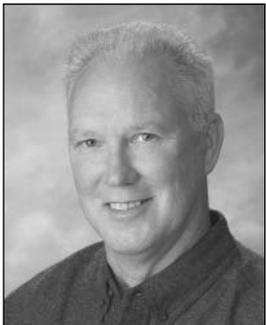


# Finding water loss requires planning and persistence

All water systems, no matter what size or where they are located, experience some type of water loss. Some may not admit it – but no system “makes” water. Historically, public water has been plentiful and relatively inexpensive. There are some water systems, even today, that really do not care about their water losses. Some water systems still are in no big hurry to find and repair water leaks, no matter how large of a water loss they have. Some even have gone so far as to say, “It’s cheaper to let it leak than to go out and find it and fix it.” It’s the old “out of sight, out of mind” attitude. All water systems should be accountable for all the water pulled from rivers and lakes or the water purchased from other systems.



Gary Armentrout  
Technical Assistant

Unfortunately, in Kansas there are still water system people who do not understand what water loss is or how to figure what a system’s unaccounted for water loss actually is.

How is unaccounted for water loss defined?

What is this water, where does it go and where did it come from? There are several questions that one might ask. Why can’t I account for it? Where do I look for it? Where do I start?

Let’s start by defining unaccounted for water.

Unaccounted for water is simply water that cannot be accounted for after all the water sold, flushed, or

used in one form or another is subtracted from the total water entering the system either through production, purchase or both. The sidebar below demonstrates the calculation.

this. Numbers must be accurate. If not, the rest of the exercise is a waste of time. Master meters must record correctly the amount of water that passes through them. Master meters should be checked

Some may not admit it – but no system “makes” water. Historically, public water has been plentiful and relatively inexpensive. There are some water systems, even today, that really do not care about their water losses.

## Let’s review the calculation

First, an operator should have meter readings of how much water was produced and/or purchased. There should be no guesswork on

for accuracy at least once a year. KRWA can assist with this. An inaccurate master meter can cost any system substantially more money than imagined.

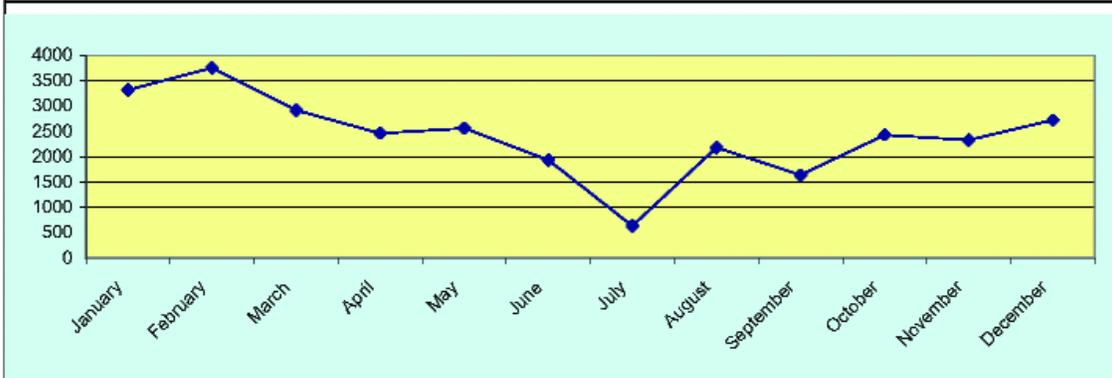
## Calculating unaccounted for water loss

- Unaccounted for water is the difference between water produced (metered at the treatment facility or produced) and metered use (i.e., sales plus non-revenue producing metered water). Unaccounted for water can be expressed in gallons per month or day but it is usually discussed as a percentage of water production. Here is the expression in formula format:
- $\text{Unaccounted for water (\%)} = (\text{produced} + \text{any purchased water} - \text{metered use} - \text{other accounted for use}) \div (\text{produced} + \text{purchased})$
- Example: A system purchased 5,000,000 gallons of water in May. The system recorded 4,250,000 gallons of sales to customers. It recorded 50,000 gallons of fire hydrant use. What is the % of unaccounted for water loss?
- To determine the unaccounted for water loss, the calculation would be:  $5,000,000 - 4,250,000 - 50,000 = 700,000 \div 5,000,000$  or 14%.

## One system's water produced, sold and lost

Typical information for Kansas Water Use Report (all data in thousands of gallons)

Month	Raw Water Diverted	Water Purchased	Water Sold Wholesale	Water Sold Bulk	Water Sold Residential	Metered Free	Unaccounted For Water	Percent by Month
January	5804	9002	44	770	10574	96	3322	22.4%
February	5150	10096	38	871	10486	95	3756	24.6%
March	3759	9106	42	962	8854	86	2921	22.7%
April	3322	9214	49	1244	7605	1175	2463	19.6%
May	5486	6736	44	1470	6570	1574	2564	21.0%
June	7426	8487	64	1040	12139	734	1936	12.2%
July	7784	8779	64	1051	14078	735	635	3.8%
August	8853	8921	81	1161	13307	1040	2185	12.3%
September	4989	8646	56	850	11013	78	1638	12.0%
October	5232	8963	39	841	10800	82	2433	17.1%
November	4570	8629	43	952	9800	73	2331	17.7%
December	6607	7688	51	1475	10012	31	2726	19.1%
Total	68982	104267	615	12687	125238	5799	28910	16.7%



The above chart represents actual numbers from a city water system in Kansas. The unaccounted for water loss ranges from 3.8% in July to a high of 24% in February. These wide fluctuations in loss indicate problems with meter reading or reporting, versus leakage being the main contributor to water loss. Notice that in the month of highest usage, the loss is lowest.

Chart reprinted from KanCap, Kansas' board/council training program

Next, determine the total amount of water sold. Here again, this is easy, right? Not always. Accurate water meters are essential and need to be read each and every month. I have visited with a number of rural water systems and some small towns that do not and will not read system meters on a monthly schedule. They say there is no need to do this as system customers do an excellent job of reading them. They say, "No one ever estimates their bill in our system! No one ever pays ahead!" If a system believes this then

meter readings should be checked at least quarterly to verify the readings. There is no way to correctly determine the amount of unaccounted for water loss if there is no confidence in the amount of water reported as being sold. Another important point is the need to read the meters as closely as possible to the same time each month. This will help in determining when or if there is an actual leak in the system.

As the calculation on the previous page demonstrates, after taking meter readings from residential meters, total these

numbers and subtract from the master meter reading. Next, total all the "free water." Free water is water metered and used to produce a system's water, e.g., if there is a water plant. Free water would also include water that is used to flush lines or do maintenance on any water storage facilities. Free water can also be water that is used at the district office or city buildings, city shop or fire department or any other place that a system provides water and does not charge for it. Free water does not include water that is lost due to a line break or from a customer who has not paid

## Finding water loss . . .

their bill. After these numbers have been subtracted, the amount that remains is “unaccounted for water.” To determine the percentage of unaccounted for water loss, divide the unaccounted for gallons by the total production or purchased water.

The issue that water system governing bodies and staff need to address is how to establish a program to reduce high unaccounted for water loss. When KRWA assists a water system with water losses, we normally will begin with a review of recordkeeping. As I mentioned earlier, the review can yield important information and from it, we can pretty well determine if the high unaccounted for water loss is due to metering or actual leaks.

The next item KRWA will look at will be the accuracy of master and residual meters. This will include a test of the master meters and the testing of some residual meters. We will record the meters’

ages, and the amount of water that has passed through them. Inaccurate metering is a big contributor to high unaccounted for water loss. Generally, systems should have a meter change-out program that results in replacing residual meters when they get near

through it. Be sure that meters are installed properly and that the right size and type of meter is in place. Inappropriate installations or incorrect application of meters are large contributors to water loss – and we find these problems regularly in Kansas systems.

**Be sure that meters are installed properly and that the right size and type of meter is in place. Inappropriate installations or incorrect application of meters are large contributors to water loss – and we find these problems regularly in Kansas systems.**

or at the 1 million gallon mark. Managers also want to look at the age of the meters. Some in the industry recommend replacing meters every 10 years.

As has been discussed in previous articles in *The Kansas Lifeline*, the installation of a meter is just as important as the age or the amount of gallons running

After KRWA has completed all of the above steps and a determination is made that there is real loss, we will move to the next phase of the water loss survey. This will begin with a review of system maps that helps determine how to isolate system sections to develop a plan to conduct an actual leak survey. In reviewing

IT'S ABOUT  
**SATISFACTION**

SERVICE. THE BARTLETT & WEST WAY.

“The customer is the ultimate judge of quality. I need an engineer who can deliver every time. I depend on that ...”

**BARTLETT & WEST**  
SERVICE. THE BARTLETT & WEST WAY.

- UNDERSTANDING YOUR NEEDS
- ACCESSIBILITY & RESPONSIVENESS
- INTEGRITY
- QUALITY
- PROACTIVE COMMUNICATION

**John Ruckman, Project Manager**

TOPEKA ■ LAWRENCE ■ MANHATTAN ■ WWW.BARTWEST.COM ■ 888.200.6464

the maps, we look at the direction of flow and valve locations. Having operable valves is essential to have any success in locating water leaks. Main line valves should be exercised annually to ensure that they are in good condition. It has been proven over and over that late at night is generally the best time to detect a water leak. So when conducting a leak survey, KRWA prefers to begin late at night. This is the time of day when water usage is normally lowest. By closing valves on the main or branch lines we can isolate sections of the system to detect abnormal movement of water. If everything goes smoothly, many miles of pipeline can be checked in one night.

After a leak is isolated between two working valves, a visual inspection of the line area helps locate the leak during daylight hours. Locating the point of the break in the line can take as long as getting it isolated between

the working valves. We all know that water will follow the path of least resistance. Therefore, not all leaks will come to the surface. Many will follow a rock ledge for some distance before coming to the surface, if at all. One thing to look for when searching for a leak is an area of cattails. Cattails do not normally grow at the top of a hill nor will they be in the middle of a field. A sighting of cattails should prompt a check of system maps to see if a water line is close. The larger the cattails, the longer they have been growing. That means the leak has been going for some time. Another place to look would be a green spot in a field of brown grass. If fire hydrants are present in the system, check them to make sure the valves are shut off completely. They can be a cause of water leaks also by leaking water out of the weep holes.

The most important factor in a leak detection and repair program is the need for accurate, detailed

records that are consistent over time and are easy to analyze. Water production and sales will become increasingly important as the cost of system operations increase. KRWA can assist a system with master meter testing and water loss surveys. KRWA has some of the most advanced detection equipment available. But when it comes right down to it, it takes a willingness and desire by the system to address water loss issues. A walk in the woods or looking for valves in horseweeds late at night with the tics, mosquitoes, snakes, chiggers and spiders and no moon isn't the ideal way to spend an evening. Proper planning is necessary. If a system wants or needs assistance in identifying contributors to water loss in the system, call KRWA at 785/336-3760 or e-mail KRWA at [krwa@krwa.net](mailto:krwa@krwa.net); we will be at your system to provide assistance.

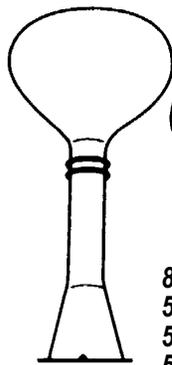
## Support Associate Members

When a city or rural water district needs products or services,

## SHOP ASSOCIATES FIRST!

Associate Members support the Kansas Rural Water Association.

For a current directory, with contact, e-mail addresses and Web site information for Associate Members, check out [www.krwa.net](http://www.krwa.net), then under "membership."



## CENTRAL TANK COATINGS, INC

*"General Water Tower Maintenance"*

877-530-6226 TOLL FREE  
563-426-5967 OFFICE  
563-380-2647 CELL  
563-426-5641 FAX

KELLY KOEHN, OWNER  
19736 CABLE AVENUE  
ELGIN, IA 52141-8134

- CREWS AVAILABLE FOR WINTER EMERGENCIES
- SANDBLASTING
- PAINTING
- ROOFS, PIPES, & JACKETS
- VIDEO INSPECTIONS
- ANNUAL MAINTENANCE CONTRACTS AVAILABLE
- OVER 20 YEARS EXPERIENCE