$0**	**$0**	**$0**
TOTAL (ALL MEASURES)	**2.00**	**0.00**	**$208,500**	**$0**	**$208,500**

[a] Does not represent the full budget of any Division, only items discussed in the Updated Strategic Plan. Recommended budget assumed to be shared between Planning, Financial, and Rate Services; Customer Account Services; and the Distribution Division Meter Section.

[b] Although assumptions have been made as to whether DWU will implement the recommended programs using DWU staff or contractors, the recommended budgets in the Updated Strategic Plan are designed to give DWU the flexibility to modify these assumptions as implementation proceeds.