
MEMORANDUM

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Project: Region C Water Supply Plan – Water Conservation Strategies

Subject: Water System Audits, Leak Detection and Repair, and Pressure Control

1. INTRODUCTION

- a. Purpose. The purpose of this memorandum is to summarize information gathered from 24 entities [Water User Groups (WUGs) and Wholesale Water Providers (WWPs)] relative to the implementation of strategies to identify leaks and to reduce water loss. The information was primarily gathered through telephone interviews and supplemented with data previously included in responses to a Region C survey conducted in 2007.

- b. Overview. The detection of leaks and actions to reduce water loss represents one of the primary Best Management Practices (BMPs) in the 2006 Region C Water Plan. This BMP consists of three components – Water System Audits, Leak Detection and Repair, and Pressure Control.

In late 2007, the Region C Water Planning Group (RCWPG) sent a comprehensive survey to Region C Water User Groups (WUGs) and Wholesale Water Providers (WWPs) requesting information on their water conservation initiatives. Surveys were completed by 96 WUGs and 25 WWPs. The Water System Audits, Leak Detection and Repair, and Pressure Control BMPs were

reported being utilized by 55 percent of the responding WUGs and 48 percent of the responding WWP. These percentages were second only to the Public Awareness and School Education BMP. Seventy five percent of the respondents using this BMP rated this practice to be “somewhat or very effective.” The respondents provided very little quantitative data or specific cost information on water savings.

In February 2008, 24 WWPs and WUGs were contacted by telephone to gather more information about this BMP. A listing of the selected entities is included in Attachment A.

2. CONSIDERATIONS

The BMP strategy to identify and reduce the quantities of water lost from systems consists of four components 1.) *Water System Audits*, 2.) *Leak Detection and Repair*, 3.) *Pressure Control*, and 4.) *Water Meter Replacement and Upgrades*.

- a. **Water System Audits.** Since 2003, water system utility audits are mandated by HB 3338 (78th Texas Legislature 2003) for retail public water utilities in Texas that provide potable water. The Texas Water Development Board (TWDB) is the implementing state agency responsible for collecting and processing the water audit information. The bill required retail public utilities that provide potable water to “perform and file with the TWDB a water audit computing the utility's most recent annual system water loss” every five years. Under this authority, the TWDB instituted new water audit reporting requirements that require retail public utilities to carefully audit their system water use at least once every five years; to estimate system water use in standard, well-defined categories; and to report their first set of water loss data to the TWDB by March 31, 2006. Attachment B includes a listing of retail public water utilities within the Region C area that submitted a water loss audit to the TWDB for 2005.

The new water audit reporting requirements follow a methodology that is recommended by the International Water Association (IWA) and the American Water Works Association (AWWA) Water Loss Control Committee. This methodology relies on strictly defined water use categories and water loss performance indicators and is becoming the international water loss accounting standard.

In 2006, an assessment of the first set of audit submissions was conducted jointly by Alan Plummer Associates, Inc. and Water Prospecting and Resource Consulting, LLC and documented in the report, *Analysis of Water Loss as Reported by Public Water Suppliers in Texas*, dated January 2007¹.

Significant conclusions in the report:

- *Approximately half of retail public utilities in Texas (representing 84 percent of the State's population) reported their water loss data.*
- *A substantial amount of water was attributed to a "balancing adjustment" (entries made to reconcile difference in water supplied with water delivered or lost from the system, and is therefore not attributed to any water use category), causing significant uncertainty in estimates of water loss.*
- *Because of the large balancing adjustment entries, some of the utilities may have underestimated their real water loss (water that was physically lost from the system, such as main breaks and leaks, customer service line breaks and leaks, storage overflows, and others).*
- *Reporting utilities experienced an average total water loss of 5.6 to 12.3 percent of all water entering the reporting systems (the range is due to uncertainty regarding the balancing adjustment). Total water loss includes real loss (as defined parenthetically above) and apparent loss (water that was not accurately measured and billed to a customer, such as unauthorized*

¹ *An Analysis of Water Loss as Reported by Public Water Suppliers in Texas – Final Report* by Alan Plummer Associates, Inc. and Water Prospecting and Resource Consulting, LLC. Funded by the Texas Water Development Board, January 24, 2007.

consumption, customer meter under-registering, and billing adjustment and waivers).

- *The State of Texas's median reported real loss on a mile of main per day basis is 233 gallons/mile/day. The State of Texas's median reported real loss on a per service connection per day basis is 18.8 gallons/connection/day. Notwithstanding other uncertainties, the results of the statewide audit submittals indicated the median statewide real loss is only 23 percent of the lowest identified real loss for selected utilities in North America. Although this could indicate excellent or superior performance regarding system maintenance and operation, it appears more likely to be an indication of imprecise data and results.*

In any event, system audits are now required of water utilities, which if prepared in strict accord with the reporting protocols should provide quantifiable data of water savings related to water system audits.

- b. **Leak Detection and Repair.** Leak Detection and Repair is an important component of system operation and maintenance. Conducting a proactive approach instead of a reactive approach to leak detection and repair represents an action that is an effective BMP. Employing electronic equipment for detecting line leaks can also be a beneficial BMP. It is noted that utilities that have practiced proactive leak detection and repair and have used electronic leak detecting equipment already benefit from this BMP. Therefore, identifying this as a new BMP will not result in as much water savings as that which would be achieved by entities that are implementing this BMP for the first time.

The size of the utility will have a bearing on the leak detection program. For small utilities, there may be no increase in their maintenance staff to successfully implement a BMP. Utility systems in small cities or utility districts may enjoy a high level of leak detection and repair since the maintenance staff is usually intimately familiar with the system and its customer base.

Large utilities have a revenue stream that allows for the procurement of specialized equipment (e.g. water leak detection devices, etc.). They can also more easily undertake capital programs for utility line replacements. Most large utilities serve a customer base with core areas that are greater than 50 years old. Because of the age of the infrastructure, maintenance and system upgrades require aggressive leak detection and repair programs to prevent increased or continued water loss from aging infrastructure.

Challenges to mid-sized utilities vary. Some have similar age problems like the larger utilities. Others have growth patterns that are more recent, and their utility systems are more modern resulting in potentially less water loss through the system.

- c. **Pressure Control.** Pressure control envisions modulating pressure in the system to reduce line pressures when the demand is not present. The direct effect is to minimize the volume of water lost to line leaks at the times when the pressure is reduced. Constraints to the concept of system pressure modulation are (1) the need to supply adequate water for fire fighting at all times, (2) the need to refill water storage tanks during off-peak hours, and (3) the need for SCADA systems and advanced technology valving to efficiently implement a pressure control program.

- d. **Water Meter Replacement and Upgrades.** A viable water meter management program is a mandatory component of the Water System Audits, Leak Detection and Repair, and Pressure Control BMP. Water meters have predetermined timeframes where the device performs with high accuracy. Therefore to maintain accuracy over time, meters must be replaced regularly. The level of sophistication among types of meters and meter reading systems is growing. Automated Meter Reading (AMR) technology is becoming employed more frequently in water utility systems. However, the most important facet of water

meters is the use of the information once the meter has been read. The comparative information can indicate the potential of a water leak. The type of water meter, the method of reading it, and the recoding system are economic choices. The use of the information and the accuracy of the meter system are the most important components of the BMP.

3. SURVEY RESULTS

In general there is much activity and use of this BMP. Many of the respondents noted the importance of this BMP's contributions in improving water conservation. However, procedures and protocols to quantify the effectiveness of water system audits, leak detection and repair, and pressure control were not evident from many of the WUGs and WWP's based on their responses.

- a. Water System Audits. Accurate water system audits are critical for identifying water losses and the potential for conservation. If audits are performed on the cycle required by HB 3338, then the next comprehensive audits performed by water suppliers will be due in 2011. The report, *Analysis of Water Loss as Reported by Public Water Suppliers in Texas*, recommended increasing the frequency of the audits. Because of uncertainties in the information provided in the audits, it would be of value to conduct comprehensive audits annually in order to gain more experience in the audit system and to focus on better categorization of whether the water is used or lost to the system.
- b. Leak Detection and Repair. In general, survey respondents were not able to quantify water savings from this BMP. The level of leak detection varied from water supplier to water supplier. The larger the population served, the more budget and manpower was dedicated to the program. The following are three examples of the program identified with the water supplier.

North Texas Municipal Water District (Wholesale Water Provider)

The North Texas Municipal Water District (NTMWD) monitors the losses of their 72 retail customers. The NTMWD estimates overall water losses at five percent.

In October 2000, the NTMWD established a preventative maintenance crew to check air valves, blow-offs, and isolation valves. During these inspections, the crew checks the system for leaks. If leaks are identified, those systems are scheduled. For Fiscal Year (FY) 2008-2009, the NTMWD intends to add two additional employees to this team. In addition to the preventative maintenance crew, the NTMWD administers an eddy current testing program to assess pipeline integrity.

The NTMWD budgets \$50,000 for valve testing and \$500,000 for the pipeline integrity program.

City of Dallas (Population > 1,200,000)

Beginning in Fiscal Year (FY) 2004, the Dallas Water Utilities (DWU) expanded its water main replacement programs to attain a 75-year replacement cycle. In FY 2007, an additional leak detection crew was budgeted in order to advance the leak detection program. An additional leak detection crew is scheduled to be added to the program beginning in FY 2009.

Dallas Water Utilities employs an innovative leak detection program, which utilizes a variety of technologies to detect, locate, and repair leaks in both its water distribution and transmission systems. During FY 2006, this program located over 200 leaks in Dallas' water distribution system, for an annual savings estimated at 100 million gallons of water. Beginning in FY 2005, Dallas expanded its leak detection program to include the use of

remote sensing acoustical technology (Sahara[®] leak location system) on its large diameter transmission mains.

The City of Dallas budgets \$405,000 per year for leak detection and an additional \$3,500,000 per year for line repairs.

City of Allen (Population <80,000)

The City of Allen has an aggressive water conservation program. The water department contributes financially to the salary of one code enforcement officer (pays ½ of the salary and benefits (\$45,500) of one code enforcement officer) to address water conservation issues. The city is typical of rapidly growing cities in north central Texas. It reports that 75 percent of its infrastructure is less than 15 years old. Accordingly, it has no short-range plans to increase its maintenance budget to add additional leak detection crews. The City has purchased electronic leak detection equipment to assist its crews in leak detection. Anecdotally, the City reported that it discovered a leak, which was discharging to a storm sewer. This leak detection and subsequent repair resulted in a one-time savings of several million gallons.

Tables 1A and 1B provide representative information regarding responses from WWP's and WUG's. The respondents were grouped in terms of large, medium, and small water suppliers.

TABLE 1A: SURVEY RESULTS – WWP LEAK DETECTION & REPAIR

ENTITY SIZE	ENTITY TYPE	BMP Implementation	Description	Annual Budget	
				Leak Detection	Repairs
Large City	WWP	Yes	Distribution Leak Detection Program	\$405,000	\$3,500,000
Large City	WWP	Yes	Leak detection loggers, dedicated field staff and contracts for water loss pilot programs, meter replacement program	\$2,000,000	
Medium City	WWP	No	Not Reported	\$438,000	
Medium City	WWP	No	Not Reported	\$125,000	
Medium City	WWP	Yes	Vigilance in locating and repairing	Not Reported	
SUD Small	WWP	No	Leaks repaired as soon as possible	Not Reported	
Medium City	WWP	No	Currently developing a program	Not Reported	
Water District Large	WWP	Yes	ARV Maintenance crew - checks lines and appurtenances	\$300,000	
Water District Large	WWP	Yes	Routine inspections (aerial and ground); Remote field eddy current transformer coupling (non-destructive) pipeline testing; Pressure Pipe Inspection Company's Sahara Leak Detection Technology	\$50,000 for air valves; \$500,000 for pipeline integrity program	

TABLE 1B: SURVEY RESULTS – WUG LEAK DETECTION AND REPAIR

Entity Size	ENTITY TYPE	BMP Implementation	Description	Annual Budget
Large City	WUG	No	N/A	\$340,550
Large City	WUG	Yes	Automated Meter Readers	Not Reported
Large City	WUG	Yes	Replacement of leaking water mains; SCADA system monitoring; Contractors use portable meters and water loss formula.	\$175,000
Medium City	WUG	Yes	Use leak detection equipment to find hidden leaks on a regular basis	\$25,000
Medium City	WUG	Yes	Closely monitor unaccounted for water loss; city departments must account for usage; all city facilities are metered	Not separated
Medium City	WUG	Yes	Monitor water production and billed consumption daily for comparison. Has a crew that looks for suspicious use of water.	\$250,000
Medium City	WUG	Yes	Water conservation crew utilized; electronic equipment to assist in leak detection.	\$125,000
Small City	WUG	Yes	Not a formal program, but use leak detection equipment and keep track to identify losses.	Not Reported
Small City	WUG	No	Employees drive system to locate leaks	Not Reported
Small City	WUG	No	Not Reported	Not Reported
Small City	WUG	Yes	Compare daily water pumped against daily average	\$15,000

The absence of quantifiable benefits makes the assessment of a leak detection program challenging. Leak detection and repair activities require additional employees and new equipment. The correlation between the costs associated with leak detection and water conservation has not been fully documented in most cases. This is a relatively new program in most utilities and will take time to establish reporting and documentation of the savings.

- c. Pressure Control. Responses were varied among the contacted WWP's and WUG's. Based on the survey results, pressure control has not been implemented on a widespread basis. The need to refill tanks and storage overnight was cited as one barrier to implementing such a program. There have been initiatives cited by some of the respondents. North Richland Hills regulates pressure throughout its system through SCADA operations. The City of Allen reported lowering water towers ten feet during summer months in order to decrease water usage.
- d. Water Meter Replacement and Upgrades. Table 2 below depicts the responses related to meter programs. The meter replacement program schedule should be prior to the expiration of a meter's life expectancy. This would ensure accurate metering. Of the entities surveyed, all but one entity reported to have an annual meter replacement program.

Changing over to automated meter readers (AMR) has not been done on a widespread basis. Based on the interviews, some utilities concluded that for their operation, changing meters to an AMR system is not cost effective. However, for other utilities, AMR have been determined to be beneficial. The utilities certainly understand the importance of a thorough meter management program.

TABLE 2: METER REPLACEMENT PROGRAM

Entity Size	Entity Type	% Meters Replaced Annually	Meter Testing and Replacement Budget	Estimated Average Line Pressure
Large CITY	WWP	10%	Not Reported	60 psi
Large CITY	WWP	15%	Not Reported	70 psi
Medium City	WWP	7.6%	Not Reported	60 psi
Medium City	WWP	10%	Not Reported	65 psi
Medium City	WWP	Not Reported	Not Reported	60-100 psi
SUD Small	WWP	100% in progress	Not Reported	65 psi
Medium City	WWP	4.50%	Not Reported	50-85 psi
Medium City	WWP	4%	Not Reported	70 psi
Water District Large	WWP	8%	Not Reported	40-50 psi
Water District Large	WWP	No set %	Not Reported	NA
Large City	WUG	6%	\$47,500	70 psi
Large City	WUG	10%	Not Reported	60 psi
Large City	WUG	5%	Not Reported	68 psi
Medium City	WUG	5%	Not Reported	60 psi
Medium City	WUG	3%	Not Reported	47 psi
Medium City	WUG	10%	Not Reported	80 psi
Medium City	WUG	10%	Not Reported	75 psi
Small City	WUG	No set %	Not Reported	65 psi
Small City	WUG	11%	Not Reported	65 psi
Small City	WUG	10%	Not Reported	52 psi
Small City	WUG	7%	Not Reported	55 psi

4. CONCLUSIONS

In general there is much activity and use of this BMP. Many of the respondents noted the importance of this BMP's contributions in improving water conservation. However, procedures and protocols to quantify the effectiveness of water system audits, leak detection and repair, and pressure control were not evident from many of the WUGs and WWPs based on their responses. The ability to quantify the practice's effectiveness will facilitate obtaining resources and support of this BMP.

Water System Audits

System audits were a first step towards accurately defining water use within water supply systems. The audits need to be repeated on a more frequent basis than the five-year program mandated by HB 3338. Without current water audit data, the Region C Water Planning Group will have to rely on the 2005 water audit data for the forthcoming regional water plan due in 2011. If water providers in Region C are currently performing water system audits, those entities should be solicited to provide audit data. This data would further define current water use within water systems to facilitate an accurate reporting for the regional water plan due in 2011.

Leak Detection and Repair

Costs for leak detection and repair activities for purposes of BMP identification were difficult to quantify as they are already part of the entities' operations and maintenance service.

The line between regular maintenance and conservation is vague. Whereas the monetary cost of leak detection and repair may be difficult to quantify, the water savings could be collected relatively simply. In order to quantify the amount of water lost in each leak detected and repaired, a protocol based on line pressure, size of aperture, and assumed duration of leak should be developed. If the major water supply providers adopted such a protocol and the results were made available to the Region C Water Planning Group, there could be an increase in the quantification of the results of the program throughout the Region. This information is not being tracked routinely by most entities.

It is apparent from survey responses that leak detection and repair is a priority among the utilities. Quantifiable results of the water savings from these individual programs will greatly help utilities to adopt and resource those activities that have the most benefits.

Pressure Control

Pressure control is not practiced for the sake of water conservation by most water supply providers, including the five major providers. No recommendations are made regarding this specific component of the BMP. However, at such time that leak information is better quantified in the Leak Detection and Repair Component, it is recommended that the consideration of use of pressure control protocols be encouraged in Region C.

Meter Replacement and Upgrade

The meter management program is reported by most respondents to be effectively managed. There does not appear to be a trend to upgrade the meter systems to AMR systems. Based on interviews, the issue is one of economics. The benefits compared to the cost of implementation have not been demonstrated to the utility managers to compel them to invest in AMR systems.

ATTACHMENT A
ENTITIES CONTACTED FOR FOCUS GROUP SURVEY

WHOLESALE WATER PROVIDERS

- CITY OF DALLAS
- CITY OF DENTON
- CITY OF FORT WORTH
- CITY OF MANSFIELD
- CITY OF NORTH RICHLAND HILLS
- CITY OF WAXAHACHIE
- CITY OF WEATHERFORD
- NORTH TEXAS MUNICIPAL WATER DISTRICT
- ROCKETT SPECIAL UTILITY DISTRICT
- TARRANT REGIONAL WATER DISTRICT
- TRINITY RIVER AUTHORITY OF TEXAS
- UPPER TRINITY REGIONAL WATER DISTRICT

WATER USER GROUPS

- CITY OF ALLEN
- CITY OF ARLINGTON
- CITY OF AUBREY
- CITY OF AZLE
- CITY OF CARROLLTON
- CITY OF CHICO
- CITY OF FRISCO
- CITY OF LEWISVILLE
- CITY OF MCKINNEY
- CITY OF PLANO
- CITY OF WYLIE

ATTACHMENT B
LISTING OF UTILITIES PROVIDING A 2005 WATER
SYSTEM AUDIT

UTILITY NAME	COUNTY
ABLES SPRINGS WSC	KAUFMAN
AERO VALLEY WATER SERVICE	DENTON
ANGUS WSC	NAVARRO
ARGYLE WSC	DENTON
ATHENS WATER SYSTEM COOP	HENDERSON
AURORA VISTA	WISE
AVALON WATER SUPPLY & SEWER SERVICE CORPORATION	ELLIS
BARTONVILLE WSC	DENTON
BEACHWOOD ESTATES & NORTH TRINIDAD	HENDERSON
BEATON LAKE ESTATES WATER SYSTEM	NAVARRO
BECKER JIBA WSC	KAUFMAN
BENBROOK HILLS	TARRANT
BENBROOK WATER & SEWER AUTHORITY	TARRANT
BENT TRAIL HOMEOWNERS ASSOC	TARRANT
BLACKLAND WATER SUPPLY CORPORATION	ROCKWALL
BLUE MOUND	TARRANT
BLUEBONNET HILLS WSC	PARKER
BOLIVAR WSC	DENTON
BRIARWOOD HARBOR	HENDERSON
BRITTANY HILL WATER SUPPLY	DENTON
BUENA VISTA BETHEL SUD	ELLIS
C R C WSC	HENDERSON
CHAMBERS MEADOW ESTATE WATER CO	ELLIS
CHATFIELD WSC	NAVARRO
CHEROKEE SHORES WATER SUPPLY	HENDERSON
CITY OF ADDISON	DALLAS
CITY OF ALLEN	COLLIN
CITY OF ALVORD	WISE
CITY OF ARLINGTON	TARRANT
CITY OF ATHENS	HENDERSON
CITY OF BARRY	NAVARRO
CITY OF BELLS	GRAYSON
CITY OF BLOOMING GROVE	NAVARRO
CITY OF BOYD	WISE
CITY OF CALLISBURG	COOKE
CITY OF CARROLLTON	DALLAS
CITY OF CELINA	COLLIN
CITY OF CHICO EAST	WISE
CITY OF COCKRELL HILL	DALLAS
CITY OF COLLINSVILLE	GRAYSON
CITY OF COPPELL	DALLAS
CITY OF CORINTH	DENTON
CITY OF CORSICANA	NAVARRO
CITY OF CRANDALL	KAUFMAN
CITY OF DAWSON	NAVARRO
CITY OF DENTON	DENTON
CITY OF DESOTO	DALLAS
CITY OF DUNCANVILLE	DALLAS

CITY OF ECTOR	FANNIN
CITY OF ENNIS	ELLIS
CITY OF EULESS	TARRANT
CITY OF EVERMAN	TARRANT
CITY OF FAIRVIEW	COLLIN
CITY OF FARMERS BRANCH	DALLAS
CITY OF FATE	ROCKWALL
CITY OF FORT WORTH	TARRANT
CITY OF FRISCO	COLLIN
CITY OF GAINESVILLE	COOKE
CITY OF GARLAND	DALLAS
CITY OF GRAND PRAIRIE	DALLAS
CITY OF GRAPEVINE	TARRANT
CITY OF GUNTER	GRAYSON
CITY OF HALTOM CITY	TARRANT
CITY OF HASLET	TARRANT
CITY OF HEATH	ROCKWALL
CITY OF HIGHLAND VILLAGE	DENTON
CITY OF HOWE	GRAYSON
CITY OF IRVING	DALLAS
CITY OF ITALY	ELLIS
CITY OF KAUFMAN	KAUFMAN
CITY OF KELLER	TARRANT
CITY OF KEMP	KAUFMAN
CITY OF KENNEDALE	TARRANT
CITY OF KRUM	DENTON
CITY OF LAKE WORTH	TARRANT
CITY OF LANCASTER	DALLAS
CITY OF LEONARD	FANNIN
CITY OF LEWISVILLE	DENTON
CITY OF LINDSAY	COOKE
CITY OF LOG CABIN	HENDERSON
CITY OF MABANK	KAUFMAN
CITY OF MALAKOFF	HENDERSON
CITY OF MANSFIELD	TARRANT
CITY OF MCKINNEY	COLLIN
CITY OF MESQUITE	DALLAS
CITY OF MIDLOTHIAN	ELLIS
CITY OF MILFORD	ELLIS
CITY OF MUENSTER	COOKE
CITY OF MURPHY	COLLIN
CITY OF NEWARK	WISE
CITY OF NORTH RICHLAND HILLS	TARRANT
CITY OF PARADISE	WISE
CITY OF PLANO	COLLIN
CITY OF POTTSBORO	GRAYSON
CITY OF RENO	PARKER
CITY OF RHOME	WISE
CITY OF RICHLAND HILLS	TARRANT
CITY OF SANSOM PARK	TARRANT

CITY OF SEAGOVILLE	DALLAS
CITY OF SOUTHLAKE	TARRANT
CITY OF TEAGUE	FREESTONE
CITY OF TERRELL	KAUFMAN
CITY OF TIOGA	GRAYSON
CITY OF TOM BEAN	GRAYSON
CITY OF TRENTON	FANNIN
CITY OF UNIVERSITY PARK	DALLAS
CITY OF VAN ALSTYNE	GRAYSON
CITY OF WATAUGA	TARRANT
CITY OF WAXAHACHIE	ELLIS
CITY OF WESTWORTH VILLAGE	TARRANT
CITY OF WHITEWRIGHT	GRAYSON
CITY OF WILMER	DALLAS
CITY OF WORTHAM	FREESTONE
CITY OF WYLIE	COLLIN
COLLEGE MOUND WSC	KAUFMAN
COMBINE WSC	DALLAS
COPEVILLE WSC	COLLIN
COUNTRY CLUB WATER SUPPLY INC	KAUFMAN
COUNTRY RIDGE WATER	COLLIN
COYOTE RIDGE ADDITION	WISE
CRAZY HORSE RANCH WATER CO	PARKER
CRESCENT HEIGHTS WSC	HENDERSON
CULLEOKA WSC	COLLIN
DALLAS COUNTY WCID 6	DALLAS
DALLAS WATER UTILITY	DALLAS
DENTON CREEK ESTATES	DENTON
DESERT WSC	COLLIN
DIAL WSC	FANNIN
DOGWOOD ESTATES WATER COMPANY	HENDERSON
DONIE WATER WORKS INC	FREESTONE
DOUBLE ROCK ESTATES	DENTON
EAST CEDAR CREEK FWSD B A MCKAY	HENDERSON
EAST CEDAR CREEK FWSD BROOKSHIRE	HENDERSON
EAST FORK SUD	COLLIN
EAST GARRETT WSC	ELLIS
ELMONT FARMINGTON WSC	GRAYSON
EMERALD FOREST	ELLIS
EMHOUSE WATER SYSTEM	NAVARRO
FOREST HILL TWO WSC	DENTON
FORNEY LAKE WSC	KAUFMAN
FRIENDLY OAKS WSC	TARRANT
FROGNOT WSC	COLLIN
GARRETT COMMUNITY WATER CO	ELLIS
GASTONIA SCURRY WSC	KAUFMAN
GOBER MUD	FANNIN
GRANDE CASA	ELLIS
GREEN ACRES WATER SYSTEM	PARKER
GUNTER RURAL WSC	GRAYSON

HARBOR GROVE WSC	DENTON
HIDDEN ACRES WATER SYSTEM	HENDERSON
HIDDEN HILLS HARBOR & CAROLYNN ESTATES	HENDERSON
HILLS OF OLIVER CREEK THE	WISE
HORSESHOE BEND WATER SYSTEM	PARKER
KENTUCKYTOWN WSC	GRAYSON
KNOB HILL WATER SYSTEM	DENTON
KYKER LANE COMMUNITY WATER SYSTEM	GRAYSON
LAKE CITIES MUNICIPAL UTILITY AUTHORITY	DENTON
LAKEVIEW RANCHETTES	ELLIS
LAKWOOD WATER EAST	HENDERSON
LAKWOOD WATER WEST	HENDERSON
LANNIUS MUD	FANNIN
LAWRENCE WSC	KAUFMAN
LONGHORN MEADOWS ADDITION	DENTON
LUELLA WSC	GRAYSON
MARKUM RANCH ESTATES	TARRANT
MEADOW RANCH WATER SYSTEM	DENTON
MICHAELS COVE WATER SUPPLY	HENDERSON
MILLIGAN WSC	COLLIN
MILLSAP WSC	PARKER
MOODY WATER SYSTEM	FREESTONE
MOUNTAIN RIVER WATER COMPANY	PARKER
MOUNTAIN SPRINGS WSC	COOKE
MUSTANG SUD	DENTON
NAVARRO MILLS WSC	NAVARRO
NORTH COLLIN WSC	COLLIN
NORTH FARMERSVILLE WSC	COLLIN
NORTH KAUFMAN WSC	KAUFMAN
NORTHCREST WATER SYSTEM	NAVARRO
NORTHERN HILLS WATER SERVICE	GRAYSON
NORTHWEST GRAYSON COUNTY WCID 1	GRAYSON
OAK RIDGE SOUTH GALE WSC	GRAYSON
PARKERVILLE EAST MOBILE HOME PARK	DALLAS
PARTICIPATION DEVELOPMENT OF TEXAS PINNACLE CLUB	HENDERSON
PAYNE SPRINGS WSC	HENDERSON
PILOT POINT RURAL WATER SUPPLY	DENTON
PINK HILL WSC	GRAYSON
PIONEER VALLEY WATER CO	COOKE
PLEASANT GROVE WSC	FREESTONE
POETRY WSC	KAUFMAN
PONDEROSA ADDITION UTILITIES	DENTON
PRESTON SHORES WATER SYSTEM	GRAYSON
PURDON WATER CO	NAVARRO
RETREAT WATER SYSTEM	NAVARRO
RICE WSC	NAVARRO
RICHLAND SYSTEM	NAVARRO
RIO BRAZOS WSC	PARKER
ROCKETT SUD	ELLIS
ROSE HILL WSC	KAUFMAN

SAGE BRUSH ESTATES	WISE
SARDIS LONE ELM WSC	ELLIS
SEIS LAGOS UTILITY DISTRICT	COLLIN
SILVER SADDLE ACRES	TARRANT
SKY VIEW RANCH ESTATES	WISE
SOUTH WINDOM WSC	FANNIN
SOUTHEAST WATER CO	KAUFMAN
SOUTHERN OAKS WATER SUPPLY	FREESTONE
SOUTHWEST FANNIN COUNTY SUD	FANNIN
SPANISH GRANT SUBDIVISION	ELLIS
SPANISH PARK ESTATES	PARKER
STARR WSC	GRAYSON
STONEBRIDGE WSC	DENTON
STONECREST ESTATES	DENTON
THE COLONY	DENTON
TOWN OF FLOWER MOUND	DENTON
TOWN OF HIGHLAND PARK	DALLAS
TOWN OF PONDER	DENTON
TOWN OF SUNNYVALE	DALLAS
TOWN OF WESTOVER HILLS	TARRANT
VACATION VILLAGE	DENTON
VERONA WSC	COLLIN
VIRGINIA HILL WSC	HENDERSON
WALNUT CREEK SUD	PARKER
WEST WISE RURAL WSC	WISE
WESTERN LAKE ESTATES	PARKER
WESTMINSTER WSC	COLLIN
WESTSIDE RURAL WSC	TARRANT
WESTVIEW	PARKER
WHITE SHED WSC	FANNIN
WHITT WSC	PARKER
WILLOWCREEK FARMS	FREESTONE
WINDMILL TRAIL	WISE
WOODBINE WSC	COOKE
WYLIE NORTHEAST WSC	COLLIN
WYNNWOOD HAVEN ESTATES	DENTON