Smart Management for Small Water Systems

Introduction to Water Loss Auditing & Non-Revenue Water Reduction

June 25 - 26| Cambridge, Ohio

www.southwestefc.unm.edu
www.efcnetwork.org

EFCN environmental finance center network

NADO National Association of Development Organizations

GFOA Government Finance Officers Association

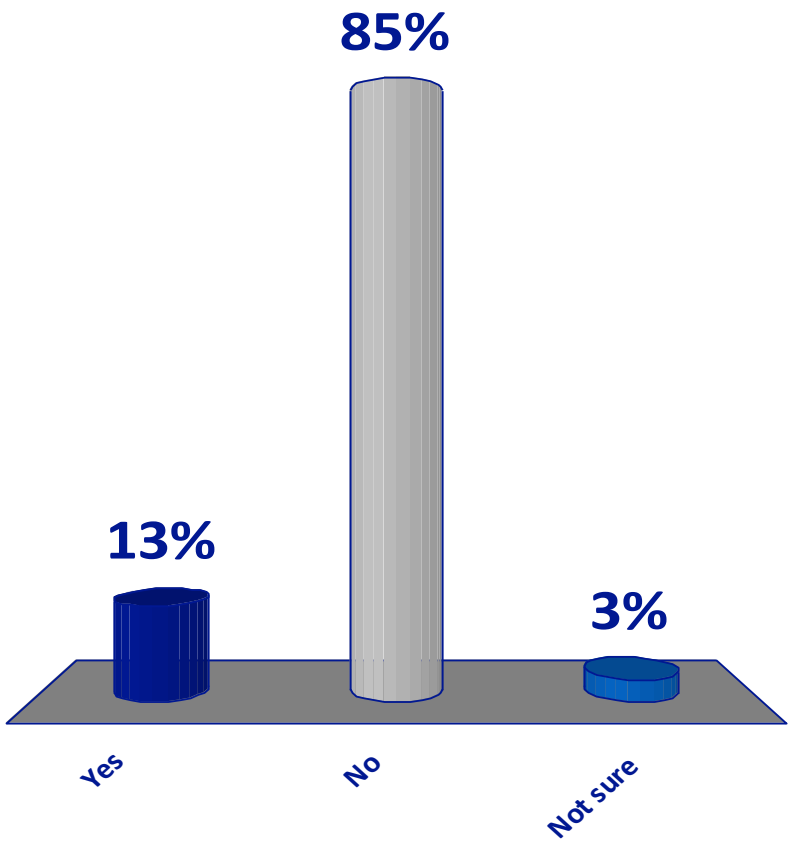
This program is made possible under a cooperative agreement with the U.S. EPA.

Have you ever been to water audit or water loss control training before?

A. Yes

B. No

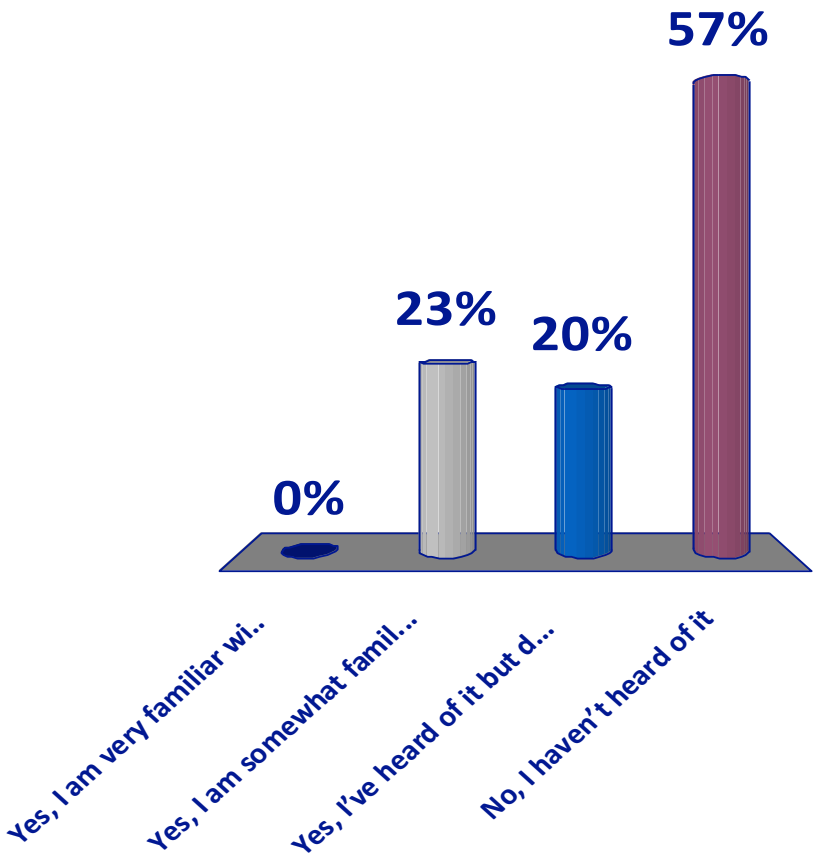
C. Not sure



For all attendees to answer

Are you familiar with the AWWA M36 Water Audit and Control Methodology?

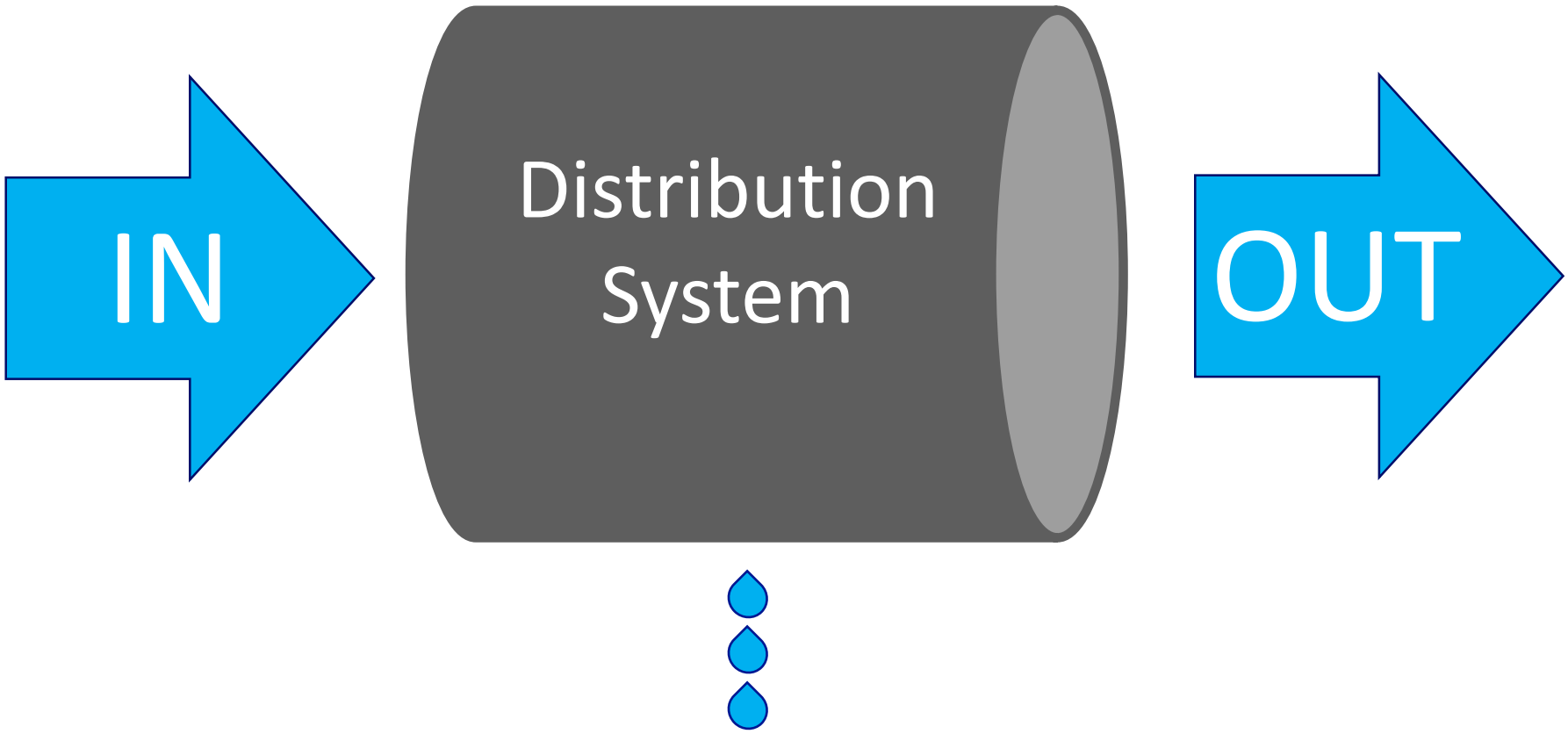
A. Yes, I am very familiar with this methodology
B. Yes, I am somewhat familiar with it
C. Yes, I've heard of it but don't know much more about it
D. No, I haven't heard of it



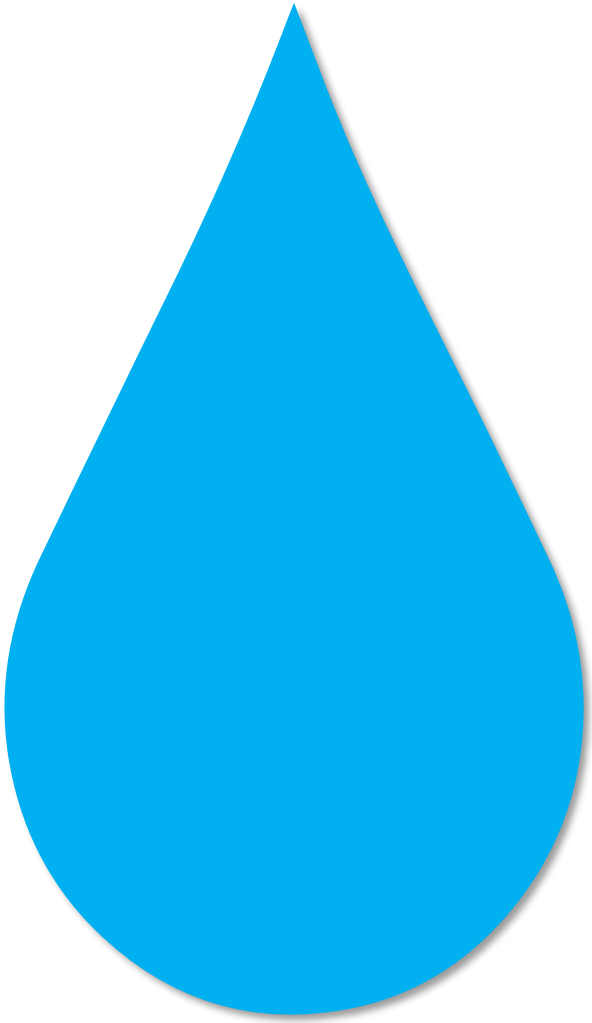
For water systems only to answer

Understanding the water balance …

What goes in, comes out … somewhere

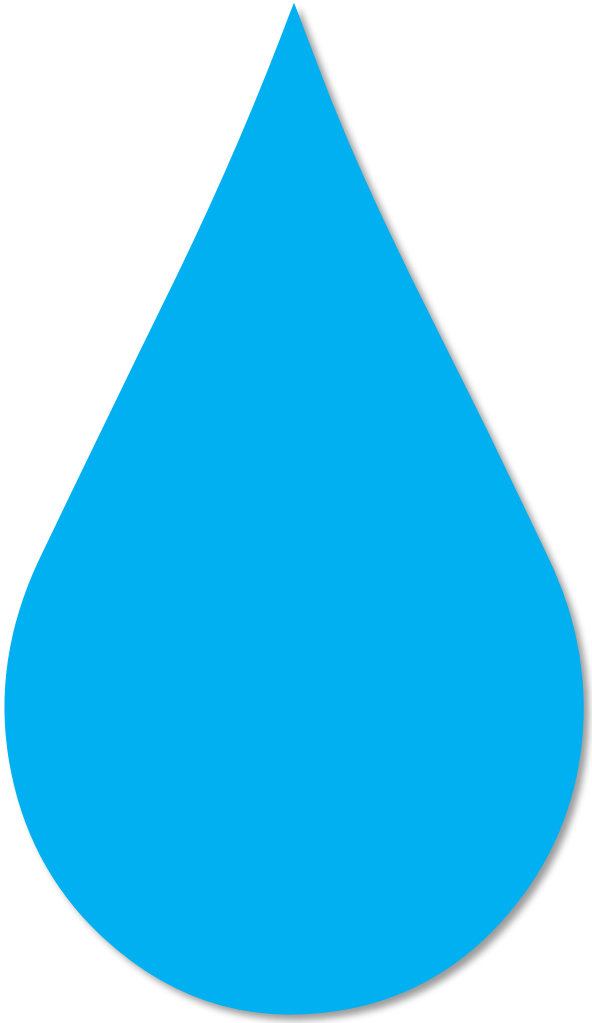


You’re either getting paid …



=

Or you’re not.



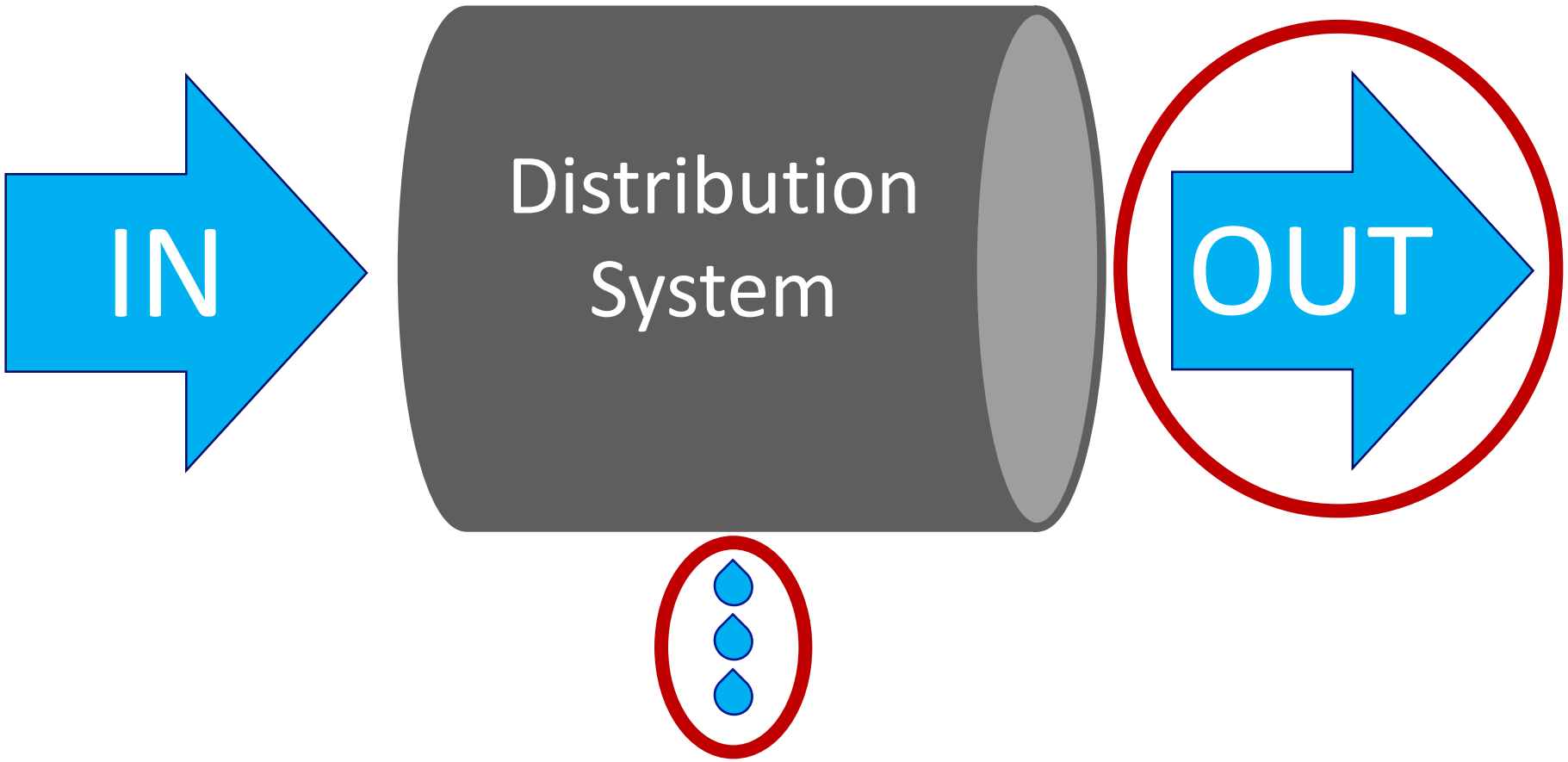
≠

So, It's a BLUE and a GREEN problem …

Water that isn't being used the way we want.

Money that we're not getting but could be.

We need a way to estimate water that isn't being used the way we want:



And the amount of money we're not getting…

One Way – The Water Balance

ALL THE WATER IN

=

ALL THE WATER OUT

What is the Water In?

=

Water from your own sources

+

Water you purchase

The Water Balance:

Water sold

+

Water given away

+

Water used by utility

+

Water not accurately metered or billed

+

Water stolen + Water leaking

=

The Water Balance:

Water fro
ow

We can measure these

Water you purchase

The Water Bala

Water sold

+

Water given away

+

Water used by utility

+

Water not accurately metered or billed

+

Water stolen + Water leaking

Theoretically we can measure all but one of these

THE WATER OUT

The Water Balance:

Water sold

+

Water given away

+

Water used by utility

+

Water not accurately metered or billed

+

Water stolen + Water leaking

Which one can't we measure?

=

The Water Balance:

Water sold

+

Water given away

+

Water used by utility

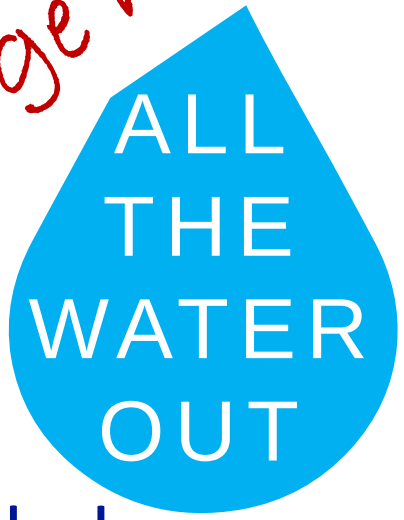
+

Water not accurately metered or billed

+

Water stolen + Water leaking

How does that knowledge help us?



The Water Balance:

ALL THE WATER IN

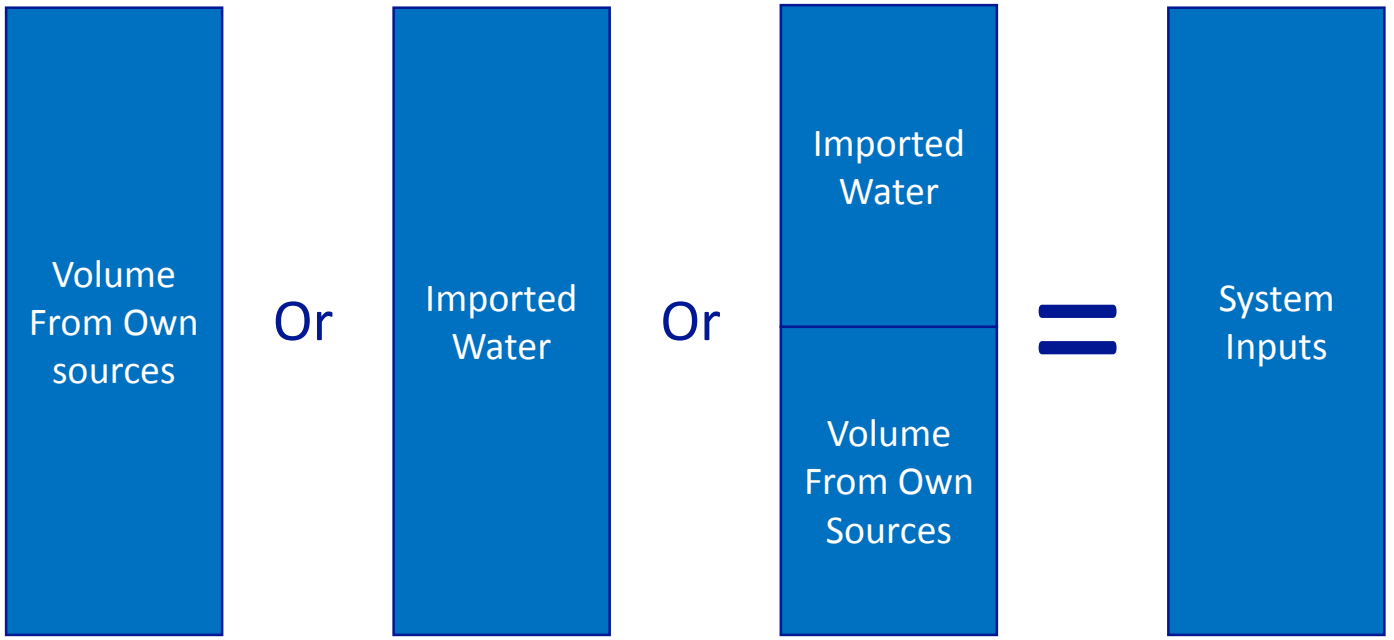
If we add up all the "water in" and subtract all of the "water out" that we know that will give us a volume for "real water loss."

ALL THE WATER OUT

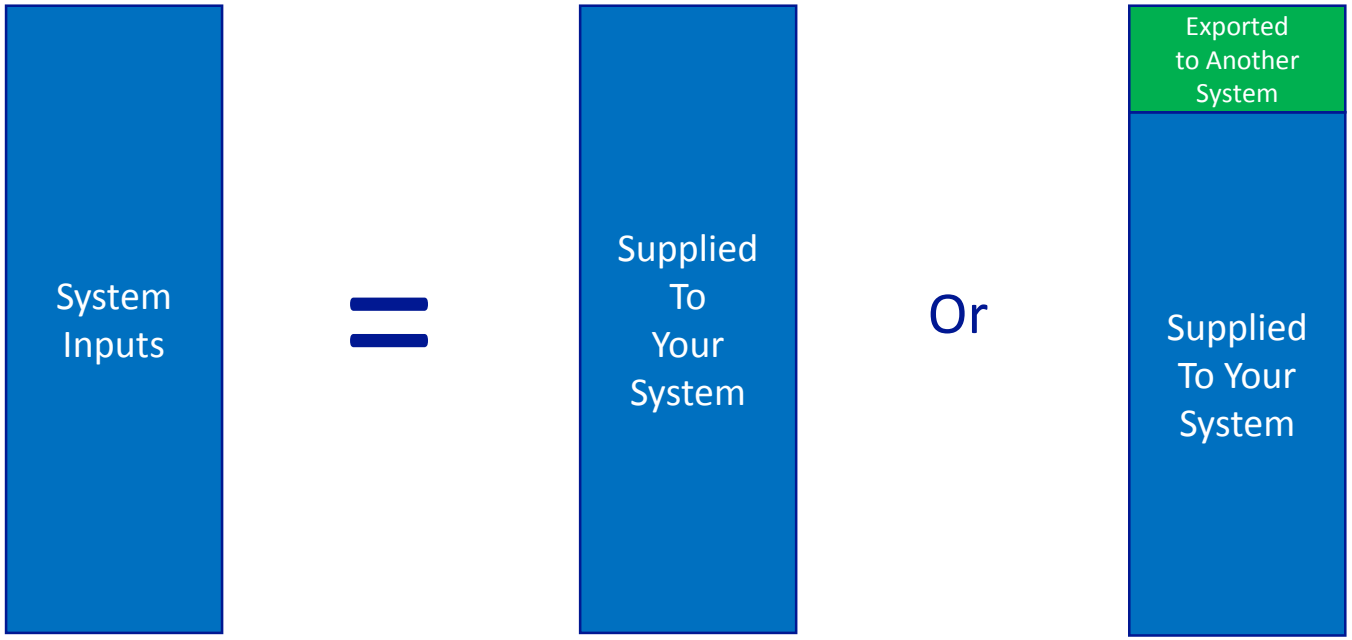
We Can Use This Theory to Create The Water Balance:

The “Water In”

ALL THE WATER IN

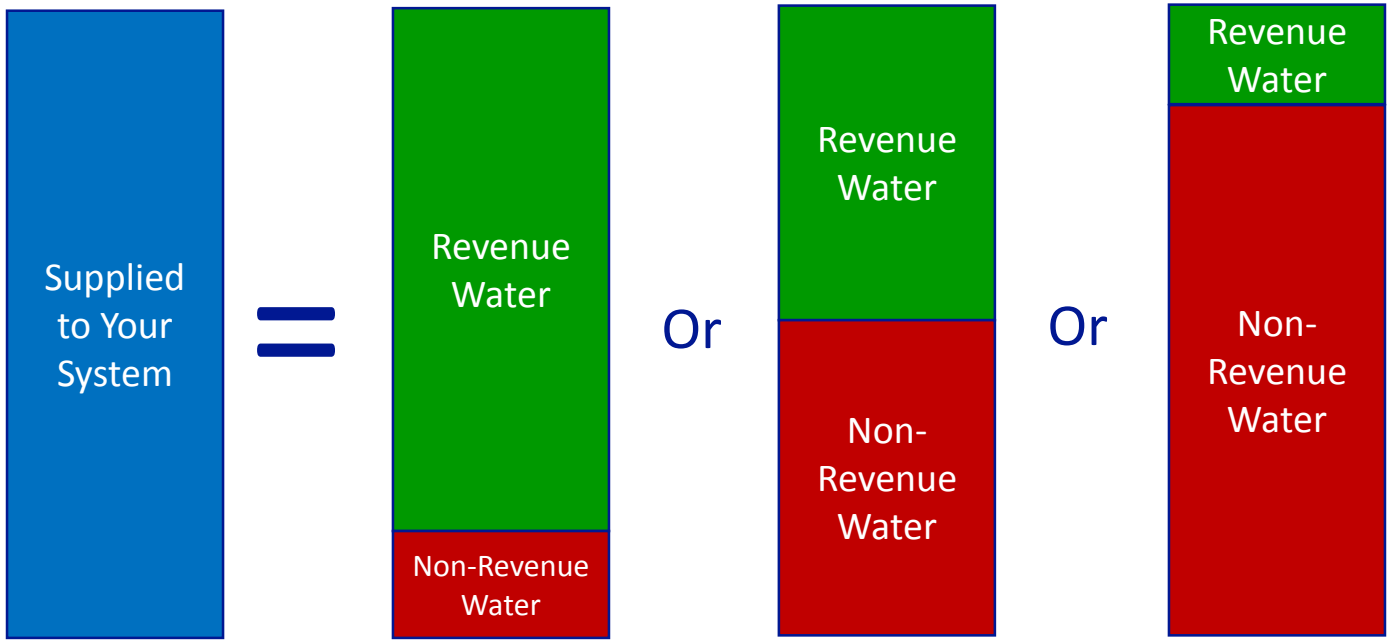


System Inputs are supplied or exported



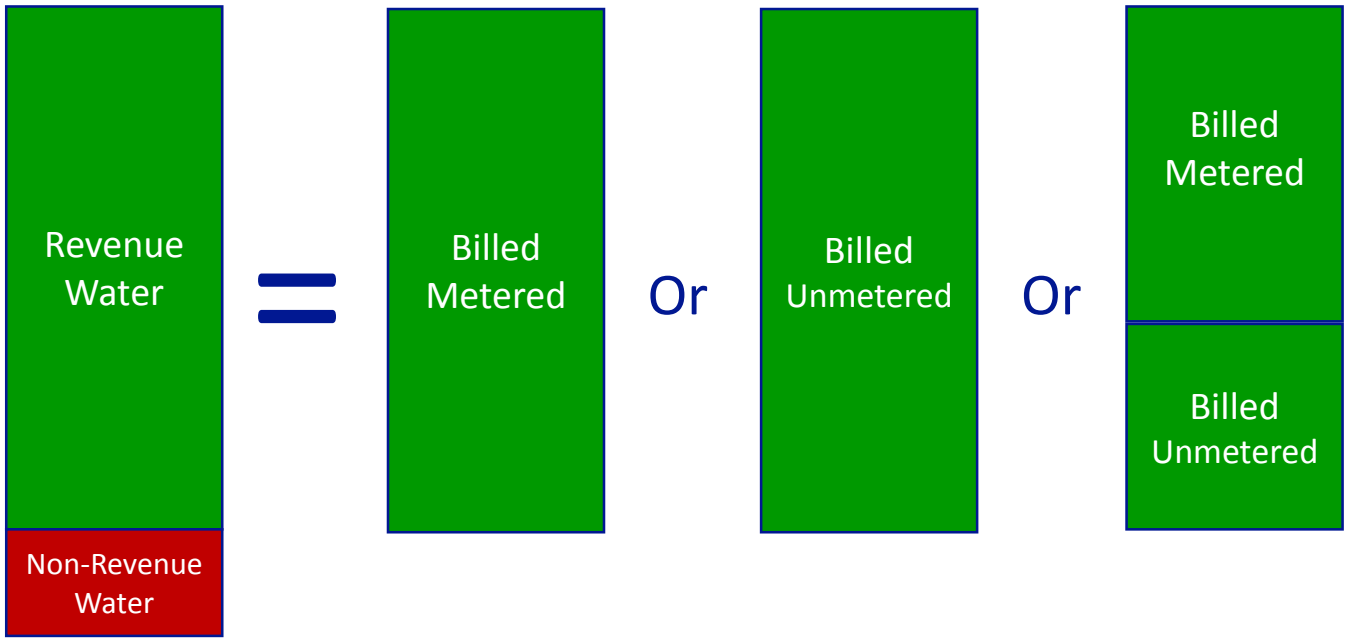
Water Out …

ALL THE WATER OUT

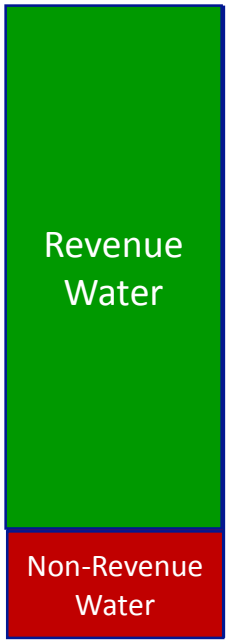


Generates Revenue or Not

Water Out: The Revenue Portion



The Water Out: The Non-Revenue Portion



The Water Out: The Non-Revenue Portion

Non-Revenue Water

=

Broken down further…

=

A bit about terminology…

Theft & Errors = Apparent Losses

NOT PHYSICAL LOSSES

- Water reaches a user
- Volumes are not counted
- Water does not generate revenue

VALUED AT THE PRICE YOU CHARGE CUSTOMERS

And a bit more …

Main Leaks
Service Line Leaks
Storage Leaks & Overflows

=

Real Losses

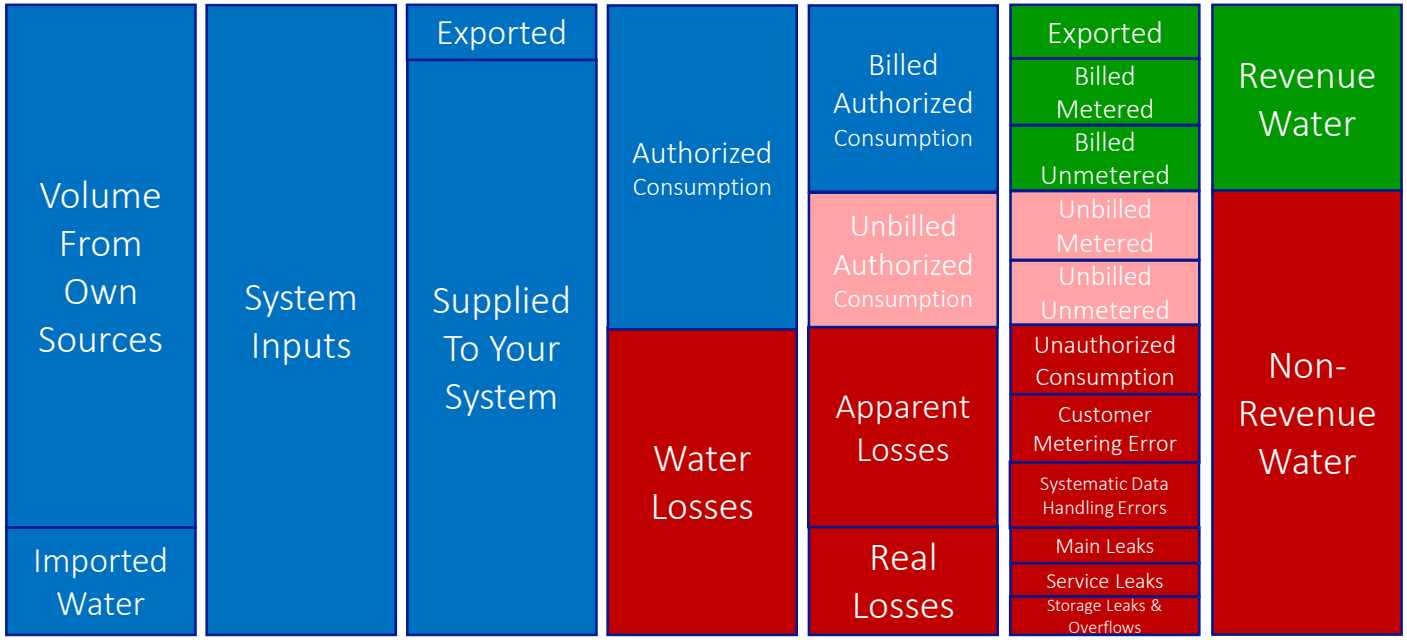
ARE PHYSICAL LOSSES

- Water did not reach a customer
- Difficult if not impossible to measure
- Water does not generate revenue

VALUED AT THE PRICE OF PRODUCTION

You CAN'T directly charge for losses, but all customers pay indirectly

Let's Put It All Together …



Questions? Thoughts? Comments?

Break time …

Remember It's a BLUE and roblem

We Want A Way to Calculate Your Water Balance

we're not
ut could be.

Water that isn't being used the way we want.

ENTER: AWWA'S WATER AUDIT SOFTWARE!

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0

Click to access definition
Click to add a comment

Water Audit Report for: Northern San Leandro Combined Water Sewer Storm Utility District (0007900)
Reporting Year: 2013 1/2013 - 12/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<---------- Enter grading in column 'E' and 'J' ----------> Master Meter Error Adjustments

			Pcnt:	Value:	
WATER SUPPLIED					
Volume from own sources:	5	1,000.000 MG/Yr	1	100.000	MG/Yr
Water imported:		MG/Yr			MG/Yr
Water exported:	1	100.000 MG/Yr	9	25.000	MG/Yr
WATER SUPPLIED:		**825.000** MG/Yr			

Enter negative % or value for under-registration
Enter positive % or value for over-registration

			Pcnt:	Value:	
AUTHORIZED CONSUMPTION					
Billed metered:	8	700.000 MG/Yr			
Billed unmetered:	9	50.000 MG/Yr			
Unbilled metered:		MG/Yr			
Unbilled unmetered:		10.313 MG/Yr	1.25%		MG/Yr

Click here: ? for help using option buttons below

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

AUTHORIZED CONSUMPTION: **760.313** MG/Yr

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption) **64.688** MG/Yr

			Pcnt:	Value:	
Apparent Losses					
Unauthorized consumption:	10	3.000 MG/Yr		3.000	MG/Yr
Customer metering inaccuracies:	5	7.071 MG/Yr	1.00%		MG/Yr
Systematic data handling errors:	4	5.000 MG/Yr		5.000	MG/Yr
Apparent Losses:		**15.071** MG/Yr			

Unauthorized consumption volume entered is greater than the recommended default value

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses: **49.617** MG/Yr

WATER LOSSES: **64.688** MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER: **75.000** MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	7	100.0 miles
Number of active AND inactive service connections:	6	1,000
Service connection density:		10 conn./mile main
Are customer meters typically located at the curbstop or property line?		Yes
Average length of customer service line:		(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure: 6 60.0 psi

COST DATA

Total annual cost of operating water system:	5	$1,000,000 $/Year
Customer retail unit cost (applied to Apparent Losses):	7	$3.50 $/1000 gallons (US)
Variable production cost (applied to Real Losses):	7	$3,000.00 $/Million gallons ☐ Use Customer Retail Unit Cost to value real losses

THE AWWA WATER AUDIT SOFTWARE

American Water Works Association

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0

Click to access definition
Click to add a comment

Water Audit Report for: Northern San Leandro Combined Water Sewer Storm Utility District (0007900)
Reporting Year: 2013 1/2013 - 12/2013

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<---------- Enter grading in column 'E' and 'J' ---------->

Master Meter Error Adjustments

			Pcnt:	Value:	
WATER SUPPLIED					
Volume from own sources:	5	1,000.000 MG/Yr		100.000	MG/Yr
Water imported:	1	MG/Yr			MG/Yr
Water exported:	1	100.000 MG/Yr	9	25.000	MG/Yr
WATER SUPPLIED:		825.000 MG/Yr			

Enter negative % or value for under-registration
Enter positive % or value for over-registration

			Pcnt:	Value:	
AUTHORIZED CONSUMPTION					
Billed metered:	8	700.000 MG/Yr			
Billed unmetered:	9	50.000 MG/Yr			
Unbilled metered:		MG/Yr			
Unbilled unmetered:		10.313 MG/Yr	1.25%		MG/Yr

Click here: for help using option buttons below

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

AUTHORIZED CONSUMPTION: 760.313 MG/Yr

Use buttons to select percentage of water supplied **OR** value

WATER LOSSES (Water Supplied - Authorized Consumption) 64.688 MG/Yr

			Pcnt:	Value:	
Apparent Losses					
Unauthorized consumption:	10	3.000 MG/Yr		3.000	MG/Yr
Customer metering inaccuracies:	5	7.071 MG/Yr	1.00%		MG/Yr
Systematic data handling errors:	4	5.000 MG/Yr		5.000	MG/Yr
Apparent Losses:		15.071 MG/Yr			

Unauthorized consumption volume entered is greater than the recommended default value

Real Losses (Current Annual Real Losses or CARL)
Real Losses = Water Losses - Apparent Losses: 49.617 MG/Yr

WATER LOSSES: 64.688 MG/Yr

NON-REVENUE WATER
NON-REVENUE WATER: 75.000 MG/Yr
= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	7	100.0	miles
Number of active AND inactive service connections:	6	1,000	
Service connection density:		10	conn./mile main
Are customer meters typically located at the curbstop or property line?		Yes	
Average length of customer service line:			(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure:	6	60.0	psi

COST DATA

Total annual cost of operating water system:	5	$1,000,000	$/Year
Customer retail unit cost (applied to Apparent Losses):	7	$3.50	$/1000 gallons (US)
Variable production cost (applied to Real Losses):	7	$3,000.00	$/Million gallons ☐ Use Customer Retail Unit Cost to value real losses

AUDIT SOFTWARE COMPONENTS:

Instructions

Reporting Worksheet

DATA CATEGORIES:

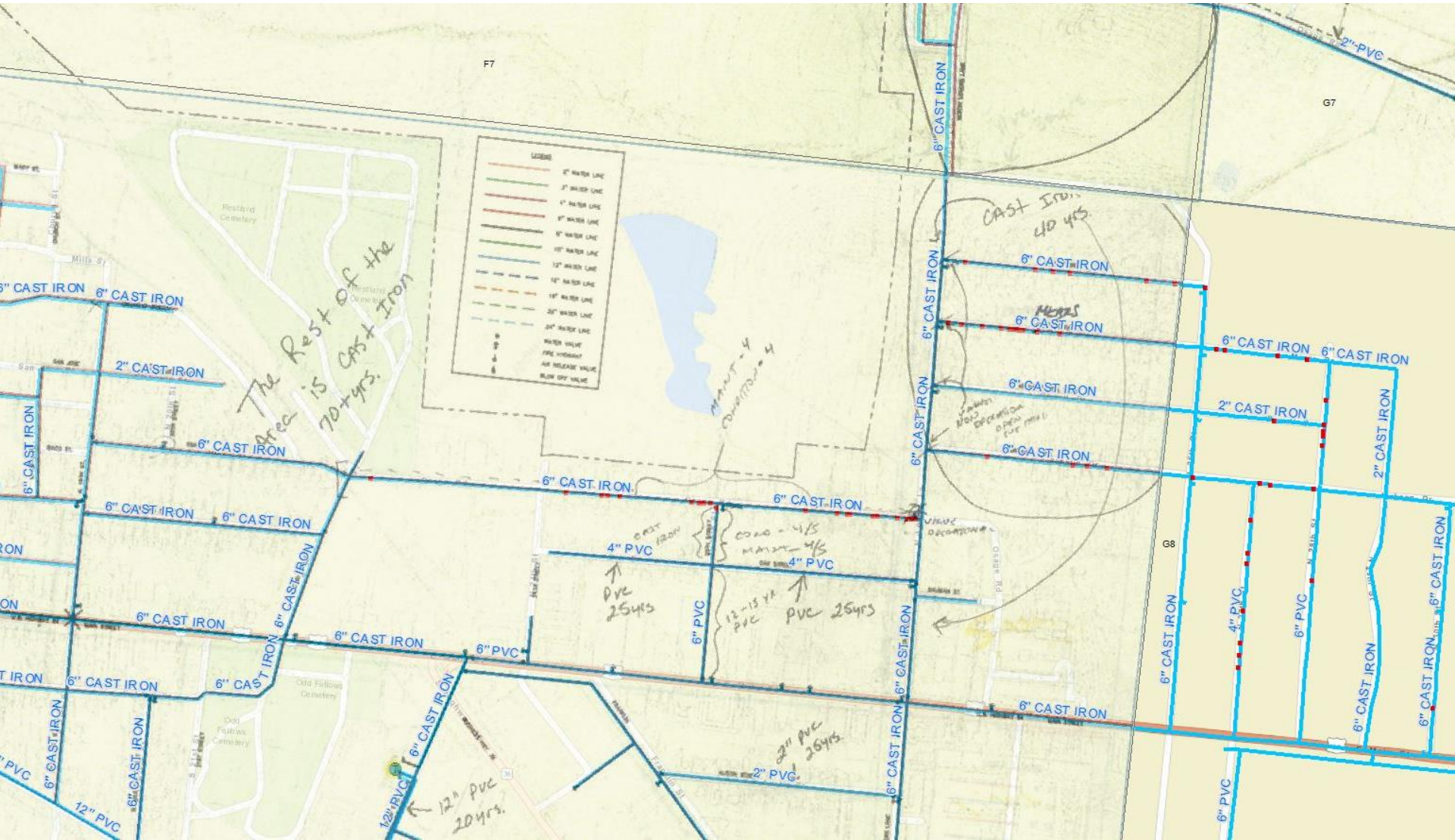
Water supplied to your system

ALL THE WATER IN

Water used by customers

System characteristics

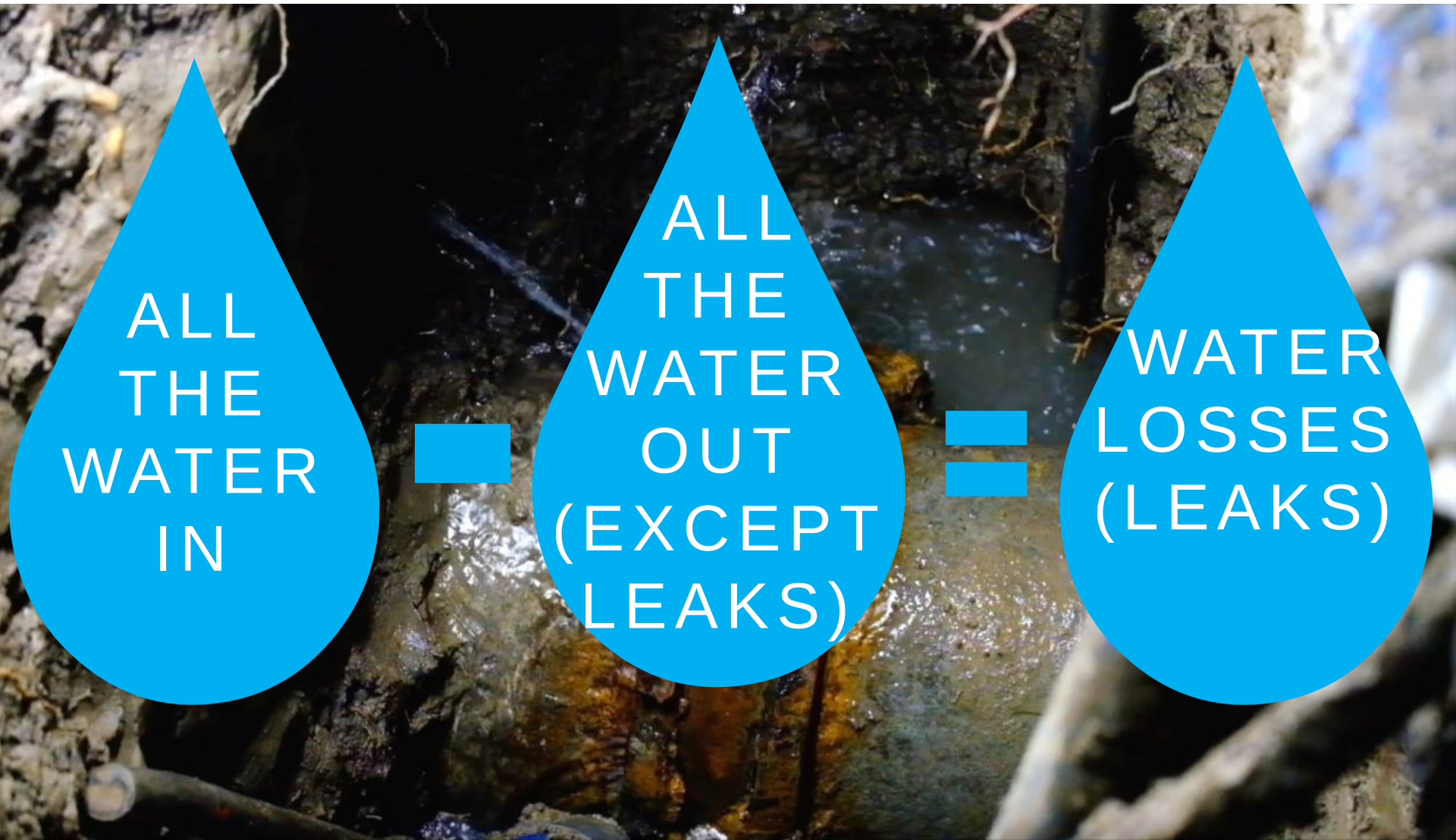
Doesn’t affect balance; part of calculation of the metrics



Financial information

Doesn’t affect balance; part of calculation of the value of water

The software calculates Non-Revenue Water



Setting Parameters

Audit Timeframe:

The Audit covers a 1 year period

Can be calendar or fiscal year

Pick one and stick with it

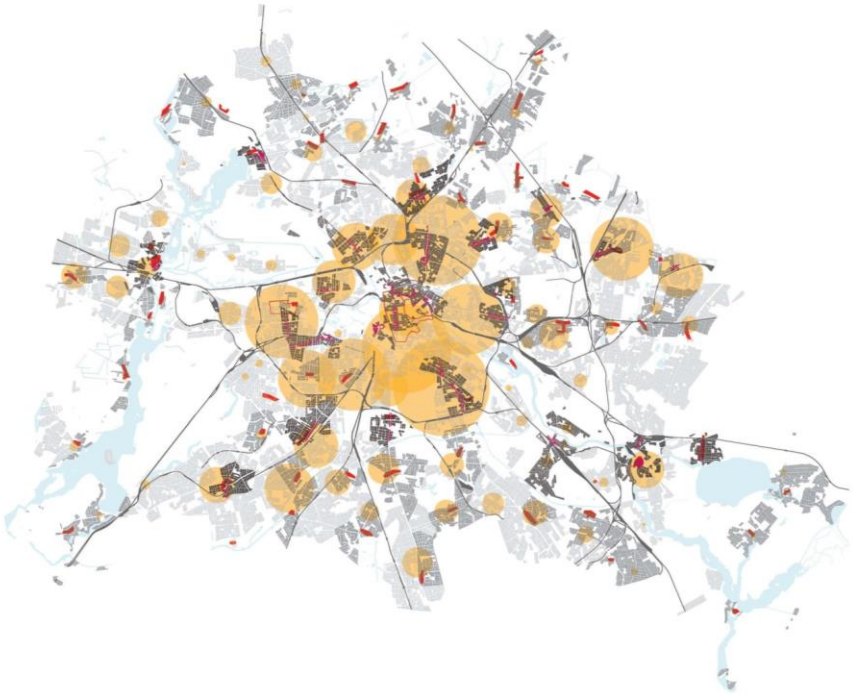
Setting Parameters

Audit Boundaries:

The Audit covers a specific area

Can be whole system or part

Have defined entry & exit points



Setting Parameters

Consistent Units of Measure:

Use Millions of Gallons, or

Megaliters, or

Acre Feet

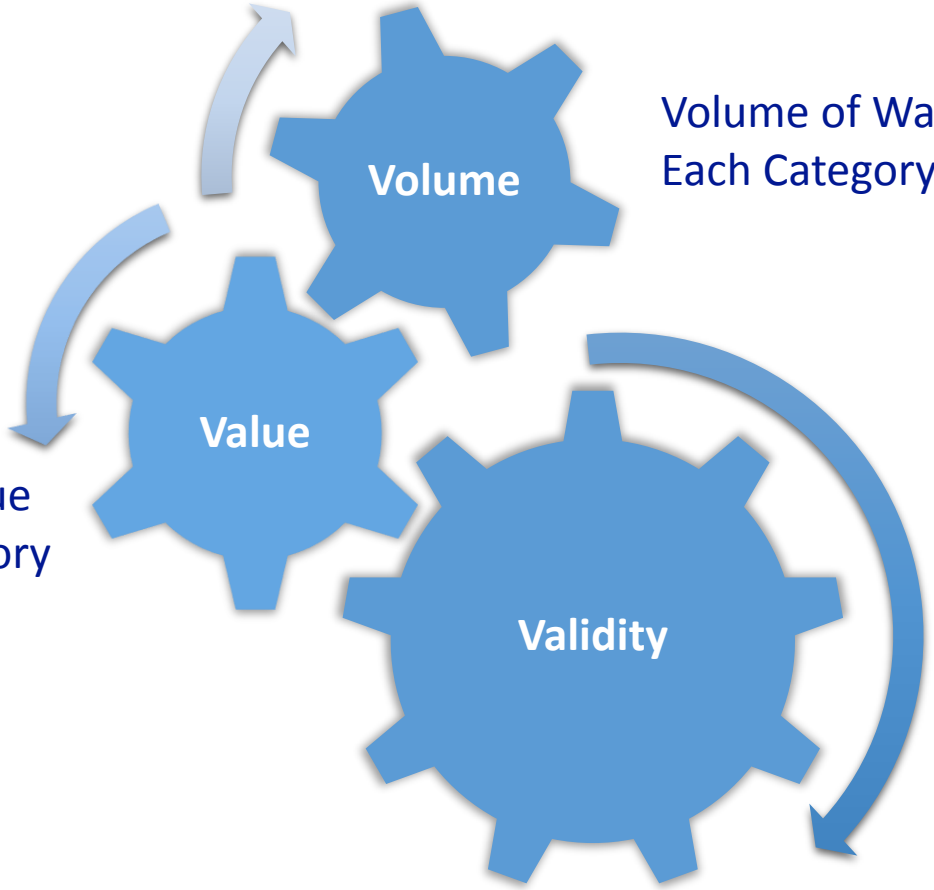
Other information Can Be Helpful (Like Breaks)

Considerations: What Data Do You Have & What is the Quality

START SOMEWHERE
AND
DO WHAT YOU CAN

DON’T LET WHAT YOU CAN’T DO STOP YOU FROM DOING WHAT YOU CAN DO

Outcomes: The Three Vs



Volume of Water in Each Category

Value of Non-Revenue Water in Each Category

Individual Data Grades & Overall Validity Score

Two positive aspects of the water audit and non-revenue water control…..

A Software Preview

Instructions

AWWA Free Water Audit Software v5.0

This spreadsheet-based water audit tool is designed to help quantify and track water losses associated with water distribution systems and identify areas for improved efficiency and cost recovery. It provides a "top-down" summary water audit format, and is not meant to take the place of a full-scale, comprehensive water audit format.

Auditors are strongly encouraged to refer to the most current edition of AWWA M36 Manual for Water Audits for detailed guidance on the water auditing process and targetting loss reduction levels

The spreadsheet contains several separate worksheets. Sheets can be accessed using the tabs towards the bottom of the screen, or by clicking the buttons below.

Please begin by providing the following information

Name of Contact Person:	
Email Address:	
Telephone | Ext.:	
Name of City / Utility:	
City/Town/Municipality:	
State / Province:	Select a state / province from the list
Country:	
Year:	2016 Calendar Year
Audit Preparation Date:	1/12/2017
Volume Reporting Units:	Million gallons (US)
PWSID / Other ID:	NM3536221

The following guidance will help you complete the Audit

All audit data are entered on the ***Reporting Worksheet***

- Value can be entered by user
- Value calculated based on input data
- These cells contain recommended default values

Use of Option (Radio) Buttons: Pcnt: 0.25% Value:

Select the default percentage by choosing the option button on the left

To enter a value, choose this button and enter a value in the cell

The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page

Instructions
The current sheet. Enter contact information and basic audit details (year, units etc)

Reporting Worksheet
Enter the required data on this worksheet to calculate the water balance and data grading

Comments
Enter comments to explain how values were calculated or to document data sources

Performance Indicators
Review the performance indicators to evaluate the results of the audit

Water Balance
The values entered in the Reporting Worksheet are used to populate the Water Balance

Dashboard
A graphical summary of the water balance and Non-Revenue Water components

Grading Matrix
Presents the possible grading options for each input component of the audit

Service Connection Diagram
Diagrams depicting possible customer service connection line configurations

Definitions
Use this sheet to understand the terms used in the audit process

Loss Control Planning
Use this sheet to interpret the results of the audit validity score and performance indicators

Example Audits
Reporting Worksheet and Performance Indicators examples are shown for two validated audits

Acknowledgements
Acknowledgements for the AWWA Free Water Audit Software v5.0

If you have questions or comments regarding the software please contact us via email at: wlc@awwa.org

Reporting Worksheet

AWWA Free Water Audit Software:

Reporting Worksheet

WAS v5.0

? Click to access definition
+ Click to add a comment

Water Audit Report for: << Please enter system details and contact information on the Instructions tab >>
Reporting Year: 2016 1/2016 - 12/2016

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades

<---------- Enter grading in column 'E' and 'J' ---------->

Master Meter and Supply Error Adjustments

			Pcnt:	Value:	
WATER SUPPLIED					
Volume from own sources:	3	19.500 MG/Yr			MG/Yr
Water imported:	n/a	0.000 MG/Yr			MG/Yr
Water exported:	n/a	0.000 MG/Yr			MG/Yr
WATER SUPPLIED:		**19.500** MG/Yr	Enter negative % or value for under-registration Enter positive % or value for over-registration		
AUTHORIZED CONSUMPTION			Click here: ? for help using option buttons below		
Billed metered:	1	18.000 MG/Yr			
Billed unmetered:	1	0.000 MG/Yr			
Unbilled metered:	1	0.030 MG/Yr			
Unbilled unmetered:		0.244 MG/Yr	1.25%		MG/Yr
Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed					
AUTHORIZED CONSUMPTION:		**18.274** MG/Yr	Use buttons to select percentage of water supplied OR value		
WATER LOSSES (Water Supplied - Authorized Consumption)		**1.226** MG/Yr			
Apparent Losses			Pcnt:	Value:	
Unauthorized consumption:		0.049 MG/Yr	0.25%		MG/Yr
Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed					
Customer metering inaccuracies:	1	0.368 MG/Yr	2.00%		MG/Yr
Systematic data handling errors:		0.045 MG/Yr	0.25%		MG/Yr
Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed					
Apparent Losses:		**0.462** MG/Yr			
Real Losses (Current Annual Real Losses or CARL)					
Real Losses = Water Losses - Apparent Losses:		**0.765** MG/Yr			
WATER LOSSES:		**1.226** MG/Yr			
NON-REVENUE WATER					
NON-REVENUE WATER:		**1.500** MG/Yr			
= Water Losses + Unbilled Metered + Unbilled Unmetered					
SYSTEM DATA					
Length of mains:	1	5.0 miles			
Number of active AND inactive service connections:	1	335			
Service connection density:		67 conn./mile main			
Are customer meters typically located at the curbstop or property line?		Yes	(length of service line, beyond the property boundary, that is the responsibility of the utility)		
Average length of customer service line:					
Average length of customer service line has been set to zero and a data grading score of 10 has been applied					
Average operating pressure:	1	60.0 psi			
COST DATA					
Total annual cost of operating water system:	1	$100,000 $/Year			
Customer retail unit cost (applied to Apparent Losses):	1	$3.00 $/1000 gallons (US)			
Variable production cost (applied to Real Losses):	1	$1,921.05 $/Million gallons	☐ Use Customer Retail Unit Cost to value real losses		

WATER AUDIT DATA VALIDITY SCORE:

***** YOUR SCORE IS: 23 out of 100 *****

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

Have you completed an annual water audit?

A. Yes, I have done an annual audit for multiple years using the AWWA Water Audit Software

B. Yes, I have done an annual audit for one year using the AWWA Water Audit Software

C. Yes, I have done an annual audit for one or more years using a different process than the AWWA Water Audit Software

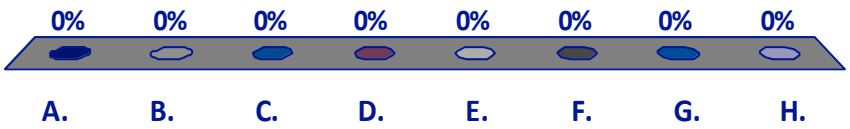
D. I have started a water audit but haven't yet finished

E. I have started a water audit but don't know how to finish it

F. I haven't started a water audit but would like to

G. I haven't started a water audit and don't intend to

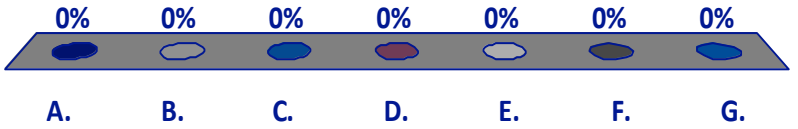
H. I don't know what a water audit is



For water systems only to answer

Have you started any water loss control activities?

A. Yes, I have a robust water loss control program in place
B. Yes, I have started a few activities
C. Yes, I am doing one activity to control water loss
D. No, but I'm thinking of starting some activities
E. No, but I think I might in the future
F. No, I don't think it is necessary for my system
G. No, I'm not sure what water loss control activities are



For water systems only to answer

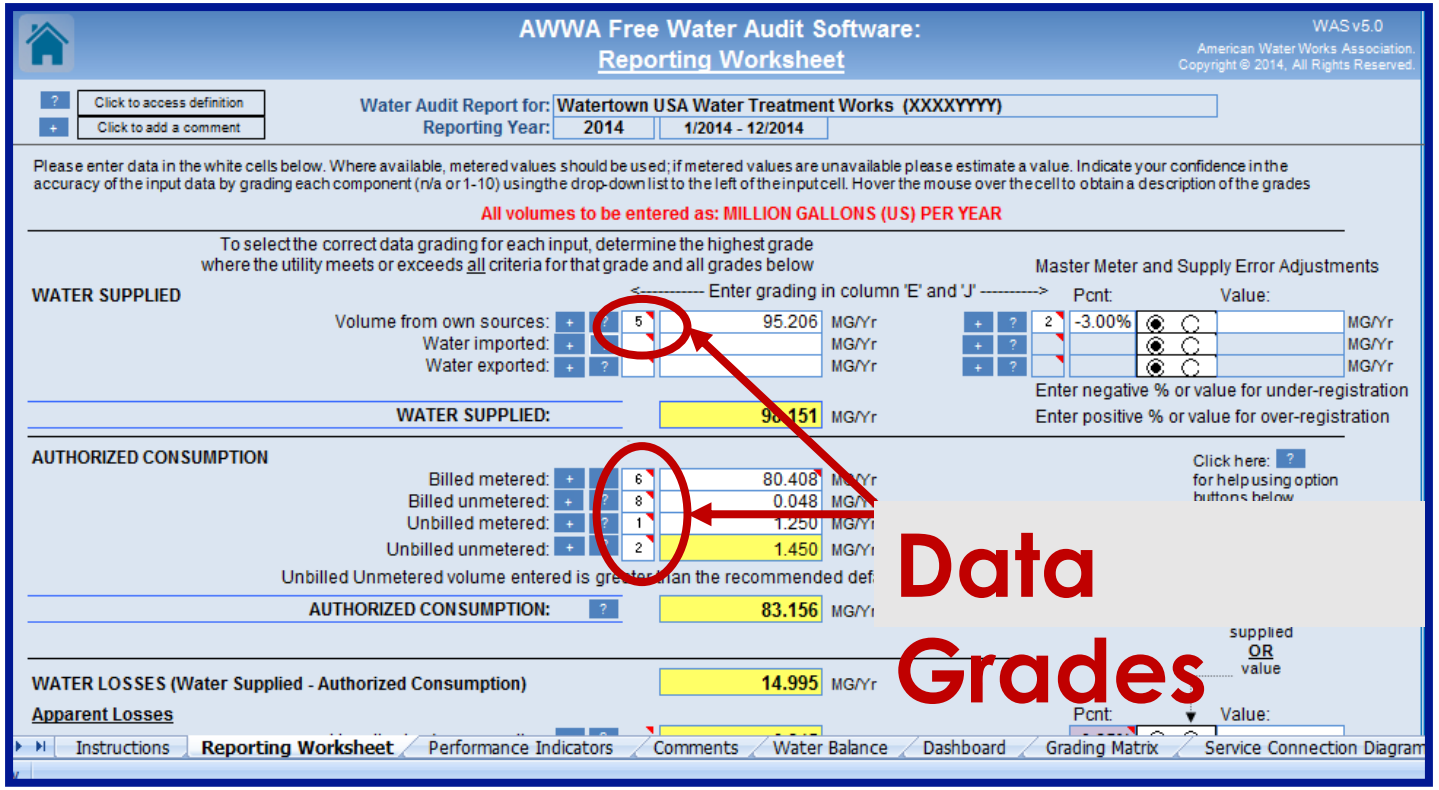
Water Audit Exercise

Water Audit Exercise Results

Break time …

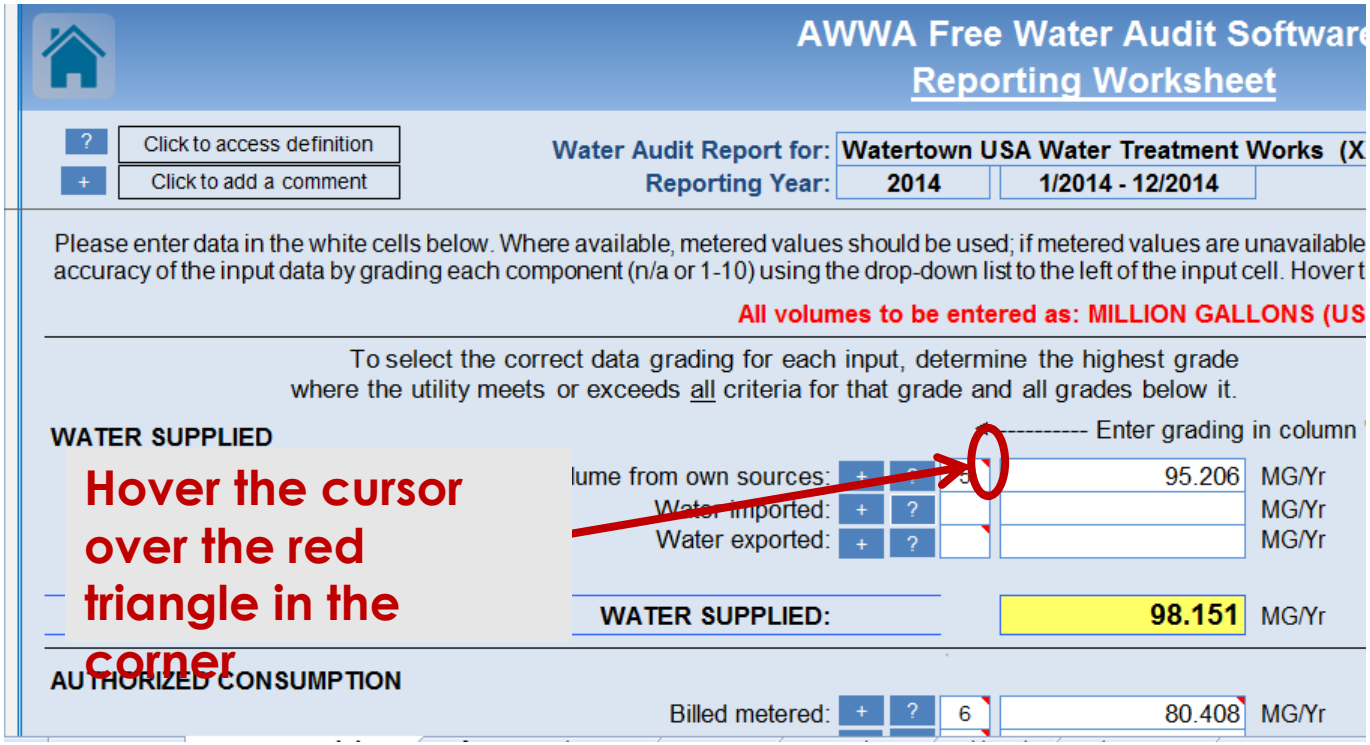
Data Grades

How Do I Judge The Quality of My Data?

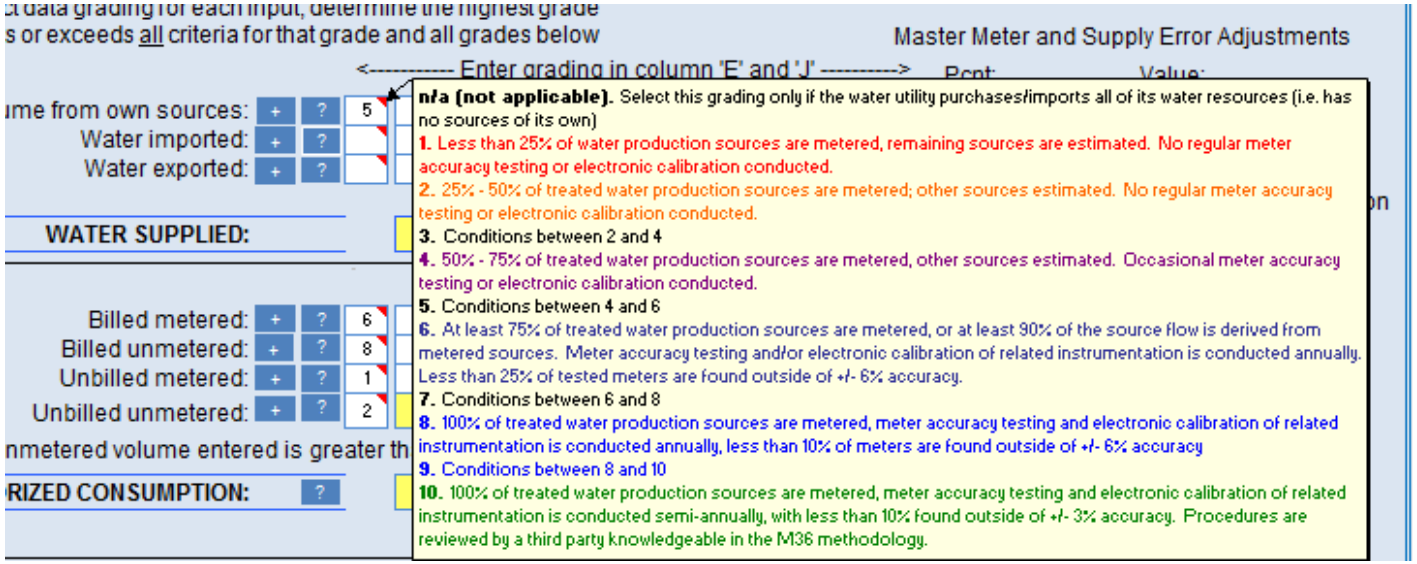


Validating the Data Using Data Grades

What Grade Should I Use?



What Grade Should I Use?

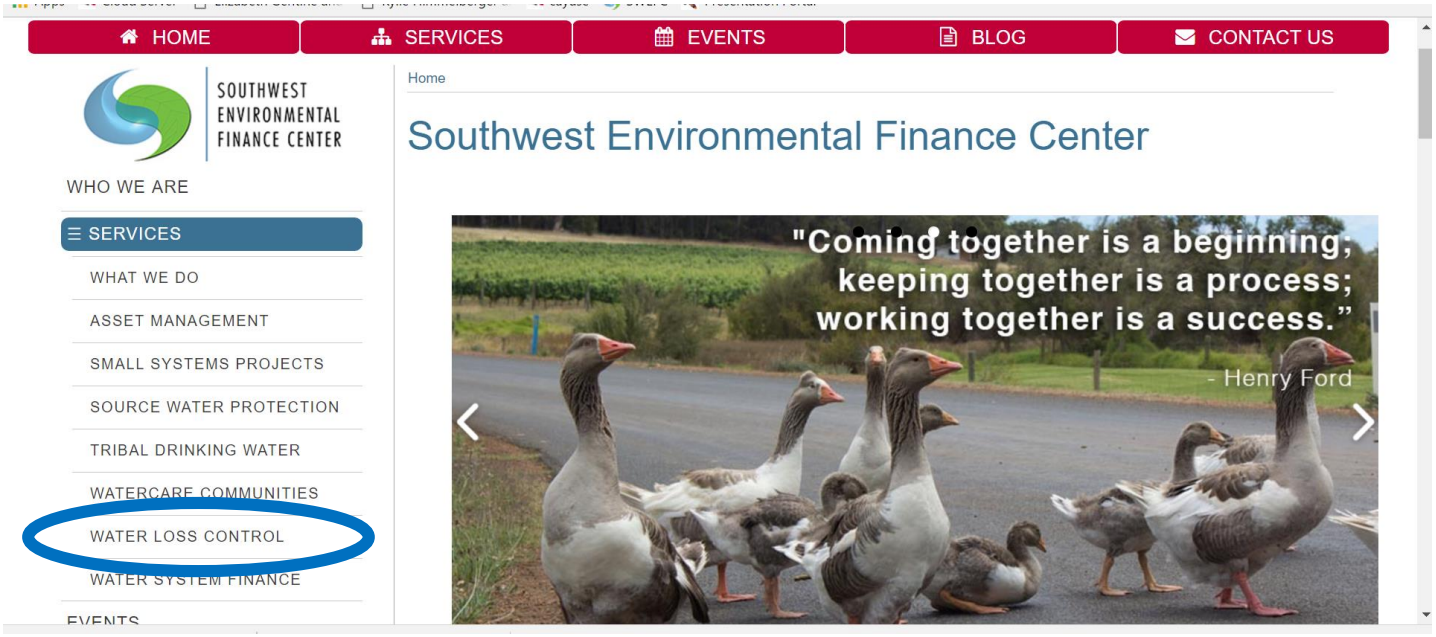


The Data Grades will show up in a pop-up box.

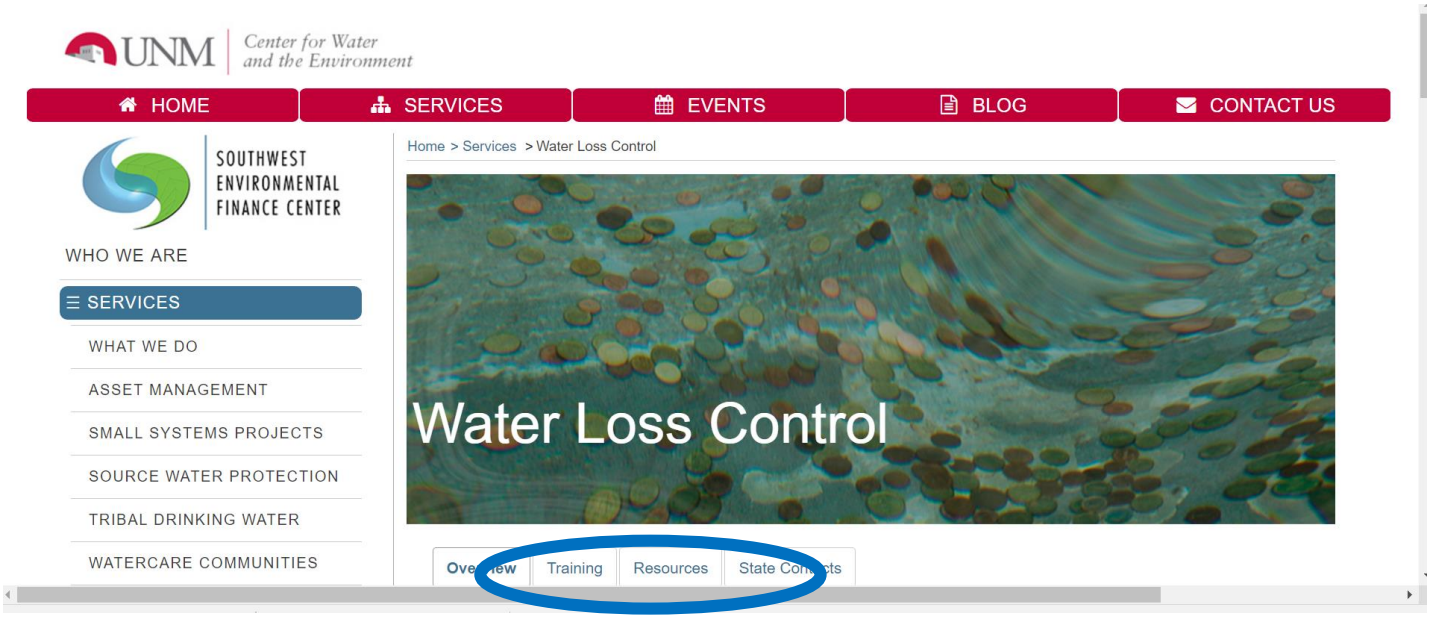
An Easier Way …

Volume from own sources		
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1		Less than 25% of water production sources are metered, remaining sources are estimated.
		No regular meter accuracy testing or electronic calibration conducted.
2		25% - 50% of treated water production sources are metered; other sources estimated.
		No regular meter accuracy testing or electronic calibration conducted.
3		Conditions between 2 and 4
4		50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing or electronic calibration conducted
5		Conditions between 4 and 6
6		At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources.
		Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually.
		Less than 25% of tested meters are found outside of +/- 6% accuracy.
7		Conditions between 6 and 8
8		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		Less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

An Easier Way …



An Easier Way …



An Easier Way …

Apps Cloud Server Elizabeth Gentine and Kylie Himmelberger a cayuse SWEFC Presentation Portal

Recent Posts

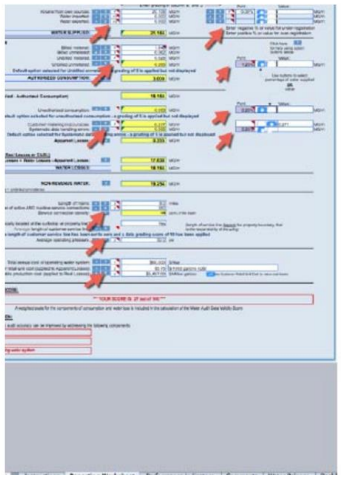
Regulations: Love 'em or Hate 'em, Common Sense or Overreach
Are You Paying Too Much? Understanding your energy rate schedules
Toxic Water – Our Responsibility
Have you seen the electric bill?
Asset Management

Events Calendar

<< Mar 2017 >>

M	T	W	T	F	S	S
27	28	1	2	3	4	5
6	7	8	9	10	11	12
13	14	15	16	17	18	19
20	21	22	23	24	25	26
27	28	29	30	31	1	2

Water Audit Data Grading Sheets



A significant component of the water loss Water Audit Software is data grading. As you will see when you review the AWWA Water Audit software, each data input and output you report in the software is graded for reliability on a scale of 1-10. However, due to the software's Excel format, the data grading criteria are somewhat difficult to read in the spreadsheet. For your convenience we have reproduced the grading criteria and instructions for each input in a Word Document, which can be downloaded HERE.

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below.

The data grades will be entered in columns E and J of the worksheet in cells denoted with a red triangle in their upper right hand corners as shown in the image at the left. Click on the image to expand.

One Sheet Per Data Input

Volume from own sources		
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1		Less than 25% of water production sources are metered, remaining sources are estimated.
		No regular meter accuracy testing or electronic calibration conducted.
2		25% - 50% of treated water production sources are metered; other sources estimated.
		No regular meter accuracy testing or electronic calibration conducted.
3		Conditions between 2 and 4
4		50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing or electronic calibration conducted
5		Conditions between 4 and 6
6		At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources.
		Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually.
		Less than 25% of tested meters are found outside of +/- 6% accuracy.
7		Conditions between 6 and 8
8		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		Less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

Grades: Policy, Practice & Procedure

Volume from own sources		
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1		Less than 25% of water production sources are metered, remaining sources are estimated.
		No regular meter accuracy testing or electronic calibration conducted.
2		25% - 50% of treated water production sources are metered; other sources estimated.
		No regular meter accuracy testing or electronic calibration conducted.
3		Conditions between 2 and 4
4		50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing or electronic calibration conducted
5		Conditions between 4 and 6
6		At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources.
		Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually.
		Less than 25% of tested meters are found outside of +/- 6% accuracy.
7		Conditions between 6 and 8
8		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		Less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

Pull Out Your Data Grade Worksheets

Grades: Policy, Practice & Procedure

Volume from own sources		
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1		Less than 25% of water production sources are metered, remaining sources are estimated.
		No regular meter accuracy testing **or** electronic calibration conducted.
2		25% - 50% of treated water production sources are metered; other sources estimated.
		No regular meter accuracy testing **or** electronic calibration conducted.
3		Conditions between 2 and 4
4		50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing **or** electronic calibration conducted
5		Conditions between 4 and 6
6		At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources.
		Meter accuracy testing **and/or** electronic calibration of related instrumentation is conducted annually.
		Less than 25% of tested meters are found outside of +/- 6% accuracy.
7		Conditions between 6 and 8
8		100% of treated water production sources are metered,
		Meter accuracy testing **and** electronic calibration of related instrumentation is conducted annually,
		Less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

% Metered Sources | Testing Frequency | Meter Accuracy | 3rd Party Review

Each data point has its own criteria:

The Data Grade for Volume of Own Sources:

- % of Sources Metered
- Testing Frequency
- Meter Acuracy
- 3rd Party Review

The Data Grade for Billed Metered is Related to:

- Whether customers receive volume-based billing
- Meter reading practices
- Meter records data handling practices
- Meter replacement practices

How to use the grade sheets:

Volume from own sources		
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1	✓	Less than 25% of water production sources are metered, remaining sources are estimated.
	✓	No regular meter accuracy testing or electronic calibration conducted.
2		25% - 50% of treated water production sources are metered; other sources estimated.
		No regular meter accuracy testing or electronic calibration conducted.
3		Conditions between 2 and 4
4		50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing or electronic
5		Conditions between 4 and 6
6		At least 75% of treated water production sources are metered sources.
		Meter accuracy testing and/or electronic calibrat
		Less than 25% of tested meters are found outs
7		Conditions between 6 and 8
8		100% of treated water production sources are m
		Meter accuracy testing and electronic calibration
		Less than 10% of meters are found outside of +/- 3% accuracy.
9		Conditions between 8 and 10
10		100% of treated water production sources are metered;
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

If you **can** meet or exceed **ALL** the criteria, in the box, move to the next line.

If You **can't** meet or exceed **ALL** of the criteria, move down to the next lower line

How to use the grade sheets: "Conditions Between"

Volume from own sources		
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1	✓	Less than 25% of water production sources are metered, remaining sources are estimated.
	✓	No regular meter accuracy testing or electronic calibration conducted.
2	✓	25% - 50% of treated water production sources are metered; other sources estimated.
	✓	No regular meter accuracy testing or electronic calibration conducted.
3	✓	Conditions between 2 and 4
4	✓	50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing or electronic
5		Conditions between 4 and 6
6		At least 75% of treated water production source metered sources.
		Meter accuracy testing and/or electronic calibrat
		Less than 25% of tested meters are found outs
7		Conditions between 6 and 8
8		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		Less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

If you are able to check **ALL** the boxes on the number below and only **SOME** of the boxes on the number above, choose the "conditions between…" box.

How to use the grade sheets:

Volume from own sources		
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1		Less than 25% of water production sources are metered, remaining sources are estimated.
		No regular meter accuracy testing or electronic calibration conducted.
2		25% - 50% of treated water production sources are metered; other sources estimated.
		No regular meter accuracy testing or electronic calibration conducted.
3		Conditions between 2 and 4
4		50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing or electronic
5		Conditions between 4 and 6
6		At least 75% of treated water production source metered sources.
		Meter accuracy testing and/or electronic calibra
		Less than 25% of tested meters are found outs
7		Conditions between 6 and 8
8		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		Less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

As an example, let's assume we have a system with 60% of the sources metered but they don't do regular testing.

How to use the grade sheets:

Volume from own sources		
GRADE	✓	DESCRIPTION
n/a		Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)
1		Less than 25% of water production sources are metered, remaining sources are estimated.
		No regular meter accuracy testing or electronic calibration conducted.
2		25% - 50% of treated water production sources are metered; other sources estimated.
		No regular meter accuracy testing or electronic calibration conducted.
3		Conditions between 2 and 4
4		50% - 75% of treated water production sources are metered, other sources estimated.
		Occasional meter accuracy testing or electronic
5		Conditions between 4 and 6
6		At least 75% of treated water production source metered sources.
		Meter accuracy testing and/or electronic calibra
		Less than 25% of tested meters are found outs
7		Conditions between 6 and 8
8		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted annually,
		Less than 10% of meters are found outside of +/- 6% accuracy
9		Conditions between 8 and 10
10		100% of treated water production sources are metered,
		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than 10% found outside of +/- 3% accuracy.
		Procedures are reviewed by a third party knowledgeable in the M36 methodology

With our example, 60% metered and no meter testing, what grade?

A New (Beta) Grading Tool …

Southwest Environmental Finance Center

WATER LOSS AUDIT DATA VALIDITY WORKSHEET

BETA Ver. 0.4 Date: 4/12/2017
ADAPTED FROM THE AWWA WATER AUDIT SOFTWARE 2016

	A	B	C	D
5	**DV01**	**VOLUME FROM OWN SOURCES:**		
6	**No.**	**Question**	**Answer (Select most appropriate answer from pull down menu):**	
7	1	Does your utility import/purchase ALL of it's water supply (i.e.utility has no sources of its own)		
8	2	What percentage of your water production sources are metered?		
9	3	How often are the meters tested and/or calibrated for accuracy?		
10	4	If you test your meters, how accurate are they?		
11	5	Are your procedures reviewed by a 3rd party knowledgeable about M36 methodology?		
12			**Data Validity Score:**	**0**
13				
14	**DV02**	**VOLUME FROM OWN SOURCES MASTER METER AND SUPPLY ERROR ADJUSTMENT:**		
15	**No.**	**Question**	**Answer (Select most appropriate answer from pull down menu):**	
16	1	Are your sources of supply metered?		
17	2	How are tank/storage elevation changes employed in calculating 'volume from own sources' component?		
18	3	How is your production supply volume logged and reviewed?		
19	4	How and when is source meter data adjusted to account for error?		
20	5	N/A - Leave answer field blank		
21			**Data Validity Score:**	**0**

A New (Beta) Grading Tool …

Southwest Environmental Finance Center

WATER LOSS AUDIT DATA VALIDITY WORKSHEET

BETA Ver. 0.4 Date: 4/12/2017
ADAPTED FROM THE AWWA WATER AUDIT SOFTWARE 2016

DV01	VOLUME FROM OWN SOURCES:		
No.	Question	Answer (Select most appropriate answer from pull down menu):	
1	Does your utility import/purchase ALL of it's water supply (i.e.utility has no sources of its own)	1 - Yes (SKIP REST OF QUESTION 1 AND PROCEED TO DV03)	
2	N/A - Leave answer field blank		
3	N/A - Leave answer field blank		
4	N/A - Leave answer field blank		
5	N/A - Leave answer field blank		
		Data Validity Score:	N/A

DV02	VOLUME FROM OWN SOURCES MASTER METER AND SUPPLY ERROR ADJUSTMENT:		
No.	Question	Answer (Select most appropriate answer from pull down menu):	
1	N/A - Leave answer field blank		
2	N/A - Leave answer field blank		
3	N/A - Leave answer field blank		
4	N/A - Leave answer field blank		
5	N/A - Leave answer field blank		
		Data Validity Score:	N/A

A New (Beta) Grading Tool …

Southwest Environmental Finance Center

GRADING MATRIX:

DATA VALIDITY SCORE SHEET

BETA Ver. 0.11 Date: 9/19/2017

ADAPTED FROM THE AWWA WATER AUDIT SOFTWARE 2016

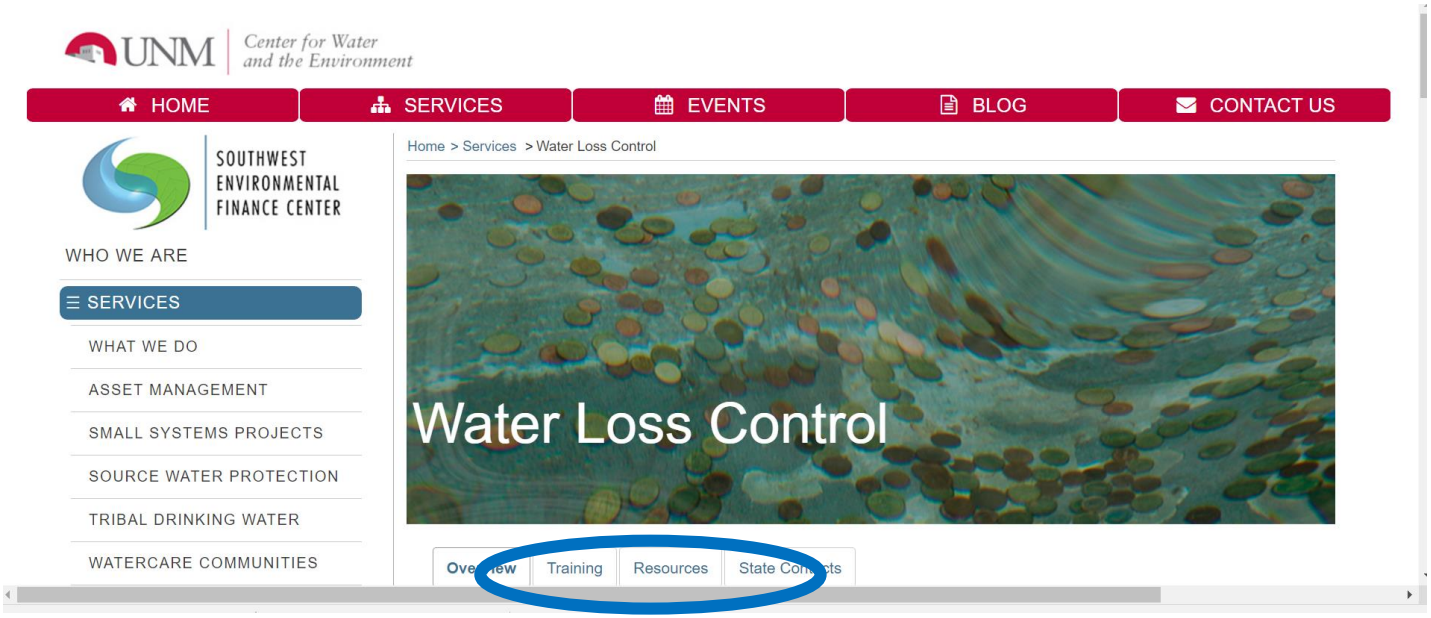
	CATEGORY	CELL IN AWWA SOFTWARE	SCORE
DV01	VOLUME FROM OWN SOURCES:	E15	3
DV02	VOLUME FROM OWN SOURCES MASTER METER AND SUPPLY ERROR ADJUSTMENT:	J15	2
DV03	WATER IMPORTED:	E16	N/A
DV04	WATER IMPORTED MASTER METER AND SUPPLY ERROR ADJUSTMENT:	J16	N/A
DV05	WATER EXPORTED:	E17	N/A
DV06	WATER EXPORTED MASTER METER AND SUPPLY ERROR ADJUSTMENT:	J17	N/A
DV07	BILLED METERED:	E23	5
DV08	BILLED UNMETERED:	E24	0
DV09	UNBILLED METERED:	E25	0
DV10	UNBILLED UNMETERED:	E26	0
DV11	UNAUTHORIZED CONSUMPTION:	E38	0
DV12	CUSTOMER METERING INACCURACIES:	E42	0

A Comparison …

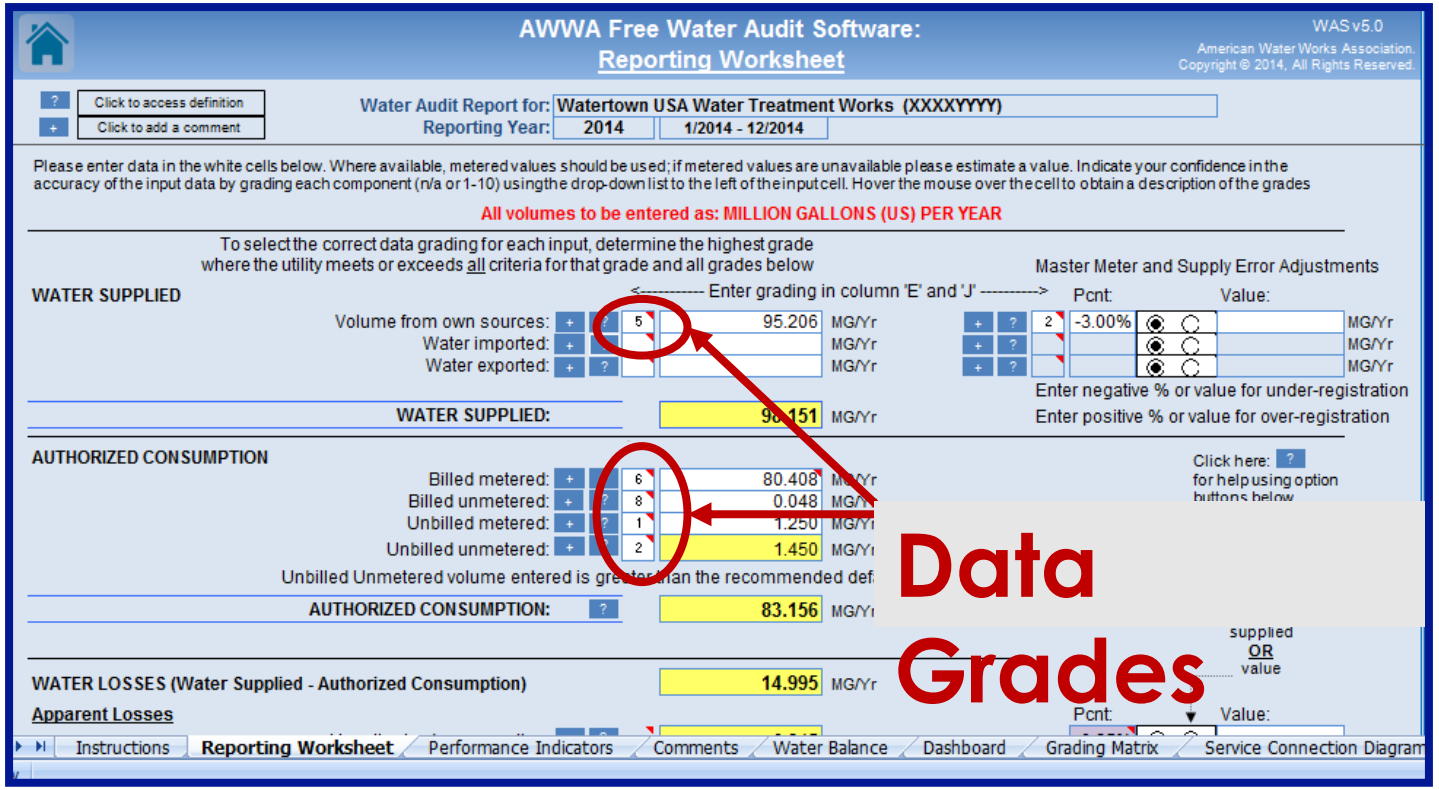
Length of Mains		
GRADE	✓	DESCRIPTION
1	✓	Poorly assembled and maintained paper as-built records of existing water main installations makes accurate determination of system pipe length impossible. Length of mains is guesstimated.
2	✓	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments).
	✓	Poor procedures to ensure that new water mains installed by developers are accurately documented.
3	✓	Conditions between 2 and 4
4		Sound written policy and procedures exist for documenting new water main installations, but gaps in management result in an uncertain degree of error in tabulation of mains length.
5		Conditions between 4 and 6
6		Sound written policy and procedures exist for permitting and commissioning new water mains.
		Highly accurate paper records with regular field validation; or electronic records and asset management system in good condition.
		Includes system backup.
7		Conditions between 6 and 8
8		Sound written policy and procedures exist for permitting and commissioning new water mains.
		Electronic recordkeeping such as a Geographical Information System (GIS) and asset management system are used to store and manage data.
9		Conditions between 8 and 10
10		Sound written policy exists for managing water mains extensions and replacements.
		Geographic Information System (GIS) data and asset management database agree and random field validation proves truth of databases.
		Records of annual field validation should be available for review

DV14	LENGTH OF MAINS:		
No.	Question	Answer (Select most appropriate answer from pull down menu):	
1	Are your utility records of existing water main installations paper or electronic?	1 - Paper (as built)	
2	What is the condition of your paper records?	2 - Fair - Maintained but in poor or uncertain condition	
3	How are the lengths of your water mains calculated?	2 - Lengths are documented during installation/removal but error rate is uncertain due to poor record keeping and tabulation	
4	Are installations and abandonments tracked on an at least annual basis?	1 - No	
5	Does your utility have and follow sound written policies and procedures for:		
	a) accurately documenting new mains installations BY DEVELOPERS?	2 - Yes	
	b) permitting and comissioning new mains installations?	1 - No	
	c) managing mains extensions and replacements?	1 - No	
6	Does your utility confirm the accuracy of your paper records with random field validation?	1 - No	
7	No further questions - continue to DV 15 below.	1 - No	
		Data Validity Score:	3

A New (Beta) Grading Tool …



Entering Your Data Grades:



Be Honest About Grading

¹hon·est \'ä-nəst\ *adj* [ME, fr. AF, fr. L *honestus* honorable, fr. *honos, honor* honor] **1** : free from deception : TRUTHFUL; *also* : GENUINE, REAL **2** : REPUTABLE **3** : CREDITABLE ⟨an ~ day's work⟩ **4** : marked by integrity **5** : FRANK ◆ ***Synonyms*** UPRIGHT, JUST, CONSCIENTIOUS, HONORABLE — **hon·est·ly** *adv* — **hon·es·ty** \-nə-stē\ *n*

The right data grade accurately reflects your practices.

Overall Data Validity Score

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0
American Water Works Assoc
Copyright © 2014, All Rights Res

? Click to access definition
\+ Click to add a comment

Water Audit Report for: Watertown USA Water Treatment Works (XXXXYYYY)
Reporting Year: 2014 1/2014 - 12/2014

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 49 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Unbilled metered
3: Customer metering inaccuracies

Your Data Validity Score

Overall Data Validity Score

B C D E F G H I J K L M N O

AWWA Free Water Audit Software:
Reporting Worksheet

WAS
American Water Works A
Copyright © 2014, All Rights

? Click to access definition
+ Click to add a comment

Water Audit Report for: Green Valley Water System (XXXXXXXX)
Reporting Year: 2012 1/2012 - 12/2012

COST DATA

Total annual cost of operating water system:	4	$400,000	$/Year	
Customer retail unit cost (applied to Apparent Losses):	1	$2.00	$/1000 gallons (US)	
Variable production cost (applied to Real Losses):	1	$2,000.00	$/Million gallons	☐ Use Customer Retail Unit Cost to value real losse

Retail costs are less than (or equal to) production costs; please review and correct if necessary

WATER AUDIT DATA VALIDITY SCORE:

Add a grading value for 2 parameter(s) to enable an audit score to be calculated

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Billed metered
3: Billed unmetered

If you miss any grades you will get a message

What Response To Low Scores?

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.
American Water Works Asso
Copyright © 2014, All Rights Res

? Click to access definition
\+ Click to add a comment

Water Audit Report for: Watertown USA Water Treatment Works (XXXXYYYY)
Reporting Year: 2014 1/2014 - 12/2014

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 49 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Unbilled metered
3: Customer metering inaccuracies

Overall Data Validity Score

AWWA Free Water Audit Software:
Reporting Worksheet

WAS v5.0
American Water Works Assoc
Copyright © 2014, All Rights Res

? Click to access definition
\+ Click to add a comment

Water Audit Report for: Watertown USA Water Treatment Works (XXXXYYYY)
Reporting Year: 2014 1/2014 - 12/2014

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 49 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Unbilled metered
3: Customer metering inaccuracies

Priority Areas for Increasing Validity Score

Grading Matrix For Action

AWWA Free Water Audit Software: Grading Matrix — American Water Works Association

The grading assigned to each audit component and the corresponding recommended improvements and actions are highlighted in yellow. Audit accuracy is likely to be improved by prioritizing those items shown in red

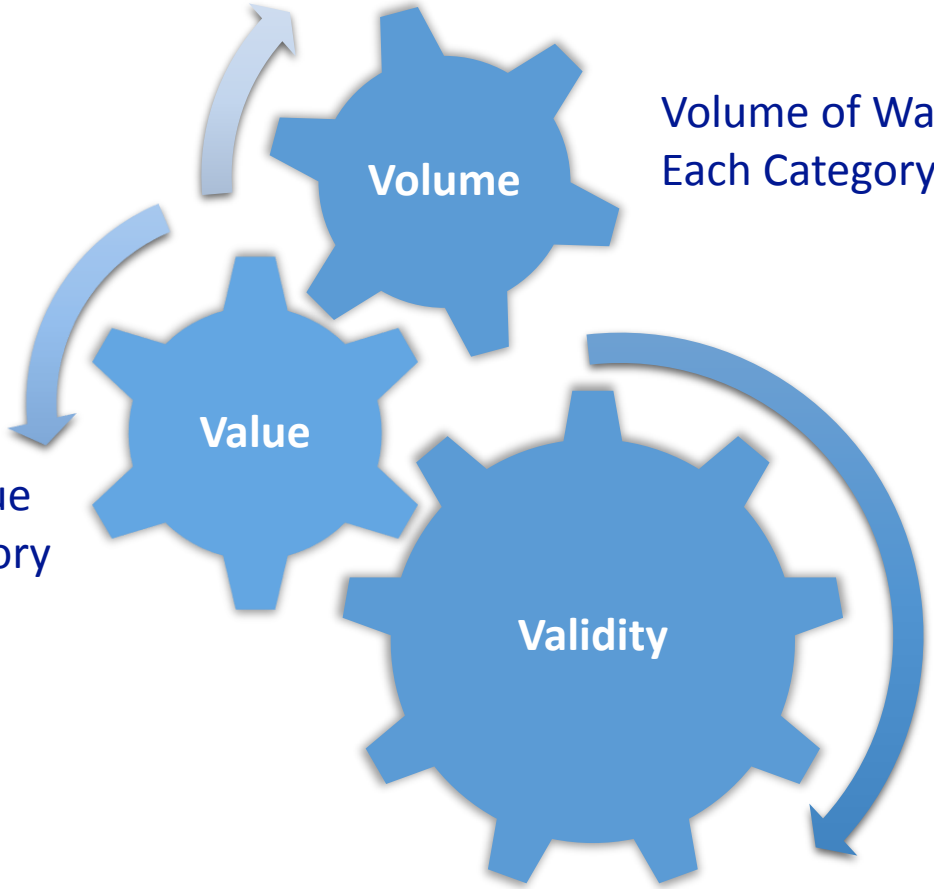
Grading >>>	n/a	1	2	3	4	5	6	7	8	9
WATER SUPPLIED										
Volume from own sources:	Select this grading only if the water utility purchases/imports all of its water resources (i.e. has no sources of its own)	Less than 25% of water production sources are metered, remaining sources are estimated. No regular meter accuracy testing or electronic calibration conducted.	25% - 50% of treated water production sources are metered; other sources estimated. No regular meter accuracy testing or electronic calibration conducted.	Conditions between 2 and 4	50% - 75% of treated water production sources are metered, other sources estimated. Occasional meter accuracy testing or electronic calibration conducted.	Conditions between 4 and 6	At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from metered sources. Meter accuracy testing and/or electronic calibration of related instrumentation is conducted annually. Less than 25% of tested meters are found outside of +/- 6% accuracy.	Conditions between 6 and 8	100% of treated water production sources are metered, meter accuracy testing and electronic calibration of related instrumentation is conducted annually; less than 10% of meters are found outside of +/- 6% accuracy	Conditions bet 8 and 10
Improvements to attain higher data grading for "Volume from own Sources" component:		to qualify for 2: Organize and launch efforts to collect data for determining volume from own sources	to qualify for 4: Locate all water production sources on maps and in the field, launch meter accuracy testing for existing meters, begin to install meters on unmetered water production sources and replace any obsolete/defective meter		to qualify for 6: Formalize annual meter accuracy testing for all source meters; specify the frequency of testing. Complete installation of meters on unmetered water production sources and complete replacement of all obsolete/defective meters.		to qualify for 8: Conduct annual meter accuracy testing and calibration of related instrumentation on all meter installations on a regular basis. Complete project to install new, or replace defective existing, meters so that entire production meter population is metered. Repair or replace meters outside of +/- 6% accuracy.		to qualify for 10: Maintain annual meter accuracy testing and calibrati related instrumentation for all meter installations. Re replace meters outside of +/- 3% accuracy. Investigat meter technology; pilot one or more replacements v innovative meters in attempt to further improve met accuracy.	
Volume from own sources master meter and supply error adjustment:	Select n/a only if the water utility fails to have meters on its sources of supply	Inventory information on meters and paper records of measured volumes exist but are incomplete and/or in a very crude condition; data error cannot be determined	No automatic datalogging of production volumes; daily readings are scribed on paper records without any accountability controls. Flows are not balanced across the water distribution system: tank/storage elevation changes are not employed in calculating the "Volume from own sources" component and archived flow data	Conditions between 2 and 4	Production meter data is logged automatically in electronic format and reviewed at least on a monthly basis with necessary corrections implemented. "Volume from own sources" tabulations include estimate of daily changes in tanks/storage facilities. Meter data is adjusted when gross data errors occur, or occasional meter testing	Conditions between 4 and 6	Hourly production meter data logged automatically & reviewed on at least a weekly basis. Data is adjusted to correct gross error when meter/instrumentation equipment malfunction is detected; and/or error is confirmed by meter accuracy testing. Tank/storage facility elevation changes are automatically used in calculating a balanced "Volume from own sources"	Conditions between 6 and 8	Continuous production meter data is logged automatically & reviewed each business day. Data is adjusted to correct gross error from detected meter/instrumentation equipment malfunction and/or results of meter accuracy testing. Tank/storage facility elevation changes are automatically used in "Volume from own sources" tabulations and data	Conditions bet 8 and 10

Instructions | Reporting Worksheet | Performance Indicators | Comments | Water Balance | Dashboard | **Grading Matrix** | Service Connection Diagram | ...

Ready Calculate 80%

Action Items For Improving Individual Grades

Remember: The Three Vs



Volume of Water in Each Category

Value of Non-Revenue Water in Each Category

Individual Data Grades & Overall Validity Score

Questions?

DATA GRADING EXERCISE

Data Grading Results

Lets Look at the audit for Green Village:

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0
American Water Works Association.

Click to access definition
Click to add a comment

Water Audit Report for: Green Village Water Utility (ssssxxx)
Reporting Year: 2016 7/2015 - 6/2016

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

Master Meter and Supply Error Adjustments

WATER SUPPLIED <---------- Enter grading in column 'E' and 'J' ----------> Pcnt: Value:

Volume from own sources:	3	9.710	MG/Yr	2	5.00%		MG/Yr
Water imported:			MG/Yr				MG/Yr
Water exported:			MG/Yr				MG/Yr
WATER SUPPLIED:		**9.248**	MG/Yr				

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION

Click here: ? for help using option buttons below

				Pcnt:	Value:	
Billed metered:	3	5.010	MG/Yr			
Billed unmetered:			MG/Yr			
Unbilled metered:	1	0.500	MG/Yr			
Unbilled unmetered:		0.116	MG/Yr	1.25%		MG/Yr
AUTHORIZED CONSUMPTION:		**5.626**	MG/Yr			

Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed

Use buttons to select percentage of water supplied OR value

WATER LOSSES (Water Supplied - Authorized Consumption) **3.622** MG/Yr

Apparent Losses

				Pcnt:	Value:	
Unauthorized consumption:	3	0.015	MG/Yr		0.015	MG/Yr
Customer metering inaccuracies:	1	0.290	MG/Yr	5.00%		MG/Yr
Systematic data handling errors:		0.013	MG/Yr	0.25%		MG/Yr
Apparent Losses:		**0.318**	MG/Yr			

Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed

Real Losses (Current Annual Real Losses or CARL)

Real Losses = Water Losses - Apparent Losses:		**3.304**	MG/Yr
WATER LOSSES:		**3.622**	MG/Yr

NON-REVENUE WATER

NON-REVENUE WATER:		**4.238**	MG/Yr

= Water Losses + Unbilled Metered + Unbilled Unmetered

SYSTEM DATA

Length of mains:	2	2.5	miles	
Number of active AND inactive service connections:	3	111		
Service connection density:		44	conn./mile main	
Are customer meters typically located at the curbstop or property line?		Yes		
Average length of customer service line:				(length of service line, beyond the property boundary, that is the responsibility of the utility)

Average length of customer service line has been set to zero and a data grading score of 10 has been applied

Average operating pressure:	1	50.0	psi	

COST DATA

Total annual cost of operating water system:	3	$60,000	$/Year	
Customer retail unit cost (applied to Apparent Losses):	5	$1.69	$/1000 gallons (US)	
Variable production cost (applied to Real Losses):	3	$492.00	$/Million gallons	Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 30 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Billed metered
3: Unbilled metered

Green Village: Results Review…

Water Audit Report for: **Green Village Water Utility (ssssxxx)**
Reporting Year: **2016** **7/2015 - 6/2016**

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 30 out of 100 ***

System Attributes:

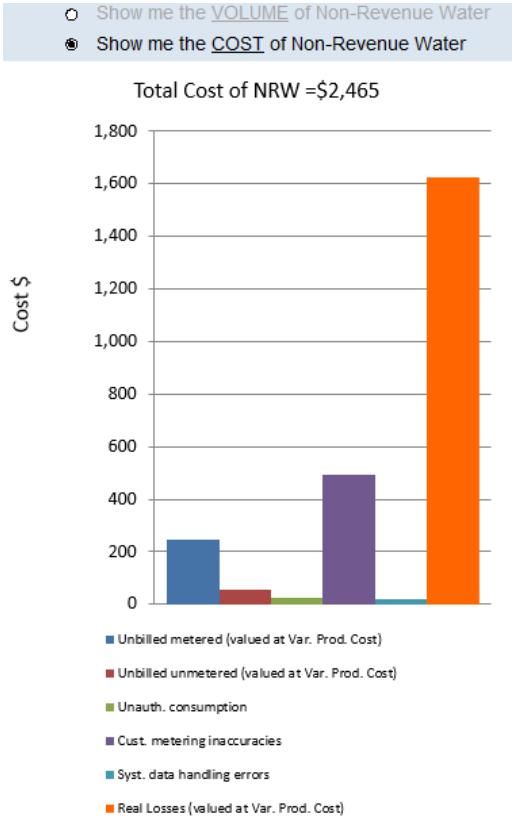
	Apparent Losses:	0.318	MG/Yr
+	Real Losses:	3.304	MG/Yr
=	**Water Losses:**	**3.622**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$537	
	Annual cost of Real Losses:	$1,626	Valued at **Variable Production Cost**

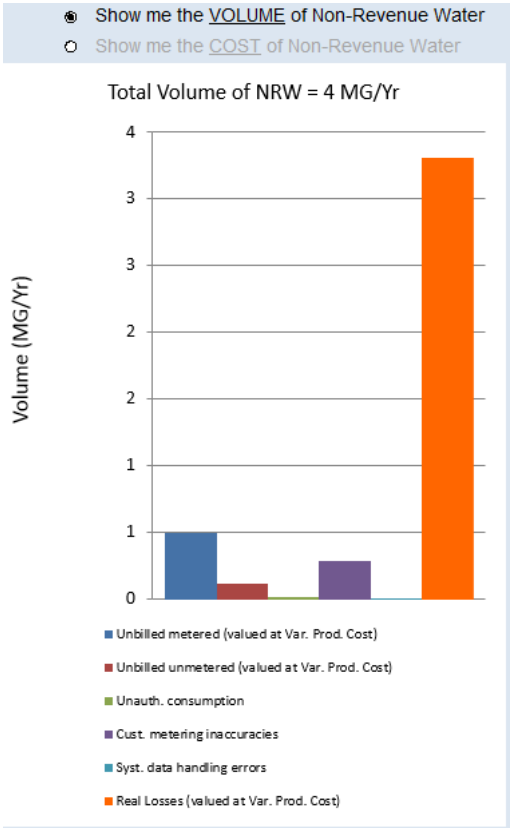
Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	45.8%	
	Non-revenue water as percent by cost of operating system:	4.1%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	7.84	gallons/connection/day
	Real Losses per service connection per day:	81.56	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	1.63	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	3.30	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		

Green Village: Results Review…





Let's look at the audit for Town Water:

AWWA Free Water Audit Software: Reporting Worksheet

WAS v5.0
American Water Works Association
Copyright © 2014, All Rights Reserved.

Click to access definition
Click to add a comment

Water Audit Report for: Town Water Utility (ssssxxx)
Reporting Year: 2016 7/2015 - 6/2016

Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable please estimate a value. Indicate your confidence in the accuracy of the input data by grading each component (n/a or 1-10) using the drop-down list to the left of the input cell. Hover the mouse over the cell to obtain a description of the grades

All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds all criteria for that grade and all grades below it.

<---------- Enter grading in column 'E' and 'J' ---------->

Master Meter and Supply Error Adjustments

WATER SUPPLIED			Pcnt:	Value:	
Volume from own sources:	5	485.210 MG/Yr	1.81%		MG/Yr
Water imported:		MG/Yr			MG/Yr
Water exported:	4	104.570 MG/Yr	1.00%		MG/Yr
WATER SUPPLIED:		**373.049** MG/Yr			

Enter negative % or value for under-registration
Enter positive % or value for over-registration

AUTHORIZED CONSUMPTION			Pcnt:	Value:	
Billed metered:	6	203.650 MG/Yr			
Billed unmetered:		MG/Yr			
Unbilled metered:	5	65.000 MG/Yr			
Unbilled unmetered:	3	12.300 MG/Yr		12.300	MG/Yr
AUTHORIZED CONSUMPTION:		**280.950** MG/Yr			

Click here: ? for help using option buttons below

Unbilled Unmetered volume entered is greater than the recommended default value

Use buttons to select percentage of water supplied OR value

WATER LOSSES (Water Supplied - Authorized Consumption)			Pcnt:	Value:	
		92.099 MG/Yr			
Apparent Losses					
Unauthorized consumption:		0.933 MG/Yr	0.25%		MG/Yr
Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed					
Customer metering inaccuracies:	3	14.139 MG/Yr	5.00%		MG/Yr
Systematic data handling errors:		0.509 MG/Yr	0.25%		MG/Yr
Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed					
Apparent Losses:		**15.581** MG/Yr			
Real Losses (Current Annual Real Losses or CARL)					
Real Losses = Water Losses - Apparent Losses:		**76.518** MG/Yr			
WATER LOSSES:		**92.099** MG/Yr			

NON-REVENUE WATER		
NON-REVENUE WATER:		**169.399** MG/Yr
= Water Losses + Unbilled Metered + Unbilled Unmetered		

SYSTEM DATA			
Length of mains:	3	87.0	miles
Number of active AND inactive service connections:	5	4,429	
Service connection density:		51	conn./mile main
Are customer meters typically located at the curbstop or property line?		Yes	
Average length of customer service line:			(length of service line, beyond the property boundary, that is the responsibility of the utility)
Average length of customer service line has been set to zero and a data grading score of 10 has been applied			
Average operating pressure:	1	60.0	psi

COST DATA			
Total annual cost of operating water system:	10	$1,872,000	$/Year
Customer retail unit cost (applied to Apparent Losses):	8	$3.39	$/1000 gallons (US)
Variable production cost (applied to Real Losses):	7	$598.00	$/Million gallons ☐ Use Customer Retail Unit Cost to value real losses

WATER AUDIT DATA VALIDITY SCORE:

*** YOUR SCORE IS: 56 out of 100 ***

A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score

PRIORITY AREAS FOR ATTENTION:

Based on the information provided, audit accuracy can be improved by addressing the following components:

1: Volume from own sources
2: Customer metering inaccuracies
3: Billed metered

Town Water: Results Review …

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0
American Water Works Association.

Water Audit Report for: Town Water Utility (ssssxxx)
Reporting Year: 2016 7/2015 - 6/2016

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 56 out of 100 ***

System Attributes:

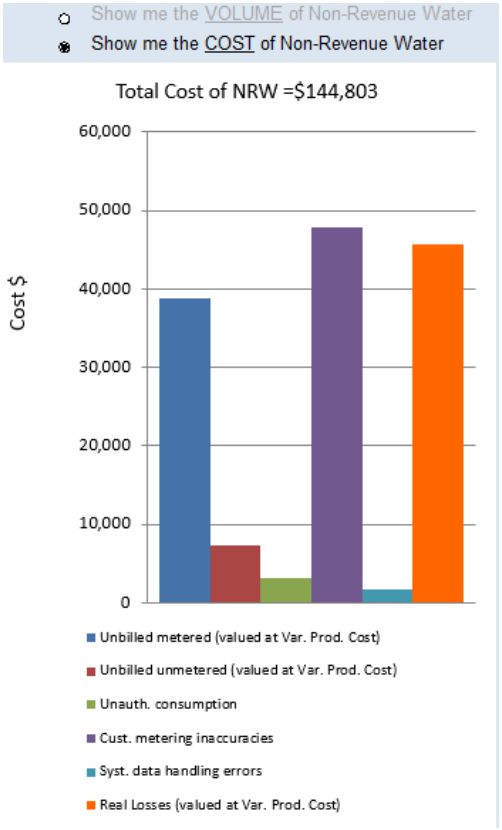
	Apparent Losses:	15.581	MG/Yr
+	Real Losses:	76.518	MG/Yr
=	**Water Losses:**	**92.099**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	24.86	MG/Yr
	Annual cost of Apparent Losses:	$52,820	
	Annual cost of Real Losses:	$45,758	Valued at **Variable Production Cost**

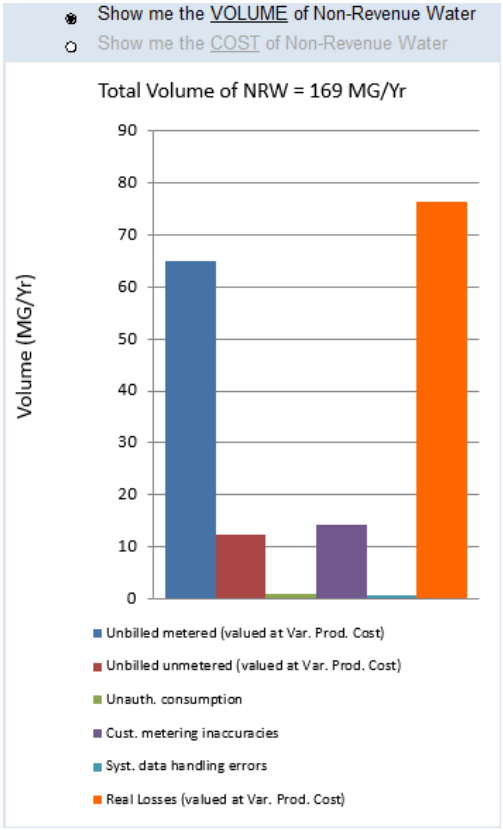
Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	45.4%	
	Non-revenue water as percent by cost of operating system:	7.7%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	9.64	gallons/connection/day
	Real Losses per service connection per day:	47.33	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.79	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	76.52	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	3.08	

Town Water: Results Review …





Break time …

Best Starting Place: Assemble Your Data

Consider: Data Wasn't Developed for Water Audit Purposes

DATA ISSUES: NOTICE ANYTHING?

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

WAS v5.0

Water Audit Report for: Waterville Water Utility (ssssxxx)
Reporting Year: 2016 7/2015 - 6/2016

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 57 out of 100 ***

System Attributes:

	Apparent Losses:	22.875	MG/Yr
+	Real Losses:	(60.126)	MG/Yr
=	**Water Losses:**	**(37.251)**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	24.86	MG/Yr
	Annual cost of Apparent Losses:	$77,546	
	Annual cost of Real Losses:	-$35,955	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

Financial:	Non-revenue water as percent by volume of Water Supplied:	-6.7%	
	Non-revenue water as percent by cost of operating system:	2.6%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	14.15	gallons/connection/day
	Real Losses per service connection per day:	-37.19	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	-0.62	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	-60.13	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	-2.42	

* This performance indicator applies for systems with a low service connection density of less than 32 service connections/mile of pipeline

I Completed My Water Audit: Now What?

Perform water balance to determine nature of NRW

Examine Data Validity: Is overall data validity high enough? Are there issues in the data?

Look at Volumes and Values of NRW components

Prioritize activities to address values and volumes of NRW components

Perform water balance to determine nature of NRW

Assume this is completed.

Examine Data Validity: Is overall data validity high enough? Are there issues in the data?

Let's focus here for a moment

Prioritize activities to address values and volumes of NRW components

and Values of NRW components

Metrics Screening

Screening Range

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 47 out of 100 ***

>50 (validated score)

Metrics Screening

			Screening Range
Non-revenue water as percent by volume of Water Supplied:	29.5%		>50 (validated score)
Non-revenue water as percent by cost of operating system:	38.7%	Real Losses valued at Var	
Apparent Losses per service connection per day:	10.92	gallons/connection/day	
Real Losses per service connection per day:	94.57	gallons/connection/day	20 – 200
Real Losses per length of main per day*:	N/A		400 – 4000
Real Losses per service connection per day per psi pressure:	0.63	gallons/connection/day/psi	
rom Above, Real Losses = Current Annual Real Losses (CARL):	110.46	million gallons/year	
? Infrastructure Leakage Index (ILI) [CARL/UARL]:	2.28		2 – 10

for systems with a low service connection density of less than 32 service connections/mile of pipeline

Perform water balance to determine nature of NRW

Assume this is completed.

Examine Data Validity: Is overall data validity high enough? Are the[illegible]s in the

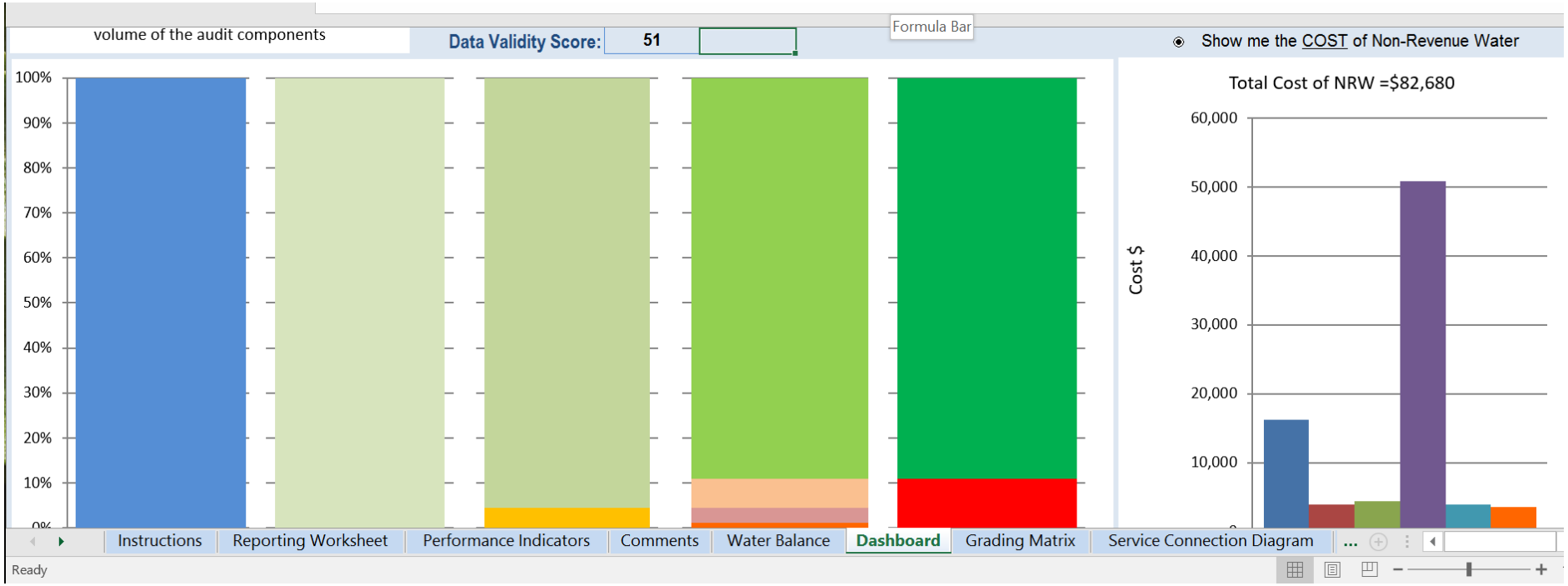
Assume this is good enough.

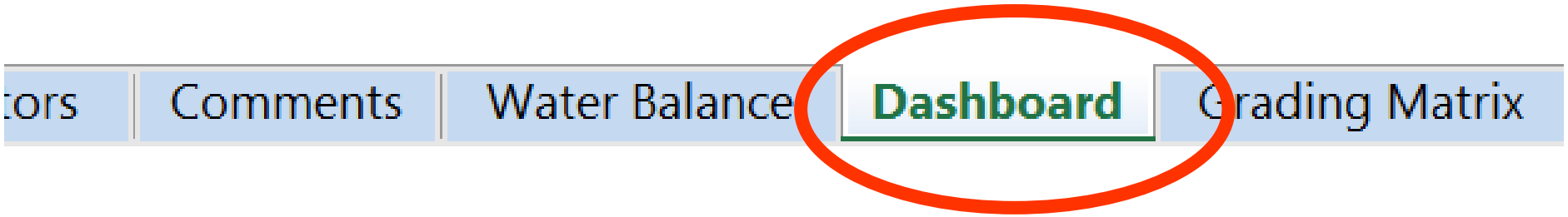
Prioritize [illegible]tiviti to addres[illegible] and vol[illegible] NRW

Let's focus here for a moment

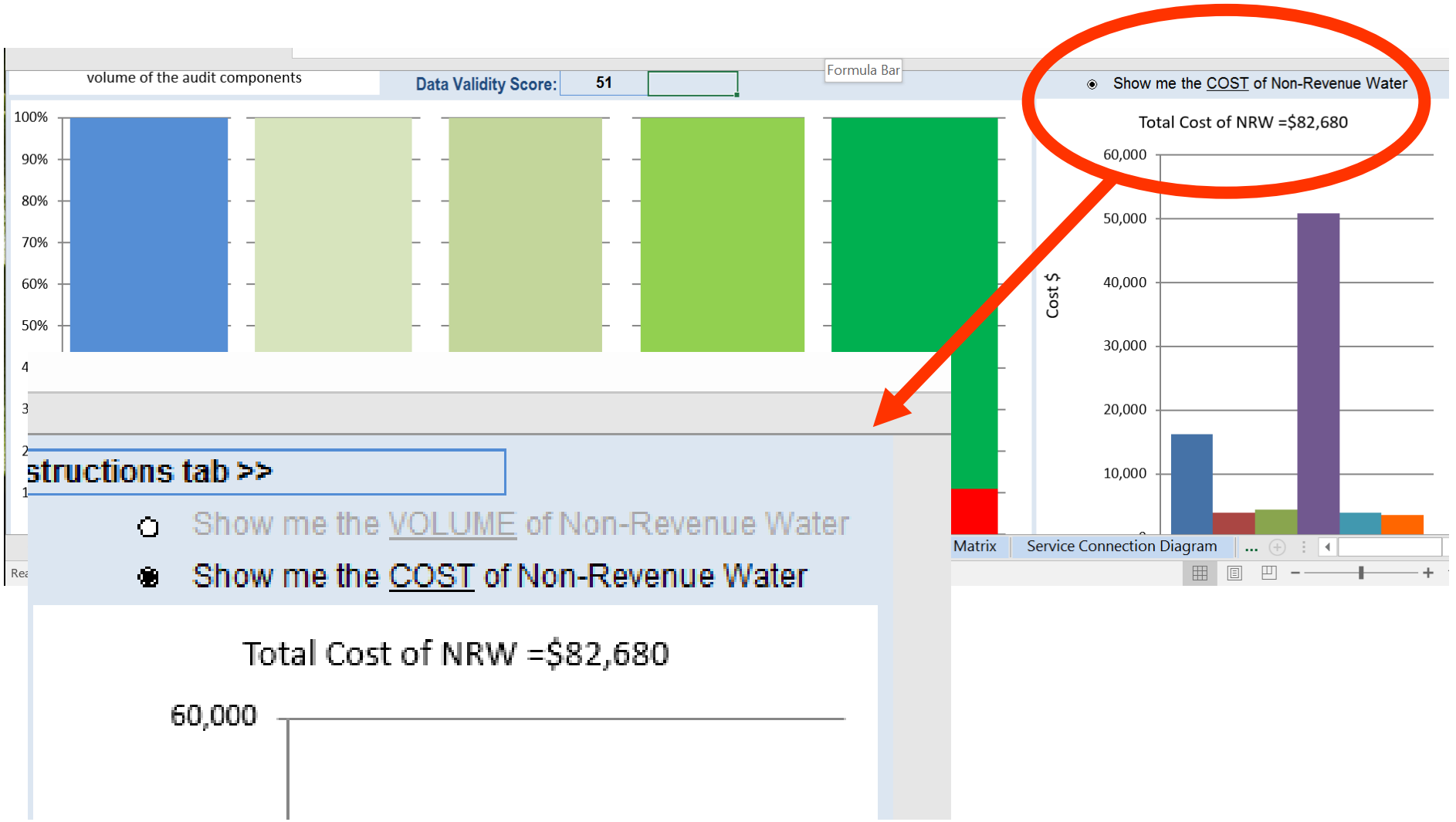
Look at Volumes and Values of NRW components

Select Dashboard on the bottom menu

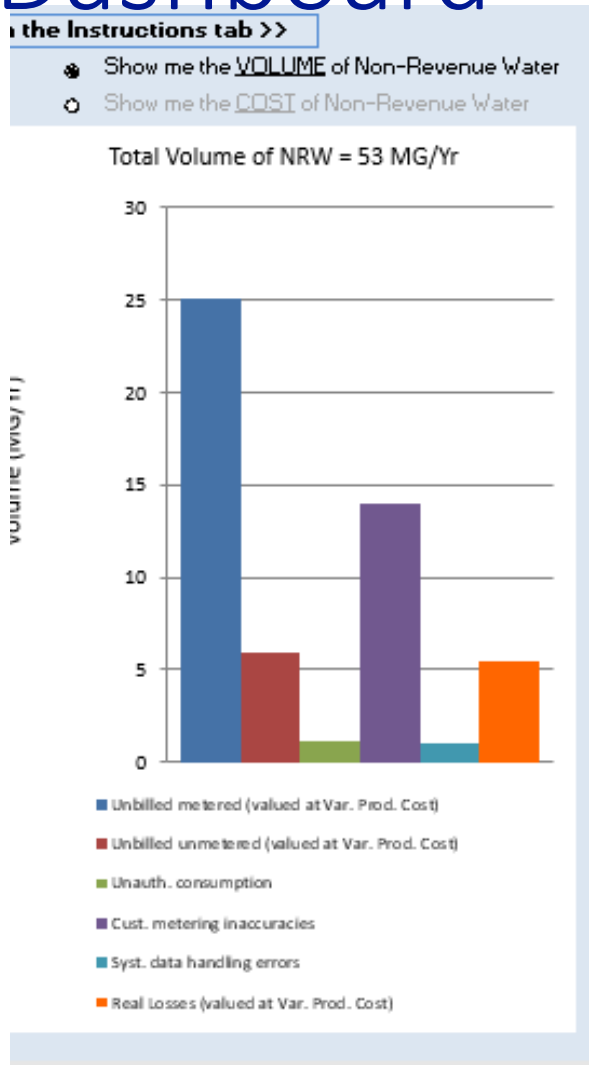




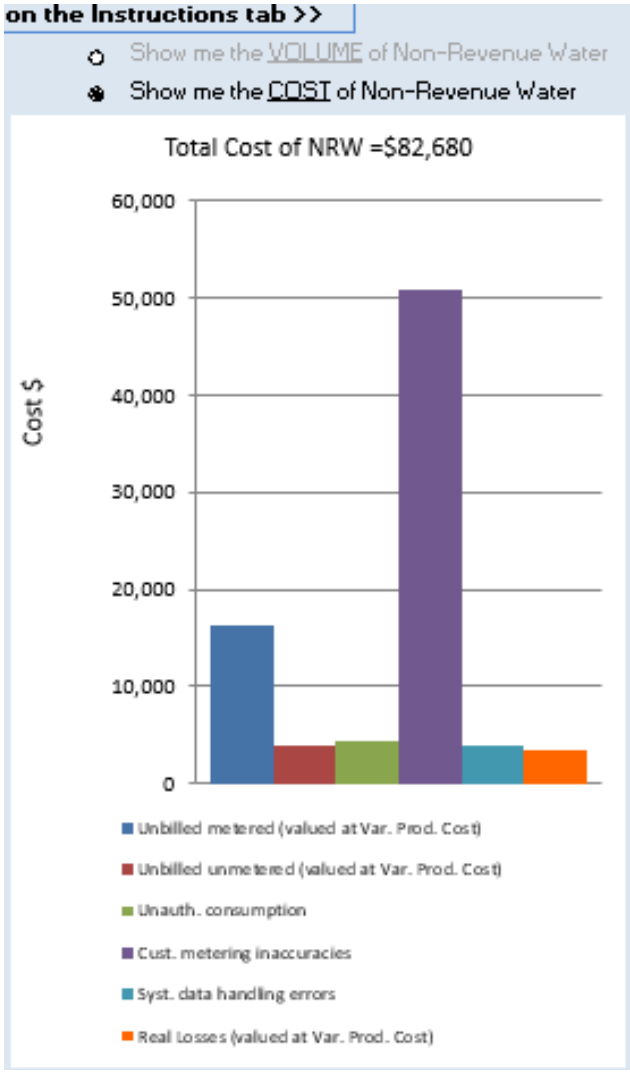
Select Volumes or Cost (value)



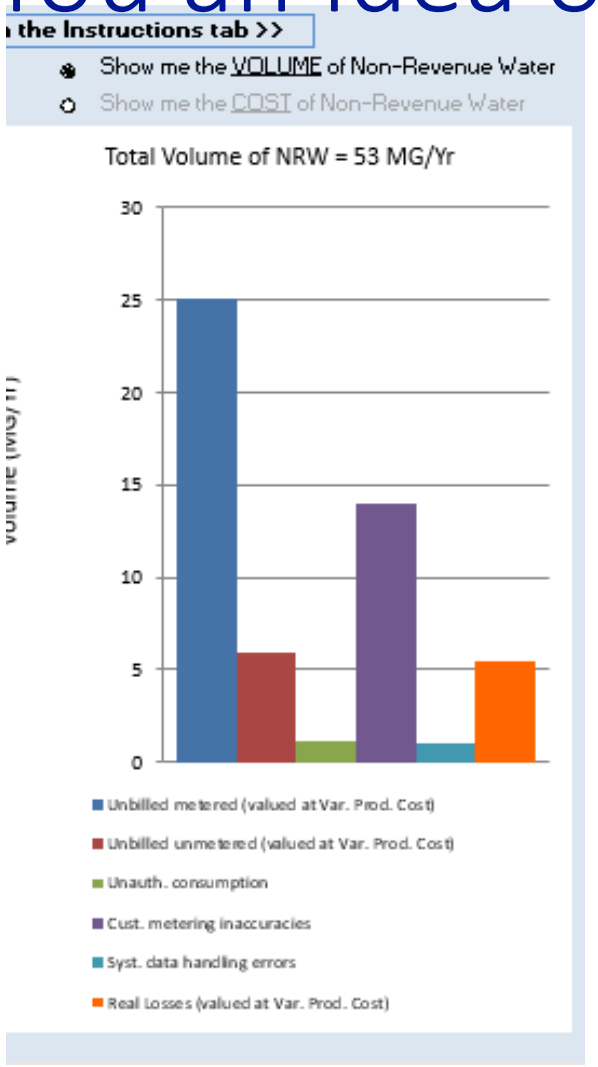
Look at Values and volumes from Dashboard



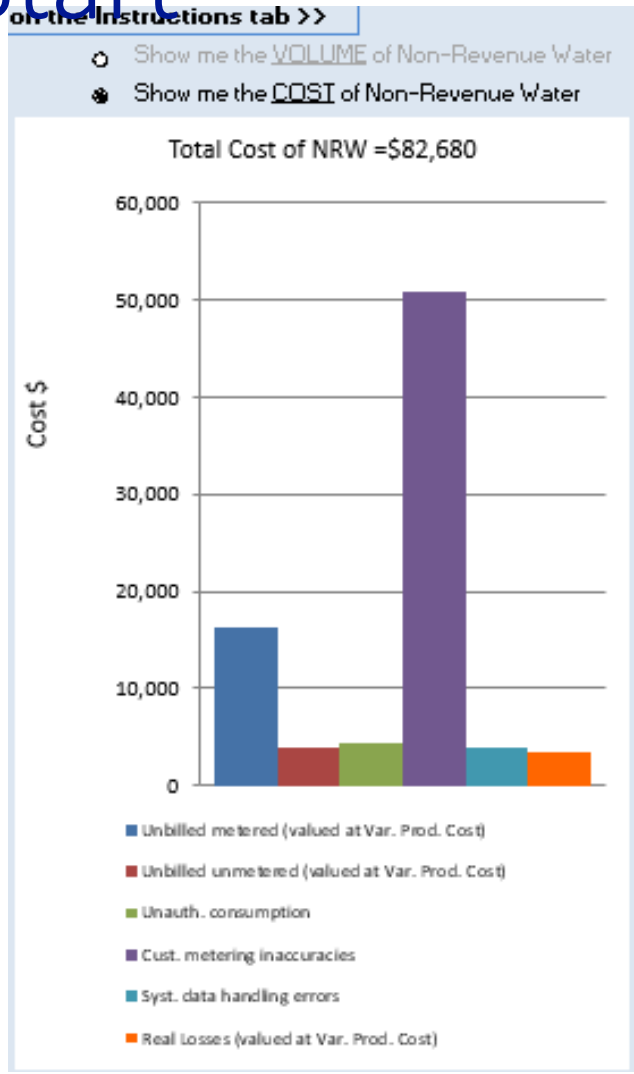
The highest volume and value (cost) don't always match!



Results of Values and Volumes Give You an Idea of Where to Start



What is most important? Saving Water, Saving Money?



Perform water balance to determine nature of NRW

Assume this is completed.

Examine Data Validity: Is overall data validity high enough? Are the[illegible]s in the

Assume this is good enough.

Let's focus here for a moment

Prioritize activities to address values and volumes of NRW components

[illegible]umes
[illegible]d Valu[illegible]RW

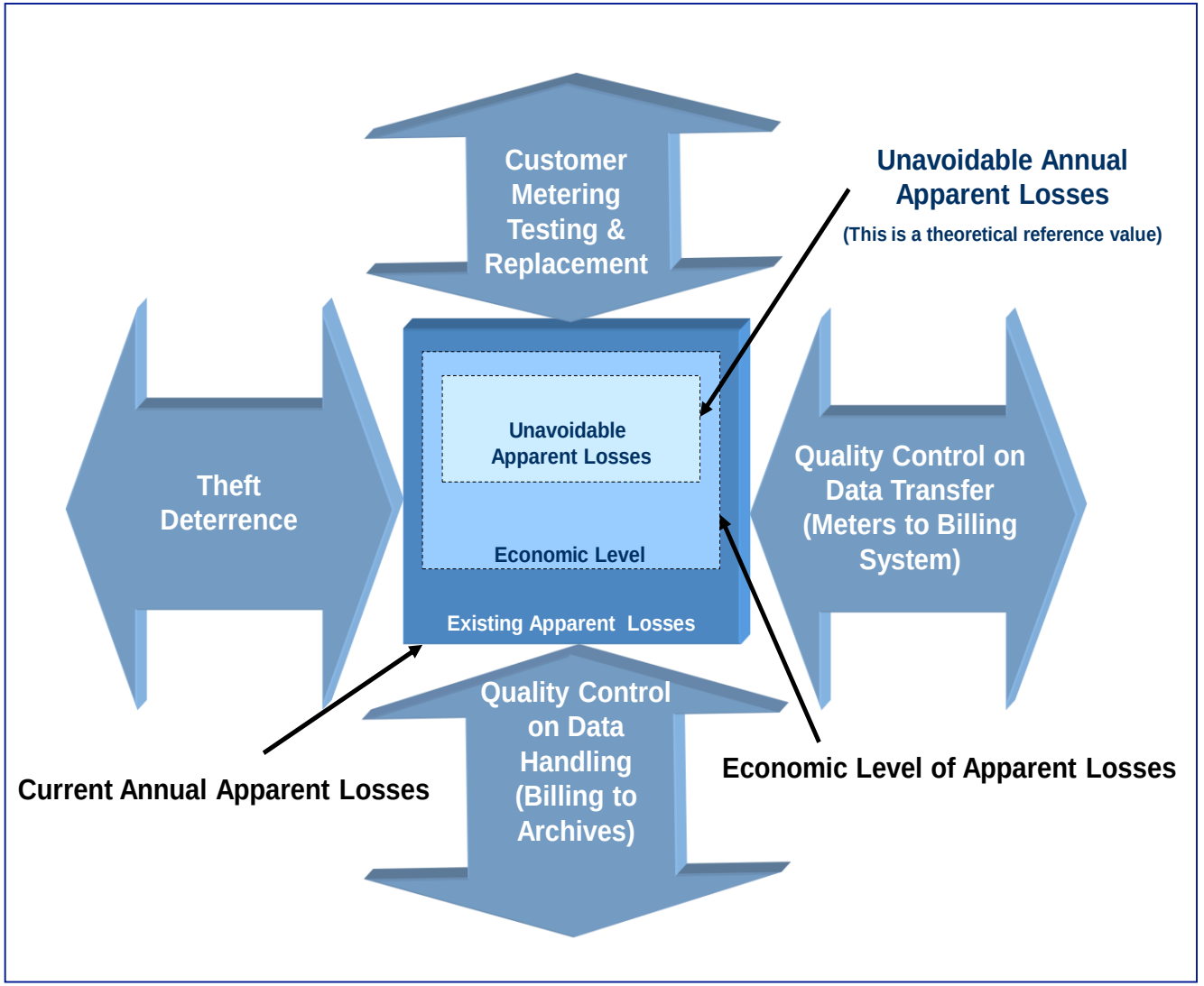
Assume you understand values and volumes of the NRW Components

Words of Wisdom

There is no single ‘silver bullet’ to leakage control. Water utilities need to have an ample ‘toolbox’ of leakage control tools and know when to use each tool in the right amount.”

George Kunkel, AWWA M36 Manual Chair

The Four Pillars of Apparent Losses Control

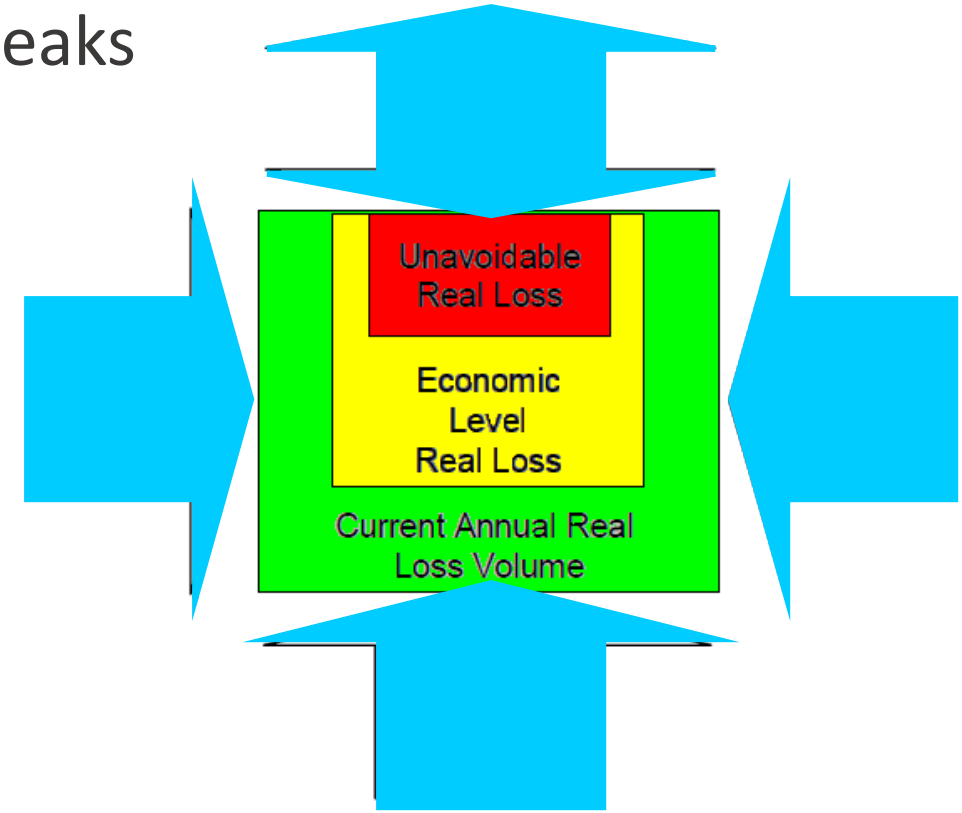


Source: AWWA M36 Publication

Addressing Real Losses

Ways to reduce real losses

1. Respond faster to known leaks
2. Asset Management
3. Reduce pressure
4. Find hidden leaks



Helps to Address	The Toolbox (Basic)	Cost Range
Data Validity, Data Results Out of Range	1 - Validation of supply & consumption volumes; Look for Data Grade Improvements	Low-Mid
Validity, Billed Unmetered Use, Unbilled Unmetered Use	2 - Estimating and tracking unmetered use	Low
Validity	3 – Master Meter Annual Testing Program	Low - Mid
Validity; Other Benefits Related to Asset Inventory & Management	4 – Mapping the System	Low - Mid
Authorized, Unbilled usage	5 – Review Policies & Procedures for unbilled customers	Low
Unbilled unmetered	6 - Unidirectional flushing program	Low
Unbilled Unmetered Use	7 - Installing meters on unmetered connections	Mid
Customer metering inaccuracy	8 - Meter testing & replacement	Mid-High
Unauthorized Use	9 - Theft Deterrence	Low - Mid
Systematic Data Handling Errors	10 - Billing system audit	Low-Mid
Real Losses	11 – Collecting & Analyzing Break Data	Low
Real Losses	12 - Improve speed/quality of repairs	Low
Real Losses	13 - Locate & eliminate pressure transients (surges, water hammer)	Low-Mid
Real Losses	14 – Night Flow Analysis	Mid
Real Losses	15 - Reduce peak and overall pressure	Mid-High
Real Losses: Leakage on Mains	16 – Main Replacement	High
Real Losses: Leakage on Services	17 – Service Replacement	Mid - High
Real Losses: Unreported Leaks	18 - Acoustic leak survey	Mid
Real Losses: Overflows and Leakage on Storage Tanks	19 – Tank Management, Data Collection, & Inspection	Low

TOOLS FOR TYPES OF PIPE LOSSES

The Toolbox (Basic)	Type of Real Loss Addressed	Cost Range
11 – Collecting & Analyzing Break Data	Reported Leaks	Low
12 - Improve speed/quality of repairs	Hidden Leaks, Reported Leaks	Low
13 - Locate & eliminate pressure transients (surges, water hammer)	Unavoidable Leaks, Hidden Leaks, Reported Leaks	Low-Mid
14 – Night Flow Analysis	Unavoidable Leaks, Hidden Leaks	Mid
15 - Reduce peak and overall pressure	Unavoidable Leaks, Hidden Leaks, Reported Leaks	Mid-High
16 – Main Replacement	Unavoidable Leaks, Hidden Leaks, Reported Leaks	High
17 – Service Replacement	Hidden Leaks, Reported Leaks	Mid - High
18 - Acoustic leak survey	Hidden Leaks	Mid

AWWA Free Water Audit Software:
System Attributes and Performance Indicators

Water Audit Report for: Town Water Utility (ssssxxx)
Reporting Year: 2016 7/2015 - 6/2016

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 56 out of 100 ***

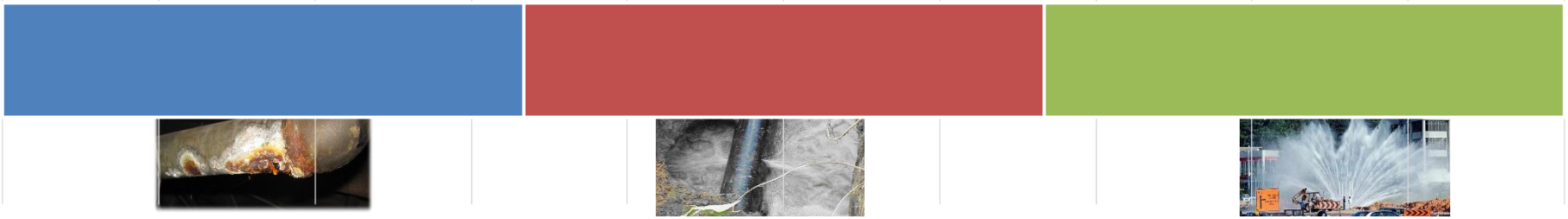
System Attributes:

	Apparent Losses:	15.581	MG/Yr
+	Real Losses:	76.518	MG/Yr
=	**Water Losses:**	**92.099**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	24.86	MG/Yr
	Annual cost of Apparent Losses:	$52,820	
	Annual cost of Real Losses:	$45,758	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

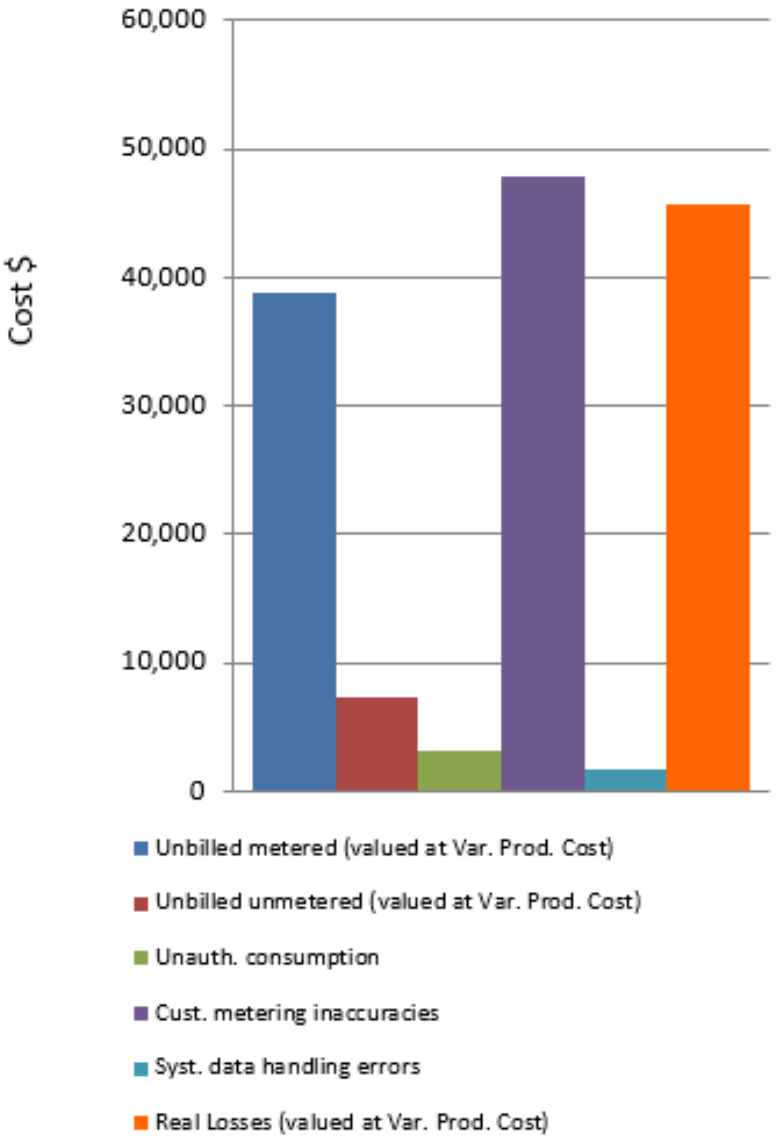
Financial:	Non-revenue water as percent by volume of Water Supplied:	45.4%	
	Non-revenue water as percent by cost of operating system:	7.7%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	9.64	gallons/connection/day
	Real Losses per service connection per day:	47.33	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	0.79	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	76.52	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:	3.08	



○ Show me the VOLUME of Non-Revenue Water

◉ Show me the COST of Non-Revenue Water

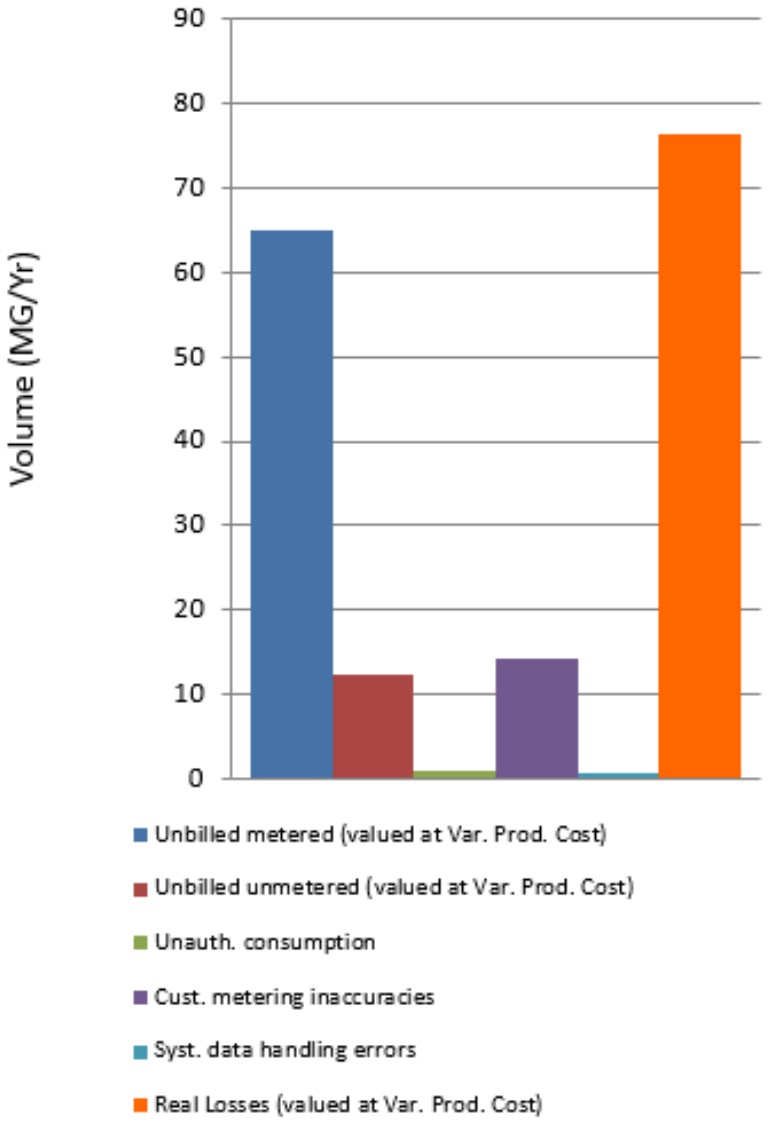
Total Cost of NRW =$144,803



◉ Show me the VOLUME of Non-Revenue Water

○ Show me the COST of Non-Revenue Water

Total Volume of NRW = 169 MG/Yr



Water Audit Report for: Green Village Water Utility (ssssxxx)
Reporting Year: 2016 7/2015 - 6/2016

*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 30 out of 100 ***

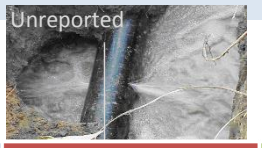
System Attributes:

	Apparent Losses:	0.318	MG/Yr
+	Real Losses:	3.304	MG/Yr
=	**Water Losses:**	**3.622**	MG/Yr
?	Unavoidable Annual Real Losses (UARL):	See limits in definition	MG/Yr
	Annual cost of Apparent Losses:	$537	
	Annual cost of Real Losses:	$1,626	Valued at **Variable Production Cost**

Return to Reporting Worksheet to change this assumpiton

Performance Indicators:

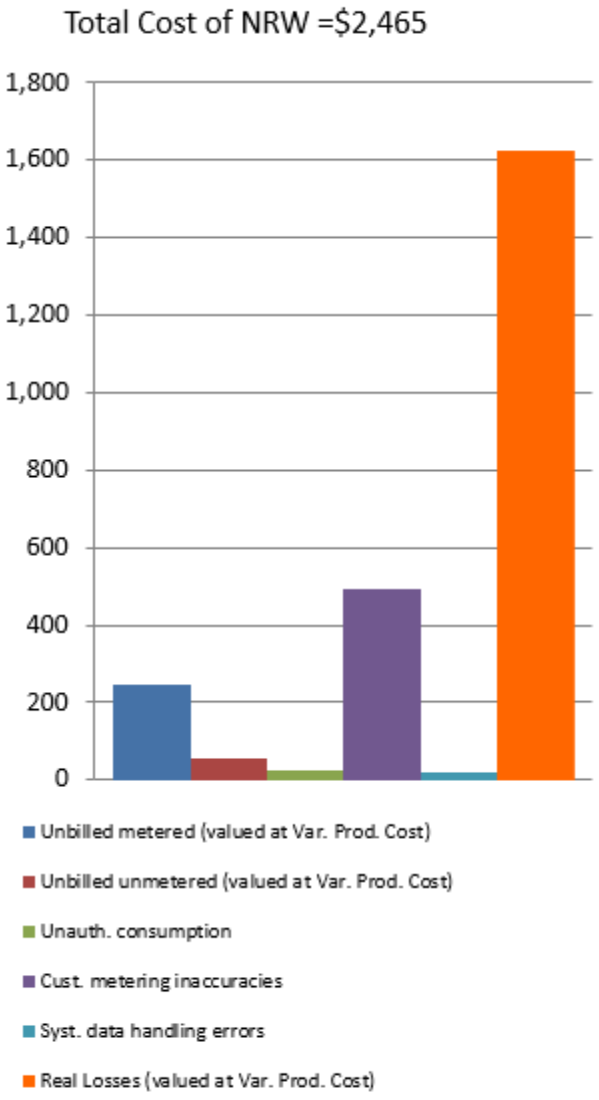
Financial:	Non-revenue water as percent by volume of Water Supplied:	45.8%	
	Non-revenue water as percent by cost of operating system:	4.1%	Real Losses valued at Variable Production Cost
Operational Efficiency:	Apparent Losses per service connection per day:	7.84	gallons/connection/day
	Real Losses per service connection per day:	81.56	gallons/connection/day
	Real Losses per length of main per day*:	N/A	
	Real Losses per service connection per day per psi pressure:	1.63	gallons/connection/day/psi
	From Above, Real Losses = Current Annual Real Losses (CARL):	3.30	million gallons/year
?	Infrastructure Leakage Index (ILI) [CARL/UARL]:		



0% 10% 20% 30% 40% 50% 60% 70% 80% 90% 100%

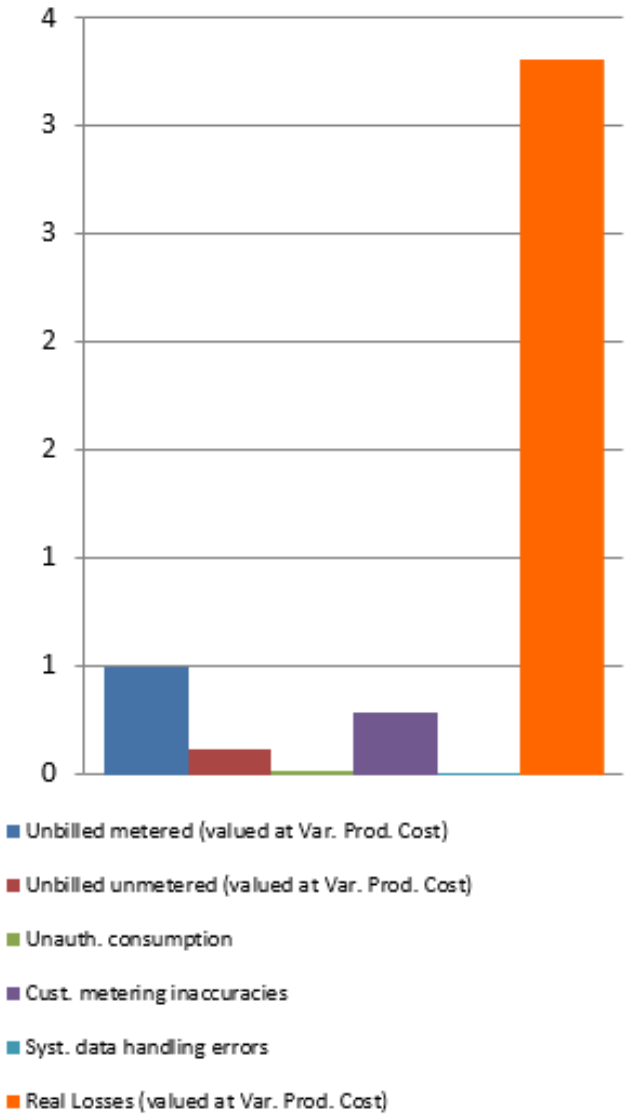
Show me the VOLUME of Non-Revenue Water

Show me the COST of Non-Revenue Water



Show me the VOLUME of Non-Revenue Water

Show me the COST of Non-Revenue Water



Wrap Up

What I LEARNED

What can you do at your own facility

SOUTHWEST
ENVIRONMENTAL
FINANCE CENTER

Heather Himmelberger: heatherh@unm.edu

Dawn Nall: dnall@unm.edu

James Markham: jmarkham@unm.edu

Department of Civil Engineering MSC01 1070
1 University of New Mexico, Albuquerque, NM 87131
505-277-0644
swefc@unm.edu
http://southwestefc.unm.edu