American Water Works Association
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IWA/AWWA Water Audit Method

What is a Water Audit?

An audit has been defined as an examination of records or financial accounts to check their accuracy. The *water audit* typically traces the flow of water from the site of water withdrawal or treatment, through the water distribution system, and into customer properties. The water audit usually exists in the form of a worksheet or spreadsheet that details the variety of consumption and losses that exist in a community water system.

The *water balance* summarizes the components and provides accountability, as all of the water placed into a distribution system should – in theory – equal all of the water taken out of the distribution system.

Photo courtesy of Hughes Supply - Utilities Services Group.

The IWA/AWWA Water Audit Method

AWWA participated in a five-country task force formed by the International Water Association (IWA) to develop a best practice water audit structure for drinking water utilities. The Task Force published its results in the 2000 IWA publication *Performance Indicators for Water Supply Services*.

AWWA's Water Loss Control Committee advocated use of the IWA/AWWA Water Audit Method in its 2003 Committee Report "Applying Worldwide Best Management Practices in Water Loss Control", published in the *Journal AWWA*.

How does the IWA/AWWA Water Audit Method work?

The IWA/AWWA Water Audit Method is effective because it features sound, consistent definitions for the major forms of water consumption and water loss encountered in drinking water utilities. It also features a set of rational performance indicators that evaluate utilities on system-specific attributes such as the average pressure in the distribution system and total length of water mains. The format of the water balance of this method is given in **Table 1** with definitions for the terms included in **Table 2**.

The performance indicators, shown in **Table 3**, allow water utilities to make a meaningful assessment of their water loss standing, benchmark themselves with other water utilities and set performance targets. The water audit tells us how much of each type of loss occurs and how much it is costing the water utility. The key concept around this method is that all water is quantified – via measurement or estimate – as either a form of beneficial consumption or as wasteful loss. A cost is placed on each volume component in order to assess its financial impact to the water utility.

Table 1. IWA/AWWA Water Balance (All data in volume for the period of reference, typically one year)

System Input Volume (corrected for known errors)	Authorized Consumption	Billed Authorized Consumption	Billed Metered Consumption (including water exported)	Revenue Water
			Billed Unmetered Consumption	
		Unbilled Authorized Consumption	Unbilled Metered Consumption	Non-Revenue Water (NRW)
			Unbilled Unmetered Consumption	
	Water Losses	Apparent Losses	Unauthorized Consumption	
			Customer Metering Inaccuracies	
			Systematic Data Handling Errors	
		Real Losses	Leakage on Transmission and Distribution Mains	
			Leakage and Overflows at Utility's Storage Tanks	
			Leakage on Service Connections up to point of Customer metering	

Table 2. Components and Definitions of the IWA/AWWA Water Balance

Water Balance Component	Definition
System Input Volume	The annual volume input to the water supply system
Authorized Consumption	The annual volume of metered and/or unmetered water taken by registered customers, the water supplier and others who are authorized to do so
Water Losses	The difference between System Input Volume and Authorized Consumption, consisting of Apparent Losses plus Real Losses
Apparent Losses	Unauthorized Consumption, all types of metering inaccuracies and systematic data handling errors
Real Losses	The annual volumes lost through all types of leaks, breaks and overflows on mains, service reservoirs and service connections, up to the point of customer metering.
Revenue Water	Those components of System Input Volume which are billed and produce revenue
Non-Revenue Water (NRW)	The difference between System Input Volume and Billed Authorized Consumption

Table 3. Performance Indicators for Non-revenue Water and Water Losses

Performance Indicator	Function	Comments
Volume of Non-revenue water as a percentage of system input volume	Financial - Non-revenue water by volume	Can be calculated from a simple water balance; good only as a general financial indicator
Volume of Non-revenue water as a percentage of the annual cost of running the water system	Financial - Non-revenue water by cost	Allows different unit costs for Non-revenue water components
Volume of Apparent Losses per service connection per day	Operational - Apparent Losses	Basic but meaningful indicator once the volume of apparent losses has been calculated or estimated
Real Losses as a percentage of system input volume	Inefficiency of use of water resources	Unsuitable for assessing efficiency of management of distribution systems
Normalized Real Losses - Gallons/service connection/day when the system is pressurized	Operational: Real Losses	Good operational performance indicator for target-setting for real loss reduction
Unavoidable Annual Real Losses (UARL)	UARL (gallons/day) = (5.41Lm + 0.15Nc + 7.5Lp) x P where Lm = length of water mains, miles Nc = number of service connections Lp = total length of private pipe, miles = Nc x average distance from curbstop to customer meter P = average pressure in the system, psi	A theoretical reference value representing the technical low limit of leakage that could be achieved if all of today's best technology could be successfully applied. A key variable in the calculation of the Infrastructure Leakage Index (ILI) It is not necessary that systems set this level as a target unless water is unusually expensive, scarce or both
Infrastructure Leakage Index (ILI)	Operational: Real Losses	Ratio of Current Annual Real Losses (CARL) to Unavoidable Annual Real Losses (UARL); good for operational benchmarking for real loss control.