American Water Works Association
California-Nevada Section

CA-NV AWWA Water Loss Technical Assistance Program

Wave 4 Water Audit Level 1 Validation Document

Validator Provided

Audit Information:

Utility: Tulare PWS ID: 5410015

System Type: Potable Audit Period: Fiscal Year 2016/17

Utility Representation: Benjamin Siegel, Tim Doyle

Validation Date: 9/6/2017 Call Time: 1:00 pm Sufficient Supporting Documents Provided: Yes

Validation Findings & Confirmation Statement:

Key Audit Metrics:

Data Validity Score: 52 Data Validity Band (Level): Band III (51-70)

ILI: 2.40 Real Loss: 26.27 (gal/conn/day) Apparent Loss: 11.39 (gal/conn/day)

Non-Revenue Water as a Percentage of Operating Costs: 1.2%

Certification Statement by Validator:

This water loss audit report has been Level 1 validated per the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34.

All recommendations on volume derivation and Data Validity Grades were incorporated into the water audit. ☒

Validator Information:

Water Audit Validator: Tory Wagoner Validator Qualifications: Contractor for CA-NV AWWA Water Loss TAP

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#	AWWA Water Audit Input	Code	Final DVG	Basis on Input Derivation	Basis on Data Validity Grade
1	Volume from Own Sources	VOS	5	Supply meter profile: Volume supplied from twenty-seven total wells scattered throughout the system, with one completely inactive during the audit period. Two non-potable wells are connected to the system. VOS input derived from: SCADA reads from production meters as archived. Comments: Input derivation from supporting documents confirmed. Exclusion of non-potable volumes confirmed.	Percent of own supply metered: 100% Signal calibration frequency: Within last 5 years but less than annually. Volumetric testing frequency: Within last 5 years but less than annually. Volumetric testing method: Insertion type. Percent of own supply tested and/or calibrated: n/a. Comments: Limiting criteria for DVG is availability of testing/calibration documentation.
2	VOS Master Meter & Supply Error Adjustment	VOS MMSEA	3	Input derivation: Left blank in absence of available test data. Net storage change included in MMSEA input: No. Comments: No additional comments.	Supply meter read frequency: Continuous. Supply meter read method: Automatic logging via SCADA telemetry. Frequency of data review for trends & anomalies: Each business day. Storage levels monitored in real-time: No. Comments: Net storage change as limiting criteria for DVG.
3	Water Imported	WI	n/a	Import meter profile: No interconnections exist	
4	WI Master Meter & Supply Error Adjustment	WI MMSEA	n/a		
5	Water Exported	WE	n/a		
6	WE Master Meter & Supply Error Adjustment	WE MMSEA	n/a		
7	Billed metered	BMAC	5	Customer meter profile: Age profile: Fully metered since 2008 Reading system: AMR, moving to AMI (no backhaul infrastructure yet). Read frequency: Monthly.	Percent of customers metered: 100% Small meter testing policy: Reactive - complaint based or flagged-consumption testing only. Number of small meters tested/year: Not quantified, but known to be small.

#	AWWA Water Audit Input	Code	Final DVG	Basis on Input Derivation	Basis on Data Validity Grade
				Comments: Lag-time correction is not employed in input derivation. Input derivation from supporting documents confirmed. Exclusion of non-potable volumes confirmed.	Large meter testing policy: Reactive - complaint based or flagged-consumption testing only. Number of large meters tested/year: Not quantified, but known to be small. Meter replacement policy: Ongoing via meter conversion project at ~ 1,800 each year in meter read technology conversion. Number of replacements/year: 1,800 meters/year Billing data auditing: Standard billing QC, plus review of volumes by use type each billing cycle. Comments: No additional comments.
8	Billed unmetered	BUAC	n/a		
9	Unbilled metered	UMAC	n/a	Profile: City facilities flow through the billing system.	
10	Unbilled unmetered	UUAC	5	Profile: Operational flushing and fire department usage. Comments: Flushing activities greatly scaled back due to drought. Custom California default of 0.25%xWS utilized.	Comments: Default grade applied.
11	Unauthorized consumption	UC	5	Comments: Default input applied.	Comments: Default grade applied.
12	Customer metering inaccuracies	CMI	3	See BMAC comments regarding meter testing & replacement activities. Input derivation: Inferred from reference data (manufacturer, anecdotal test results) but not derived from test data analysis & calculation. Comments: No additional comments.	Characterization of meter testing: Limited (upon request AND consumption flag only). Characterization of meter replacement: Ongoing (proactive), annual. Comments: No additional comments.
13	Systematic data handling errors	SDHE	5	Comments: Default input applied.	Comments: Default grade applied.
14	Length of mains	Lm	7	Input derivation: Annual additions to legacy mileage number. Hydrant leads included: Not included. Recommend including in input derivation for next audit. Comments: No additional comments.	Mapping format: Paper. Asset management database: Not currently in place. Map updates & field validation: Accomplished through normal work order processes. Comments: No additional comments.

#	AWWA Water Audit Input	Code	Final DVG	Basis on Input Derivation	Basis on Data Validity Grade
15	Number of service connections	Ns	7	Input derivation: Standard report run from billing system. Basis for database query: Location or other premise-based ID. Comments: No additional comments.	CIS updates & field validation: Accomplished through normal meter reading processes. Estimated error of total count within: 3%. Comments: No additional comments.
16	Ave length of cust. service line	Lp	10	Comments: Default input and grade applied, as customer meters are typically located at the property boundary given California climate.	
17	Average operating pressure	AOP	7	Number of zones, general profile: One large zone based on flat terrain Typical pressure range: 45 -55 psi Input derivation: Calculated as weighted average from analysis of field data. Comments: No additional comments.	Extent of static pressure data collection: Hydrant pressures taken during routine system flushing and/or hydrant testing. Characterization of real-time pressure data collection: Well-covered - telemetry or pressure logging at all wells sites that are spread throughout the system, thus representative of the whole. Hydraulic model: In place and calibrated within the last 5 years. Comments: No additional comments.
18	Total annual operating cost	TAOC	10	Input derivation: From official financial reports. Comments: Confirmed costs limited to water only, and water debt service included.	Frequency of internal auditing: Annually. Frequency of third-party CPA auditing: Annually. Comments: No additional comments.
19	Customer retail unit cost	CRUC	7	Input derivation: Straight average based on each rate/tier. Sewer charges are based on water meter readings (non-residential). Sewer revenues are not incorporated into calculation. Comments: Recommend for next audit to derive as total consumptive revenue for water (and sewer if applicable) divided by BMAC (cell G23), converted as needed.	Characterization of calculation: Non-weighted average. Input calculations have not been reviewed by an M36 water loss expert. Comments: No additional comments.
20	Variable production cost	VPC	1	Supply profile: Own sources only. Primary costs included: N/a - input is estimated. Secondary costs included: N/a - input is estimated. Comments: No additional comments.	Characterization of calculation: Estimate. Input calculations have not been reviewed by an M36 water loss expert. Comments: No additional comments.

Key Audit Metrics

(~) VALIDITY Data Validity Score: 56 Data Validity Band (Level): Band III (51-70)

(#) VOLUME ILI: 2.40 Real Loss: 26.27 (gal/conn/day) Apparent Loss: 11.39 (gal/conn/day)

($) VALUE Annual Cost of Real Losses: $48,053 Annual Cost of Apparent Losses: $57,745

Infrastructure & Water Loss Management Practices:

Infrastructure age profile: Varying Infrastructure replacement policy (current, historic): Capital based program in coordination with streets program (3 to 5 miles annually)

Estimated main failures/year: minimal Estimated service failures/year: 60 - 75

Extent of proactive leakage management: None currently in place.

Other water loss management comments: No additional comments.

Comments on Audit Metrics & Validity Improvements

The Infrastructure Leakage Index (ILI) of 2.40 describes a system that experiences leakage at 2.40 times the modeled technical minimum for its system characteristics. The Data Validity Score falling within Band III (51-70) suggests that next steps may be focused simultaneously on improving data reliability and evaluating cost-effective interventions for water & revenue loss recovery. Opportunities to improve the reliability of audit inputs and outputs include:

- Improved understanding of Supply Meter (Own or Import) Master Meter Error: consider adopting or increasing the rigor of a source meter volumetric testing and calibration program, informed by the guidance provided in AWWA Manual M36 – Appendix A.
- Temporal alignment of Billed Metered Authorized Consumption with Water Supplied: consider pro-rating the first and last months of the audit period to better align consumption with actual dates of use, and using read date as basis for reporting.
- Level 2 validation on raw data for Billed Metered Authorized Consumption to determine and resolve any instances of potable volume duplication or non-potable volume inclusion.
- Customized estimate of Unbilled Unmetered Authorized Consumption: consider producing itemized, agency-specific estimates of unbilled unmetered (operational) uses, rather than using the default. Ensure leakage estimates are excluded.
- Improved estimation of CMI: consider a customer meter testing program which tests a sample of random meters whose stratification (by size, age, or other characteristics) represents the entire customer meter stock.

When the CA-NV AWWA Water Audit Validator (WAV) program comes online after this year, is the utility planning on having a staff member become certified to perform the Level 1 Validation for future audits? Unsure.

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Water System Name: Tulare **Water System ID Number:** 5410015 **Water Audit Period:** Fiscal Year 2016/17

Water Audit & Water Loss Improvement Steps:

Steps taken in preceding year to increase data validity, reduce real loss and apparent loss as informed by the annual validated water audit:

The Utility implemented an annual retail meter replacement program in FY 16/17, replacing meters on a 15 year life cycle. The Utility has already been tracking production water losses, and recently implemented detailed tracking of flushing and break-related losses (estimates) volumes. The Utility's SCADA software has been upgraded to include archiving to allow better correlated production and delivery volumes.

Certification Statement by Utility Executive:

This water loss audit report meets the requirements of California Code of Regulations Title 23, Division 2, Chapter 7 and the California Water Code Section 10608.34 and has been prepared in accordance with the method adopted by the American Water Works Association, as contained in their manual, *Water Audits and Loss Control Programs, Manual M36, Fourth Edition* and in the Free Water Audit Software version 5.

Trisha Whitfield	Director, Public Works		9/29/2017
Executive Name (Print)	Executive Position	Signature	Date

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