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Center for Water Resource Studies
Western Kentucky University
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COHH Room 2109
P: 270-745-2761
F: 270-745-4244

October 1, 2012

Jeff Derouen, Executive Director
Kentucky Public Service Commission
Post Office Box 615
Frankfort, KY 40602-0615

Re: Continuing Education approval request

Dear Mr. Derouen:

Western Kentucky University's Center for Water Resource Studies will be conducting a Water Auditing and Loss Control Workshop, jointly with the KY/TN Section of American Water Works Association, in Bowling Green, KY on December 4, 2012. The intent of the workshop is to teach best practices in the industry for controlling water loss, including saving operating expenses and increasing revenues.

We respectfully request approval of 6 hours of continuing education credit for board members and commissioners who attend this training. I've attached the agenda for the workshop, as well as speaker biographies and a sampling of the written materials that will be distributed to attendees. As you will note on the agenda, we would be thrilled if a representative of the PSC could attend and speak to the importance of controlling water loss. Applications for 6 hours of CEU credit for licensed operators are also being submitted to KY's Division of Compliance Assistance and TN's Water and Wastewater Operator Certification Board.

Please let me know if you have any questions or need additional information in order to process this request. I can be reached by phone at 270-745-8706 or via email at jana.fattic@wku.edu.

Sincerely,

Jana Fattic
Interim Director

Water Auditing and Loss Control Workshop
Draft Agenda
December 4, 2012

9:15-9:30	Welcome/ Intro – Steve Cavanaugh & Jana Fattic
9:30-9:45	Framing the Issue – "The Big Why" – Steve Cavanaugh
9:45-10:15	Water Auditing Basics – Will Jernigan
10:15-10:30	Break
	System Case Studies
10:30-11:00	Small – Chris Leauber, Water & Wastewater Authority of Wilson County – TN
11:00-11:30	Medium – Tony Rojas, Macon Water Authority – GA
11:30-12:00	Large – George Kunkel, Philadelphia Water Works – PA
12:00-12:45	Working Lunch – Lessons learned from Georgia's Water Stewardship Act
12:45-1:15	Software Demonstration – Will Jernigan
1:15-1:45	Interpreting Data/Data Validity – high level – Will Jernigan
1:45-2:15	Source Meter Testing – "A Common Challenge" – Stu Bowns, Hydromax – KY
2:15-2:30	Break
2:30-3:00	Regulatory Perspective Julie Roney – KY Division of Water Representative – Public Service Commission
3:00-3:30	Panel Q&A – All speakers
3:30-3:45	Wrap up/Summary – Steve Cavanaugh

Water Auditing and Loss Control Workshop

Speaker Biographies

Steve Cavanaugh, Jr., P.E.

President, CEO – Cavanaugh & Associates, P.A.

A creative visionary with an unshakeable dedication to environmental stewardship and preservation, Steve Cavanaugh's vast engineering experience encompasses a wide range of both domestic and international projects. For more than two decades, Steve has worked with public and private sector clients to develop intelligent environmental solutions to some of today's most challenging issues. In addition to his agricultural expertise on waste-to-energy and biomass facilities, Steve is known among his peers as an expert in the field of Water Loss and Recovery. His dedication to improve and protect the world's water resources through urban and agricultural areas, streams, lakes and reservoirs, water distribution systems, wastewater collection systems and water/wastewater treatment plants has helped him forge lasting relationships across the board with federal, state and municipal clients to effectively solve their water problems.

Will Jernigan, P.E.

Director of Water Efficiency – Cavanaugh & Associates, P.A.

Mr. Jernigan has been with Cavanaugh for 10 years and his area of expertise is Water Efficiency with a focus on Revenue Recovery. He serves on the national AWWA Water Loss Control Committee and its subcommittees in developing tools and standards for the water industry. He has authored several technical papers and articles in the area of water efficiency, presented at both regional and national conferences. Will has worked with hundreds of water utilities in the Southeast in water auditing and efficiency programming, and is presently managing a statewide water audit training project in Georgia. Will lives in Asheville, North Carolina.

Tony Rojas

Executive Director – Macon Water Authority, GA

Tony Rojas leads the Macon Water Authority (MWA), comprising 200 dedicated employees that proudly serve the water and sewer needs of 54,000 customers in the City of Macon and Bibb County. Tony has over 20 years of experience in local government and public utility management. Prior to joining the MWA, he had the privilege of serving as the city manager for the cities of Moultrie, Vidalia and Hawkinsville, Georgia. Tony is a member of the American Water Works Association (AWWA) and the Water Environment Federation (WEF) and is the past chair of the Georgia Section of WEF. He serves as a member of the Middle Ocmulgee Regional Planning Council, and since 2009, he has served on the State Board of Examiners for Certification of Water and Wastewater Treatment Plant Operators and Laboratory Analysts. Tony has a Bachelor's degree from Augusta State University and his Master's degree in Public Administration from the University of Georgia (UGA).

Chris Leauber

Executive Director – Water & Wastewater Authority of Wilson County, TN

Chris Leauber is responsible for managing 323 miles of water distribution main and 7,000 connections in the rural eastern area of Wilson County. Prior to joining the Authority in 2006, he managed water audit and leakage control projects for services provided to hundreds of water utilities throughout the United States and abroad. He has written various technical papers and provided many presentations and training classing on water loss control. He is a graduate from the Pennsylvania State University, has been

an active member of the Tennessee Association of Utility Districts for over 20 years, and has served on the national AWWA Water Loss Control Committee for 14 years.

George Kunkel, P.E.
Water Efficiency Program Manager – Philadelphia Water Department
Mr. Kunkel has worked for the Philadelphia Water Department for 32 years and has chaired the city's Water Accountability Committee for the past 19 years. He is active in the American Water Works Association, having served as a trustee in the Distribution & Plant Operations Division and chair of the Water Loss Control Committee. He has been involved in a number of water loss projects in AWWA and the Water Research Foundation, and has authored numerous publications on water loss control. Mr. Kunkel is also a member of the Water Loss Specialist Group of the International Water Association and the recipient of the 2010 Water Star Award from the Alliance for Water Efficiency.

Julie Roney
Drinking Water Program Coordinator – KY Division of Water
Julie has over 32 years of experience in the environmental field, with 25 years devoted to drinking water. She currently holds the position of Drinking Water Program Coordinator for the KY Division of Water with the responsibility for overseeing the implementation of the Safe Drinking Water Act and related drinking water regulations for the Division. Prior positions with the Division of Water include Supervisor of the Technical Assistance and Outreach section of the Drinking Water Branch (2003-2008) and drinking water technical assistance (1999-2003). She also held various positions with Kentucky-American Water Company (1987-1999) in the production and water quality departments, progressing from chemist to Water Quality Director. Her career began with Commonwealth Technology, Incorporated (1980-1987) as a laboratory chemist with promotion to Water and Microbiology Supervisor. She currently holds a Kentucky Class IVA Water Treatment license and a Kentucky Class IVD Water Distribution license.

Jana Fattic, M.S., R.S.
Interim Director, Center for Water Resource Studies – Western Kentucky University
Jana Fattic is the Interim Director of the Center for Water Resource Studies at Western Kentucky University. She has served in various management capacities throughout her career, spanning the private, regulatory and academic sectors. Jana has experience in drinking water and wastewater treatment, stormwater and watershed management, public health and safety, and solid waste management. She holds a Master of Science degree in Geoscience from Western Kentucky University, and conducted research for her Master's thesis on ways to connect hands-on experiential components with distance learning opportunities for future water and wastewater treatment operators.

Stu Bowns
Hydromax, USA
Stu has 40+ years in the water and wastewater industry and has worked on over 400 sanitary sewer and water distribution system evaluation projects throughout the country. He has implemented innovative technologies for the water industry and is an active National AWWA Water Loss Control Committee member. Stu is an expert in production metering accuracy.

2011

Water Auditing, Loss Control & Revenue Recovery Briefing

CAVANAUGH
Stewardship through Innovation

IWA/AWWA—WATER AUDITING & REVENUE RECOVERY

1. Recognized Globally as Best-Practices for Water Loss Accounting and Water Loss Control.
2. Establishment of Benchmarks for Water System Efficiency, in terms of **gallons** and **dollars**.
2. Development of a program for **ongoing tracking and management** of Water System Efficiency.
3. Development of **Strategies** to:
    a. Optimize **Water Losses**
    b. Maximize **Water and Sewer Revenues**
    c. Improve **Data Validity**

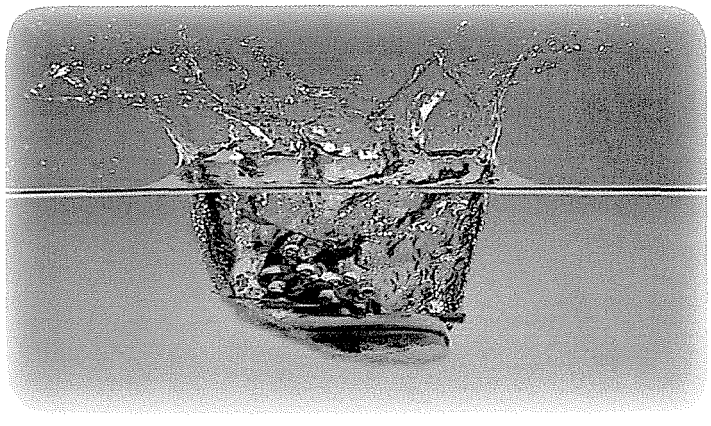
TERMINOLOGY

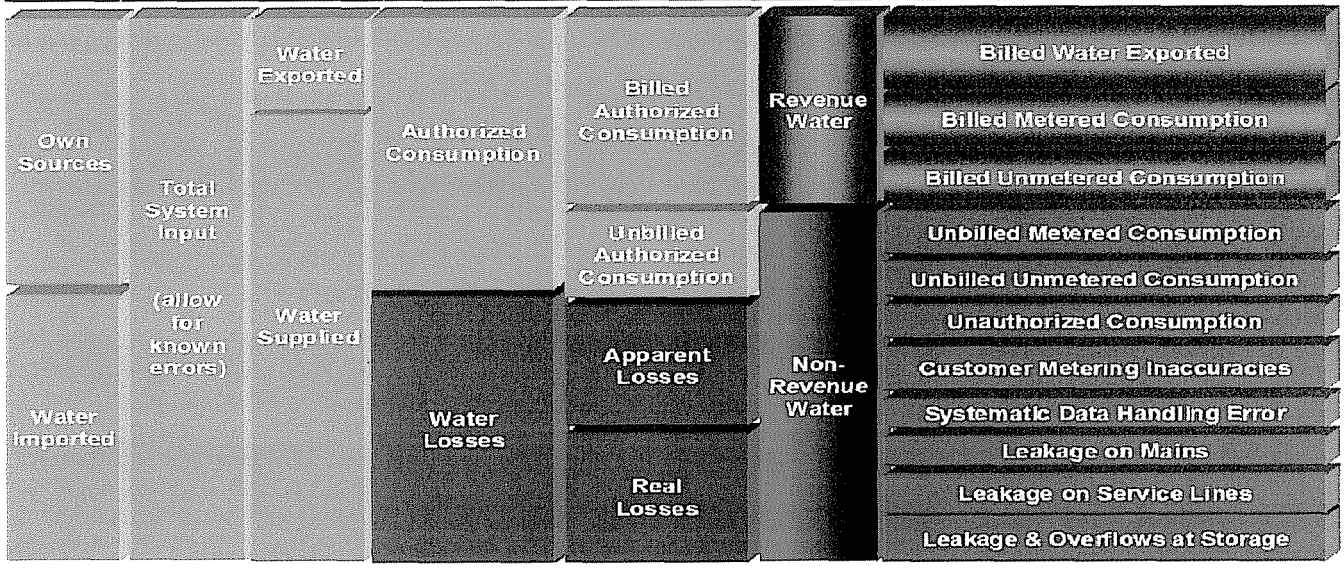
- ◊ Data Validity = How *reliable* is our data? AWWA Standard provides a means to quantify this.
- ◊ Water Loss = What we put in … less … total authorized consumption
- ◊ Apparent Loss = Paper Loss (meter inaccuracy, billing system anomalies, theft)
- ◊ Real Loss = Leakage (mains, services, or overflows at tanks)
- ◊ Loss Valuation = How much is our Water Loss *worth*? Moreover, how much *should* we invest in Water Loss Control?

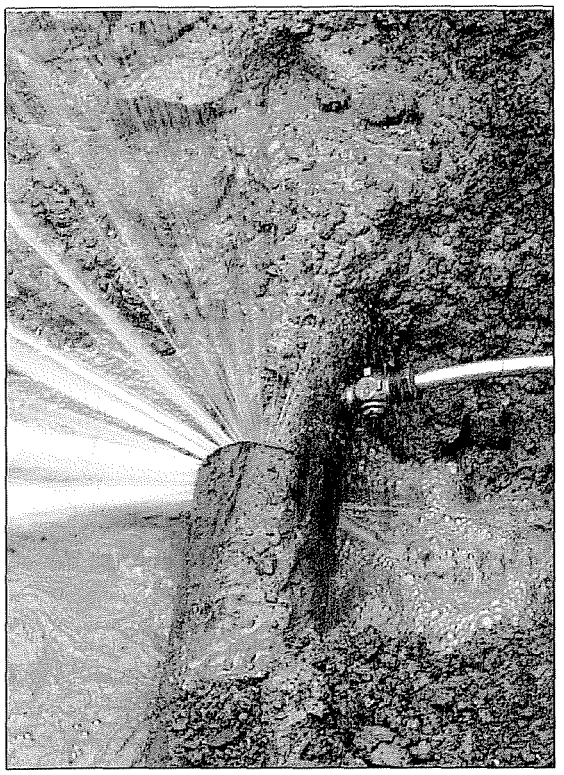
WATER LOSS CONTROL TEAM

- ◊ Distribution & Collection
- ◊ Treatment
- ◊ Metering
- ◊ Billing & Finance
- ◊ Customer Service
- ◊ Public Works
- ◊ Engineering
- ◊ Fire
- ◊ Parks & Rec
- ◊ GIS-Mapping
- ◊ Executive

.....Multi-departmental, cross-functional
.....Essential for establishment of a **Culture of Efficiency**







With new methods of water auditing and loss control, water utilities hold the potential to recapture large volumes of treated water as well as additional revenues.

Photo courtesy of Halifax Regional Waste Commission.

Unaccounted for No More

Water Audit Software Assesses Water Loss

by George Kunkel

Water utilities now have a standardized tool to determine water supply efficiency: a spreadsheet software package for compiling a basic audit of water supply operations, developed by AWWA's Water Loss Control Committee. The software, which exists in Microsoft Excel, is available to anyone for free download from the Water Loss Control pages on WaterWiser, the water efficiency clearinghouse, accessible from the AWWA website. It is also accessible from the AWWA Science and Technology Web pages for AWWA members.

The software was developed to

- promote the best-practice water audit method developed by the International Water Association and AWWA,
- assess water supply efficiency in a standard, reliable manner, and
- give utilities a simple, user-friendly way to compile and compare their water audit data with other utilities.

The WLC Committee envisions that many utilities will find the software highly useful through defining their water loss standing and revealing the effects of losses on operations and revenue streams.

Why Use Water Audit Software?

Although North American utilities have a solid track record in protecting public health by delivering high-*quality* water, today's water suppliers also need to ensure a sustainable *quantity* of water. Water supplies are stressed by limited water resources and burgeoning populations in many regions of the United States. Water efficiency is taking on greater importance in these locales, as well as in areas that have been historically perceived as "water rich." Many utilities now employ standing programs for water conservation, water reuse, and water loss control.

Water loss control minimizes lost volumes of treated water, helping to limit unnecessary source water withdrawals, excess infrastructure capacity, and chemical and operating costs. Often, water utilities can recover additional revenue as part of a good loss-control program. Until recently, a lack of proactive, standard methods made it difficult to quantify losses and plan for loss-reduction programs. Several reasonable water-audit approaches exist, including the method in AWWA manual M36, *Water Audits and Leak Detection*, but all fall short by categorizing a portion of the supply as "unaccounted-for" water. Not only is this term inconsistently defined, it has frequently fallen prey to manipulation, with many system managers arbitrarily quoting an "unaccounted-for percentage," without the means to validate the source data and no sense of how implementing water supply efficiency could quantify and better control losses.

The WLC Committee commissioned the comprehensive *Survey of State Agency Water Loss Reporting Practices*, which showed that most state and regional regulators don't require water suppliers to submit routine water audits in a consistent format that can be validated. A better way had to be developed if water suppliers were to be truly accountable for their water and demonstrate effective loss control.

The IWA organized the Water Loss Task Force, a five-member international group

George Kunkel, PE, is assistant chief of the Water Conveyance Section of the Philadelphia Water Department. He is a trustee in AWWA's Distribution and Plant Operations Division and formerly chaired the AWWA Water Loss Control Committee.

that included AWWA as the North American representative. The purpose of the WLTF was to identify the best features of existing water audit practices from around the world and assemble a single best management practice (BMP) method that would reliably portray water-loss standing and allow effective performance comparisons. The method was published by IWA in 2000 in *Performance Indicators for Water Supply Services*. The WLC Committee formally recommended this method to water utilities in its report, *Applying Worldwide Best Management Practices in Water Loss Control*, in 2003.

The IWA/AWWA Water Audit Method features rational terms and definitions and an array of strong performance indicators. For example, all water supplied to a distribution system is consumed by valid users or wasted through loss. Hence, no water is "unaccounted-for" but instead quantified under some category of consumption or loss. Many water utilities will need to estimate their losses — at least initially — when using the software. However, new quantification techniques exist, such as night-flow analyses to measure leakage volumes in small areas of distribution systems, known as District Metered Areas or DMAs, which generate accurate data that can be plugged into the software, making the water audit more reliable than using purely estimates. The software features a set of rational performance indicators that incorporate both loss-by-volume and loss-by-cost. These indicators are more consistent and reliable than the traditional unaccounted-for water percentage, which the WLC Committee recommends be dropped from the vernacular.

How Does the Method Work?

Recognizing that water cannot be created or destroyed, the IWA/AWWA Water Audit Method breaks down the total water managed by a utility into components of consumption or loss. A water audit looks at the supply operations of a water utility over a period of time, typically one year, as any shorter periods obscure seasonal effects and meter-reading-lag effects. The audit can trace water through untreated raw water transmission mains, treated water distribution systems, and isolated sections of the distribution system, such as DMAs. Commonly, the entire treated water distribution system is audited, taking into account water supplied into the grid, water consumed by customers, and water that does not reach customers. The Water Balance (Figure 2 on page 19) ensures that the water volumes balance, with the total supply to the distribution grid equaling the total water leaving the grid.

Several new terms and definitions introduced in the method replace the inconsistent terminology used in the variety of earlier methods:

Water Supplied represents the treated water delivered to the distribution system.

Authorized Consumption includes the volumes that reach beneficial use. *Water Losses* are comprised of *Apparent Losses* and *Real Losses*. Apparent Losses are the "paper" losses that occur from customer meter inaccuracies, unauthorized consumption, and data handling error in the meter reading and billing process. These losses corrupt the integrity of customer consumption data and cost the utility revenue because they represent underbilling and unauthorized consumption.

Real Losses are the "physical losses" of leakage and tank overflows. These losses cause the water utility to withdraw, treat, and deliver more water than the customer population requires, resulting in excess production costs, oversized infrastructure, and unneeded source water withdrawals.

Non-revenue Water is the total of Apparent Losses, Real Losses, and the unbilled portions of Authorized Consumption, such as fireflow,

continued on page 18

Audit (from page 17)

maintenance flushing, and withdrawals for municipal uses like park watering. This component represents the water that does not generate billings for the water utility. The term Non-revenue Water is preferred to "unaccounted-for" water.

The method also includes an array of new performance indicators. The most powerful is the Infrastructure Leakage Index, which is the ratio of a utility's actual Real Losses over its Unavoidable Annual Real Losses. The UARL is a new measure that represents the theoretical technical low level of leakage that could be achieved if the best of today's leakage control technologies could be employed by the utility. This value is different for every utility, because the calculation takes into account the utility's number of service connections, average pressure, miles of water mains, and average distance of service lines from the curbstop to the customer meter. Utilities with excellent leakage control have an ILI value near 1.0. Typically, these systems exist in parts of the world where water is scarce, expensive, or both. Figure 1 provides general guidelines on setting leakage reduction targets using the ILI.

How Does the Software Work?

The WLC Committee's Water Audit Software includes five Excel worksheets:

Instructions. On this worksheet the user enters demographic information that includes the name of the water utility, the person completing the water audit, contact information, and the year of the audit, including start and end dates. This worksheet also includes instructions for using the software package.

Reporting Worksheet. This is the audit's core worksheet. All operational and financial data is entered here, and all loss components and performance indicators are calculated and displayed on one page (Figure 1).

Water Balance. The water balance is a summary that shows the totals of each component of the audit in columns that balance — with all water entering the system equaling all water leaving the system. The water balance,

AWWA WLCC Water Audit Software: Reporting Worksheet

Back to Instructions

Click to access definition

Water Audit Report for: Philadelphia Water Department

Reporting Year: 2004

Please enter data in the white cells below. Where possible, metered values should be used; if metered values are unavailable please estimate a value. Indicate this by selecting a choice from the gray box to the left, where M = measured (or accurately known value) and E = estimated.

ALL VOLUMES TO BE ENTERED AS ANNUAL QUANTITIES

WATER SUPPLIED				
Master meter error adjustment:	M	695.4	under-registered	million gallons (US) per year
Water Imported:	M	0.0	million gallons (US) per year	
Water Exported:	M	7,210.2	million gallons (US) per year	
WATER SUPPLIED:		89,011.2	million gallons (US) per year	
AUTHORIZED CONSUMPTION				
Billed metered:	M	57,535.2	million gallons (US) per year	
Billed unmetered:	M	0.0	million gallons (US) per year	
Unbilled metered:	M	179.3	million gallons (US) per year	
Unbilled unmetered:	E	693.6	million gallons (US) per year	
AUTHORIZED CONSUMPTION:		58,408.1	million gallons (US) per year	
WATER LOSSES (Water Supplied - Authorized Consumption)		30,603.1	million gallons (US) per year	
Apparent Losses				
Customer metering inaccuracies:	E	162.5	million gallons (US) per year	
Data handling errors:	E	2,751.2	million gallons (US) per year	
Apparent Losses:		4,058.9	million gallons (US) per year	
Real Losses				
Real Losses (Water Losses - Apparent Losses):		26,544.2	million gallons (US) per year	
WATER LOSSES:		30,603.1	million gallons (US) per year	
NON REVENUE WATER				
NON-REVENUE WATER:		31,476.0	million gallons (US) per year	
SYSTEM DATA				
Number of active AND inactive service connections:	M	548,289		
Connection density:		174	conn./mile main	
			(pipe length between curbstop and customer meter or property	
Average operating pressure:	E	55.0	psi	
COST DATA				
Total annual cost of operating water system:	M	$167,604,000	$/Year	
Customer retail unit cost (applied to apparent losses):	M	$3.95	$/1000 gallons (US)	
Variable production cost (applied to real losses):	M	$133.58	$/million gallons (US)	

Figure 1 illustrates part of the Water Audit Method reporting worksheet, where sample data from the Philadelphia Water Department show non-revenue water use of nearly 31,500 mil gal/yr.

read from left-to-right, follows the path of the water supply from delivery to customer consumption (Figure 2).

Definitions. This page provides definitions and guidelines for use of all terms established in the IWA/AWWA method. The user can easily toggle from the Reporting Worksheet to the Definitions Worksheet to access definitions as the audit is compiled.

Water Loss Standing. This worksheet offers guidance in the assessment of the ILI value and its use as an approximate leakage-reduction, target-setting tool. After entering data and determining the performance indicators, utility personnel can refer to this sheet to obtain a sense of how their ILI value ranks with a self-selected target ILI.

The software package is designed to be downloaded at no cost by individual users without outside support. The formulas for the calculations are displayed so the user can track how the quantities and performance indicators are determined. The software is programmed with basic proofreading checks to flag illogical data, such as the customer consumption recorded as greater than the water supplied to the distribution system. All worksheets may be printed on a single sheet of paper, and the software file can be saved to create different versions of the water audit for each year. The website download page provides an opportunity for users to provide feedback and comments to the WLC Committee.

Promoting Better Accountability

The state of Texas has taken a lead role in the United States by legislating the use of water audits by water utilities. Throughout 2006, the Texas Water Development Board will be collecting and analyzing water audit data submitted by utilities using a format similar to the IWA/AWWA method. As other water resource agencies adopt the IWA/AWWA method, water system accountability will be improved, because this consistent method allows reliable comparisons with water utilities in other states, provinces, and countries. The software tool compiles water audit information in a standard format, with meaningful performance indicators that provide policy makers with better information to gauge water loss standing and create improvements.

For More Information

The WLC Committee is also in the process of rewriting M36, *Water Audits and Leak Detection,* using the IWA/AWWA method. Many features of the present edition of M36 will be retained in the new edition, which is expected to be published in 2007.

Acknowledgments

The Water Audit Software Subcommittee reviewed this article and includes Andrew Chastain-Howley, Water Prospecting and Resource Consulting, Fort Worth, Texas (chair); Alain Lalonde, Veritec Consulting, Mississauga, Ont.; David Sayers, Delaware River Basin Commission, West Trenton, N.J.; David Goff, PE, Goff Water Audits and Engineering, East Haven, Conn.; and contribution from Andrew Day, Water Prospecting and Resource Consulting, Fort Worth.

Thanks go to the water utilities who served as beta testers for the software; WLC Committee chair, Don Kirkland of the Wichita Water & Sewer Department; Scott Borman of the Benton/Washington Regional Public Water Authority in Arkansas; AWWA and the WaterWiser Committee; the California Urban Water Conservation Council; and Delaware River Basin Commission.

AWWA WLCC Water Audit Software: Water Balance

Water Audit Report For:	Report Yr:
Philadelphia Water Department	2004

	Water Exported 7,210.2	Billed Water Exported			
Own Sources (Adjusted for known errors) 96,221.4	Water Supplied 89,011.2	Authorized Consumption 58,408.1	Billed Authorized Consumption 57,535.2	Billed Metered Consumption (inc. water exported) 57,535.2	Revenue Water 57,535.2
				Billed Unmetered Consumption 0.0	
			Unbilled Authorized Consumption 872.9	Unbilled Metered Consumption 179.3	Non-Revenue Water (NRW) 31,476.0
				Unbilled Unmetered Consumption 693.6	
		Water Losses 30,603.1	Apparent Losses 4,058.9	Unauthorized Consumption 1,145.2	
				Customer Metering Inaccuracies 162.5	
				Data Handling Errors 2,751.2	
Water Imported 0.0			Real Losses 26,544.2	Leakage on Transmission and/or Distribution Mains Not broken down	
				Leakage and Overflows at Utility's Storage Tanks Not broken down	
				Leakage on Service Connections Not broken down	

Figure 2, the Water Balance worksheet, breaks down the authorized consumption and water losses into individual components.