

Water Loss

from

Texas Water Suppliers



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This study is conducted as an activity of the Texas Living Waters Project. This project is a collaborative effort of the National Wildlife Federation, Environmental Defense, and the Lone Star Chapter. The goals of the project are to 1) ensure adequate water for people and environmental needs, 2) reduce future demand for water and foster efficient and sustainable use of current water supplies, 3) educate the public and decision makers about the impact of wasteful water use and the opportunities for water conservation, and 4) involve citizens in the decision making process for water management.

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Executive Summary

Due to water leaks, inaccurate meters, and theft, between ten and fourteen percent of the water produced by Texas water utilities is unaccounted-for or lost. This amount of water loss equates to over 450,000 acre-feet annually, the conservation storage capacity of a medium-sized reservoir. Over 700 water utilities in Texas report water losses in excess of ten percent; the American Water Works Association recommends immediate action by a water utility if losses are greater than ten percent.

Unfortunately, these data do not provide a complete picture of water loss in Texas. Although required by law to file annual reports of water loss, over 2,400 water utilities did not file water loss reports in 2000. In addition, there is variability in the reported water loss data. Water loss percentages reported by the same utilities responding to different surveys differ by more than ten percent about one-third of the time. These differences may result from different interpretations of water loss, different methodologies for calculating water loss, or using different units to report water loss. Currently, there are no efforts by the state to correct the errors associated with water loss reporting.

A water audit is the primary method for determining water loss in a water utility. The 78th Texas Legislature, in 2002, enacted House Bill 3338 requiring public utilities to complete an audit every five years. The information from these audits is to be used in the regional water planning process. The first audits however, are not required until 2006, after the second round of regional plans are to have been completed.

Some water suppliers recognize the lost revenue that results from water losses and make serious attempts to correct these losses using leak detection equipment and replacing inaccurate meters. Other utilities, however, do not monitor their water loss and refuse to answer questions regarding such losses. The State Water Plan proposes to spend billions of dollars to increase water supply in Texas, yet there is not comprehensive and accurate data on the amount of water lost in water utilities.

Recommendations

Texas should aggressively monitor water loss

- Texas should adopt clearly defined water loss terminology for all water suppliers, in order that information on water loss can be more easily obtained, understood, and compared.
- TWDB and TCEQ should make an aggressive effort to gather additional information about water loss in Texas.
- TWDB, under the new law HB 3338, should develop a water audit that aims to identify causes of water loss. The water audit should not simply ask for the difference between water produced and water sold, but should include a breakdown of system losses (i.e. line flushing, backwashing filters) and public uses (i.e. fire fighting, filling public swimming pools)
- Water suppliers should be penalized if they do not comply with reporting laws, including filing the new water audit in a timely and accurate manner.

Texas should make reduction of water loss part of the water rights permitting and financial assistance process

- A water supplier should be required to reduce water loss to a reasonable level before requesting additional water rights or seeking financial assistance to develop additional water supplies- (unless the financial assistance is sought to reduce water loss).

Texas should make reduction of water loss a priority as a means to meeting future water demand

- Expensive and environmentally destructive projects should not be recommended in the regional water plans unless water utilities in the region implement programs for leak detection and meter repair or replacement.
- As Region A recommends, all of Texas should employ water loss reduction as a solution to meeting future water demands.

I. Introduction

In Texas, over 3,700 public and private water supply systems withdraw over 4 million acre-feet of water annually.¹ This amount supplies the needs of over 20 million people, about 94 percent of the State's population. The 2002 State Water Plan projects a municipal water demand of over 7 million acre-feet per year for over 40 million people in 2050.²

Not all of the water withdrawn by water supply systems is sold to customers. Some water is used for purposes such as firefighting, public swimming pools, and public fountains. Some water not sold to customers is also lost to pipe leaks, inaccurate meters, and theft. While some water loss, also referred to as unaccounted-for water, is bound to occur, the American Water Works Association recommends immediate action if more than 10% of water is lost annually.

Unaccounted-for water is not specifically addressed in the Texas State Water Plan. Identifying and reducing water loss, however, is a cost-effective and environmentally sound way to provide Texas with more of the water it needs, potentially reducing the need for additional reservoirs or interbasin transfers.

In order to better understand the extent of water loss from water suppliers in Texas, the Lone Star Chapter of the Sierra Club undertook an effort in the summer of 2003 to research the various methodologies for defining, determining, and detecting water loss. Water-loss data from water supply systems around the state were also collected. The findings of this effort are presented in this report. This focus of this report is water loss within water utilities; it does not address water savings resulting from user-oriented conservation efforts. The Sierra Club hopes that the findings and recommendations resulting from this study will assist both decision-makers and the public in addressing water loss in water utilities as a way to meet our state's water needs.

¹ *Water for Texas 2002: State Water Plan*, Texas Water Development Board, p. 29, available online at www.twdb.state.tx.us

² *Id.* at 29

II. What is Water Loss?

Water loss, also called unaccounted-for water, is “the difference between the amount of water a utility purchases or produces and the amount of water that it can account for in sales and other known uses for a given period.”³ Simply, water loss is the water that cannot be accounted for by a utility. There are several reasons not all water purchased or produced reaches a consumer: inaccurate or incomplete record keeping; meter error; un-metered uses (fire-fighting, line flushing, public use, wastewater treatment plants); leaks; and water theft.⁴

Water utilities do not always calculate or report water loss in the same manner. Some utilities calculate water loss as all non-metered water, while other utilities calculate loss as only the water lost through leaks. Some utilities report loss in million gallons a day, while other use gallons per day or acre-feet. Other utilities report water loss as a percentage of total withdrawal.⁵ The International Water Association recommends looking at water loss in volume, not percentage.

Physical differences between water systems also have an influence on water loss. The number of service connections, the length of mains, the infrastructure condition, the average operating pressure, and the percentage of time per year the system is pressurized, has been shown to influence water loss.⁶ Texas is one of only three states that recognize that different types of water systems may have different levels of unaccounted-for water.⁷ The Texas Water Development Board (TWDB) recommends immediate action if unaccounted-for water is above 15% for municipal systems and above 15-18% for widespread rural systems.⁸

³ A Guidebook for Reducing Unaccounted-for Water Texas Water Development Board, Revised August 1999 available online at www.twdb.state.tx.us

⁴ *Id.*

⁵ Beecher, Janice A. *Survey of State Agency Water Loss Reporting Practices* Final Report of the American Water Works Association, (January 2002): 3.

⁶ Lambert, A. “Losses from Water Supply Systems: Standard Terminology and Recommended Performance Measures” The Blue Pages, International Water Association, October 2000 available online at www.iwahq.org.uk

⁷ Beecher, Janice A. *Survey of State Agency Water Loss Reporting Practices* at 14.

⁸ *Id.* at 14.

III. Determining Water Loss

A water audit is the primary method for determining the volume of water loss in a water utility. A typical water audit first obtains information on the total amount of water purchased or produced by a utility, and then determines the amount of water sold by the utility. Next, the audit determines the additional amount of water used for system and public uses. System uses include backwashing filters and flushing water mains. Public uses include fire fighting, filling public fountains and swimming pools, and irrigating parks. Water loss is then calculated by subtracting water sales, system uses, and public uses from the total amount of water produced.⁹

The Texas Legislature has recently recognized the importance of water audits. The 78th Texas Legislature in the general session of 2003 enacted H.B 3338.¹⁰ This bill requires the public utilities to complete and file a water audit with the TWDB every five years (TWDB determines the appropriate methodologies within parameters set in the bill).¹¹ The information obtained from these audits should vastly improve knowledge about water loss and is to be incorporated into the regional water planning process. The bill became effective September 1st, 2003, but water audits are not required until 2006, too late for the second round of regional water plans.

⁹ Wyatt, Steve “The Economics of Water Lo\$\$: What is unaccounted-for water?” *On Tap* Fall 2002, available online at www.nesc.wvu.edu

¹⁰ TEX. WATER CODE § 16.0121; TEX. WATER CODE § 16.053.

¹¹ *Id.*

IV. Reducing Water Loss

“Had a 30% loss in 1996. We changed out all polybutylene service lines, old meters and started doing in-house leak detection each week. Now all meters are checked every 5 years and annual loss is less than 10%.” - A.J. Olson, Brushy Creek MUD

a. Visual Inspections

Water loss is often caused by leaks. Visual inspections can be a very inexpensive method to locate and repair leaks, requiring little equipment or expertise. Some water utilities encourage local residents to participate in leak detection. The Santo Water Supply Corporation adds an incentive to its customers by paying \$10 to each person who reports a leak.

Unfortunately, visual inspections have a limited capacity for locating and repairing leaks, as all leaks are not visible. Some leaks can be hard to locate, and small leaks may go unnoticed for long periods of time. Such leaks not only waste water, they can cause costly damage to the surrounding area as well.

b. Leak Detection

Leak detection programs locate leaks not visible to the eye using various sonic or acoustic sensors to locate “leak sounds”.¹² Some water utilities have an internal leak detection program, while others contract an outside firm to detect their leaks. Listed below are just some of the benefits of a leak detection program:

- Reduce unaccounted-for water
- Recover lost water and generate revenues
- Reduce legal public liability
- Improve public relations
- Reduce road damage
- Increase water system knowledge (Identify 100% of distribution system and update mapping)
- Eliminate unnecessary water demand and identifies system efficiency¹³

A leak detection program has many benefits and is more effective than relying solely on visual inspections. Leak detection programs can locate all leaks in a water supplier’s distribution system, including smaller leaks that go undetected for longer periods of time.

c. Meter Repair and Replacement Program

Water loss is often attributable to meters that have been left in service too long and should be replaced. A broken or inaccurate meter is similar to a broken cash register¹⁴. Meter life expectancy depends on water quality and the volume of water metered.¹⁵ Determining whether meter replacement is cost-effective depends on a number of factors, including the cost of meter replacement or repair, water rates, and the volume of water the meter reads.¹⁶

¹² Sam Godfrey, “Leak Detection – Accounting For Lost Water” Texas Water Utilities Association

¹³ *Id.*

¹⁴ Wyatt, Steve “The Economics of Water Lo\$\$: What is unaccounted-for water?”

¹⁵ “When is Meter Replacement Cost-Effective?” Opflow 11/98 available online at www.awwa.org

¹⁶ *Id.*

The TWDB Guidebook for Reducing Unaccounted-for Water states “meter repair and replacement is often the single most cost-effective action a utility can take to reduce the volume of unaccounted-for water.” Tyler Water Utilities reports that as a result of replacing inaccurate meters, they will see an increase in annual revenue of 2.2 million dollars¹⁷.

Meter repair and replacement is not only cost-effective for utilities, it is cost-effective for Texans. If a utility believes it consumes a certain per capita volume of water annually, it will assume it needs more water as its customer base increases. This misinformation leads to unnecessary water development projects, developed to meet a demand that does not truly exist.

d. Meter Recalibration Program

Meter recalibration has many of the same benefits as a meter repair and replacement program, but without the repair or replacement. Recalibration “corrects” an inaccurate meter.

e. Other

There are other less common ways utilities can reduce water loss. By lowering the pressure in mains and storage tanks a utility can reduce the risk of leaks. Water utilities can also educate customers to identify leaks in their own home by checking their water meter for movement with all faucets, spigots, and toilets turned off. Such movement can indicate a leak in the water lines serving the house.

¹⁷ Results of the Sierra Club Water Loss Survey are available at ...

V. Water Loss in State Planning

Water loss in water utilities is addressed in the State Water Plan and in water conservation plans. However, the manner in which it is addressed in these documents is incomplete, and oftentimes, ineffective.

a. 2002 State Water Plan

Over 3,700 water systems supply over 4 million acre-feet of water per year to 20 million people in Texas.¹⁸ The 2002 State Water Plan estimates that by 2050 more than 20 million acre-feet of water will be needed to serve all water users in Texas; about 35 percent of this amount (7 million acre-feet) will be needed by water supply systems to serve a projected population of 40 million.¹⁹ The Plan estimates capital costs of implementing water management strategies to meet all water needs at 17.9 billion dollars. This includes 4.41 billion dollars to implement strategies involving new major and minor reservoirs.²⁰

The water management strategies recommended in the State Water Plan include water conservation, new and continuing groundwater sources, new and continuing surface water sources, reuse, desalination, brush control, and major conveyances.²¹ Some of these recommendations could potentially harm the environment.

“...We are ignoring the environmental consequences of repeatedly damming and diverting our rivers. In building Marvin Nichols [a proposed reservoir to provide water for North Central Texas], 30,000 acres of increasingly rare bottomland hardwood forest and 15,000 acres of mixed post-oak forest will be destroyed. These types of forests provide habitat to a wide variety of birds and other wildlife species. In addition, any time the natural flow of a river is diverted, it affects fish and wildlife habitat downstream...we shouldn't sacrifice our natural heritage to wasteful water use.”²²

The Sierra Club and the Texas Living Waters Project partners recognize the value of water planning to ensure adequate water in the future for people and the environment. Nevertheless, the Sierra Club and its Project partners have questioned the accuracy of the water demand projections in the 2002 State Water Plan. The project partners feel that these demand projections are inflated.

Texas is divided into sixteen regions (A through P) for purposes of water planning. Eleven of the sixteen regions in the 2002 State Water Plan have adopted water conservation as a strategy to meet part of the future water demand in their respective regions: A, E-H, J-O. However, with the exception of a few regions, such water conservation strategies are underutilized. Specific attention to identifying and addressing water loss in water utilities appears to be even more rare, with only a handful of regions mentioning water loss in their regional water plans. A review of the plans indicates the following:

- Region A recommended “TNRCC (now the Texas Commission on Environmental Quality) should encourage utilities to monitor unaccounted-for water losses. There is no current regulatory guidance to provide incentives for utilities to monitor unaccounted-for

¹⁸ *Water for Texas 2002* at 29.

¹⁹ *Id.* at 29.

²⁰ *Id.* at 13.

²¹ *Id.* at 69-72.

²² Gray, David. “Water Plan can't consist just of dams” Dallas Morning News July 27, 2001: Opinion.

water losses. TNRCC should review its current rules and evaluate ways to provide encouragement for utilities to more closely monitor and reduce unaccounted-for water losses.”²³

- Region E and J specifically mention reducing water loss as a conservation strategy.

It is unclear whether the other planning regions have addressed water loss reduction as part of their water conservation strategy, apart from the water conservation plans already in effect.

b. Water Conservation Plans

New entities and water suppliers who provide more than 1,000 acre-feet per year for municipal use²⁴ are required to have a water conservation plan in effect. All water conservation plans for municipal uses must have “measures to determine and control unaccounted-for uses of water (for example, periodic visual inspections along distribution lines; or annual or monthly audit of the water system to determine illegal connections, abandoned services, etc.)”²⁵ If a water supplier serves a population of 5,000 or more then the water conservation plan must also include “a program of leak detection, repair, and water loss accounting for the water transmission, delivery, and distribution system in order to control unaccounted-for uses of water.”²⁶

Unfortunately, not all water suppliers are required to have a water conservation plan. It is also unclear whether those suppliers who have a plan actually implement it, or even know that they have such a plan. In 2002, the Texas Commission on Environmental Quality (TCEQ) surveyed 502 municipal water suppliers required to have a conservation plan.²⁷ Some of the findings in the survey include:

- 124 suppliers did not return the surveys either because they are unwilling to participate or are unable to locate their conservation plans.
- Of the 378 water suppliers that responded, 334 (88%) can not identify their quantifiable water conservation goal with a time frame for achieving that goal.
- Of the 378 respondents, 349 (92%) stated that they calculated water loss.
- Although 93% of the respondents state that their conservation programs are effective, 27% responded that the effectiveness of these programs is not monitored.²⁸

²³ Region A Regional Plan, ch.6, p.1, available online at www.twdb.state.tx.us

²⁴ 30 TEX. ADMIN. CODE § 288.30(C)(1-3).

²⁵ 30 TEX. ADMIN. CODE § 288.2(a)(1)(E).

²⁶ 30 TEX. ADMIN. CODE § 288.2(a)(2)(A)

²⁷ TCEQ Water Conservation Survey 2002, available online at www.tceq.state.tx.us

²⁸ *Id.* at 1-4.

VI. Water Loss from Water Utilities

In an effort to quantify the amount of water loss in water utilities in Texas, three different sources of information have been evaluated. The first source of information is TWDB. The Texas Water Code requires a yearly report from all governmental water systems. This report, entitled, “Survey of Ground and Surface Water Use” contains information on unaccounted-for water.

The second source of information is from TCEQ. All investor-owned utilities are required to submit a document entitled, “Water and Wastewater Utilities Annual Report” to TCEQ on an annual basis. This report has a section on annual water loss.

The third source of information is a Sierra Club survey mailed to water utilities around Texas. This survey attempted to more accurately portray water loss by requesting information that allows water loss to be calculated in a standardized manner.

a. Texas Water Development Board Water Loss Report

Each year public water utilities are required to file a report with TWDB entitled “Survey of Ground and Surface Water Use.”²⁹ This report, designed primarily to collect water-use data, requests information on withdrawal, purchase, and sale of ground and surface water. The report requests information on unaccounted-for water as well. Unaccounted-for water, as defined in the report, is the total amount of water produced or purchased, less metered sales. Water losses to system and public uses such as street washing, public fountains, and hydrant flushing are, therefore, considered unaccounted-for water.

The purpose of the report is to collect water use information not to determine or evaluate water loss. Consequently, TWDB does contact utilities about large discrepancies in the volume of water purchased or produced, but does not question utilities on sales or unaccounted-for water. TWDB acknowledges these questions are often left blank, even though the law requires that the survey be completed.³⁰

Water-use information is available for the year 2002, but relatively accurate water loss data from TWDB are only available for the year 2000. Consequently, data for 2000 are used in this report. The following graphics include data for only those utilities that answered both the question of total produced/purchased and the total amount of unaccounted-for water in 2000.

²⁹ Section 16.012m of Texas Water Code; a copy of the report may be viewed at: http://www.twdb.state.tx.us/data/water_use/Municipal.asp

³⁰ HB1378, 78th TX legislature, regular session,

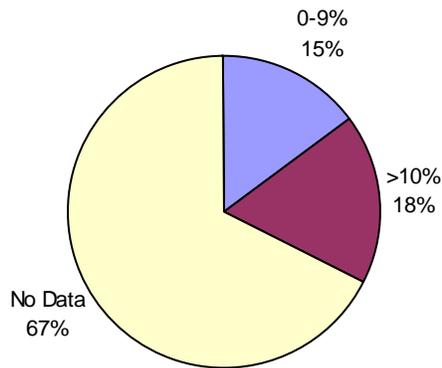


Figure 1. Percentage of Unaccounted-for Water in Texas Water Utilities

Of the 3,114 water users required to submit reports, only 1,015 (33%) reported information on unaccounted-for water (figure 1). *More than one half of the reporting utilities (560) have unaccounted-for water amounts greater than 10 percent of the amount produced or purchased.* As previously mentioned, the American Water Works Association recommends immediate action if losses are greater than 10 percent.

Name	Total Water Produced/Purchased (acre-feet)	Unaccounted-for Water (acre-feet)	Water Loss %
All 1,015 Reporting Utilities	2,280,000	226,000	11.7

Table 1. Water Production and Unaccounted-for Water in Reporting Water Utilities.

Over 2.2 million acre-feet of water are produced or purchased by the water utilities that reported to TWDB (Table 1). This amount represents about 50 percent of the total municipal water withdrawals in Texas.³¹ Assuming that the 226,000 acre-feet of unaccounted-for water also represents about 50 percent of the total statewide losses, it can be estimated that over 450,000 acre-feet of water in Texas is unaccounted-for. This estimation may be low as those utilities that do report to TWDB probably keep better records of water loss, and therefore, have less water loss than those utilities that do not track their water losses.

Table 2 lists those utilities reporting the largest volume of water produced or purchased. Table 3 lists those utilities reporting the most unaccounted-for water. Table 4 lists those utilities reporting the highest percentage of unaccounted-for water. The ten utilities reporting a percentage of 100 percent or greater are excluded because of inaccurate data.

³¹ “2001 Water Use Survey Summary Estimates”, available online at www.twdb.state.tx.us

Name	Total Water Produced/Purchased (acre-feet)	Unaccounted-for Water (acre-feet)	Water Loss %
City of Dallas	458,000	56,900	12.4
City of Austin	153,000	13,400	8.8
City of Arlington	70,700	5,640	8.0
City of Amarillo	57,700	2,850	4.9
City of Wichita Falls	45,100	6,110	13.5
City of Lubbock	44,800	3,930	8.8
City of Abilene	43,100	814	1.9
City of Garland	41,300	1,480	3.6
City of Laredo	39,800	8,070	20.3
City of Waco	30,000	2,720	9.1

Table 2. Ten Water Utilities with the Most Reported Annual Production/Purchases of Water

Name	Total Water Purchased/Produced (acre-feet)	Unaccounted-for Water (acre-feet)	Water Loss %
City of Dallas	458,000	56,900	12.4
City of Austin	153,000	13,400	8.8
City of Beaumont	29,400	9,190	31.3
City of Laredo	39,800	8,070	20.3
City of Mount Pleasant	8,580	7,660	89.3
City of Wichita Falls	45,100	6,110	13.6
City of Galveston	19,500	6,000	30.9
City of Del Rio	14,800	5,950	40.3
City of Arlington	70,700	5,640	7.8
Bell Co WCID #1	24,900	3,960	15.9

Table 3. Ten Water Utilities with the Most Reported Unaccounted-for Water in Volume

Name	Total Water Purchased/Produced	Unaccounted-for Water	Water Loss %
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	(acre-feet)	(acre-feet)	
The Coves WSC	10.6	10.5	99.1
Jackson WSC	317	296	93.3
City of Karnes City	447	416	93.1
Harris Co MUD #371	7.13	6.63	93.0
Barlow Lake Estates	62.8	57.4	91.4
City of Mount Pleasant	8,850	7,660	89.3
Mount Neches Lake Estates	21.6	19.1	88.4
Harris Co MUD #372	261	225	86.2
Red River Authority	18.3	14.9	81.4
B-B-S WSC	112	88.9	79.4

Table 4. Ten Water Utilities with the Highest Reported Percentage of Water Loss (excluding those reporting 100% or greater)

The high percentage losses shown in Table 4 may be the result of inaccurate reporting. A comparison of the water loss data reported to both TWDB and to the Sierra Club shows that water loss values differ between surveys by more than 5 percent in 24 of 40 utilities, and by more than 10 percent in 13 of 40 utilities.

As previously mentioned in this section, some of this unaccounted-for water may not be lost. It may serve system and public uses. Preliminary sampling of water utilities by the Sierra Club, however, shows system losses and public uses to be less than one percent. This result needs additional study as most water loss reporting combines system and public uses with other losses.

b. Texas Commission on Environmental Quality Water Loss Report

There are 661 water utilities owned by investors in the State of Texas. These non-governmental utilities serve a total population of about 425,000. By law, every investor-owned utility is required to fill out a report entitled “Water and Wastewater Utilities Annual Report”³² and return the report to the TCEQ by April 1 each year.³³ Section 7 of the Report, entitled “Water Production and Consumption”, asks four questions relating to water loss: 1) What is the total amount of water produced/purchased? 2) What is the total amount of water sold/billed? 3) How much water is lost? 4) What is the total percent of water lost? There is also a section for comments.

The TCEQ requests this information primarily for two reasons: to provide the public with the information and to review rate case applications. Although the law provides a penalty for

³² V.T.C.A., Water, § 13.132, & § 13.136(b); a copy of the report may be viewed at: www.tnrcc.state.tx.us/permitting/forms/20052.pdf

³³ V.T.C.A., Water, § 13.411, § 13.414-15.

failure to return the report (up to \$100 per day without approval for an extension), to date, the TCEQ has not penalized any utility for failure to submit the report.

Approximately one half (331) of the investor-owned utilities had returned their reports to the TCEQ at the time the Sierra Club analyzed the data in July of 2003, three months after the deadline. Of those that did report, seven utilities left Section 7 blank, fourteen answered they did not know the answers, eleven answered they did not know because their water was not metered, and seven answered 'not applicable.' Therefore, information on water loss in investor-owned utilities is available for only 41% (292) of the investor-owned utilities.

Comments made by the utilities in Section 7 make it clear that some utilities interpret the questions differently, especially those regarding the amount and percent water lost. Some utilities calculate total water loss as the difference between the total amount of water produced and the total amount of water sold. Thus, water used for system and public uses (line flushing, fire fighting, swimming pools) is included with water lost through leaks and faulty meters. Other utilities, however, exclude system and public uses from water loss calculations.

The total volume of water purchased or produced in 2002 by 41% of the investor-owned utilities is 12.6 billion gallons, or about 39,000 acre-feet (Table 5). Of this amount, 1.75 billion gallons is considered lost. This amount is about 5,400 acre-feet, or 13.8% of the water purchased or produced. (Note: adding the region totals in Table 5 will not equal the state total due to rounding and the fact that several utilities are included in more than one region). A little more than half (52%) of the utilities report water losses greater than 10 percent.

Region A reports the highest percentage of water lost, 27 percent. This can be attributed to the fact that investor-owned utilities in the northern portion of the Panhandle (Region A) serve large rural areas, which tend to have higher rates of water loss. However, the high value for Percentage of Lost Water for Region A may also be attributed to a small sample size; there are only nine investor-owned utilities in Region A.

Regions B, E, F, M, N, O, and P all have small sample sizes (less than 10) that skew downward the values for Percentage of Lost Water. In these cases, there are either a small number of investor-owned utilities in each region or a small number of utilities that filed reports with TCEQ.

Regions C, D, G, H, I, J, K, and L each have between 15 and 65 utilities submitting reports to TCEQ. The Percentage of Lost Water values for these regions range between 9.2 and 22.0 percent. These values better reflect the statewide average of 13.8 percent.

The investor-owned utilities that filed reports with TCEQ serve about 50 percent of the total population served by investor-owned utilities. Therefore, by doubling the Total Water Lost value in Table 5 (1.75 billion gallons), it can be estimated that 3.5 billion gallons (10,800 acre-feet) are lost annually by these utilities in Texas. This amount of water lost is equivalent to the conservation storage capacity of White Rock Lake in Dallas.³⁴

³⁴ Texas Almanac, The Dallas Morning News.

**Table
Owned Utility
Loss for 2002 by
(units are
and represent
utilities that
with TCEQ).**

Region	Total Water Produced/Purchased	Total Water Sold	Total Water Lost	Percentage of Lost Water
A	378	274	102	27.0
B	9.09	8.77	0.32	3.5
C	902	816	93.6	10.4
D	1,630	1,270	334	20.5
E	258	245	12.5	4.8
F	70.2	61.9	8.3	11.8
G	704	620	64.5	9.2
H	2,210	1,790	292	13.2
I	1,660	1,290	365	22.0
J	244	198	44.0	18.0
K	5,400	4,690	733	13.5
L	281	259	41.2	14.6
M	2.34	2.07	0.27	11.7
N	102	88.8	4.32	4.2
O	95.0	64.2	5.64	5.9
P	2.83	2.72	0.12	4.1
Total	12,600	10,600	1,750	13.8

**5: Investor
Water Use and
Planning Region
million gallons
the only those
filed reports**

c. Sierra Club
Both the
TCEQ reports
loss in
matters. In
determine
Texas using a

Survey
TWDB and
define water
different
an effort to
water loss in
standardized

method, the Sierra Club prepared a water loss survey using terminology recommended by the International Water Association. One goal of the Association’s adoption of this terminology is to “prepare a recommended basic standard terminology for calculation of real and apparent losses.”³⁵

The Sierra Club sent out one thousand surveys to water suppliers around Texas. Unfortunately, only sixty-seven surveys were received back, a return rate of 6.7%. The possible causes of this low rate of return are:

- Outdated addresses
- Lack of one person in charge of requested information
- Lack of time to fill out the survey
- Lack of information available
- Lack of desire to answer the questions (perhaps because of a high percentage of water loss)
- Lack of understanding of the terminology
- Lack of a reporting format compatible with the survey

The survey had four sections: water audits, water loss, reducing water loss, and water conservation plans. The answers and comments from those water suppliers who did return the survey are available in the appendix 4.

1. Water Audits

The survey begins with four questions about the utility’s water audit procedure.

- 1) Do you complete water audits on a routine basis?

³⁵ Lambert, A. “Losses from Water Supply Systems: Standard Terminology and Recommended Performance Measures” *The Blue Pages*, International Water Association, October 2000, available online at www.iwahq.org.uk

- 2) *If you do not* complete water audits on a routine basis, do you determine water loss in another manner? How?
- 3) *If you do* complete water audits on a routine basis, how often?
- 4) How long have you been completing water audits?

Out of the sixty-seven responses, fifty-two responded that they did complete water audits on a routine basis. (Three did not complete the water audit section). Thus 78% responded that they complete water audits on a routine basis.

The results of question two show that of the eleven respondents who do not complete water audits on routine basis (one responded “Don’t Know”), eight calculate water loss in another manner. This method usually calculates water loss by comparing water sold with water produced.

Question three asks those who do complete routine water audits, how often these audits are performed. The responses are as follows:

- Nineteen complete water audits yearly (37%)
- Twenty-nine complete water audits monthly (56%)
- One completes water audits both monthly and yearly (2%)
- One completes a water audit every five years. (2%)
- One completes a water audit as needed. (2%)
- One left the question blank. (2%)

The last question in the section on water audits asks the utility how long they have been completing water audits. The lengths of time are as follows:

- Two – Since 2002 (4%)
- Two – Since 2001 (4%)
- Two – Since 2000 (4%)
- Three – Since 1999 (6%)
- Forty – Since 1998 or prior (77%)
- Three left the question blank (6%)

Overall, it appears that most of the utilities responding to the survey actively monitor their water loss through water audits. These utilities will have an easier time complying with the new law requiring water audits³⁶.

2. *Water Loss*

The second section of the survey asks for specific numbers on water loss for the year 2002. As stated above, the section uses terminology suggested by the International Water Association. In addition to basic questions regarding water produced and water sold, the survey asks additional questions to more specifically identify water loss. First, it asks for billing adjustments. A utility’s billing cycle is not always the same as its meter reading cycle, so an adjustment may be necessary. Second, the survey addresses two other items necessary to compute water loss, billed un-metered sales and unbilled authorized consumption. An example of an un-metered sale is bulk water sold to a customer through a hydrant. Unbilled authorized consumption includes system uses, such as water main flushing, and public uses for fire fighting, public fountains, and swimming pools.

³⁶ HB 3338, 78th legislature

Data gathered from annual reports to TCEQ and TWDB do not specifically request these additional data when determining water loss. Thus, some utilities may include them in their calculations and others may not. It may be unclear from the annual reports, therefore, how much water is actually lost. The results of this more detailed survey attempt to more accurately portray the water lost in water utilities (Table 2).

Total Water Produced	333 billion gallons
Total Water Sold	298 billion gallons
Net Lost Water	33 billion gallons
Percent of Lost Water	10.1%
Cost of Water Lost	\$29 million

Table 6. Water Production, Sales, and Losses reported by utilities in the Sierra Club Survey.

Over 33 billion gallons of water are lost annually by the 69 water utilities that responded to the survey. These 69 utilities produce 333 billion gallons per year, or about 1.02 million acre-feet. According to TWDB, this amount is about one-fourth of all municipal water produced in Texas in 2002 (about 4.04 million acre-feet)³⁷. Estimating statewide water loss by extrapolating (multiplying water loss by four) the results of this survey shows that about 132 billion gallons of water are lost annually by water utilities. This is equivalent to 405,000 acre-feet and is very similar to the estimate of water loss based on TWDB report data. This amount is equivalent to the conservation storage capacity for Lake Conroe (north of Houston) or Lake Ray Hubbard (east of Dallas). As with the estimate based on TWDB data, this estimate of statewide water loss based on Sierra Club data may be conservative. The utilities that respond to this survey probably keep better records of water loss, and therefore, probably have more efficient systems.

The percent of lost water from the Sierra Club survey shows 10.1 percent, while the TWDB report shows 11.7 percent and the TCEQ report shows 13.8 percent. The differences may be attributed to three factors. First, the TWDB and TCEQ reports have a different sample population. Second, the Sierra Club survey result includes system and public uses in the calculation of water loss. These uses, however, are generally found to be less than one percent of the total water produced by utilities in the survey. This result should be further evaluated, as not much information is currently available locally or nationally. Third, there is a lack of consistency between water utilities reporting water loss data. Water loss percentages reported by the same utilities responding to the Sierra Club survey and the TWDB report differ by more than five percent in 65 percent of the utilities, and more than ten percent in 32 percent of the utilities.

Only 42 of the 67 surveys answered the question regarding the cost of water lost. This reported cost, based on the price of water at the utility, is \$29 million.

3. Reducing Water Loss

The third section of the survey asks what the utilities do to address the issue of water loss. The utilities are asked if they do leak detection, visual inspection, meter repair and replacement, meter recalibration, or any 'other' program. Some utilities take one or no steps to address water loss, while others employ a variety of tactics (Figure 2). Two of the 67 utilities implement all

³⁷ "2002 Water Use Survey Summary Estimates (Draft)", available online at www.twdb.state.tx.us

five steps to reduce water loss. The most popular ways to reduce water loss by those surveyed are meter repair/replacement and visual inspection. Below are the different methods and the number of utilities that utilize that particular method; most utilities use more than one method:

- Leak Detection – 32 (49% of the survey respondents)
- Visual Inspection – 45 (68%)
- Meter Repair and Replacement – 62 (94%)
- Meter Recalibration – 30 (45%)
- Other – 8 (12%)

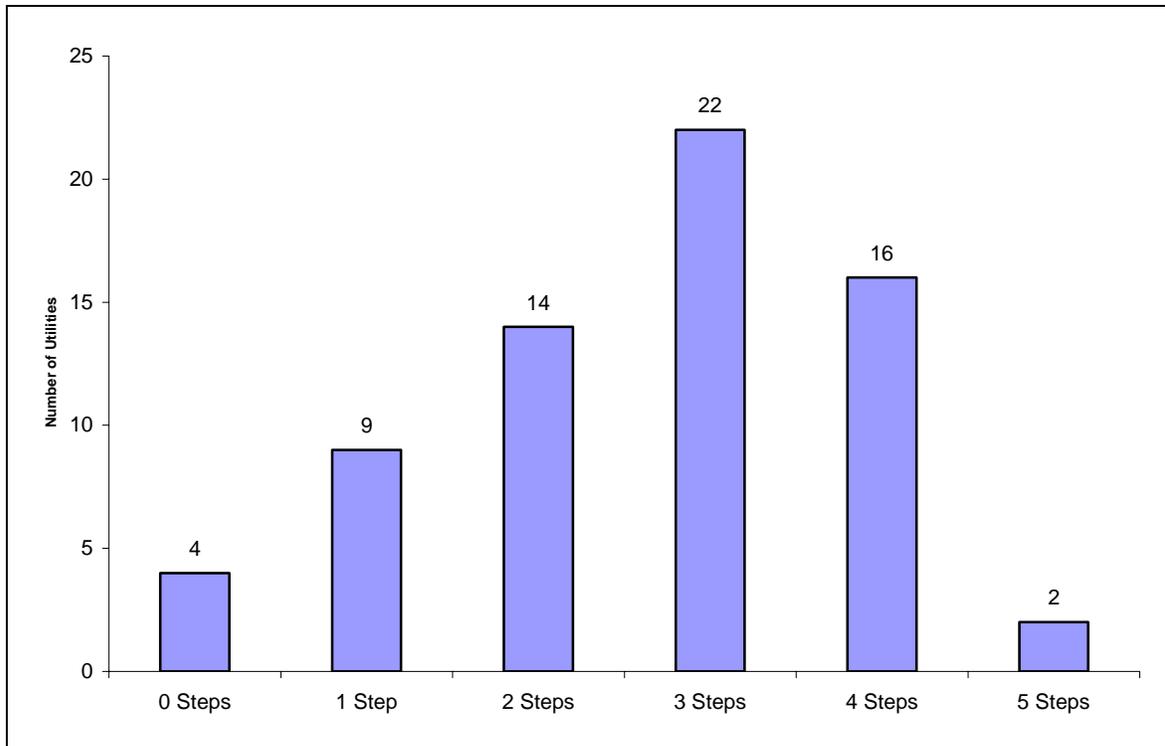


Figure 2. Number of steps taken to reduce water loss by utilities in Sierra Club Survey

The next question asks if there is any effort to track changes in water loss that result from taking the above steps. The responses include the following:

- Leak Detection – 14 (44% of those utilities using this method)
- Visual Inspection – 12 (26%)
- Meter Repair and Replacement – 26 (42%)
- Meter Recalibration – 10 (33%)
- Other – 0 (0%)

The third question is whether any of these steps taken actually result in reduced water loss. The responses are as follows:

- Leak Detection – 11 (34% of those total who completed leak detection)
- Visual Inspection – 11 (24%)
- Meter Repair and Replacement – 20 (32%)
- Meter Recalibration – 9 (30%)
- Other – 2 (25%)

4. Water Conservation

The survey contains two questions relating to water conservation. “Do you have a water conservation plan in effect?” and “If you have a water conservation plan, does it address the issue of water loss?” Fifty-one of the sixty-seven surveyed affirmed that they had a water conservation plan in effect. One utility answered, “Don’t Know.” Thirty-one of the 51 water conservation plans address the issue of water loss.

As discussed above, any public utility serving a population of 5,000 or more is required to have a water conservation plan in effect. This plan must address the issue of water loss. Six out of the sixteen utilities without a water conservation plan serve a population greater than 5,000.³⁸

³⁸ Population Statistics available in the Water Utility Database, Texas Commission on Environmental Quality, August 7, 2003 <<http://www.tnrcc.state.tx.us/permitting/waterperm/ud/iwud.html>>

VIII. Conclusion and Recommendations

Existing data suggest that water loss from public and private utilities in Texas averages between ten and fourteen percent of the water production. On average, this loss equates to over 145 billion gallons, or over 450,000 acre-feet annually. This amount is approximately equivalent to the conservation storage capacities for Lake Conroe north of Houston or Lake Ray Hubbard east of Dallas.

There is much to be gained by decreasing water loss in Texas water utilities. The American Water Works Association recommends immediate action if more than 10 percent of water is lost annually. While 510 of the reporting utilities in the state lose less than 10 percent, over 700 utilities lose more than 10 percent, exceeding the target.

These data do not provide a complete picture of utility water loss in Texas. Although they are required to file by law, over 2,400 utilities did not file their respective water loss reports with TWDB or TCEQ. In addition, there is oftentimes variability in the reported water loss data. Water loss percentages reported by the same utilities responding to the Sierra Club survey and the TWDB report differ by more than five percent in 65 percent of the utilities, and more than ten percent in 32 percent of the utilities.

It is truly unfortunate that such a lack of accurate data exists on water loss in Texas. The State Water Plan proposes to spend billions of dollars to increase the water supply in Texas, yet water planners have little idea how much water utilities waste. While some water suppliers take water loss seriously and attempt to minimize it, there are many others who refuse to answer questions regarding water loss, perhaps because they do not monitor it or do not wish to inform the public of their water loss. Water suppliers are required by law to monitor and reduce water loss, yet many ignore the law and suffer no consequences.

It seems illogical to continue to develop new and expensive water supply projects without knowing how much of the existing water supplies are lost annually. The Sierra Club makes the following recommendations:

Texas should aggressively monitor water loss

- Texas should adopt clearly defined water loss terminology for all water suppliers, in order that information on water loss can be more easily obtained, understood, and compared.
- TWDB and TCEQ should make an aggressive effort to gather additional information about water loss in Texas.
- TWDB, under the new law HB 3338, should develop a water audit that aims to identify causes of water loss. The water audit should not simply ask for the difference between water produced and water sold, but should include a breakdown of system losses (i.e. line flushing, backwashing filters) and public uses (i.e. fire fighting, filling public swimming pools)
- Water suppliers should be penalized if they do not comply with reporting laws, including filing the new water audit in a timely and accurate manner.

Texas should make reduction of water loss part of the water rights permitting and financial assistance process

- A water supplier should be required to reduce water loss to a reasonable level before requesting additional water rights or seeking financial assistance to develop additional water supplies unless the financial assistance is sought to reduce water loss.

Texas should make reduction of water loss a priority as a means to meeting future water demand

- Expensive and environmentally destructive projects should not be recommended in the regional water plans unless water utilities in the region implement programs for leak detection and meter repair or replacement.
- As Region A recommends, all of Texas should employ water loss reduction as a solution to meeting future water demands.

IX. Appendices

1. Sierra Club Survey (Texas Living Waters Project Survey)
2. Recommended Websites (for more information)
3. Texas House Bill 3338

TX Living Waters Project Survey

General Information

Name of Utility					
CCN or Registration number					
City, County, TWDB Region		City		County	
OwnershipType (Please circle one)		Investor	Water District	Municipal-ity	Water Supply Corp
					Other

Water Loss

Do you complete water audits on a routine basis?	Yes	No	Don't Know		
If you do not complete water audits on a routine basis, do you determine water loss in another manner? How?	Yes	No	How?		
If you do complete water audits on a routine basis, how often?	Yearly	Monthly	Other (Please Explain)		
How long have you been completing water audits? Since	2002	2001	2000	1999	1998 or Prior
Was a water audit done for the year 2002?	Yes	No	Unknown		
Calculating Water Loss (Please use 2002, or the most recent year available. YEAR _____. Choose only one: Gallons, Million Gallons or Acre-feet per year)	Gallons	Million Gallons	Acre-Feet Per Year	Prior Year (Optional)	
1. Total Water Supply (Total water purchased/produced as measured by master meters)					
2. Adjustments to Water Delivery (Known increase or decrease in storage capacity from the beginning to the end of the study period or adjustment for known broken or inaccurate master meters)					
3. Net Water Produced (Net water produced and/or measured through the master meters, after adjustments)					
4. Total Water Meter Sold (Includes all metered sales; consumption during meter reading period must be adjusted to match the production/purchase period)					
5. Billed Unmetered Sales (These are sales to customers that are not metered. They include connections that are not metered and any bulk sales, e.g through hydrants)					
6. Unbilled Authorized Consumption (Please estimate unmetered uses; examples include water main flushing, sewer/storm drain flushing, parks, swimming pools, golf courses, cemeteries, road medians, fire fighting, construction and storage tank drainage)					
7. Apparent Water Losses (These consist of unauthorized consumption & meter inaccuracies)					
8. Real Water Losses (These losses are generally those that cannot be metered. They primarily include leaks and tank overflow. Any water that has not been documented in other categories should be listed as lost)					
9. Net Lost Water (Net lost or unmeasured water is determined by subtracting the sum of lines 4, 5, and 6 from line 3. This should be the same value as the sum of lines 7 and 8)					
Percentage of Lost Water (This can be calculated by dividing line 9					

Appendix 2. Recommended Websites (for more information)

Region A – Panhandle

<http://www.panhandlewater.org/> (web page not working right now 4/9/02)

Region B - Red River

<http://www.rra.dst.tx.us/rwpg/>

Region C – North Texas

<http://www.freese.com/Senbill1/Regionc/Index.htm>

Region D – NE Texas

<http://www.netmwd.com/SB1water/StrategiesMatrix.htm>

Region E – Far West Texas

<http://24.28.171.253/rio/rgcog/EnvSvcs/FWTWPG/fwtwpg.htm> (web page not working right now 4/9/02)

Region F – Colorado River

<http://www.crmwd.org/mainsb.htm>

Region G – Brazos

<http://www.brazoswater.org/index.html>

Region H – They do not have a webpage

Region I – East Texas

<http://www.detcog.org/etrwpg/>

Region J – Plateau

<http://ugra.org/plateau.htm>

Region K – Lower Colorado River

<http://www.lcra.org/water/waterco/>

Region L – South Texas

<http://www.watershedexperience.com/>

Region N – Coastal Bend

<http://nueces-ra.tamucc.edu/rwpgsite.html>

Region O – Llano Estacado

<http://www.llanoplan.org/>

Region P – They do not have a webpage

TWDB SB1 Regional Water Planning webpage

<http://www.twdb.state.tx.us/assistance/rwpg/main-docs/rwpg-main.htm>

TPW Texas Water

<http://www.tpwd.state.tx.us/texaswater/sb1/index.htm>

Texas Administrative Code for Water Planning

[http://info.sos.state.tx.us/pub/plsql/readtac\\$ext.ViewTAC?tac_view=3&ti=31&pt=10](http://info.sos.state.tx.us/pub/plsql/readtac$ext.ViewTAC?tac_view=3&ti=31&pt=10)

Texas Water Code for Regional Planning

<http://www.capitol.state.tx.us/statutes/watoc.html>

Freese and Nichols SB1 Page

<http://www.freese.com/Senbill1/Index.htm>

AN ACT

relating to the performance of a water audit by a retail public utility providing potable water.

BE IT ENACTED BY THE LEGISLATURE OF THE STATE OF TEXAS:

SECTION 1. Subchapter B, Chapter 16, Water Code, is amended by adding Section 16.0121 to read as follows:

Sec. 16.0121. WATER AUDITS. (a) In this section, "retail public utility" has the meaning assigned by Section 13.002.

(b) 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.

(c) The board shall develop appropriate methodologies and submission dates for a water audit required under Subsection (b) for the following categories of retail public utilities:

(1) retail public utilities serving populations of 100,000 or more;

(2) retail public utilities serving populations of 50,000 or more but less than 100,000;

(3) retail public utilities serving populations of more than 3,300 but less than 50,000; and

(4) retail public utilities serving populations of 3,300 or less.

(d) In developing the methodologies required by Subsection (c), the board shall ensure that each methodology:

(1) is financially feasible for the category of retail public utility for which it is developed; and

(2) considers differences in population density, source of water supply, the mean income of the service population, and other factors determined by the board.

(e) The methodologies required by Subsection (c) shall account for various components of system water loss, including loss from distribution lines, inaccuracies in meters or accounting practices, and theft.

(f) The board shall compile the information included in the water audits required by Subsection (b) according to category of retail public utility and according to regional water planning area. The regional planning group for a regional planning area shall use the information to identify appropriate water management strategies in the development of a regional water plan under

Section 16.053.

SECTION 2. Section 16.053(j), Water Code, is amended to read as follows:

(j) The board may provide financial assistance to political subdivisions under Subchapters E and F of this chapter, Subchapters C, D, E, F, J, O, and P, Chapter 15, and Subchapters D, I, K, and L, Chapter 17, for water supply projects only if:

(1) the board determines that the needs to be addressed by the project will be addressed in a manner that is consistent with the state water plan; ~~and~~

(2) beginning January 5, 2002, the board:

(A) has approved a regional water plan as provided by Subsection (i), and any required updates of the plan, for the region of the state that includes the area benefiting from the proposed project; and

(B) determines that the needs to be addressed by the project will be addressed in a manner that is consistent with that regional water plan; and

(3) the board finds that the water audit required under Section 16.0121 has been completed and filed.

SECTION 3. This Act takes effect September 1, 2003.

President of the Senate

Speaker of the House

I certify that H.B. No. 3338 was passed by the House on May 10, 2003, by a non-record vote.

Chief Clerk of the House

I certify that H.B. No. 3338 was passed by the Senate on May 28, 2003, by the following vote: Yeas 31, Nays 0.

Secretary of the Senate

APPROVED: _____

Date
