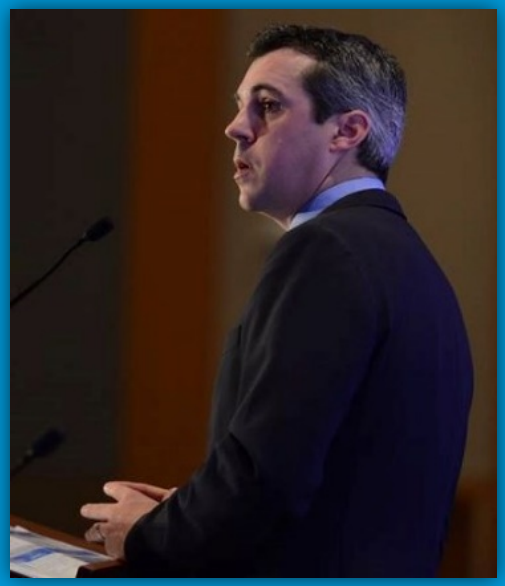
CAVANAUGH

*Stewardship Through Innovation*



# TAKING THE V6 FOR A SPIN

## THE NEW AWWA FREE WATER AUDIT SOFTWARE IS HERE


Will Jernigan, P.E.

Chair / AWWA Water Loss Software Committee

Chair / North American Water Loss Conference

CFO, Director of Water Efficiency / Cavanaugh

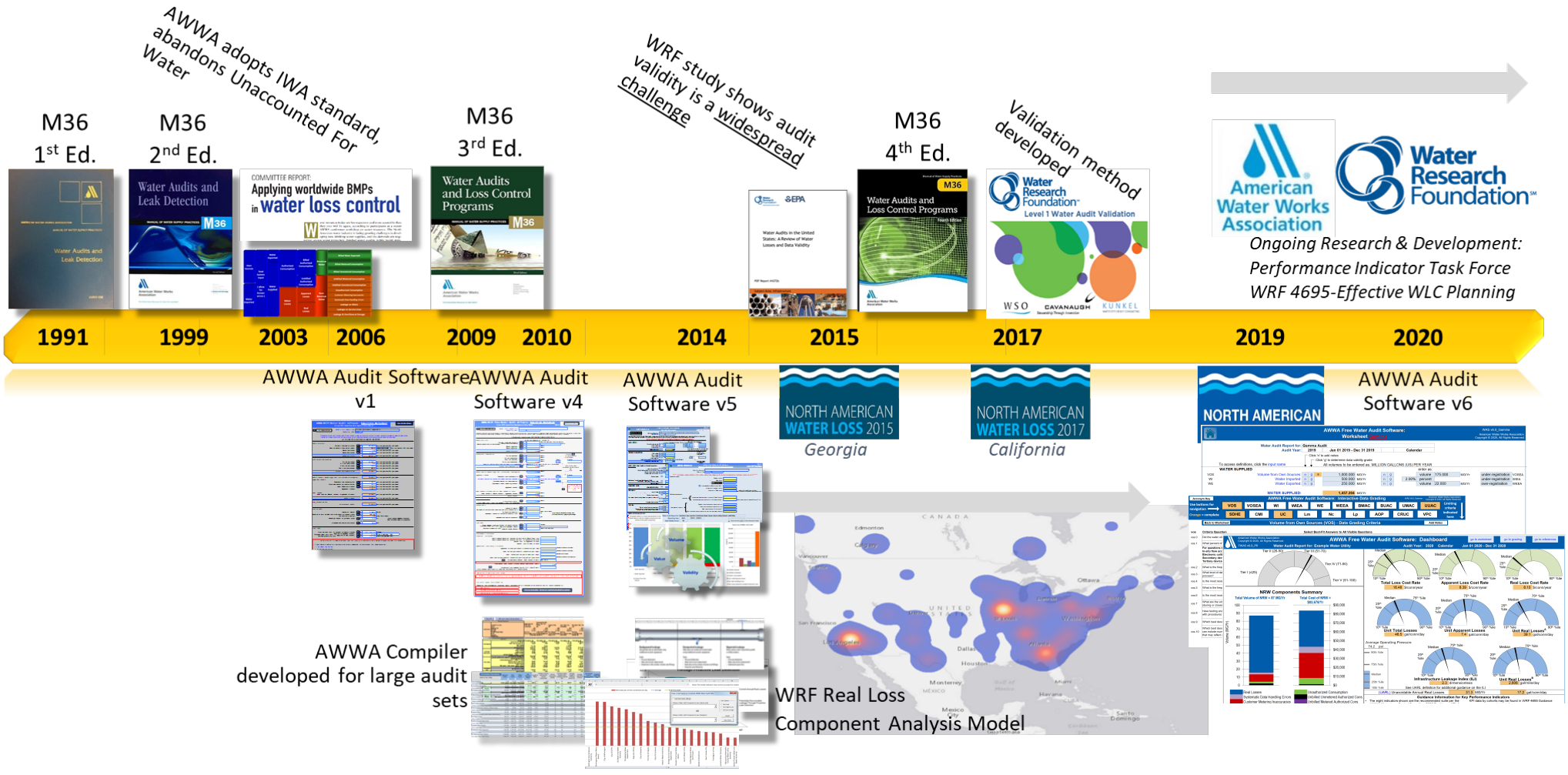

25 YEARS 1995-2020 DELIVERING STEWARDSHIP THROUGH INNOVATION CAVANAUGH

# LEARNING OBJECTIVES

- Learn the key upgrades from FWAS v5 to v6
- Learn how the new Interactive Data Grading works
- Test drive the new v6

# ATTENDEE POLL –

# GAUGING YOUR EXPERIENCE WITH THE AWWA FREE WATER AUDIT SOFTWARE


M36
1st Ed.
M36
2nd Ed.
AWWA adopts IWA standard, abandons Unaccounted For Water
M36
3rd Ed.
WRF study shows audit validity is a widespread challenge
M36
4th Ed.
Validation method developed
American Water Works Association
Water Research Foundation
Ongoing Research & Development:
Performance Indicator Task Force
WRF 4695-Effective WLC Planning
1991
1999
2003
2006
2009
2010
2014
2015
2017
2019
2020
AWWA Audit Software v1
AWWA Audit Software v4
AWWA Audit Software v5
NORTH AMERICAN WATER LOSS 2015
Georgia
NORTH AMERICAN WATER LOSS 2017
California
AWWA Audit Software v6
AWWA Compiler developed for large audit sets
WRF Real Loss Component Analysis Model

AWWA adopts IWA standard, abandons Unaccounted For Water

WRF study shows audit validity is a widespread challenge

Validation method developed

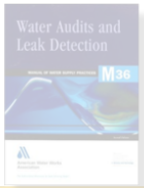
M36 1st Ed.

M36 2nd Ed.

M36 3rd Ed.

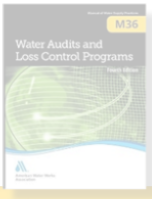
M36 4th Ed.













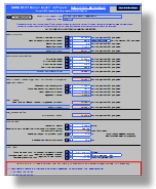
American Water Works Association

Water Research Foundation

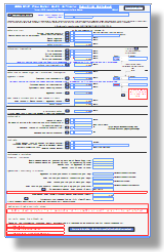
Ongoing Research & Development:
Performance Indicator Task Force
WRF 4695-Effective WLC Planning

1991 | 1999 | 2003 | 2006 | 2009 | 2010 | 2014 | 2015 | 2017 | 2019 | 2020

AWWA Audit Software v1



AWWA Audit Software v4



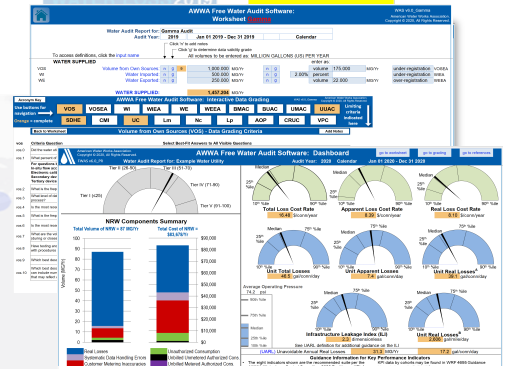
AWWA Audit Software v5

NORTH AMERICAN WATER LOSS 2015
Georgia

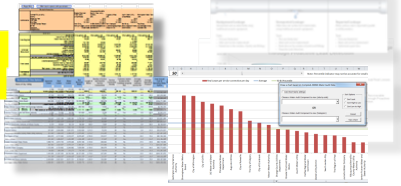
NORTH AMERICAN WATER LOSS 2017
California

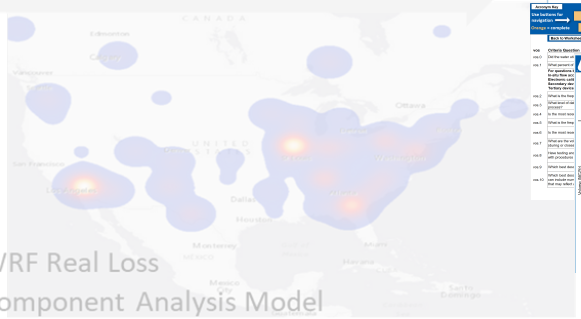
NORTH AMERICAN WATER LOSS 2019

AWWA Audit Software v6



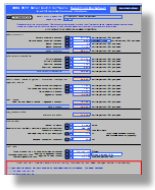

AWWA Compiler developed for large audit sets





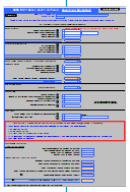
WRF Real Loss Component Analysis Model

## FWAS v1
(200)



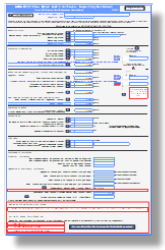
MG volumes only
Data grading:
either ‘measured’
or ‘estimated’

FWAS v2 – v3



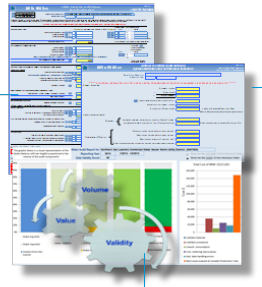
Megaliters added
Two financial performance indicators added (cost of real and apparent losses)
Acre-ft added
Example audits included
Two default values
Data checks / instant feedback added

## FWAS v4
(2,000)



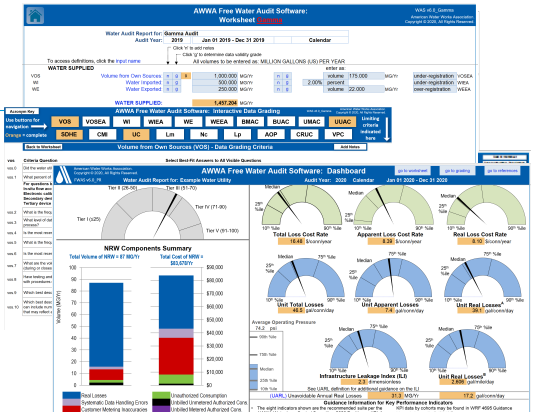
Data grading matrix (1-10)
Service connection diagram
French language version available

## FWAS v5
(13,000)

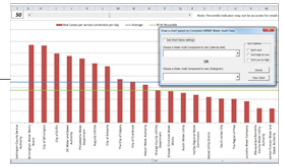


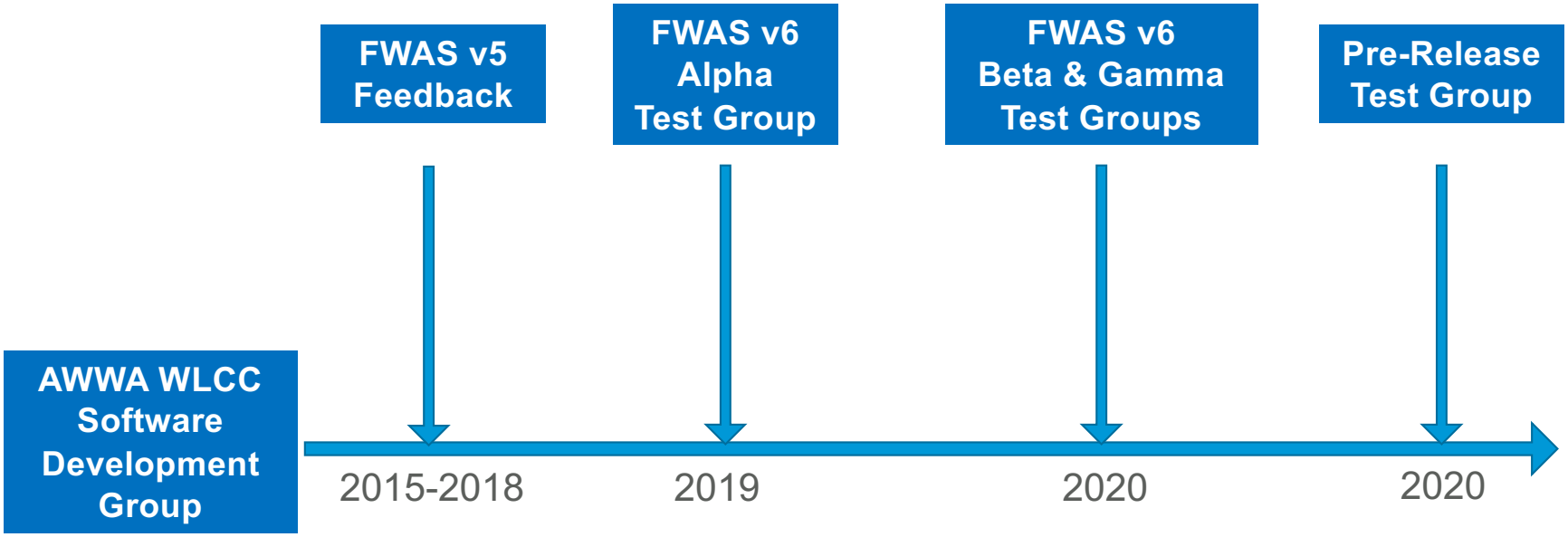

Separate data input/output tabs
Dashboard
Volume weighted data grading
Comments page
Meter error adjustment for all water supplied components

## FWAS v6




AWWA Compiler developed for large audit sets

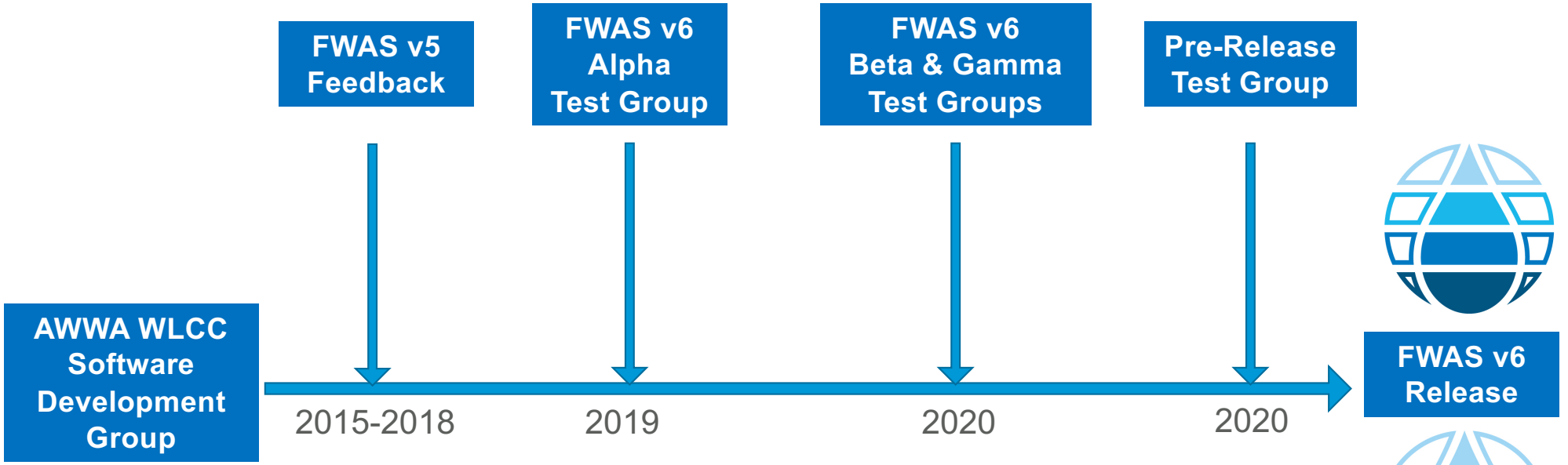





American Water Works Association

*Dedicated to the World's Most Important Resource®*

- Volunteer effort
- Large stakeholder team
- Utilities, consultants, regulators
- Multiple feedback loops
- Over 1,000 comments received to date related to v6 development




World Water Loss Day
4th December

- Volunteer effort
- Large stakeholder team
- Utilities, consultants, regulators
- Multiple feedback loops
- Over 1,000 comments received to date related to v6 development

American Water Works Association
*Dedicated to the World's Most Important Resource®*

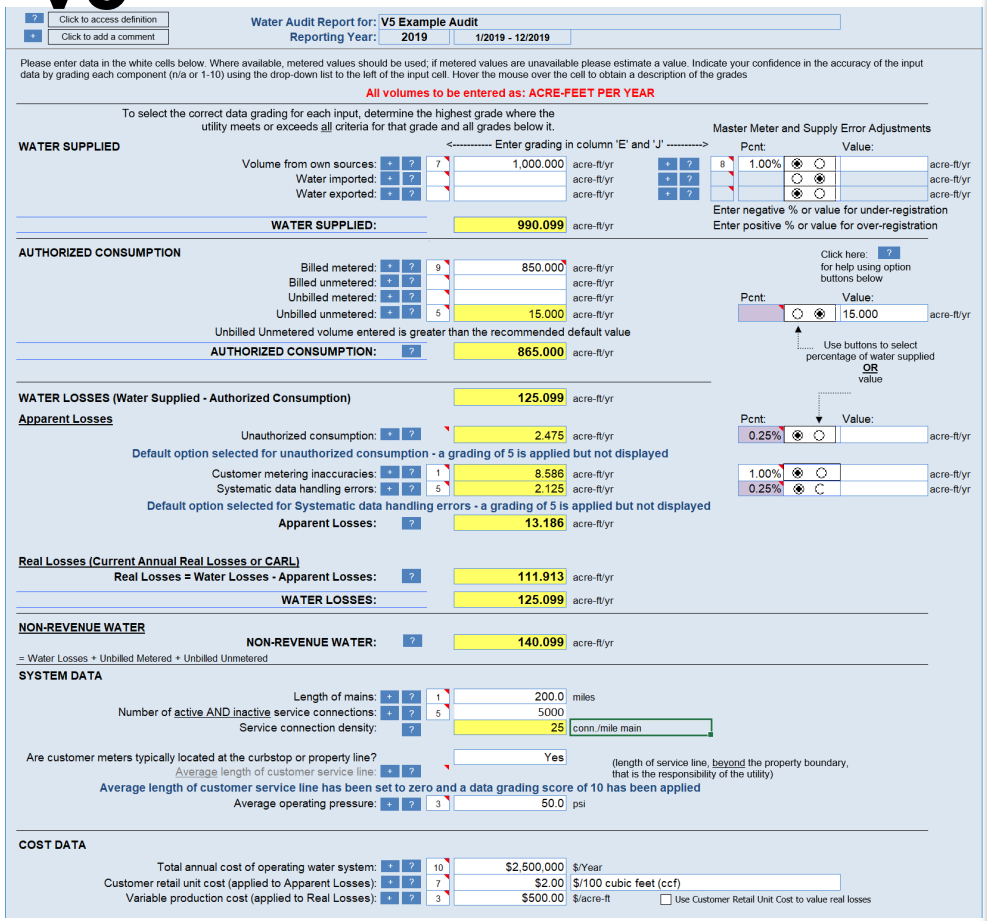
# v6.0 Design Objectives

- **Accommodate a very wide range of water system setups**, including small to large, retail v wholesale, own supply v purchased supply, metered v unmetered, and many more parameters that can widely vary across the over 50,000 water systems in North America;
- **Accommodate a very wide range of user knowledge**, from first-time FWAS users to highly experienced water loss management practitioners;
- **Achieve sufficient technical detail and rigor** for tool effectiveness;
- **Achieve sufficient simplicity** for tool efficiency;
- **Minimize cognitive load** on the user interface for tool intuitiveness;
- **Maximize awareness of user for best-practices** through data grading questions;
- **Remove any Data Grading criteria subjectivity** or ambiguity that existed in FWAS v5.0;
- **Update Data Grading criteria questions** where needed to reflect best-practice or technological advancements;
- **Minimize inevitable variance** that will be observed **in total Data Validity Score** for any given audit, with same or similar input parameters, between FWAS v5.0 and FWAS v6.0;


v6.0 – What's New?

# Worksheet

## v5



Click to access definition
Click to add a comment

Water Audit Report for: V5 Example Audit
Reporting Year: 2019 1/2019 - 12/2019

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: ACRE-FEET 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' ----------> Pcnt: Value: Master Meter and Supply Error Adjustments

**WATER SUPPLIED**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| Volume from own sources: | 7 | 1,000.000 | acre-ft/yr | 8 | 1.00% | | acre-ft/yr |
| Water imported: | | | acre-ft/yr | | | | acre-ft/yr |
| Water exported: | | | acre-ft/yr | | | | acre-ft/yr |
| **WATER SUPPLIED:** | | 990.099 | acre-ft/yr | | | | |

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

**AUTHORIZED CONSUMPTION**

| | | | | | |
|---|---|---|---|---|---|
| Billed metered: | 9 | 850.000 | acre-ft/yr | | |
| Billed unmetered: | | | acre-ft/yr | | |
| Unbilled metered: | | | acre-ft/yr | | |
| Unbilled unmetered: | 5 | 15.000 | acre-ft/yr | | 15.000 acre-ft/yr |
| **AUTHORIZED CONSUMPTION:** | | 865.000 | acre-ft/yr | | |

Click here: for help using option buttons below
Pcnt: Value:
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)** 125.099 acre-ft/yr

Pcnt: Value:

**Apparent Losses**

| | | | | | |
|---|---|---|---|---|---|
| Unauthorized consumption: | | 2.475 | acre-ft/yr | 0.25% | acre-ft/yr |
| Default option selected for unauthorized consumption - a grading of 5 is applied but not displayed | | | | | |
| Customer metering inaccuracies: | 1 | 8.586 | acre-ft/yr | 1.00% | acre-ft/yr |
| Systematic data handling errors: | 5 | 2.125 | acre-ft/yr | 0.25% | acre-ft/yr |
| Default option selected for Systematic data handling errors - a grading of 5 is applied but not displayed | | | | | |
| **Apparent Losses:** | | 13.186 | acre-ft/yr | | |

**Real Losses (Current Annual Real Losses or CARL)**

| | | | |
|---|---|---|---|
| **Real Losses = Water Losses - Apparent Losses:** | | 111.913 | acre-ft/yr |
| **WATER LOSSES:** | | 125.099 | acre-ft/yr |

**NON-REVENUE WATER**

| | | | |
|---|---|---|---|
| **NON-REVENUE WATER:** | | 140.099 | acre-ft/yr |

= Water Losses + Unbilled Metered + Unbilled Unmetered

**SYSTEM DATA**

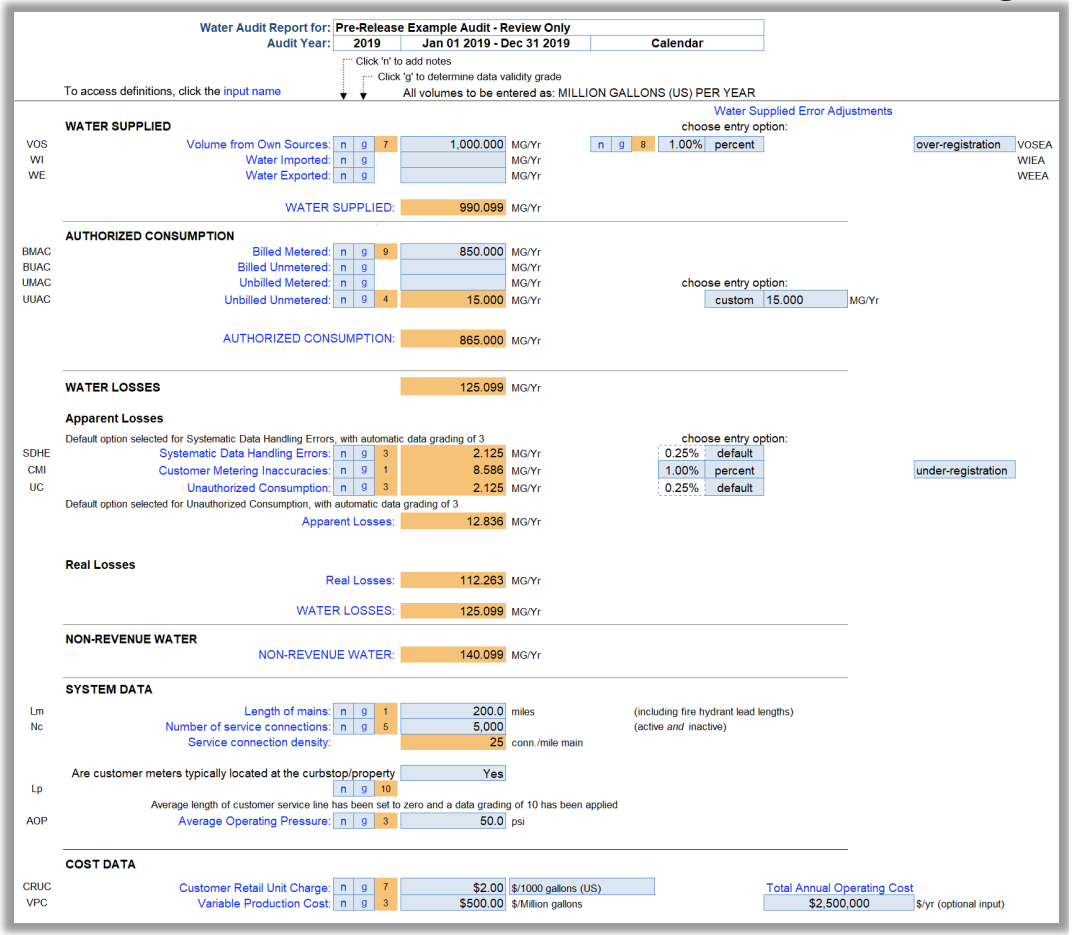
| | | | |
|---|---|---|---|
| Length of mains: | 1 | 200.0 | miles |
| Number of active AND inactive service connections: | 5 | 5000 | |
| Service connection density: | | 25 | conn./mile main |
| Are customer meters typically located at the curbstop or property line? | | Yes | |
| Average length of customer 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: | 3 | 50.0 | psi |

**COST DATA**

| | | | |
|---|---|---|---|
| Total annual cost of operating water system: | 10 | $2,500,000 | $/Year |
| Customer retail unit cost (applied to Apparent Losses): | 7 | $2.00 | $/100 cubic feet (ccf) |
| Variable production cost (applied to Real Losses): | 3 | $500.00 | $/acre-ft |

Use Customer Retail Unit Cost to value real losses

## v6



Water Audit Report for: Pre-Release Example Audit - Review Only
Audit Year: 2019 Jan 01 2019 - Dec 31 2019 Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To access definitions, click the input name

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

Water Supplied Error Adjustments

**WATER SUPPLIED**

| | | | | | | | | |
|---|---|---|---|---|---|---|---|---|
| VOS | Volume from Own Sources: | n g | 7 | 1,000.000 | MG/Yr | n g 8 1.00% percent | over-registration | VOSEA |
| WI | Water Imported: | n g | | | MG/Yr | | | WIEA |
| WE | Water Exported: | n g | | | MG/Yr | | | WEEA |
| | WATER SUPPLIED: | | | 990.099 | MG/Yr | | | |

**AUTHORIZED CONSUMPTION**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| BMAC | Billed Metered: | n g | 9 | 850.000 | MG/Yr | | |
| BUAC | Billed Unmetered: | n g | | | MG/Yr | | |
| UMAC | Unbilled Metered: | n g | | | MG/Yr | choose entry option: | |
| UUAC | Unbilled Unmetered: | n g | 4 | 15.000 | MG/Yr | custom 15.000 MG/Yr | |
| | AUTHORIZED CONSUMPTION: | | | 865.000 | MG/Yr | | |

**WATER LOSSES** 125.099 MG/Yr

**Apparent Losses**

Default option selected for Systematic Data Handling Errors, with automatic data grading of 3 — choose entry option:

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| SDHE | Systematic Data Handling Errors: | n g | 3 | 2.125 | MG/Yr | 0.25% default | |
| CMI | Customer Metering Inaccuracies: | n g | 1 | 8.586 | MG/Yr | 1.00% percent | under-registration |
| UC | Unauthorized Consumption: | n g | 3 | 2.125 | MG/Yr | 0.25% default | |

Default option selected for Unauthorized Consumption, with automatic data grading of 3

Apparent Losses: 12.836 MG/Yr

**Real Losses**

Real Losses: 112.263 MG/Yr

WATER LOSSES: 125.099 MG/Yr

**NON-REVENUE WATER**

NON-REVENUE WATER: 140.099 MG/Yr

**SYSTEM DATA**

| | | | | | | |
|---|---|---|---|---|---|---|
| Lm | Length of mains: | n g | 1 | 200.0 | miles | (including fire hydrant lead lengths) |
| Nc | Number of service connections: | n g | 5 | 5,000 | | (active *and* inactive) |
| | Service connection density: | | | 25 | conn./mile main | |
| | Are customer meters typically located at the curbstop/property | | | Yes | | |
| Lp | | n g | 10 | | | |
| | Average length of customer service line has been set to zero and a data grading of 10 has been applied | | | | | |
| AOP | Average Operating Pressure: | n g | 3 | 50.0 | psi | |

**COST DATA**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CRUC | Customer Retail Unit Charge: | n g | 7 | $2.00 | $/1000 gallons (US) | Total Annual Operating Cost | |
| VPC | Variable Production Cost: | n g | 3 | $500.00 | $/Million gallons | $2,500,000 | $/yr (optional input) |

# Worksheet

## v5

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

Water Audit Report for: V5 Example Audit
Reporting Year: 2019 1/2019 - 12/2019

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: ACRE-FEET 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: | + ? | 7 | 1,000.000 | acre-ft/yr | + ? | 8 | 1.00% | | acre-ft/yr |
| Water imported: | + ? | | | acre-ft/yr | + ? | | | | acre-ft/yr |
| Water exported: | + ? | | | acre-ft/yr | + ? | | | | acre-ft/yr |

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

**WATER SUPPLIED:** 990.099 acre-ft/yr

## v6

Water Audit Report for: Pre-Release Example Audit - Review Only
Audit Year: 2019 Jan 01 2019 - Dec 31 2019 Calendar

Click 'n' to add notes
Click 'g' to determine data validity grade

To access definitions, click the input name

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

Water Supplied Error Adjustments

**WATER SUPPLIED**

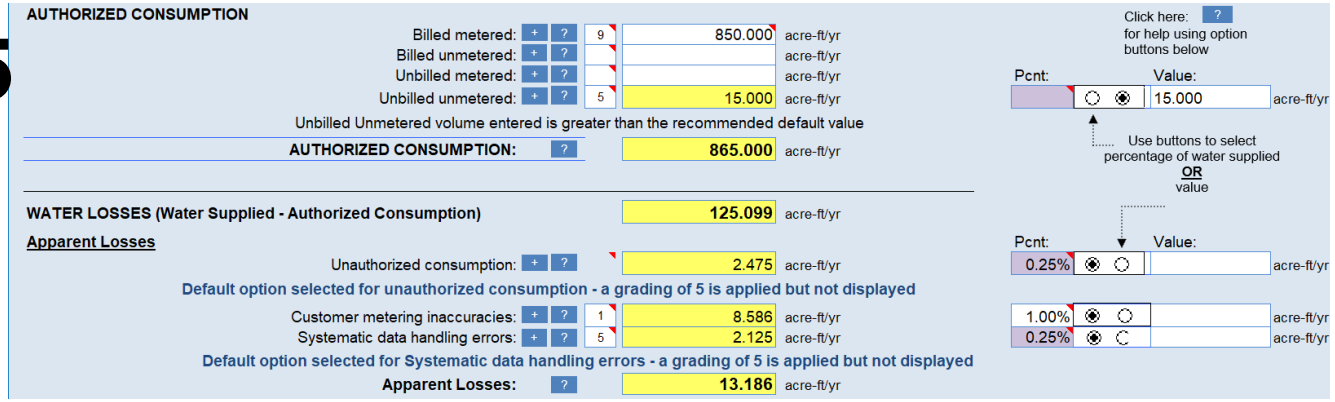
choose entry option:

| | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|
| VOS | Volume from Own Sources: | n g | 7 | 1,000.000 | MG/Yr | n g | 8 | 1.00% | percent | over-registration | VOSEA |
| WI | Water Imported: | n g | | | MG/Yr | | | | | | WIEA |
| WE | Water Exported: | n g | | | MG/Yr | | | | | | WEEA |

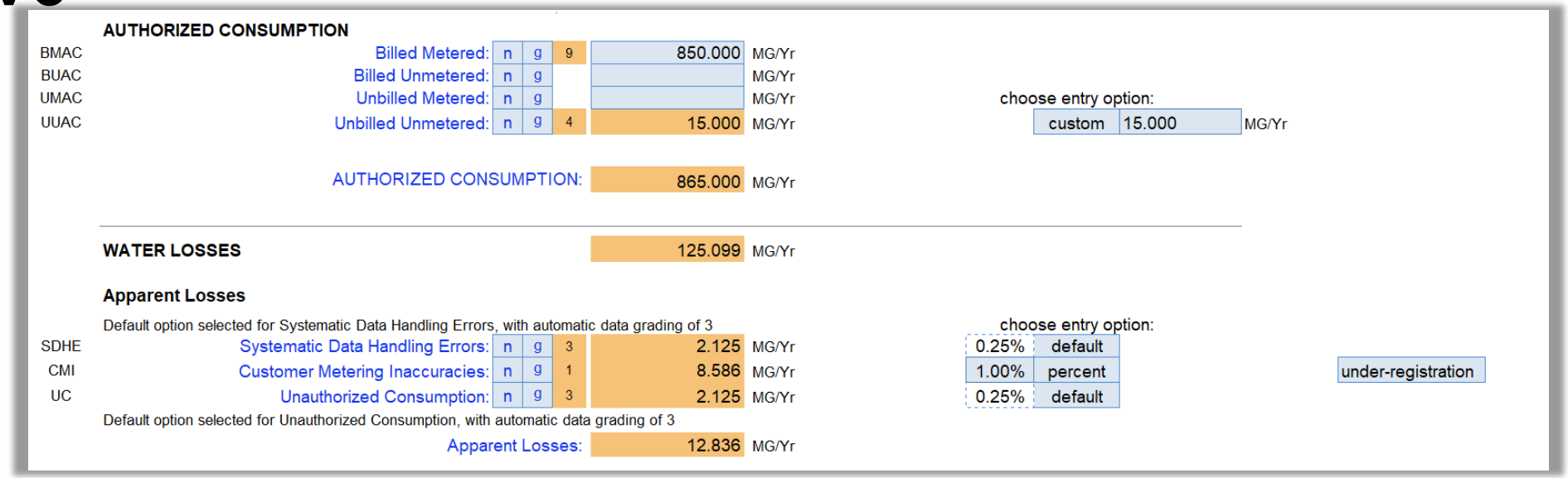
WATER SUPPLIED: 990.099 MG/Yr

# Worksheet

v5




v6



# Worksheet

## v5

**COST DATA**

| | | | | | |
|---|---|---|---|---|---|
| Total annual cost of operating water system: | + | ? | 10 | $2,500,000 | $/Year |
| Customer retail unit cost (applied to Apparent Losses): | + | ? | 7 | $2.00 | $/100 cubic feet (ccf) |
| Variable production cost (applied to Real Losses): | + | ? | 3 | $500.00 | $/acre-ft |

☐ Use Customer Retail Unit Cost to value real losses

## v6

**COST DATA**

| | | | | | | | |
|---|---|---|---|---|---|---|---|
| CRUC | Customer Retail Unit Charge: | n | g | 7 | $2.00 | $/1000 gallons (US) | |
| VPC | Variable Production Cost: | n | g | 3 | $500.00 | $/Million gallons | |

Total Annual Operating Cost: $2,500,000 $/yr (optional input)

# Worksheet

## v5

**WATER AUDIT DATA VALIDITY SCORE:**

*** YOUR SCORE IS: 62 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: Variable production cost (applied to Real Losses)

## v6

**WATER AUDIT DATA VALIDITY TIER:**

*** The Water Audit Data Validity Score is in Tier III (51-70). See Dashboard tab for additional outputs. ***

go to dashboard

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

**PRIORITY AREAS FOR ATTENTION TO IMPROVE DATA VALIDITY:**

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

| |
|---|
| 1: Volume from Own Sources (VOS) |
| 2: Customer Metering Inaccuracies (CMI) |
| 3: Length of Mains (Lm) |

**KEY PERFORMANCE INDICATOR TARGETS:**

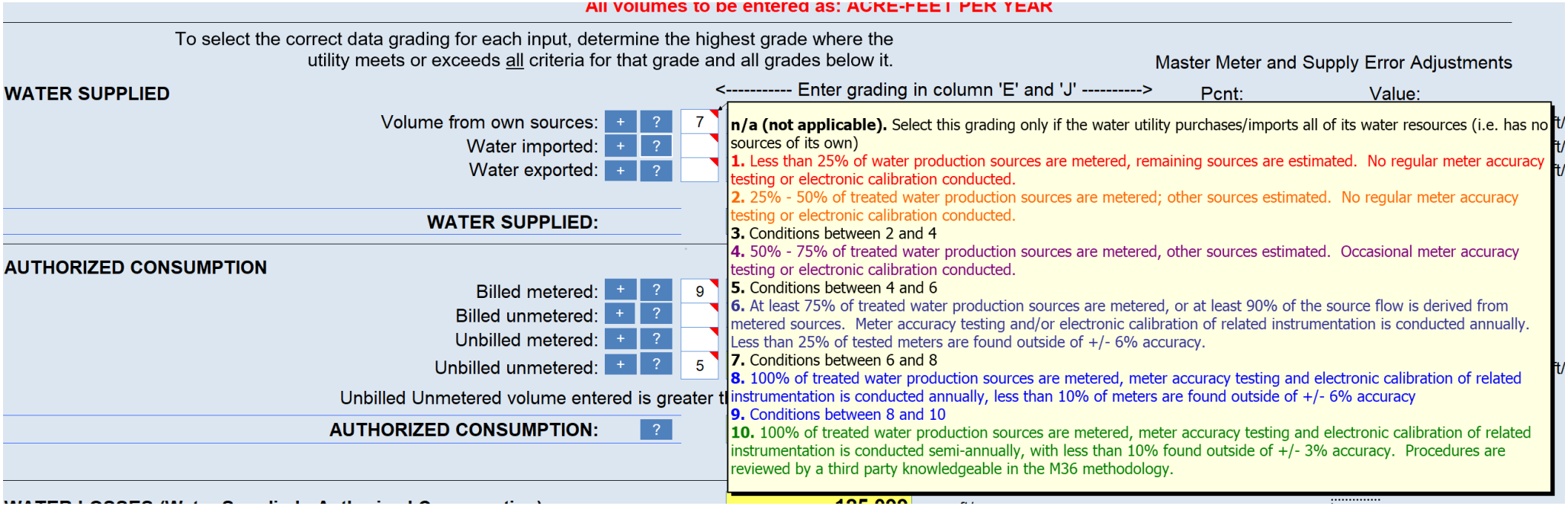
OPTIONAL: User may enter targets for operational performance indicators below

| | | |
|---|---|---|
| Unit Total Losses: | 45.0 | gal/conn/day |
| Unit Apparent Losses: | 5.0 | gal/conn/day |
| Unit Real Losses[A]: | 40.0 | gal/conn/day |
| Unit Real Losses[B]: | 500 | gal/mile/day |
| Infrastructure Leakage Index: | 1.5 | dimensionless |

If entered above by user, targets will display on KPI gauges (see Dashboard)

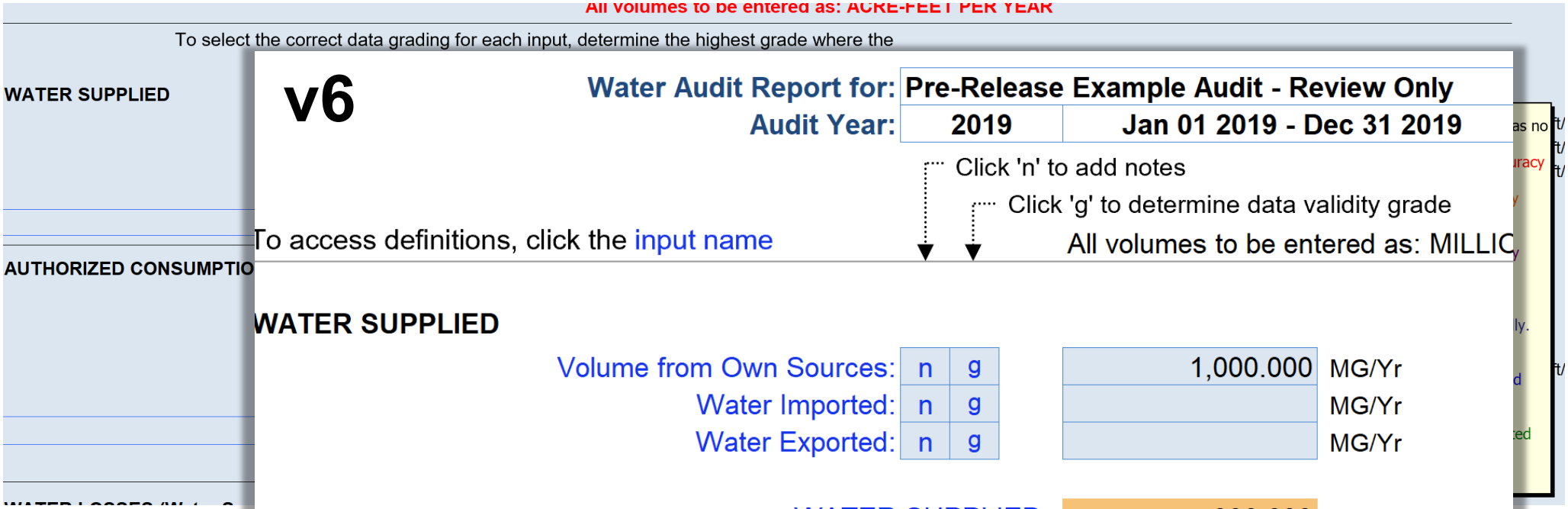
# Data Validity Grading

## v5



# Data Validity Grading

## v5




## v6

Water Audit Report for: **Pre-Release Example Audit - Review Only**

Audit Year: **2019** **Jan 01 2019 - Dec 31 2019**

Click 'n' to add notes

Click 'g' to determine data validity grade

To access definitions, click the input name

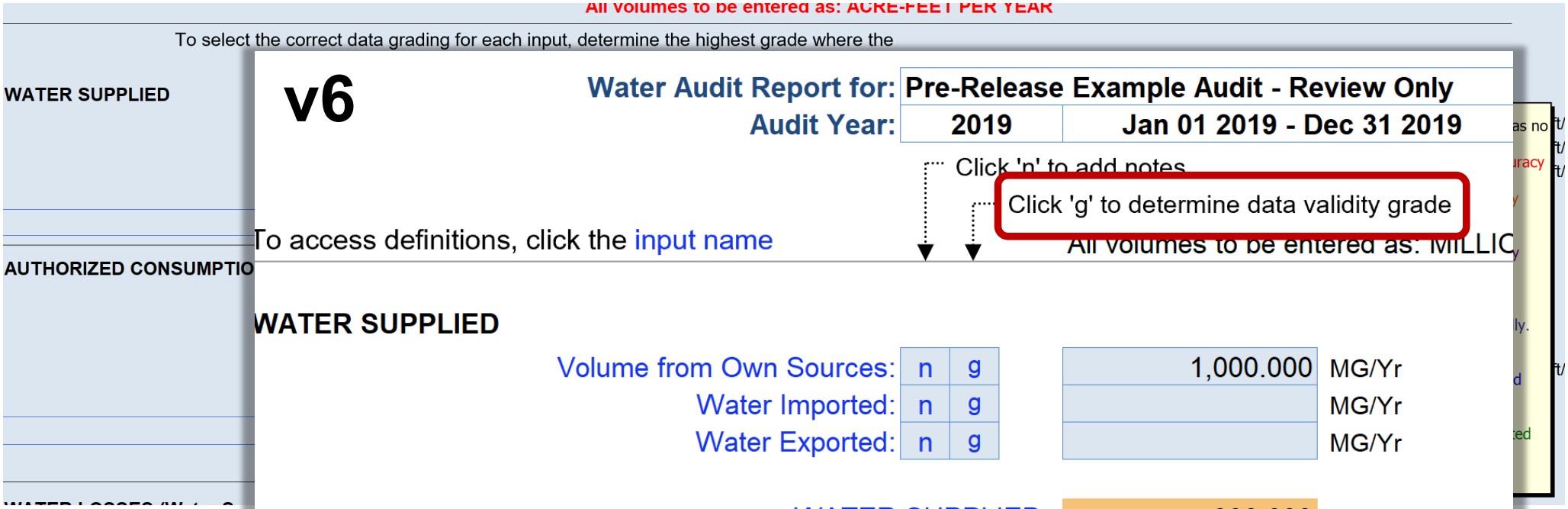
All volumes to be entered as: MILLIC

**WATER SUPPLIED**

| | | | | |
|---|---|---|---|---|
| Volume from Own Sources: | n | g | 1,000.000 | MG/Yr |
| Water Imported: | n | g | | MG/Yr |
| Water Exported: | n | g | | MG/Yr |
| WATER SUPPLIED: | | | 990.099 | MG/Yr |

# Data Validity Grading

## v5



# Data Validity Grading

v6

Test Utility
2019

AWWA Free Water Audit Software: Interactive Data Grading

| | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| VOS | VOSEA | WI | WIEA | WE | WEEA | BMAC | BUAC | UMAC | UUAC |
| SDHE | CMI | UC | Lm | Nc | Lp | AOP | CRUC | VPC | |

White = incomplete
Orange = complete
Use acronyms for navigation

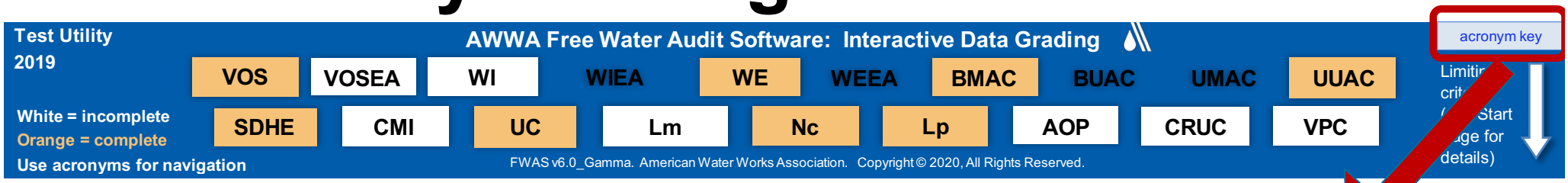


acronym key

Limiting criteria (see Start Page for details)

# Data Validity Grading

v6



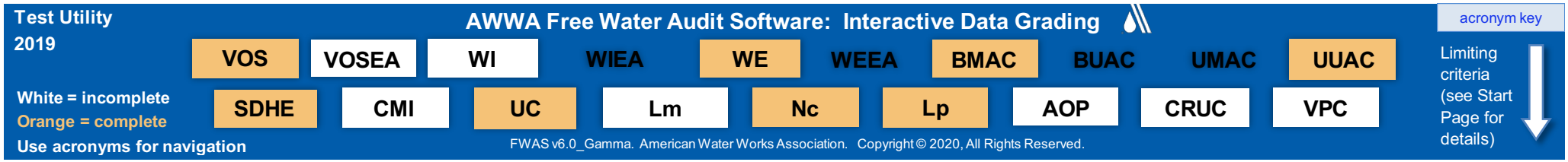

## Key of Input Acronyms

*In order of appearance in the Worksheet*

| | |
|---|---|
| **VOS** | Volume from Own Sources |
| **VOSEA** | VOS Error Adjustment |
| **WI** | Water Imported |
| **WIEA** | WI Error Adjustment |
| **WE** | Water Exported |
| **WEEA** | WE Error Adjustment |
| **BMAC** | Billed Metered Authorized Consumption |
| **BUAC** | Billed Unmetered Authorized Consumption |
| **UMAC** | Unbilled Metered Authorized Consumption |
| **UUAC** | Unbilled Unmetered Authorized Consumption |
| **SDHE** | Systematic Data Handling Errors |
| **CMI** | Customer Metering Inaccuracies |
| **UC** | Unauthorized Consumption |
| **Lm** | Length of mains |
| **Nc** | Number of service connections |
| **Lp** | Average length of (private) customer service line |
| **AOP** | Average Operating Pressure |
| **CRUC** | Customer Retail Unit Charge |
| **VPC** | Variable Production Cost |

# Data Validity Grading

v6




Use acronym buttons in IDG header to navigate among inputs. Acronym Key above.
White = needs answers, orange = complete, clear = not required.

After clicking an acronym button, answer all visible questions in the order they're presented, choosing best-fit answer

Grade will populate when all visible questions are complete for an input

7

The limiting criteria will be labeled along the right. If only 1 limiting criterion is shown, improving on that criterion will achieve a higher data grade. If multiple limiting criteria are shown, improving on each limiting criteria is necessary to achieve a higher data grade. A complete inventory of data grading criteria is available in the Data Grading Matrix v6.0 (see web resources)

Limiting

# Data Validity Grading v6

Test Utility
2019

White = incomplete
Orange = complete
Use acronyms for navigation

**AWWA Free Water Audit Software: Interactive Data Grading**

VOS | VOSEA | WI | WIEA | WE | WEEA | BMAC | BUAC | UMAC | UUAC

SDHE | CMI | UC | Lm | Nc | Lp | AOP | CRUC | VPC

acronym key

Limiting criteria (see Start Page for details)



go to input

## Volume from Own Sources (VOS) - Data Grading Criteria

go to notes

| vos | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|---|---|---|
| vos.0 | Did the water utility supply any water from its own sources during the audit year? | Yes |
| vos.1 | What percent of own supply volume is metered? | >99% |
| | **For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the finished water volume.**<br>**In-situ flow accuracy testing** refers to a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location.<br>**Electronic calibration** refers to a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).<br>**Secondary device** can include meter transmitter, DP cell, chart recorder or similar instrumentation.<br>**Tertiary device** can include SCADA, historian or other computerized archival system. | |
| vos.2 | What is the frequency of electronic calibration? | Annually |
| vos.3 | What level of data transfer errors are checked as part of the electronic calibration process? | Data transfer errors are checked at secondary device(s) AND tertiary device(s) |
| vos.4 | Is the most recent electronic calibration documentation available for review? | Yes |
| vos.5 | What is the frequency of in-situ flow accuracy testing? | Less than annual but within last 5 years |
| vos.6 | Is the most recent in-situ flow accuracy testing documentation available for review? | Yes |
| vos.7 | What are the total volume-weighted average results of in-situ flow accuracy testing (during or closest to audit year)? | |
| vos.8 | Have testing and calibration procedures been closely scrutinized for compliance with procedures described in the AWWA M36 and/or M33 Manual(s)? | |
| vos.9 | Which best describes the frequency of finished water meter readings? | |
| vos.10 | Which best describes the frequency of data review for anomalies/errors? These can include numbers that are outside of typical patterns, and zero or 'null' values that may reflect a gap in data recording. | |

At ±6% or greater
Between ±3% to ±6%
At or within ±3%

**FINAL DATA GRADE FOR THIS AUDIT INPUT:**

# Data Validity Grading v6

Test Utility
2019

AWWA Free Water Audit Software: Interactive Data Grading

VOS | VOSEA | WI | WIEA | WE | WEEA | BMAC | BUAC | UMAC | UUAC
SDHE | CMI | UC | Lm | Nc | Lp | AOP | CRUC | VPC

White = incomplete
Orange = complete
Use acronyms for navigation

acronym key

Limiting criteria (see Start Page for details)



go to input

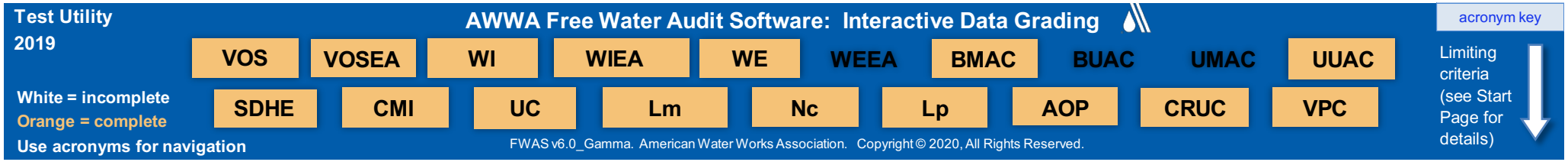
## Volume from Own Sources (VOS) - Data Grading Criteria

go to notes

| vos | Criteria Question | Select Best-Fit Answers to All Visible Questions | |
|---|---|---|---|
| vos.0 | Did the water utility supply any water from its own sources during the audit year? | Yes | |
| vos.1 | What percent of own supply volume is metered? | >99% | |
| | **For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the finished water volume.**<br>**In-situ flow accuracy testing** refers to a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location.<br>**Electronic calibration** refers to a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).<br>**Secondary device** can include meter transmitter, DP cell, chart recorder or similar instrumentation.<br>**Tertiary device** can include SCADA, historian or other computerized archival system. | | |
| vos.2 | What is the frequency of electronic calibration? | Annually | |
| vos.3 | What level of data transfer errors are checked as part of the electronic calibration process? | Data transfer errors are checked at secondary device(s) AND tertiary device(s) | |
| vos.4 | Is the most recent electronic calibration documentation available for review? | Yes | |
| vos.5 | What is the frequency of in-situ flow accuracy testing? | Less than annual but within last 5 years | Limiting |
| vos.6 | Is the most recent in-situ flow accuracy testing documentation available for review? | Yes | |
| vos.7 | What are the total volume-weighted average results of in-situ flow accuracy testing (during or closest to audit year)? | At or within ±3% | |
| vos.8 | Have testing and calibration procedures been closely scrutinized for compliance with procedures described in the AWWA M36 and/or M33 Manual(s)? | Yes | |
| vos.9 | Which best describes the frequency of finished water meter readings? | Continuous | |
| vos.10 | Which best describes the frequency of data review for anomalies/errors? These can include numbers that are outside of typical patterns, and zero or 'null' values that may reflect a gap in data recording. | Daily | |
| | **FINAL DATA GRADE FOR THIS AUDIT INPUT:** | 7 | |

# Data Validity Grading

v6

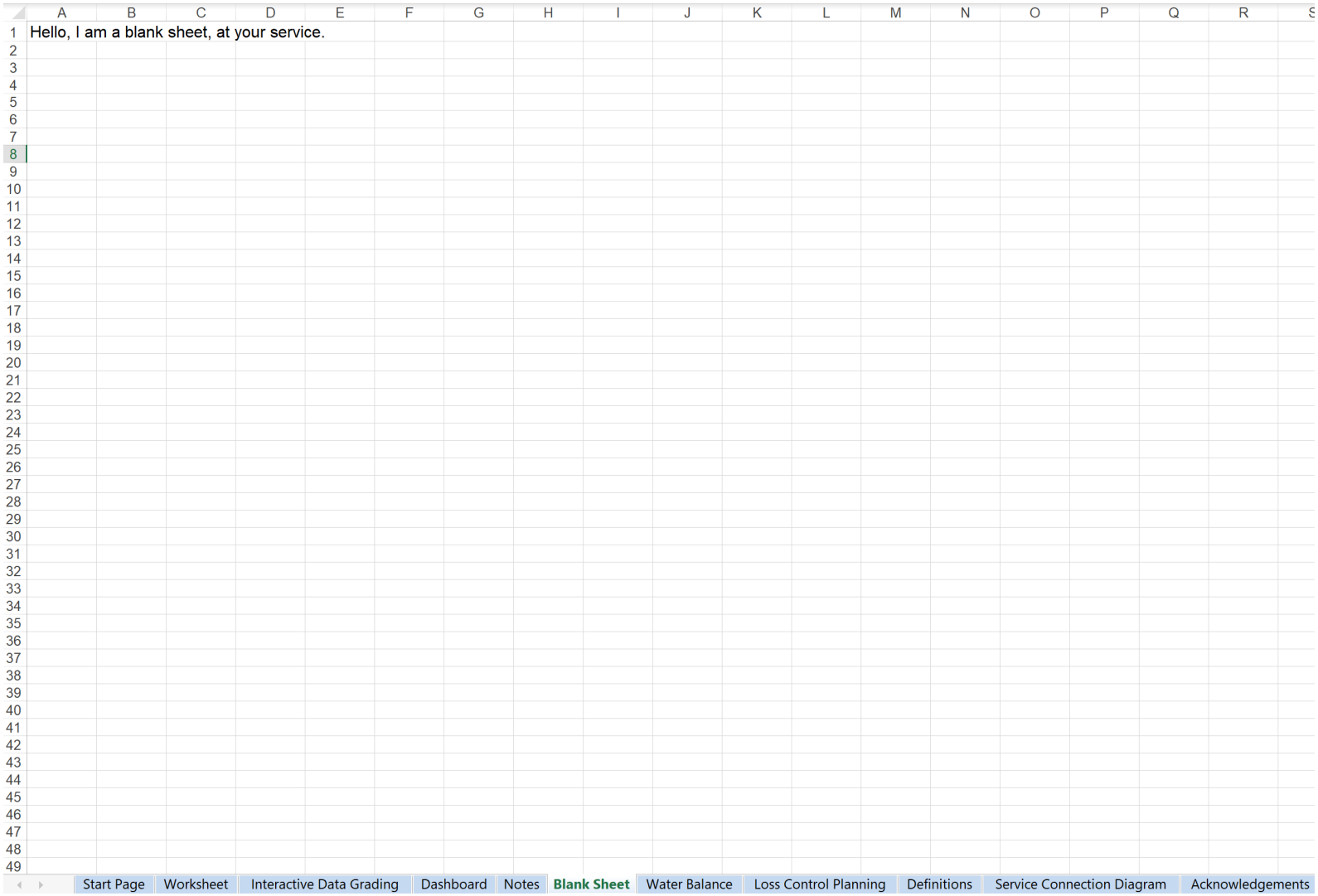



**When acronym buttons in IDG header are no longer WHITE, you are complete with the IDG questions**

(if any are clear, they are not required)

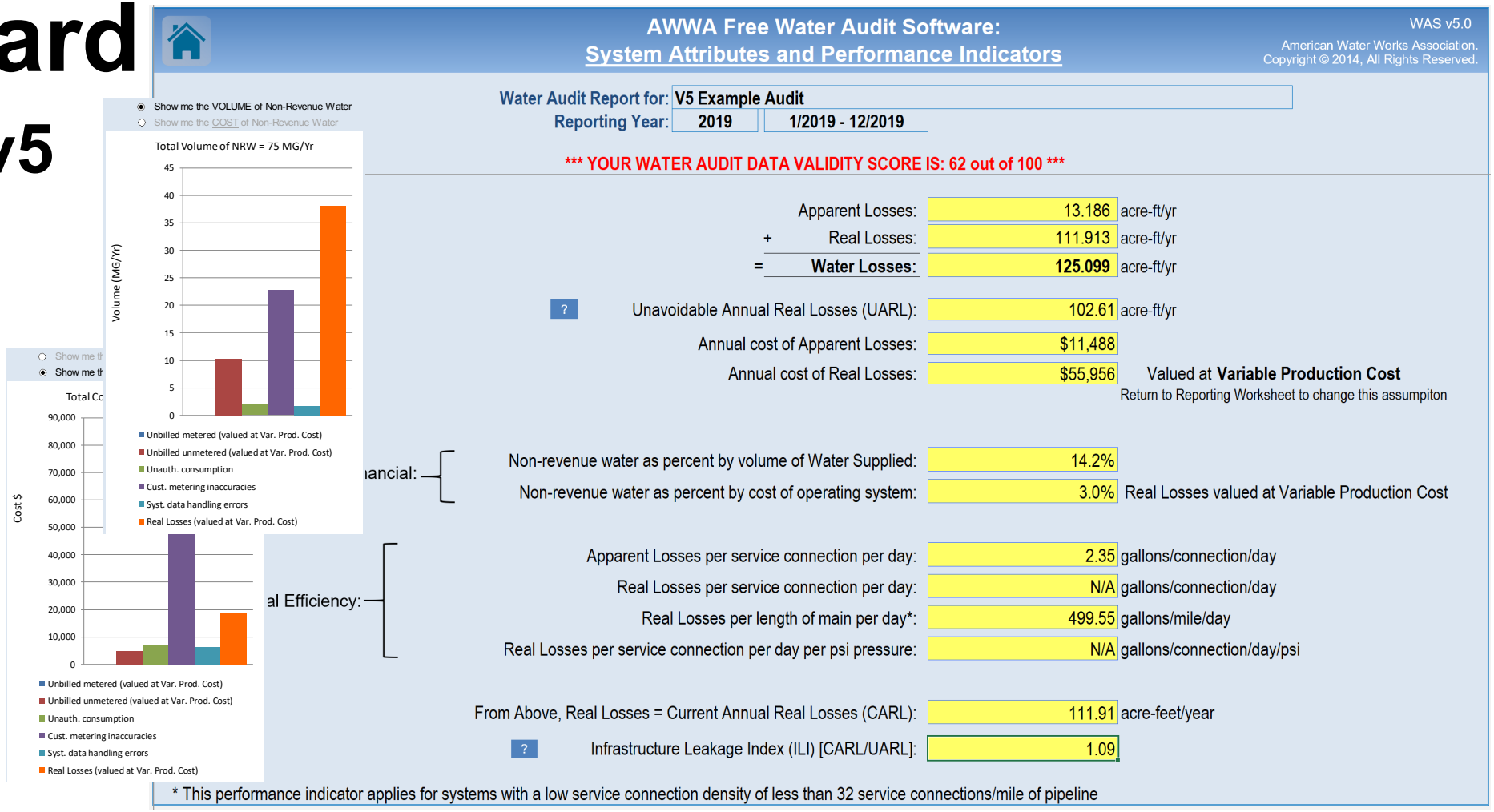
# v6 Blank Sheet

***Alexa,***
***find my blank sheet***



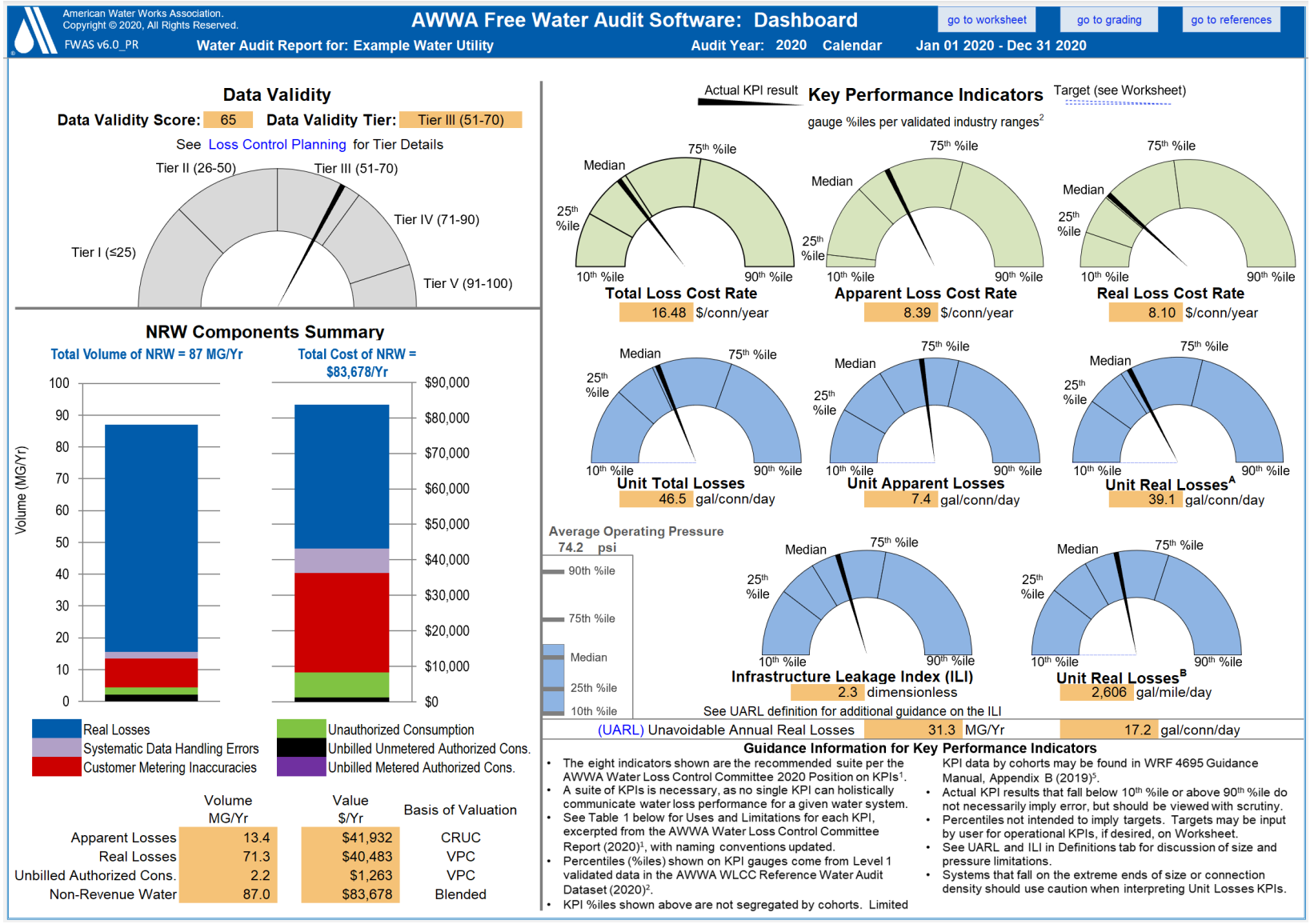
# Dash-board

## v5



# Dash-board

## v6



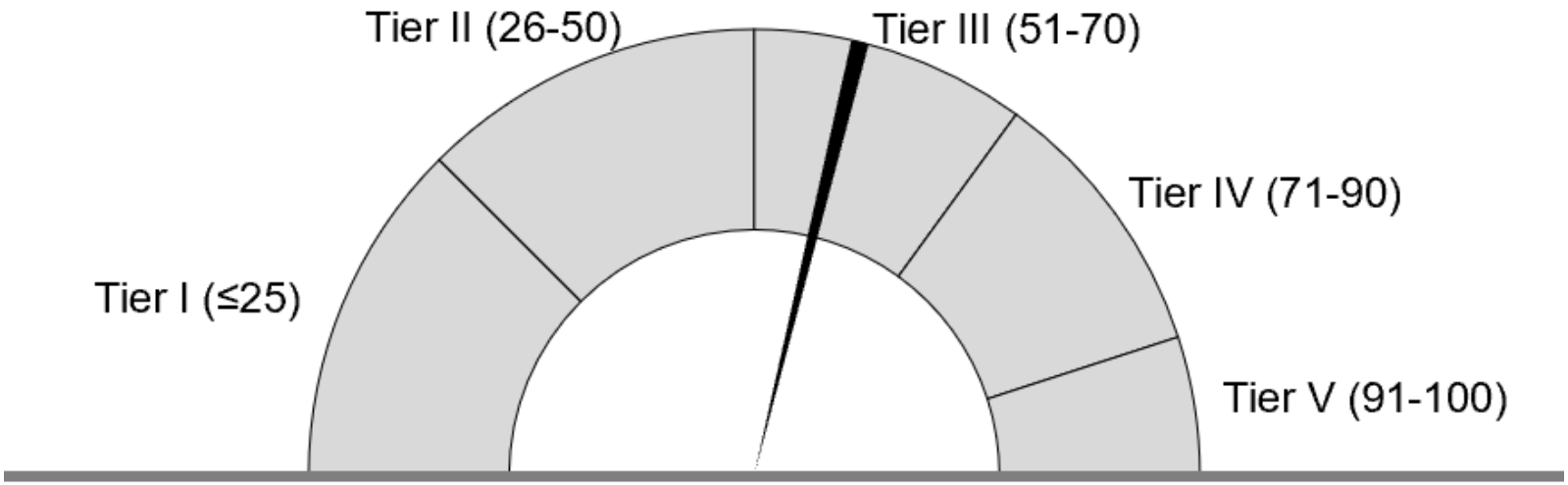
# Dash-board

## v6

### Data Validity

**Data Validity Score:** 57 **Data Validity Tier:** Tier III (51-70)

See Loss Control Planning for Tier Details



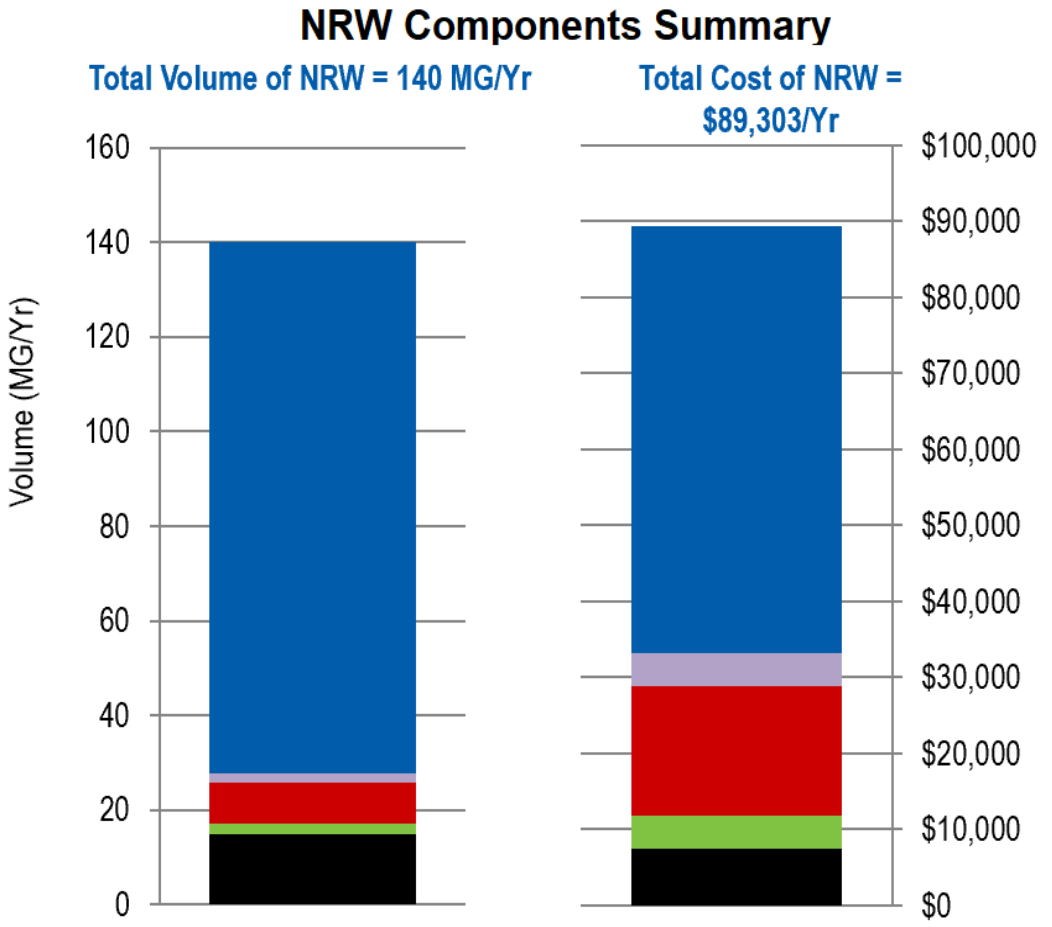
# Water Loss Control Planning Guide

| | Water Audit Data Validity Tier (Score Range) | | | | |
|---|---|---|---|---|---|
| **Functional Focus Area** | **Tier I (1-25)** | **Tier II (26-50)** | **Tier III (51-70)** | **Tier IV (71-90)** | **Tier V (91-100)** |
| Audit Data Collection | Launch auditing and loss control team; address supply metering deficiencies | Analyze business process for customer metering and billing functions and water supply operations; Identify data gaps; improve supply metering | Establish/revise policies and procedures for data collection | Refine data collection practices and establish as routine business process | Annual water audit is a reliable gauge of year-to-year water efficiency standing |
| Short-term loss control | Research information on leak detection programs; Begin flowcharting analysis of customer billing system | Conduct loss assessment investigations on a sample portion of the system: customer meter testing, leak survey, unauthorized consumption, etc | Establish ongoing mechanisms for customer meter accuracy testing, active leakage control and infrastructure monitoring | Refine, enhance or expand ongoing programs based upon economic justification | Stay abreast of improvements in metering, meter reading, billing, leakage management and infrastructure rehabilitation |
| Long-term loss control | | Begin to assess long-term needs requiring large expenditure: customer meter replacement, water main replacement program, new customer billing system or AMR/AMI system | Begin to assemble economic business case for long-term needs based upon improved data becoming available through the water audit process | Conduct detailed planning, budgeting and launch of comprehensive improvements for metering, billing or infrastructure management | Continue incremental improvements in short-term and long-term loss control interventions |
| Target-setting | | | Establish long-term apparent and real loss reduction goals (+10 year horizon) | Establish mid-range (5 year horizon) apparent and real loss reduction goals | Evaluate and refine loss control goals on a yearly basis |
| Benchmarking | | | Preliminary Comparisons - can begin to rely upon with PIs for performance comparisons for real losses | Performance Benchmarking with PIs is meaningful in comparing real loss standing | Identify Best Practices/ Best in class; PIs are very reliable as real loss performance indicators for best in class service |

*For validity scores of 50 or below, the shaded blocks should not be focus areas until better data validity is achieved.*

# Dash-board

## v6




| | Volume MG/Yr | Value $/Yr | Basis of Valuation |
|---|---|---|---|
| Apparent Losses | 12.8 | $25,672 | CRUC |
| Real Losses | 112.3 | $56,132 | VPC |
| Unbilled Authorized Cons. | 15.0 | $7,500 | VPC |
| Non-Revenue Water | 140.1 | $89,303 | Blended |

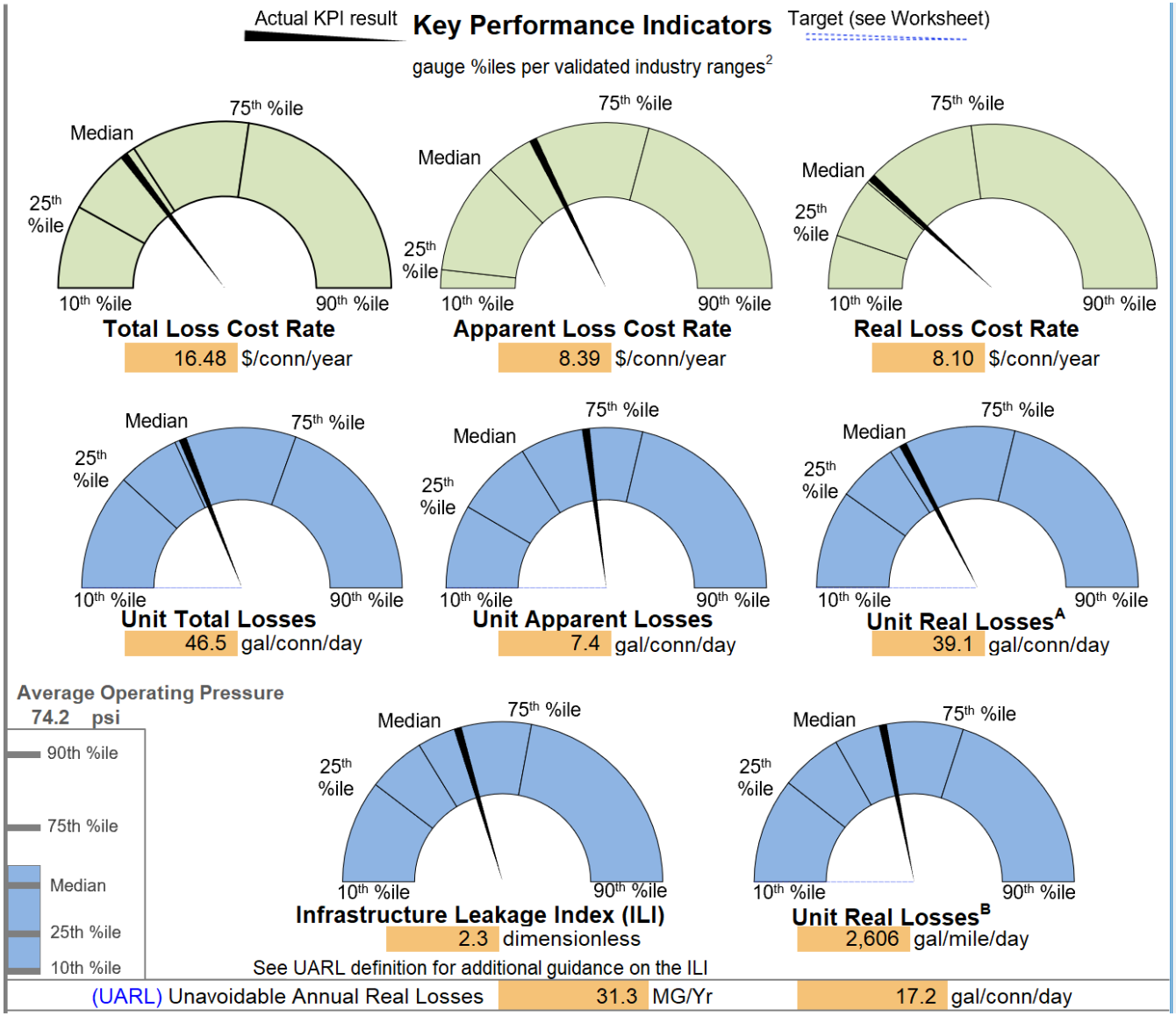
# Dash-board

## v6

### Key Performance Indicators

gauge %iles per validated industry ranges[2]

Actual KPI result



# Dash-board

## v6

### Guidance Information for Key Performance Indicators

- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs[1].
- A suite of KPIs is necessary, as no single KPI can wholistically communicate water loss performance for a given water system.
- See Table 1 below for Uses and Limitations for each KPI, excerpted from the AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated.
- %iles shown on KPI gauges come from Level 1 validated data in the AWWA WLCC Reference Water Audit Dataset (2020)[2].
- KPI %iles shown above are not segregated by cohorts. Limited KPI data by cohorts may be found in WRF 4695 Guidance Manual, Appendix B (2019)[5].
- Actual KPI results that fall below 10th %ile or above 90th %ile do not necessarily imply error, but should be viewed with scrutiny.
- Percentiles not intended to imply targets. Targets may be input by user for operational KPIs, if desired, on Worksheet.
- See UARL and ILI in Definitions tab for discussion of size and pressure limitations.
- Systems that fall on the extreme ends of size or connection density should use caution when interpreting Unit Losses KPIs.

Source: AWWA Water Loss Control Committee Report (2020)[1], with naming conventions updated

**Table 1**

**2020 AWWA Water Audit Method – Water Audit Outputs and Key Performance Indicators: Uses and Limitations**

| Type | Indicator | Description | Suitable Purposes | | | | | Uses and Limitations | Principal Users |
|---|---|---|---|---|---|---|---|---|---|
| | | | Assessment | Bench-marking | Target-Setting | Planning | Tracking | | |
| Volume | Unit Apparent Losses (vol / conn / day) | Strong and understandable indicator for multiple users | ✓ | ✓ | ✓ | ✓ | ✓ | Used for performance tracking and target-setting | Utilities Regulators |
| | Unit Real Losses[A] (vol / conn / day) | Strong and understandable indicator for multiple users | ✓ | ✓ | ✓ | ✓ | ✓ | Used for performance tracking and target-setting | Utilities, Regulators, Policy Makers |
| | Unit Real Losses[B] (vol / pipeline length / day) | Strong and understandable indicator for use by utilities with low connection density | ✓ | ✓ | ✓ | ✓ | ✓ | Data collection and assessment of systems with "low" connection density | Utilities, Regulators, Policy Makers |
| | Unit Total Losses (vol / conn / day) **New KPI** | Strong and understandable indicator; suitable for high-level performance measurement | ✓ | | | | ✓ | High level indicator for trending analysis. Not appropriate for target-setting or benchmarking | Utilities, Customers |
| | Infrastructure Leakage Index (ILI) | Robust, specialized ratio KPI; can be influenced by pressure and connection density. | ✓ | ✓ | | | ✓ | Benchmarking after pressure management is implemented | Utilities |
| Value | Apparent Loss Cost Rate (value / conn / year) **New KPI** | Indicators with sufficient technical rigor. Provide the unit financial value of each type of loss, which is very useful for planning and assessment of cost efficiency of water loss reduction and control interventions and | ✓ | | | ✓ | ✓ | Data collection and assessment on AWWA indicators or contextual parameters to use in conjunction with Loss Cost Rates | Utilities, Regulators, Customers |
| | Real Loss Cost Rate | | | | | | | | |

## Key Performance Indicators

gauge %iles per validated industry ranges[2]

**Source: AWWA Free Water Audit Software v6**

Actual KPI result

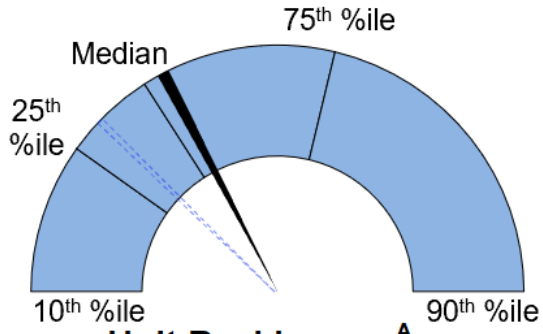
Target (optional, user-provided)

**KEY PERFORMANCE INDICATOR TARGETS:**

OPTIONAL: If targets exist for the operational performance indicators, they can be input below:

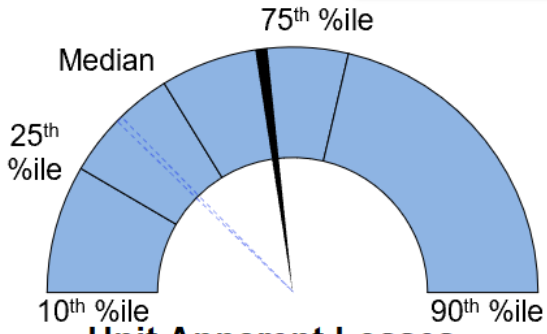
| | | |
|---|---|---|
| Unit Total Losses: | 32.0 | gal/conn/day |
| Unit Apparent Losses: | 4.0 | gal/conn/day |
| Unit Real Losses[A]: | 28.0 | gal/conn/day |
| Unit Real Losses[B]: | 900 | gal/mile/day |

If entered above by user, targets will display on KPI gauges (see Dashboard)



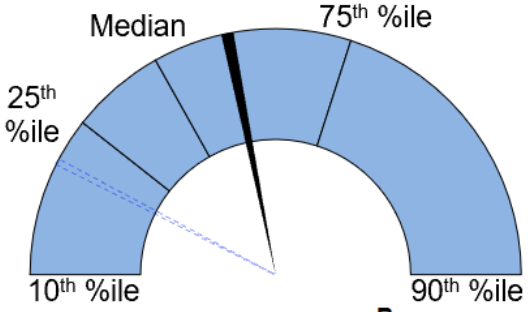

**Unit Real Losses[A]**

39.1 gal/conn/day



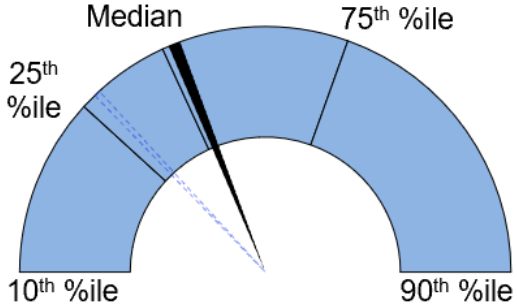

**Unit Apparent Losses**

7.4 gal/conn/day




**Unit Real Losses[B]**

2,606 gal/mile/day




**Unit Total Losses**

46.5 gal/conn/day

# SUMMARY OF MAJOR V6 IMPROVEMENTS

- Interactive Data Grading to improve consistency, objectivity, transparency in data grade assignment for each input
- Blank sheet for user calculations / extras
- Fighterjet Dashboard
- KPIs updated per AWWA 2020 Position
- KPIs shown on gauge against industry ranges

# ACKNOWLEDGEMENTS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- George Kunkel

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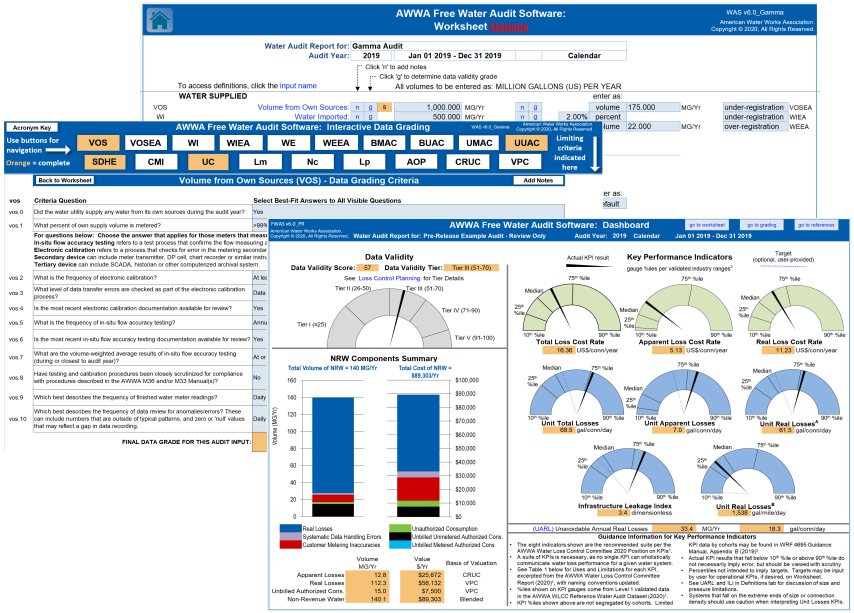
- Drew Blackwell
- Heather Himmelberger
- Yannis Kachani
- Chris Leauber
- Sofia Marcus
- Brian Skeens
- Dan Strub
- Ken Brothers

# OFFICIAL RELEASE DATE




# AWWA FWAS v6.0

# World Water Loss Day

## 4th December

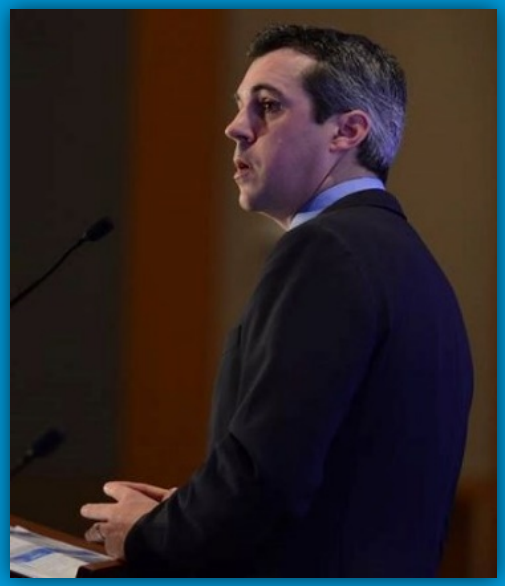
American Water Works Association

*Dedicated to the World's Most Important Resource®*


PRESENTATION'S OVER
IT'S DEMO TIME!
memegenerator.net

CAVANAUGH

*Stewardship Through Innovation*



# TAKING THE V6 FOR A SPIN

## THE NEW AWWA FREE WATER AUDIT SOFTWARE IS HERE


Will Jernigan, P.E.

Chair / AWWA Water Loss Software Committee

Chair / North American Water Loss Conference

CFO, Director of Water Efficiency / Cavanaugh

Will.Jernigan@cavanaughsolutions.com


25 YEARS 1995-2020 DELIVERING STEWARDSHIP THROUGH INNOVATION CAVANAUGH