

Introduction to Water Loss Auditing & Non-Revenue Water Reduction

June 25 - 26 | Cambridge, Ohio

<u>www.southwestefc.unm.edu</u> <u>www.efcnetwork.org</u>





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. YesB. NoC. 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



Distribution System





You're either getting paid ...



Or you're not.



So, It's a BLUE and a GREEN problem ...

Money that we're not getting but could be.

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

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







What is the Water In?



Water from your own sources



Water you purchase









The Water Balance:







The Water Balance:



The Water Balance:

ALL THE WATER IN

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

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





Broken down further...





A bit about terminology...



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 ...



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 ...

		Exported		Dillod	Exported	
			Authorized	Authorized Consumption	Billed Metered Billed Unmetered	Revenue Water
From Own	System	Supplied	consumption	Unbilled Authorized Consumption	Unbilled Metered Unbilled Unmetered	
Sources	Inputs	To Your System	Water Losses	Apparent Losses	Unauthorized Consumption Customer Metering Error Systematic Data Handling Errors	Non- Revenue Water
Imported Water				Real Losses	Main Leaks Service Leaks Storage Leaks & Overflows	

Questions? Thoughts? Comments?





Break time ...



Remember It's a BLUE and hate

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2Nenna

rer of the United States.

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

ENTER: AWWA'S WATER AUDIT SOFTWARE!



	AWV	VA Free	Water Audit Se	oftware:				W.	\S v5.0
		<u>Repo</u>	rting Workshee	<u>et</u>			Cop	American Water Work oyright © 2014, All Ri	s Association ghts Reserved
Click to access definition Click to add a comment	Water Audit Report for: No Reporting Year:	rthern Sar 2013	Leandro Combined 1/2013 - 12/2013	Water Sewer Storm Utilit	y Distr	ict (00079	00)		
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	WATER SUPPLIED:		825.000	MG/Yr	Enter	positive %	or value	e for over-registra	ation
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	Billed unmetered:	? 9	50.000	MG/Yr			bu	ttons below	
	Unbilled metered: +	?		MG/Yr		Pcnt:		Value:	-
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					_			supplied OR	
WATER LOSSES (Water Supplie	d - Authorized Consumption)		64.688	MG/Yr				····· value	
Annaront Lossos	,					Pont	1	Value	
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		_							_
	Apparent Losses:	?	15.071	MG/Yr					
Real Losses (Current Annual Re	al 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 + L	Inbilled Unmetered								_
SYSTEM DATA									
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Number of activ	AND inactive service connections: And inactive service connection density:	? 6	1,000	conn /milo main					
	Service connection density.	2	10	contrivitie main					
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Ave	rage length of customer service line:	?		boundary, that is th	ne respo	nsibility of th	ne utility)		
Average length o	customer service line has been set t	o zero and	a data grading scor	e of 10 has been applied					
	Average operating pressure:	? 6	60.0	psi					
									-
COST DATA									
Total an	nual cost of operating water system:	? 5	\$1,000,000	\$/Year					
Customer retail un	It cost (applied to Apparent Losses): +	? 7	\$3.50	\$/1000 gallons (US)	ustoma-	atail Hait Ca	et to unlive	a real locas	
vanable prou	Journ cost (applied to real Losses):		φ 3,000.00	www.onganons Use c	ustomer i	verdii Unit CO	st to value	e rear losses	

THE AWWA WATER AUDIT SOFTWARE



	AN	/WA Free	Water Audit Se	oftware:						
		Repo	rting Workshee	et					American Water Wo Copyright © 2014, All	orks Associa Rights Rese
Click to access definition Click to add a comment	Water Audit Report for: Reporting Year:	Vorthern San 2013	Leandro Combined 1/2013 - 12/2013	Water Sewer St	orm Utility I	Distri	ct (000	7900)		
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	WATER LOSSES:		64.688	MG/Yr						
NON-REVENUE WATER										_
		2								
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AUDIT SOFTWARE COMPONENTS:

Instructions

Reporting Worksheet
DATA CATEGORIES:



Water supplied to your system

ALL THE WATER IN



Water used by customers

ALL THE WATER OUT

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

ALL THE WATER IN

ALL THE WATER OUT (EXCEPT (EXCEPT LEAKS)

WATER LOSSES (LEAKS)

Setting Parameters

Audit Timeframe:

The Audit covers a 1 year period

Can be calendar or fiscal year

Pick one and stick with it

2017 FEBRUARY APRIL JANUARY MARCH 1 2 3 4 1 2 3 4 2 3 4 5 6 7 7 8 9 10 11 10 11 9 10 11 12 13 14 5 6 5 6 7 8 9 2 3 4 5 12 13 14 15 16 17 18 16 17 18 19 20 21 12 13 14 15 16 17 18 9 10 11 12 13 14 15 15 23 24 25 26 27 28 19 20 21 22 23 24 25 19 20 21 22 23 24 25 16 17 18 19 20 21 22 26 27 28 29 30 31 29 30 31 26 27 28 23 24 25 26 27 28 29 30 MAY JUNE JULY AUGUST 2 3 4 5 6 23 1 2 З 4 8 9 10 11 12 13 4 5 6 7 8 9 10 2 3 4 5 6 78 7 8 9 10 11 12 6 14 15 16 17 18 19 20 11 12 13 14 15 16 17 9 10 11 12 13 14 15 13 14 15 16 17 18 19 21 22 23 24 25 26 27 18 19 20 21 22 23 24 16 17 18 19 20 21 22 20 21 22 23 24 25 26 23 24 25 26 27 28 29 28 29 30 31 25 26 27 28 29 30 27 28 29 30 31 30 31 NOVEMBER DECEMBER SEPTEMBER OCTOBER 2 3 4 5 6 7 2 3 4 2 3 4 5 6 7 8 9 9 10 11 12 13 14 5 6 7 8 9 10 11 8 3 4 5 6 789 10 11 12 13 14 15 16 15 16 17 18 19 20 21 12 13 14 15 16 17 18 10 11 12 13 14 15 16 17 18 19 20 21 22 23 22 23 24 25 26 27 28 19 20 21 22 23 24 25 17 18 19 20 21 22 23 24 25 26 27 28 29 30 29 30 31 26 27 28 29 30 24 25 26 27 28 29 30

31



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





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



Outcomes: The Three Vs





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



A Software Preview





AWWA Free Water Audit Software v5.0

American Water Works Association Copyright © 2014, All Rights Reserved

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 The following guidance will help you complete the Audit Name of Contact Person: All audit data are entered on the Reporting Worksheet Email Address: Value can be entered by user Telephone | Ext.: Value calculated based on input data Name of City / Utility: These cells contain recommended default values City/Town/Municipality: Select a state / province from the list State / Province: Value: Pcnt: Use of Option (Radio) Buttons: ۲ 0.25% 0 Country: 2016 Calendar Year Year: Select the default To enter a value. choose this button and percentage by choosing the enter a value in the cell option button on the left Audit Preparation Date: 1/12/2017 Volume Reporting Units: Million gallons (US) PWSID / Other ID: NM3536221 The following worksheets are available by clicking the buttons below or selecting the tabs along the bottom of the page Instructions Reporting Worksheet Comments Performance Water Balance **Dashboard** Indicators Enter comments to The values entered in The current sheet. Enter the required data A graphical summary of on this worksheet to explain how values were the Reporting the water balance and Enter contact Review the Worksheet are used to information and basic calculate the water calculated or to performance indicators Non-Revenue Water document data sources populate the Water audit details (year, balance and data grading to evaluate the results components units etc) of the audit Balance **Grading Matrix** Service Connection Definitions Loss Control **Example Audits** Acknowledgements <u>Diagram</u> Planning Presents the possible Use this sheet to **Reporting Worksheet** Acknowledgements for grading options for understand the terms and Performance the AWWA Free Water **Diagrams** depicting Use this sheet to each input component Audit Software v5.0 used in the audit process Indicators examples are possible customer service interpret the results of of the audit shown for two connection line the audit validity score validated audits configurations and performance indicators If you have guestions or comments regarding the software please contact us via email at: wic@awwa.org

Instructions

AWWA Free Water Audit Software: Reporting Worksheet Click to access definition Water Audit Report for: << Please enter system details and contact information on the Instructions tab >> + Click to add a comment 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 Master Meter and Supply Error Adjustments - Enter grading in column 'E' and 'J' --WATER SUPPLIED Pont Value: Volume from own sources: 19.500 MG/Yr 3 MG/Yr Water imported: ? n/a 0.000 MG/Yr MG/Yr Water exported: + ? n/a 0.000 MG/Yr Ō MG/Yr ۲ Enter negative % or value for under-registration WATER SUPPLIED: 19.500 MG/Yr Enter positive % or value for over-registration AUTHORIZED CONSUMPTION Click here: ? Billed metered: 18.000 MG/Yr for help using option Billed unmetered: + ? 1 0.000 MG/Yr buttons below Unbilled metered: + ? 1 0.030 MG/Yr Pcnt: Value: Unbilled unmetered: + 0.244 MG/Yr 1.25% \bigcirc MG/Yr Default option selected for Unbilled unmetered - a grading of 5 is applied but not displayed Use buttons to select AUTHORIZED CONSUMPTION: 18.274 MG/Yr percentage of water supplied OR value WATER LOSSES (Water Supplied - Authorized Consumption) 1.226 MG/Yr Apparent Losses Value: Pont: 0.25% 🖲 🔿 Unauthorized consumption: + ? 0.049 MG/Yr MG/Yr Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed 2.00% 🔍 🔿 Customer metering inaccuracies: + ? 1 0.368 MG/Yr MG/Yr Systematic data handling errors: + ? 0.25% 💿 🔿 0.045 MG/Yr MG/Yr Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed 0.462 MG/Yr Apparent Losses: Real Losses (Current Annual Real Losses or CARL) 0.765 MG/Yr Real Losses = Water Losses - Apparent Losses: WATER LOSSES: 1.226 MG/Yr NON-REVENUE WATER ? 1.500 MG/Yr NON-REVENUE WATER: = Water Losses + Unbilled Metered + Unbilled Unmetered SYSTEM DATA Length of mains: 5.0 miles Number of active AND inactive service connections: 335 2 1 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 Average length of customer service line: + ? 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 \$100,000 \$/Year Total annual cost of operating water system: + ? 1 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

Reporting Worksheet

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



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



Water Audit Exercise



Water Audit Exercise Results





Break time ...



Data Grades

When you know better you do better.

~ Maya Angelou

How Do I Judge The Quality of My Data?



Validating the Data Using Data Grades

What Grade Should I Use?

AWWA Free Water Audit Softwa <u>Reporting Worksheet</u>					
 Click to access definition Click to add a comment 	Water Audit Report for: Waterton Reporting Year: 2014	wn USA Water Treatment Works (X 1/2014 - 12/2014			
Please enter data in the white cells below. Where available, metered values should be used; if metered values are unavailable 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 t All volumes to be entered as: MILLION GALLONS (US					
To select the correct data grading for each input, determine the highest grade where the utility meets or exceeds <u>all</u> criteria for that grade and all grades below it.					
WATER SUPPLIED		Column			
Hover the cursor over the red	lume from own sources: + ? Weter imported: + ? Water exported: + ?	95.206 MG/Yr MG/Yr MG/Yr			
triangle in the	WATER SUPPLIED:	98.151 MG/Yr			
AUTHORIZED CONSUMPTION					
	Billed metered: + ?	6 80.408 MG/Yr			

What Grade Should I Use?



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

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





To s

🏢 Apps \land Cloud Server 🖹 Elizabeth Gentine and 🥂 Kylie Himmelberger an 🔿 cayuse 🤄 SWEFC 🚴 Presentation Portal

Recent Posts

Water Audit Data Grading Sheets

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				>>	
М	Т	W	Т	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

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 spread convenience we have reproduced the grading et For criter and instruction or each input in a Word Document, which can be dow oaded HERE.

ect the correct day grading for each input, determine the highest ere the utility heets or exceeds all criteria for that grade and all grade grades b

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

1			
Volume from own sources			
GRADE	GRADE DESCRIPTION		
n/a	n/a Select this grading only if the water unity parameter an orits 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.		
2	No regular meter accuracy testing or electronic calibration conducted.		
3	3 Conditions between 2 and 4		
	50% - 75% of treated water production sources are metered, other sources estimated.		
4	Occasional meter accuracy testing or electronic calibration conducted		
5	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		
6	metered sources.		
0	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		
	100% of treated water production sources are metered,		
8	Meter accuracy testing and electronic calibration of related instrumentation is conducted annually,		
	Less than 10% of meters are found outside of +/- 6% accuracy		
9	9 Conditions between 8 and 10		
	100% of treated water production sources are metered,		
10	Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less t	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	GRADE DESCRIPTION			
n/a	n/a Select this grading only if the water utmy parents an or 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.		
1		No regular meter accuracy testing or electronic calibration conducted.		
2		25% - 50% of treated water production sources are metered; other sources estimated.		
2		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.		
4		Occasional meter accuracy testing or electronic calibration conducted		
5		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		
6		metered sources.		
Ĭ		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		
		100% of treated water production sources are metered,		
8		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			
		100% of treated water production sources are metered,		
10		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than		
10		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.		
2		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		
		At least 75% of treated water production sources are metered, or at least 90% of the source flow is derived from		
6		metered sources.		
Ŭ		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		
		100% of treated water production sources are metered,		
8		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		

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.		
6		25% - 5% 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 wates production sources are metered, other sources estimated.		
4		Occasional meter accuracy testing or electronic		
5		Conditions between 4 and 6	f you can meet or exceed ALL the	
		At least 75% of treated water production source		
6		metered sources.	criteria, in the box, move to the next	
v		Meter accuracy testing and/or electronic calibra	ne	
		Less than 25% of tested meters are found outs		
7		Conditions between 6 and 8		
		100% of treated water production sources are n	Vou emitment or evened All of	
8		Meter accuracy testing and electronic calibration	TOU Can three of exceed ALL of	
		Less than 10% of meters are found outside of +/- y	ne criterio, move down to the next	
9		Conditions between 8 and 10		
		100% of treated water production sources are meter	<u>awer line</u>	
40		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than		
10		10% found outside of +/- 3% accuracy.		
		Procedures are reviewed by a third party knowledge	eable in the M36 methodology	
How to use the grade sheets: "Conditions Between"

	Volume from own sources								
GRADE	✓	DESCRIPTION							
n/a		elect 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.							
'	✓	regular meter accuracy testing or electronic calibration conducted.							
2	~	25% - 50% of treated water production sources	i% - 50% of treated water production sources are metered; other sources estimated.						
2	×	regular meter accuracy testing or electronic calibration conducted.							
3		Conditions between 2 and 4							
	\checkmark	50% 75% of treated water production sources	are metered, other sources estimated.						
-		Occasional meter accuracy testing or electronic							
5		Conditions between 4 and 6	IT YOU ARE ADIE TO CHECK ALL THE						
6		At least 75% of treated water production source metered sources.	boxes on the number below and only						
0		Meter accuracy testing and/or electronic calibra	SOME of the boxes on the number						
		Less than 25% of tested meters are found outs	above chaose the "conditions						
7		Conditions between 6 and 8	above, choose me conditions						
		100% of treated water production sources are n	between" box						
8		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							
		100% of treated water production sources are m	netered,						
10		Meter accuracy testing and electronic calibration	of related instrumentation is conducted semi-annually, with less than						
	<u> </u>	Procedures are reviewed by a third party knowle	edgeable in the M36 methodology						
8 9 10		Meter accuracy testing and electronic calibration Less than 10% of meters are found outside of +, Conditions between 8 and 10 100% of treated water production sources are m Meter accuracy testing and electronic calibration 10% found outside of +/- 3% accuracy. Procedures are reviewed by a third party knowle	of related instrumentation is conducted annually, /- 6% accuracy netered, of related instrumentation is conducted semi-annually, with less that edgeable in the M36 methodology						

How to use the grade sheets:

		Volume fro	m own sources					
GRADE	~		DESCRIPTION					
n/a		lect 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.						
1		No regular meter accuracy testing or electronic (lo regular meter accuracy testing or electronic calibration conducted.					
2		25% - 50% of treated water production sources a	are metered; other sources estimated.					
2	No regular meter accuracy testing or electronic calibration conducted.							
3		Conditions between 2 and 4						
4		50% - 75% of treated water production sources a	are metered, other sources estimated.					
4		Occasional meter accuracy testing or electronic						
5		Conditions between 4 and 6	As an example, let's assume we have a					
		At least 75% of treated water production source	system with 60% of the sources metered but					
6		metered sources.	system with boys of the sources metered but					
v		Meter accuracy testing and/or electronic calibra	they don't do regular testing.					
		Less than 25% of tested meters are found outs						
7		Conditions between 6 and 8						
		100% of treated water production sources are m	etered,					
8		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						
		100% of treated water production sources are m	etered,					
10		Meter accuracy testing and electronic calibration	of related instrumentation is conducted semi-annually, with less than					
10		10% found outside of +/- 3% accuracy.	••					
		Procedures are reviewed by a third party knowle	edgeable in the M36 methodology					

How to use the grade sheets:

	Volume from own sources							
GRADE	1	DESCRIPTION						
n/a		elect 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.								
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						
		75% of treated water production sources are metered, other sources estimated.						
-4		Occasional meter resuracy testing or electronic						
5		Conditions between 4 and 0 With our example, 60% metered and						
		At least 75% of treated water production source no meter testing what grade?						
6		metered sources.						
v		Meter accuracy testing and/or electronic calibra						
		Less than 25% of tested meters are found outs						
7		Conditions between 6 and 8						
		100% of treated water production sources are metered,						
8		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						
		100% of treated water production sources are metered,						
10		Meter accuracy testing and electronic calibration of related instrumentation is conducted semi-annually, with less than						
10		10% found outside of +/- 3% accuracy.						
		Procedures are reviewed by a third party knowledgeable in the M36 methodology						

	А	В	C	D
1 2 3		Southwest Environmental Finance Center	ATA VALIDITY WORKSHEET BETA Ver. 0.4 Dat ADAPTED FROM THE AWWA WATER AUDIT SOFT	e: 4/12/2017 WARE 2016
4				
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?		
	2	How are tank/storage elevation changes employed in calculating 'volume from own sources'		
17		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

	Α	В	С	D
1 2 3		Southwest Environmental Finance Center	ATA VALIDITY WORKSHEET BETA Ver: 0.4 Dat ADAPTED FROM THE AWWA WATER AUDIT SOFT	e: 4/12/2017 WARE 2016
4				
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)	1 - Yes (SKIP REST OF QUESTION 1 AND PROCEED TO DV03)	
8	2	N/A - Leave answer field blank		
9	3	N/A - Leave answer field blank		
10	4	N/A - Leave answer field blank		
11	5	N/A - Leave answer field blank		
12			Data Validity Score:	N/A
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	N/A - Leave answer field blank		
	2	N/A - Leave answer field blank		
17				
18	3	N/A - Leave answer field blank		
19	4	N/A - Leave answer field blank		
20	5	N/A - Leave answer field blank		
21			Data Validity Score:	N/A

	GRADING MATRIX:		
	Environmental DATA VALIDITY SCORE SHEET		
	Finance	TA Vor 0 11 Do	ha. 0/10/2017
1.124			
	ADAPTED FROM THE AWWA WAT		WARE 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	\checkmark	Paper records in poor or uncertain condition (no annual tracking of installations & abandonments).				
2	\checkmark	Poor procedures to ensure that new water mains installed by developers are accurately documented.				
3	\checkmark	Conditions between 2 and 4				
4		Sound written policy and procedures exist for documenting new water main installations, but gaps in management				
4		result in an uncertain degree of error in tabulation of mains length.				
5		Conditions between 4 and 6				
		Sound written policy and procedures exist for permitting and commissioning new water mains.				
6		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				
		Sound written policy and procedures exist for permitting and commissioning new water mains.				
8		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				
		Sound written policy exists for managing water mains extensions and replacements.				
10		Geographic Information System (GIS) data and asset management database agree and random field validation				
10		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:		
	 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



Entering Your Data Grades:



Be Honest About Grading

hon-est \'a-nəst\ adj [ME, fr. AF, fr. L honestus honorable, fr. honos, honor honor] 1: free from deception : TRUTH-FUL; also : GENUINE, REAL 2 : REP-UTABLE 3 : CREDITABLE $\langle an \sim day's \rangle$ work) 4 : marked by integrity 5 : FRANK • Synonyms UPRIGHT, JUST. CONSCIENTIOUS, HONORABLE - honest-ly adv - hon-es-ty \-nə-stē\ n

The right data grade accurately reflects your practices.





Overall Data Validity Score

В	С	D	EF	G		J	Ł	М	N	0
		AWWA F <u>R</u> e	ree Wa eportin	ater Audit S ng Workshe	oftware: <u>et</u>			,≙ Cop	∖merican W yright©20	WAS /aterWorks / 14, All Rights
?	Click to access definition Water Audit F Click to add a comment Repor	Report for: Green V ting Year: 2012	/alley Wa	ater System (XX) 1/2012 - 12/2012	XXXXXX)					
COST	DATA									
	Total annual cost of operating wat	er system: + ?	4	\$400,000	\$/Year					
	Customer retail unit cost (applied to Apparer	nt Losses): 🔸 🤶	1	\$2.00	\$/1000 gallons (L	JS)				
	Variable production cost (applied to Rea	al Losses): 🔸 ?	1	\$2,000.00	\$/Million gallons	Use Custom	ner Retail U	Init Cost to v	alue real lo	sse:
	Retail costs are less t	han (or equal to) pro	duction c	osts; please review	v and correct if ne	cessary				
WAT	ER AUDIT DATA VALIDITY SCORE:									
	Add a gradin	ig value for 2 parar	neter(s) t	o enable an audit	score to be calc	ulated				
PRIO Based	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						lf yo grad	u m es y	niss you	any wil	r
						get a	m	essa	Ige	

What Response To Low Scores?

	AWWA Free Water Audit Software: <u>Reporting Worksheet</u>	WAS v5. American Water Works Asso Copyright © 2014, All Rights Res						
?	Click to access definition Water Audit Report for: Watertown USA Water Treatment Works (XXXXYYY) Click to add a comment Reporting Year: 2014 1/2014 - 12/2014							
WAT	WATER AUDIT DATA VALIDITY SCORE:							
	A weighted scale for the components of consumption and water loss is included in the calculation of the Water Audit Data Validity Score							
PRIC	DRITY AREAS FOR ATTENTION:							
Base	d 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							



		AW	WA Free	Water Audit So	oftware:		American Water W	WAS v5.0
			<u>Repo</u>	rting Workshee	<u>t</u>		Copyright © 2014, All	Rights Res
 Click to access de Click to add a con 	finition Wat	er Audit Report for: V Reporting Year:	/atertown U 2014	SA Water Treatment 1/2014 - 12/2014	Works (XXXXYY	(Y)		
			•••••					
WATER AUDIT DATA	VALIDITY SCORE:							
		*** '	YOUR SCOR	E IS: 49 out of 100 ***	ŧ.			
	A weighted scale for the	components of consump	tion and water	loss is included in the ca	Iculation of the Water	Audit Data Validity Score		
PRIORITY AREAS FOR								
Based on the information	provided, audit accuracy ca	n be improved by addres	sing the follow	ing components:				
1: Volume from own	sources							
2: Unbilled metered								
3: Customer metering	g inaccuracies		~					
						Priority	Areas fo	or
						Increasi	ng	
						Validity	Secre	
						valuity	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 corre	sponding recomm	ended improvements and actio	ns are highlighted	in yellow. Audit accuracy is likely	to be improved by	y prioritizing those items shown i	n 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, <u>or</u> 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: cocate all water production sources on maps and in the ield, launch meter accuracy testing for existing of terrs, begin to install meters on unmetered water production sources and replace any obsolete/defective meter		testing for all source testing. Complete ad water production iccement of all leters.	to qualify for 8: Conduct annual meter accuracy testing and calibration of revied instrumentation on all meter installations on a regult basis. Complete project to install new, or replace defig five existing, meters so that entire production of pullation is metered. Repair or replace meters outside of +/- 6% accuracy.		to <u>qualify for 10</u> . Maintain annual meter accuracy testing and calibrati related instrumentation for all meter installations. Re e replace meters outside of +/- 3% accuracy. Investiga meter technology; pilot one or more replacements s innovative meters in attempt to further improve me 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
Instruct	tions Reportin	g Worksheet Perfor	mance Indicators Co	mments W	ater Balance Dashboa	rd Grading	Matrix Service Conne	ction Diagram	(+) : 4	•
Ready Calculate										1 💾 80%

Action Items For Improving Individual Grades



Remember: The Three Vs



Questions?



DATA GRADING EXERCISE





Data Grading Results



	A	WWA Free Repo	e Water Audit So orting Workshee	oftware:			America Conviciant 4	WA: an Water Work	S v5.0 s Associati
Click to access definition	Water Audit Report for:	Green Village	e Water Utility (ssssx	xx)				o 2011, All 10g	
Click to add a comment	Reporting Year:	2016	7/2015 - 6/2016]					
Please enter data in the white cells be input data by grading each component	low. Where available, metered values sho t (n/a or 1-10) using the drop-down list to	ould be used; if r the left of the inp	metered values are unava out cell. Hover the mouse	ilable please estimate over the cell to obtair	e a value. Indicat n a description of	e your confide the grades	ence in the acc	uracy of the	
	All volu	nes to be ente	ered as: MILLION GAL	LONS (US) PER Y	'EAR				-
To select t	he correct data grading for each input e utility meets or exceeds all criteria f	, determine the	e highest grade where and all grades below it		Mae	tor Motor and	Supply Erro	r Adjustmon	te
WATER SUPPLIED		<	Enter grading	in column 'E' and 'J	J'>	Pont:	Valu	e.	
	Volume from own sources:	+ ? 3	9.710	MG/Yr	+ ? 2	5.00%			MG/Yr
	Water imported:	+ ?		MG/Yr	+ ?	١	00		MG/Yr
	Water exported:	+ ?		MG/Yr	+ ?				MG/Yr
	WATER SUPPLIED		9 248	MG/Vr	Ente	r negative %	or value for o	under-regist	ration
	inviter soft field.		0.240	morn	Line	i positive se	or value for o		-
AUTHORIZED CONSUMPTION	Pilled metered:	+ 2 2	5.010	MONA			Click here	e: ?	
	Billed unmetered:	+ ?	5.010	MG/Yr MG/Yr			buttons b	elow	
	Unbilled metered:	+ ? 1	0.500	MG/Yr		Pont:	Valu	ie:	_
	Unbilled unmetered:	+ ?	0.116	MG/Yr		1.25% ($\mathbf{)}$		MG/Yr
Defa	ult option selected for Unbilled un	netered - a gr	ading of 5 is applied b	out not displayed		4	Line butte	and to coloct	
	AUTHORIZED CONSUMPTION:	?	5.626	MG/Yr		1	percenta	ige of water	
							su	pplied OR	
WATER LOSSES (Water Supplie	d Authorized Consumption)		2 600	MONE			V	alue	
WATER LOSSES (Water Supplie	a - Authorized Consumption)		3.022	MG/Yr					
Apparent Losses	I have the size of a second strengthere.		0.045	1004		Pent:	Valu	ie:	
	Unauthorized consumption:		0.015	MG/Yr			.) (0] [0.01	5	MG/Yr
	Customer metering inaccuracies: Systematic data bandling errors:	+ ? 1	0.290	MG/Yr MG/Yr		5.00%			MG/YI
Default	ontion selected for Systematic data	a handling er	rors - a grading of 5 is	applied but not d	lisplayed	0.2370			
Dorada			iono - a graamig or o io	applied but not d	nopiayou				
	ADDarent Losses:	?	0.318	MG/Yr					
	Apparent Losses:	?	0.318	MG/Yr					
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Real Losses (Current Annual Re Real Losses Real Losses NON-REVENUE WATER = Water Losses + Unbilled Metered + SYSTEM DATA Number of acti Are customer meters typically loc Average length COST DATA Total an Customer retail un Variable proc WATER AUDIT DATA VALIDITY SC A weig PRIORITY AREAS FOR ATTENTION Based on the information provided, and 1: Volume from own sources 2: Billed metered	Apparent Losses: al Losses or CARL) • Water Losses - Apparent Losses: WATER LOSSES: NON-REVENUE WATER: Unbilled Unmetered Length of mains: Service connection density: Service connection density: stated at the curbstop or property line? of customer service line has been in Average operating meters line end Average operating mater system: int cost (applied to Apparent Losses): luction cost (applied to Real Losses): SCRE: * with accuracy can be improved by address	2 2 2 2 2 2 2 2 2 2 2 2 2 2	0.318 3.304 3.622 4.238 2.5 111 44 Yes d a data grading scorr 50.0 \$60,000 \$1.69 \$492.00 RE IS: 30 out of 100 ** r loss is included in the ca	MG/Yr MG/Yr MG/Yr miles conn/mile main (length of s boundary, conf 10 has been a psi \$/Year \$	service line, <u>beyy</u> that is the respo pplied (S) Use Customer er Audit Data Val	Ind the proper nsibility of the Retail Unit Cost	ty utility) to value real loss	265	-

Green Village: Results Review...



Green Village: Results Review...



• Show me the <u>VOLUME</u> of Non-Revenue Water





	A	WWA Free <u>Repo</u>	Water Audit So rting Workshee	oftware: et	(WAS American Water Works Copyright © 2014, All Rigt	S v5.0 s Association hts Reserved
Click to access definition Click to add a comment	Water Audit Report for: Reporting Year:	Town Water U 2016	ltility (ssssxxx) 7/2015 - 6/2016				
Please enter data in the white cells input data by grading each component	below. Where available, metered values sho ent (n/a or 1-10) using the drop-down list to	uld be used; if m he left of the inp	etered values are unavai ut cell. Hover the mouse	lable please estimate a value over the cell to obtain a descr	 Indicate your confidence in ription of the grades 	n the accuracy of the	
	All volur	nes to be enter	red as: MILLION GAL	LONS (US) PER YEAR			_
To selec	t the correct data grading for each input	, determine the	highest grade where		Master Mater and Sun	nhu Error Adjuntenent	10
	the duity meets of exceeds an enterial	<->	Enter grading	in column 'E' and 'J'	-> Pont:	Value:	ts
WATER SOFFLIED	Volume from own sources:	+ ? 5	485.210	MG/Yr + ?	2 1.81% 0 0	value.	MG/Yr
	Water imported:	+ ?	100.210	MG/Yr + ?			MG/Yr
	Water exported:	+ ? 4	104.570	MG/Yr + ?	1 1.00% O C		MG/Yr
	WATER SUPPLIED:		373 049	MG/Yr	Enter negative % or va	alue for under-registr lue for over-registrat	tion
	HATER SOTTEED.		0/0.040	morti	Enter positive // or va		-
AUTHORIZED CONSUMPTION	Pilled metered	* 2 e	202 650	MONA		Click here: ?	
	Billed unmetered:	+ ?	203.050	MG/Yr		outtons below	
	Unbilled metered:	+ ? 5	65.000	MG/Yr	Pont:	Value:	_
	Unbilled unmetered:	+ ? 3	12.300	MG/Yr		12.300	MG/Yr
	Unbilled Unmetered volume ente	red is greater th	han the recommended	default value	1	lee buttons to select	
	AUTHORIZED CONSUMPTION:	?	280.950	MG/Yr	<u></u>	percentage of water	
						OR	
WATER LOSSES (Water Suppl	ied - Authorized Consumption)		92,099	MG/Yr	-	value	
Annaront Lossos	eu - Autionzeu consumption,		02.000	inor ri	Dent:	Value	
Apparent Losses	Unauthorized consumption:	+ ?	0.933	MG/Yr	0.25%	Value.	MG/Yr
Default o	option selected for unauthorized con-	sumption - a g	rading of 5 is applied	but not displayed	0.20 /0		
	Customer metering inaccuracies:	+ 7 3	1/ 139	MG/Vr	5.00%	7	MG/Vr
	Systematic data handling errors:	+ ?	0.509	MG/Yr	0.25% ((<u>,</u>	MG/Yr
Defau	It option selected for Systematic dat	a handling err	ors - a grading of 5 is	applied but not displaye	bd		
	Apparent Losses:	?	15.581	MG/Yr			
Real Losses (Current Annual F	Real Losses or CARL)						
Real Losses	s = Water Losses - Apparent Losses:	?	76.518	MG/Yr			
	WATER LOSSES:		92.099	MG/Yr			
NON-REVENUE WATER	NON REVENUE WATER	2	169 399	MGIV			-
= Water Losses + Unbilled Metered	+ Unbilled Unmetered		100.000	in or fi			
SYSTEM DATA							-
	Length of mains:	+ ? 3	87.0	miles			
Number of ac	tive AND inactive service connections:	+ ? 5	4,429				
	Service connection density:	?	51	conn./mile main			
Are customer meters typically le	ocated at the curbstop or property line?	1	Yes	(length of service lit	ne, beyond the property		
<u>A</u>	verage length of customer service line:	+ ?		boundary, that is th	e responsibility of the utility)		
Average lengt	h of customer service line has been s	et to zero and	a data grading score	of 10 has been applied			
	Average operating pressure:	+ ? 1	60.0	psi			
							-
COST DATA		2 40	\$1,872,000	\$/Year			
COST DATA Total	annual cost of operating water system:	10					
COST DATA Total Customer retail	annual cost of operating water system: unit cost (applied to Apparent Losses):	+ ? 8	\$3.39	\$/1000 gallons (US)			
COST DATA Total Customer retail Variable pr	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses):	+ ? 8 + ? 7	\$3.39 \$598.00	\$/1000 gallons (US) \$/Million gallons Use C	ustomer Retail Unit Cost to valu	ie real losses	
COST DATA Total Customer retail Variable pr	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses):	+ ? 8 + ? 7	\$3.39 \$598.00	\$/1000 gallons (US) \$/Million gallons Use C	ustomer Retail Unit Cost to valu	ie real losses	-
COST DATA Total Customer retail Variable pr WATER AUDIT DATA VALIDITY S	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses): SCORE:	+ ? 8 + ? 7	\$3.39 \$598.00	\$/1000 gallons (US) \$/Million gallons Use C	ustomer Retail Unit Cost to valu	e real losses	-
COST DATA Total Customer retail Variable pr WATER AUDIT DATA VALIDITY 1	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses): SCORE:	+ ? 8 + ? 7	\$3.39 \$598.00 RE IS: 56 out of 100 **	\$/1000 gallons (US) \$/Million gallons Use C	ustomer Retail Unit Cost to valu	e real losses	-
COST DATA Total Customer retail Variable pr WATER AUDIT DATA VALIDITY S	annual cost of operating water system: unit cost (applied to Apparent Losses); oduction cost (applied to Real Losses); SCORE; eighted scale for the components of consum	+ ? 8 + ? 7	\$3.39 \$598.00 RE IS: 56 out of 100 ** loss is included in the ca	S/1000 gallons (US) S/Million gallons USe C	ustomer Retail Unit Cost to valu	ue real losses	-
COST DATA Total Customer retail Variable pr WATER AUDIT DATA VALIDITY 3 WATER AUDIT DATA VALIDITY 3 A w PRIORITY AREAS FOR ATTENTI	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses): SCORE: * eighted scale for the components of consun ON:	YOUR SCOR	\$3.39 \$598.00 RE IS: 56 out of 100 ** loss is included in the ca	\$/1000 gallons (US) \$/Million gallons Use of block of the Water Audit D	ustomer Retail Unit Cost to valu	ie real losses	-
COST DATA Total Customer retail Variable pr WATER AUDIT DATA VALIDITY ! A w PRIORITY AREAS FOR ATTENTI Based on the information provided	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses): SCORE: eighted scale for the components of consun ON: audit accuracy can be improved by address		\$3.39 \$598.00 RE IS: 56 out of 100 ** loss is included in the ca	S/1000 gallons (US) S/Million gallons Use C	ustomer Retail Unit Cost to valu	e real losses	-
COST DATA Total Customer retail Variable pr WATER AUDIT DATA VALIDITY S WATER AUDIT DATA VALIDITY S A w PRIORITY AREAS FOR ATTENTI Based on the information provided, 1: Volume from own sources	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses): SCORE: eighted scale for the components of consun ON: audit accuracy can be improved by address	YOUR SCOR	\$3.39 \$598.00 RE IS: 56 out of 100 ** loss is included in the ca	SYNUIOO gallons (US) SyNUIION gallons Lue C	ustomer Retail Unit Cost to valu	e real losses	-
COST DATA Total Customer retail Variable pr WATER AUDIT DATA VALIDITY S WATER AUDIT DATA VALIDITY S A w PRIORITY AREAS FOR ATTENTI Based on the information provided 1: Volume from own sources 2: Customer matarian lacance	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses): SCORE: * sighted scale for the components of consum ON: audit accuracy can be improved by address arbies	YOUR SCOR	\$3.39 \$598.00 RE IS: 56 out of 100 ** loss is included in the ca	Str1000 gallons (US) Str1000 gallons Use of the Water Audit D Str1000 of the Water Audit D Str1000 of the Water Audit D Str1000 gallons	ustomer Retail Unit Cost to valu	e real losses	-
COST DATA Total Customer retail Variable pr WATER AUDIT DATA VALIDITY S WATER AUDIT DATA VALIDITY S A w PRIORITY AREAS FOR ATTENTI Based on the information provided, 1: Volume from own sources 2: Customer metering inaccurr	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses): SCORE: sighted scale for the components of consun ON: audit accuracy can be improved by address tcles	YOUR SCOR	\$3.39 \$598.00 RE IS: 56 out of 100 ** loss is included in the ca	S/1000 gallons (US) S/Million gallons Use of the second s	ustomer Retail Unit Cost to valu	e real losses	-
COST DATA Total Customer retail Variable pr WATER AUDIT DATA VALIDITY S Market AUDIT DATA VALIDITY S A w PRIORITY AREAS FOR ATTENTI Based on the information provided, 1: Volume from own sources 2: Customer metering inaccura 3: Billed metered	annual cost of operating water system: unit cost (applied to Apparent Losses): oduction cost (applied to Real Losses): SCORE: eighted scale for the components of consun <u>ON:</u> audit accuracy can be improved by address actes	YOUR SCOR	\$3.39 \$596.00 KE IS: 56 out of 100 ** loss is included in the ca i components:	S/1000 gallons (US) S/Million gallons Use of Culation of the Water Audit D	ustomer Retail Unit Cost to valu	er real losses	-

Town Water: Results Review ...



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:	WAS v5.0
	System Attributes and Performance Indicators	American Water Works Association. Copyright © 2014, All Rights Reserved.
	Water Audit Report for: Waterville Water Utility (ssssxxx)	
	Reporting Year: 2016 7/2015 - 6/2016	
System Attributes:	TOUR WATER AUDIT DATA VALIDIT F SCORE IS: 57 out of 100 ***	
<u></u>	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 Reportin	g Worksheet to change this assumpiton
Performance Indicators:		
Financial	Non-revenue water as percent by volume of Water Supplied: -6.7%	
i manota.	Non-revenue water as percent by cost of operating system: 2.6% Real Losses v	alued at Variable Production Cost
Г	Apparent Losses per service connection per day: 14.15 gallons/connec	tion/day
Operational Efficiency:	Real Losses per service connection per day: -37.19 gallons/connec	tion/day
Operational Eniciency.	Real Losses per length of main per day*: N/A	
	Real Losses per service connection per day per psi pressure: -0.62 gallons/connec	tion/day/psi
	· · · · · · · · · · · · · · · · · · ·	
	From Above, Real Losses = Current Annual Real Losses (CARL):	/ear
	Infrastructure Leakage Index (ILI) [CARL/UARL]: -2.42	
* This performance indicator applies for s	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

Perform water balance to determine nature of NRW Assume this is

completed.

a moment

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

Prioritize activities to address values and volumes of **NRW** components

Let's focus here for lumes a and Values of NRW components

Metrics Screening

Screening Range

*** YOUR WATER AUDIT DATA>50VALIDITY SCORE IS: 47 out of
100 ***(validated
score)

Metrics Screening

Screening Range

score)

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

ation density of less than 20 convice connections/mile of ninaling

Perform water balance to determine nature of NRW Assume this is

completed.

Examine Data Validity: Is overall data validity high enough? Are Assume this is <u>s in the</u> good enough.

Prioritize **Estivit** Let's focus here for to address and vol a moment NRv

Look at Volumes and Values of NRW components

Select Dashboard on the bottom menu



ors Comments Water Balance **Dashboard** Grading Matrix
Select Volumes or Cost (value)



Look at Values and volumes from

Dashboard

- the instructions (ab 77
 - Show me the <u>VOLUME</u> of Non-Revenue Water
 - Show me the <u>COST</u> of Non-Revenue Water





Unbilled metered (valued at Var. Prod. Cost)

Unbilled unmetered (valued at Var. Prod. Cost)

- Unauth. consumption
- Cust. metering in accuracies
- Syst. data handling errors
- Real Losses (valued at Var. Prod. Cost)

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

on the Instructions tab >>

- Show me the <u>VOLUME</u> of Non-Revenue Water.
- Show me the <u>COST</u> of Non-Revenue Water

Total Cost of NRW =\$82,680



Real Losses (valued at Var. Prod. Cost)

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

- Show me the <u>VOLUME</u> of Non-Revenue Water
 - Show me the <u>COST</u> of Non-Revenue Water





Unbilled metered (valued at Var. Prod. Cost)

Unbilled unmetered (valued at Var. Prod. Cost)

- Unauth. consumption
- Cust. metering inaccuracies
- Syst. data handling errors
- Real Losses (valued at Var. Prod. Cost)

What is most important? Saving Water, Saving Money?

- Show me the <u>VOLUME</u> of Non-Revenue Water.
- Show me the <u>COST</u> of Non-Revenue Water

Total Cost of NRW =\$82,680



- Cust. metering inaccuracies
- Syst. data handling errors
- Real Losses (valued at Var. Prod. Cost)

Perform water balance to determine nature of NRW Assume this is

completed.

Examine Data Validity: Is overall data validity high enough? Are Assume this is sin the good enough.

umes

Assume you understare

the NRW Components

values and volumes of

Let's focus here for

a moment

Prioritize activities to address values and volumes of **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 Unavoidable Real Loss Economic Level 3. Reduce pressure Real Loss Current Annual Real Loss Volume 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



- Show me the <u>VOLUME</u> of Non-Revenue Water
- Show me the <u>COST</u> of Non-Revenue Water

Total Cost of NRW =\$144,803 60,000 50,000 40,000 30,000 20,000 10,000

- Unbilled metered (valued at Var. Prod. Cost)
- Unbilled unmetered (valued at Var. Prod. Cost)
- Unauth. consumption

0

- Cust. metering inaccuracies
- Syst. data handling errors
- Real Losses (valued at Var. Prod. Cost)

- Show me the <u>VOLUME</u> of Non-Revenue Water
- Show me the <u>COST</u> of Non-Revenue Water

Total Volume of NRW = 169 MG/Yr



Volume (MG/Yr)

Cost \$

		, , , , , , , , , , , , , , , , , , ,	Water Audit Re Report	eport for: Green Vil ing Year: 2016	lage Water Utility (7/2015 - 6/20	sssxxx) 16					
*** YOUR WATER AUDIT DATA VALIDITY SCORE IS: 30 out of 100 ***											
System Attributes:											
					Apparent Lo	sses:	0.318	MG/Yr			
					+ Real Lo	sses:	3.304	MG/Yr			
					= VVater Lo	sses:	3.622	MG/Yr			
			?	Unavoidable A	nnual Real Losses (U	ARL): See lin	nits in definition	MG/Yr			
				Annu	al cost of Apparent Lo	sses:	\$537]			
				/	Annual cost of Real Lo	sses:	\$1,626	Valued at Variable	e Production Cos	st	
D-4-								Return to Reporting Works	heet to change this as	sumpiton	
Perform	nance indicators:	_						1			
Fir	Fina	incial:	Non-revenu	e water as percent by	volume of Water Su	plied:	45.8%				
		L	Non-rever	Non-revenue water as percent by cost of operating system:			. 4.1% Real Losses valued at Variable			on Cost	
		_						1			
Operational Efficiency:		4	Apparent Losses per	service connection pe	r day:	7.84	gallons/connection/day				
	1		Real Losses per	service connection pe	r day:	81.56	gallons/connection/day				
	,.	sonoy.		Real Losses	per length of main pe	day*:	N/A				
		Real Losses per service connection per day per psi pressure:				sure:	1.63 gallons/connection/day/psi				
From Above, Real Losses = Current Annual Real Losses (CARL):						ARL):	3.30	million gallons/year			
			?	Infrastructure Leakag	e Index (ILI) [CARL/U	ARL]:	The second s				
Backgr	ound	reported					Řepo	rted			
The file		5 La									
. A second								ATTIM TO AND			
0%	10%	20%	30%	40%	50%	60%	70%	80%	90%	100%	

Show me the <u>VOLUME</u> of Non-Revenue Water

Show me the COST of Non-Revenue Water

h.

Total Cost of NRW =\$2,465 1,800 1,600 1,400 1,200 1,000 800 600 400 200 0

- Unbilled metered (valued at Var. Prod. Cost)
- Unbilled unmetered (valued at Var. Prod. Cost)
- Unauth. consumption
- Cust. metering inaccuracies
- Syst. data handling errors
- Real Losses (valued at Var. Prod. Cost)

Show me the <u>VOLUME</u> of Non-Revenue Water

Show me the COST of Non-Revenue Water

Total Volume of NRW = 4 MG/Yr



Real Losses (valued at Var. Prod. Cost)

Wrap Up



What can you do at your own facility



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