



March 19, 2021

Rosemary Chiavetta, Secretary
PA Public Utility Commission
P.O. Box 3265
Harrisburg, PA 17105-3265

RE: Water Loss Audit
Year Ending December 31, 2020
Docket No. M-2021-3023555

Dear Secretary Chiavetta:

Enclosed is the Columbia Water Company's Water Loss Audits for the year ending December 31, 2020. This audit is being filed as required by PUC Order at M-2008-2062697. Attached is a paper copy of the audit and an electronic Excel copy.

Should you require any additional information, please feel free to contact me.

Sincerely,

A handwritten signature in blue ink that reads "David Lewis". The signature is fluid and cursive.

David T. Lewis, P.E.
Vice President and
General Manager

Copy via email: Clinton McKinley

Columbia Water Company

220 Locust Street ■ P.O. Box 350 ■ Columbia, PA 17512
Phone: 717-684-2188 ■ Fax: 717-684-4566



AWWA Free Water Audit Software v6.0

FWAS v6.0

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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 targeting loss reduction levels. This tool contains several separate worksheets. Sheets can be accessed using the tabs at the bottom of the screen, or by clicking the TOC links below.

Table of Contents (TOC)

- Start Page** The current sheet. Enter contact information and basic audit details.
- Worksheet** Enter the required data on this worksheet to calculate the water balance and data grading.
- Interactive Data Grading** Answer questions about operational practices for each audit input, and the data validity grades will automatically populate.
- Dashboard** Review NRW components, performance indicators and graphical outputs to evaluate the results of the audit.
- Notes** Enter notes to explain how values were calculated, document data sources, and related information about data management practices.
- Blank Sheet** By popular demand! A blank sheet. The world is your canvas.
- Water Balance** The values entered in the Worksheet automatically populate the Water Balance.
- Loss Control Planning** Use this sheet to interpret the results of the audit validity score and performance indicators.
- Definitions** Use this sheet to understand the terms used in the audit process.
- Service Connection Diagram** Diagrams depicting possible customer service connection line configurations.
- Acknowledgements** Acknowledgements for development of the AWWA Free Water Audit Software v6.0.

AWWA Web Resources for Water Loss Control

<https://www.awwa.org/Resources-Tools/Resource-Topics/Water-Loss-Control>

Items referenced in the Free Water Audit Software v6.0 on the web:

- Data Grading Matrix v6.0
- Example Water Audit v6.0
- Water Audit Compiler v6.0
- AWWA Reports on Performance Indicators
- M36 Manual

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

Enter Basic Information

| | |
|---|----------------------------------|
| Name of Utility: | Columbia Water Company |
| Name of Contact Person: | David Lewis |
| Email: | dlewis@columbiawater.net |
| Telephone Ext.: | (717) 684-2188 |
| City/Town/Municipality: | Columbia |
| State / Province: | Pennsylvania (PA) |
| Country: | USA |
| Audit Preparation Date: | Mar 18 2021 |
| Audit Year: | 2020 |
| Audit Year Label: | Calendar (Fiscal, Calendar, etc) |
| Audit Period Start Date: | Jan 01 2020 |
| Audit Period End Date: | Dec 31 2020 |
| Volume Reporting Units: | Million gallons (US) |
| Water System Structure: | Retail |
| Water Type: | Potable Water |
| System ID Number: | 7360123 |
| Validator Name/ID: | n/a |
| Validator Email: | n/a |
| Estimated Total Population Served by Water Utility: | 35,000 |

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

Color Key

User input

Calculated

Optional default

Guidance for the Worksheet

Choosing to enter unit of **percent** or **volume** (applies to VOSEA, WIEA, WEEA, CMI) choose entry option:

| | | |
|-------|---------|--------|
| 1.00% | percent | or |
| | volume | 25.000 |

Choosing to enter **default** or **custom input** (applies to UUAC, SDHE, UC) choose entry option:

| | | |
|-------|---------|--------|
| 0.25% | default | or |
| | custom | 75.000 |

Guidance for the Interactive Data Grading

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

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

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 criterion 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



AWWA Free Water Audit Software: Worksheet

FWAS v6.0
American Water Works Association.

Water Audit Report for: **Columbia Water Company**
 Audit Year: **2020** | **Jan 01 2020 - Dec 31 2020** | **Calendar**

Click 'n' to add notes | Click 'g' to determine data validity grade | To edit water system info: [go to start page](#)
 All volumes to be entered as: MILLION GALLONS (US) PER YEAR

To access definitions, click the [input name](#)

[Water Supplied Error Adjustments](#)

choose entry option:

| | | | |
|-----------------------|--|---|--|
| WATER SUPPLIED | Volume from Own Sources: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="5"/> <input type="text" value="920.019"/> MG/Yr Water Imported: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="n/a"/> <input type="text" value="0.000"/> MG/Yr Water Exported: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="n/a"/> <input type="text" value="0.000"/> MG/Yr | <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="10"/> <input type="text" value="0.10%"/> <input type="text" value="percent"/> | <input type="text" value="over-registration"/> VOSEA <input type="text" value=""/> WIEA <input type="text" value=""/> WEEA |
| | WATER SUPPLIED: <input type="text" value="919.100"/> MG/Yr | | |

| | | | |
|-------------------------------|---|---|--|
| AUTHORIZED CONSUMPTION | Billed Metered: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="8"/> <input type="text" value="762.459"/> MG/Yr Billed Unmetered: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="n/a"/> <input type="text" value="0.000"/> MG/Yr Unbilled Metered: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="10"/> <input type="text" value="31.724"/> MG/Yr Unbilled Unmetered: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="8"/> <input type="text" value="20.513"/> MG/Yr | choose entry option: <input type="text" value="custom"/> <input type="text" value="20.513"/> MG/Yr | |
| | AUTHORIZED CONSUMPTION: <input type="text" value="814.696"/> MG/Yr | | |

| | | | |
|------------------------|--|---|---|
| WATER LOSSES | <input type="text" value="104.404"/> MG/Yr | | |
| Apparent Losses | Default option selected for Systematic Data Handling Errors, with automatic data grading of 3 | | |
| SDHE | Systematic Data Handling Errors: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="3"/> <input type="text" value="1.906"/> MG/Yr | choose entry option: <input type="text" value="0.25%"/> <input type="text" value="default"/> <input type="text" value="0.09%"/> <input type="text" value="percent"/> <input type="text" value="0.25%"/> <input type="text" value="default"/> | <input type="text" value="under-registration"/> |
| CMI | Customer Metering Inaccuracies: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="4"/> <input type="text" value="0.715"/> MG/Yr | | |
| UC | Unauthorized Consumption: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="3"/> <input type="text" value="1.906"/> MG/Yr | | |
| | Default option selected for Unauthorized Consumption, with automatic data grading of 3 | | |
| | Apparent Losses: <input type="text" value="4.528"/> MG/Yr | | |

| | | | |
|--------------------|---|--|--|
| Real Losses | Real Losses: <input type="text" value="99.876"/> MG/Yr | | |
| | WATER LOSSES: <input type="text" value="104.404"/> MG/Yr | | |

| | | | |
|--------------------------|--|--|--|
| NON-REVENUE WATER | NON-REVENUE WATER: <input type="text" value="156.641"/> MG/Yr | | |
|--------------------------|--|--|--|

| | | | |
|--------------------|---|--|--|
| SYSTEM DATA | | | |
| Lm | Length of mains: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="10"/> <input type="text" value="136.0"/> miles | | (including fire hydrant lead lengths) |
| Nc | Number of service connections: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="10"/> <input type="text" value="10,481"/> | | (active <i>and</i> inactive) |
| | Service connection density: <input type="text" value="77"/> conn./mile main | | |
| Lp | Are customer meters typically located at the curbsto/property <input type="text" value="No"/> | | |
| | Average length of (private) customer service line: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="10"/> <input type="text" value="30.0"/> ft | | (average distance between property line and meter) |
| AOP | Average Operating Pressure: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="7"/> <input type="text" value="79.5"/> psi | | |

| | | | |
|------------------|--|--|--|
| COST DATA | | | |
| CRUC | Customer Retail Unit Charge: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="9"/> <input type="text" value="\$7.39"/> \$/1000 gallons (US) | | Total Annual Operating Cost |
| VPC | Variable Production Cost: <input type="text" value="n"/> <input type="text" value="g"/> <input type="text" value="9"/> <input type="text" value="\$861.79"/> \$/Million gallons | | <input type="text" value=""/> \$/yr (optional input) |

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: | KEY PERFORMANCE INDICATOR TARGETS: |
| Based on the information provided, audit reliability can be most improved by addressing the following components: | OPTIONAL: If targets exist for the operational performance indicators, they can be input below: |
| 1: Volume from Own Sources (VOS) | Unit Total Losses: <input type="text" value=""/> gal/conn/day |
| 2: Customer Metering Inaccuracies (CMI) | Unit Apparent Losses: <input type="text" value=""/> gal/conn/day |
| 3: Billed Metered (BMAC) | Unit Real Losses ^A : <input type="text" value=""/> gal/conn/day |
| | Unit Real Losses ^B : <input type="text" value=""/> gal/mile/day |
| | If entered above by user, targets will display on KPI gauges (see Dashboard) |

2020

White = incomplete
Orange = complete

Use acronyms for navigation

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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% | |
| <p>For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the finished water volume.</p> <p>In-situ flow accuracy testing = a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location, using an independent reference volume.</p> <p>Electronic calibration = a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).</p> <p>Secondary device can include conversion to mA, meter transmitter or similar instrumentation.</p> <p>Tertiary device can include SCADA, historian or other computerized archival system.</p> | | | |
| vos.2 | What is the frequency of electronic calibration? | Less than annual but within last 5 years | Limiting |
| 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), but not to 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: | | 5 | |

go to input

Volume from Own Sources Error Adjustment (VOSEA) - Data Grading Criteria

go to notes

| vosea | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|--|--|--|
| vosea.1 | Are tank levels monitored automatically & recorded daily? | Yes |
| vosea.2 | Are daily changes of stored water volumes in distribution system tanks included in the tabulation of the daily "Volume from Own Sources" quantity? | Yes |
| vosea.3 | Is the annual net distribution storage change included in either the VOS input or the VOSEA input? | Yes |
| vosea.4 | Are the flow accuracy test and/or electronic calibration results included in the VOSEA input in the water audit? | Yes, results are analyzed and incorporated |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 10 |

go to input

Water Imported (WI) - Data Grading Criteria

go to notes

| wi | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|---|---|--|
| wi.0 | Did the water utility import any water during the audit year? | No |
| wi.1 | | |
| <p>For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the water imported volume.</p> <p>In-situ flow accuracy testing = a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location, using an independent reference volume.</p> <p>Electronic calibration = a process that checks for error in the metering secondary device(s) and/or the tertiary device(s).</p> <p>Secondary device can include conversion to mA, meter transmitter or similar instrumentation.</p> <p>Tertiary device can include SCADA, historian or other computerized archival system.</p> | | |
| wi.2 | | |
| wi.3 | | |
| wi.4 | | |
| wi.5 | | |
| wi.6 | | |
| wi.7 | | |
| wi.8 | | |
| wi.9 | | |
| wi.10 | | |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | n/a |

go to input

Water Imported Error Adjustment (WIEA) - Data Grading Criteria

go to notes

| wiea | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|--|-------------------|--|
| wiea.1 | | |
| wiea.2 | | |
| wiea.3 | | |
| wiea.4 | | |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | n/a |

[go to input](#) **Water Exported (WE) - Data Grading Criteria** [go to notes](#)

| we | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|---|---|--|
| we.0 | Did the water utility export any water during the audit year? | No |
| we.1 | | |
| <p>For questions 2-10 below: Choose the answer that applies for those meters that measure >90% of the water exported volume. In-situ flow accuracy testing = a test process that confirms the flow measuring accuracy of the primary device (the flowmeter), in its installed location, using an independent reference volume. Electronic calibration = a process that checks for error in the metering secondary device(s) and/or the tertiary device(s). Secondary device can include conversion to mA, meter transmitter or similar instrumentation. Tertiary device can include SCADA, historian or other computerized archival system.</p> | | |
| we.2 | | |
| we.3 | | |
| we.4 | | |
| we.5 | | |
| we.6 | | |
| we.7 | | |
| we.8 | | |
| we.9 | | |
| we.10 | | |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | n/a |

[go to input](#) **Water Exported Error Adjustment (WEEA) - Data Grading Criteria** [go to notes](#)

| weea | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|--|-------------------|--|
| weea.1 | | |
| weea.2 | | |
| weea.3 | | |
| weea.4 | | |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | n/a |

[go to input](#) **Billed Metered Authorized Consumption (BMAC) - Data Grading Criteria** [go to notes](#)

| bmac | Criteria Question | Select Best-Fit Answers to All Visible Questions | |
|--|---|--|----------|
| bmac.0 | Were any customers metered in the audit year? | Yes | |
| bmac.1 | For billed metered accounts, what % of bills are estimated in a typical billing cycle? | 5% or less | |
| bmac.2 | How often does the utility read its customer meters? For systems with multiple read frequencies, select the reading frequency that describes the majority of your customers. | Monthly | |
| bmac.3 | Is the BMAC volume pro-rated to represent consumption occurring exactly during the audit period? | No | Limiting |
| bmac.4 | How frequently does internal review by utility staff of the BMAC volumes occur? | Every billing cycle | |
| bmac.5 | What level of detail is examined in the internal review of BMAC volumes? | Totals grouped by use type or customer class and specific accounts flagged for anomalous consumption | |
| bmac.6 | When was the most recent billing data review by someone who is independent of the utility billing process? | Within last 3 years | |
| bmac.7 | What level of detail was examined in the review by someone who is independent of the utility billing process? | Full billing database query and analysis of raw data to verify the summary consumption volumes | |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 8 | |

[go to input](#) **Billed Unmetered Authorized Consumption (BUAC) - Data Grading Criteria** [go to notes](#)

| buac | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|--|---|--|
| buac.0 | Was there any billed consumption on unmetered accounts in the audit year? | No |
| buac.1 | | |
| buac.2 | | |
| buac.3 | | |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | n/a |

[go to input](#) **Unbilled Metered Authorized Consumption (UMAC) - Data Grading Criteria** [go to notes](#)

| umac | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|---|--|--|
| umac.0 | Did the water utility have any unbilled-metered consumption in the audit year? | Yes |
| umac.1 | Does the water utility policy articulate which accounts are exempt from billing? | Policy includes specific exemptions |
| umac.2 | How many unbilled metered accounts exist? | Monitored, count available |
| umac.3 | How often is each unbilled customer meter read? For systems with multiple read frequencies, select the reading frequency that describes the majority of your customers. | Monthly or more frequently |
| umac.4 | How often are unbilled metered volumes reviewed for error? | Each billing cycle |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 10 |

[go to input](#) **Unbilled Unmetered Authorized Consumption (UUAC) - Data Grading Criteria** [go to notes](#)

| uuac | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|---|--|--|
| uuac.0 | On the Worksheet, the status of the default option is: | A system specific volume has been entered |
| uuac.1 | How well-understood is the extent of unbilled unmetered use? | Majority identified and tracked |
| uuac.2 | Which best describes the records that are kept for events of unbilled unmetered use? | Each event is documented |
| uuac.3 | How is the majority of unbilled unmetered use estimated? | Entirely from event-specific estimates |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 8 |

Limiting

[go to input](#) **Systematic Data Handling Error (SDHE) - Data Grading Criteria** [go to notes](#)

This Data Grading Criteria is hidden when the 'default' input is used on the Worksheet

| | |
|---|----------|
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | 3 |
|---|----------|

[go to input](#) **Customer Metering Inaccuracies (CMI) - Data Grading Criteria** [go to notes](#)

| cm1 | Criteria Question | Select Best-Fit Answers to All Visible Questions | |
|--|--|--|----------|
| cm1.0 | Was there any metered customer usage during the audit period? | Yes | |
| cm1.1 | Do you test meters reactively (when triggered by customer complaint or billing/consumption flag)? | Reactive testing conducted | |
| cm1.2 | For small size customer meters, which best describes the frequency of proactive testing (effort beyond when triggered by customer complaint or billing/consumption flags)? | No testing conducted, but at least 10% of meter stock has been replaced within two years of the audit period | |
| cm1.3 | | | |
| cm1.4 | For mid and large size customer meters, which best describes the frequency of the proactive testing program? | Not recurring, last testing effort occurred more than 5 years prior to audit period | Limiting |
| cm1.5 | | | |
| cm1.6 | Which best describes how the input was derived? | Meter accuracy test results or manufacturer specs are referenced but not analyzed and used directly in calculation | |
| cm1.7 | Has the input derivation been reviewed by someone with expert knowledge in the M36 methodology? | No | |
| cm1.8 | To what extent does meter replacement occur and for which meters? | Annual proactive replacement of subset of meters (i.e. by age or throughput) | |
| cm1.9 | Which best describes the reliability of meter installation records? | Records are kept for meter installations, and they include data on installation date, type, size, and manufacturer | |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 4 | |

[go to input](#) **Unauthorized Consumption (UC) - Data Grading Criteria** [go to notes](#)
This Data Grading Criteria is hidden when the 'default' input is used on the Worksheet

FINAL DATA GRADE FOR THIS AUDIT INPUT: 3

[go to input](#) **Length of Mains (Lm) - Data Grading Criteria** [go to notes](#)

| Lm | Criteria Question | Select Best-Fit Answers to All Visible Questions | |
|--|---|--|--|
| Lm.1 | How was the input derived? | Derived directly from Mains inventory (GIS, ledger, etc) | |
| Lm.2 | Are hydrant laterals included in the input derivation? | Yes | |
| Lm.3 | Which best describes how the Mains inventory (GIS, ledger, etc) is kept up to date? | Additions or subtractions are updated in the mains inventory (GIS, ledger, etc), at least annually | |
| Lm.4 | Which best describes how the Mains inventory (GIS, ledger, etc) is field validated to confirm field conditions match the inventory? | Field validation is accomplished (i.e. in daily operations or specific validation projects) | |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 10 | |

[go to input](#) **Number of Service Connections (Nc) - Data Grading Criteria** [go to notes](#)

| Nc | Criteria Question | Select Best-Fit Answers to All Visible Questions | |
|--|--|---|--|
| Nc.1 | How was the input derived? | Extracted from Services inventory (GIS, billing system, etc) | |
| Nc.2 | What is the count of services based on? | Premise based, i.e. service connection count, location ID count | |
| Nc.3 | Are inactive (but still pressurized) service lines included in the input? These may be metered or unmetered. | Yes | |
| Nc.4 | Which best describes how the inventory of service connections (GIS, billing system, etc) is kept up to date? | Additions or subtractions are updated in the service line inventory (GIS, billing system, etc), at least annually | |
| Nc.5 | Which best describes how the inventory of service connections (GIS, billing system, etc) is field validated to confirm field conditions match the inventory? | Field validation is accomplished for the entire system (i.e. in daily operations or specific validation projects) | |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 10 | |

[go to input](#) **Average Length of (Private) Customer Service Line (Lp) - Data Grading Criteria** [go to notes](#)

| Lp | Criteria Question | Select Best-Fit Answers to All Visible Questions |
|---|--|---|
| Lp.0 | Are customer meters typically located at the curbstop or property line? | No |
| Lp.1 | How was the input derived? | Derived from full mapping and customer inventory |
| Lp.2 | Which best describes how the Customer Service Line and Meter Locations mapping is kept up to date? | Additions or subtractions are updated in the service line and meter locations inventory, at least annually |
| Lp.3 | Which best describes how the Customer Service Line mapping is validated to what is in the field? | Field validation is accomplished (i.e. through normal work order processes or specific validation projects) |
| Lp.4 | Which best describes the policy to define where the utility's ownership of the service line ends, and the customer's ownership of the service line begins? | Policy is clear, and adherence in practice is consistent |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 10 |

[go to input](#) **Average Operating Pressure (AOP) - Data Grading Criteria** [go to notes](#)

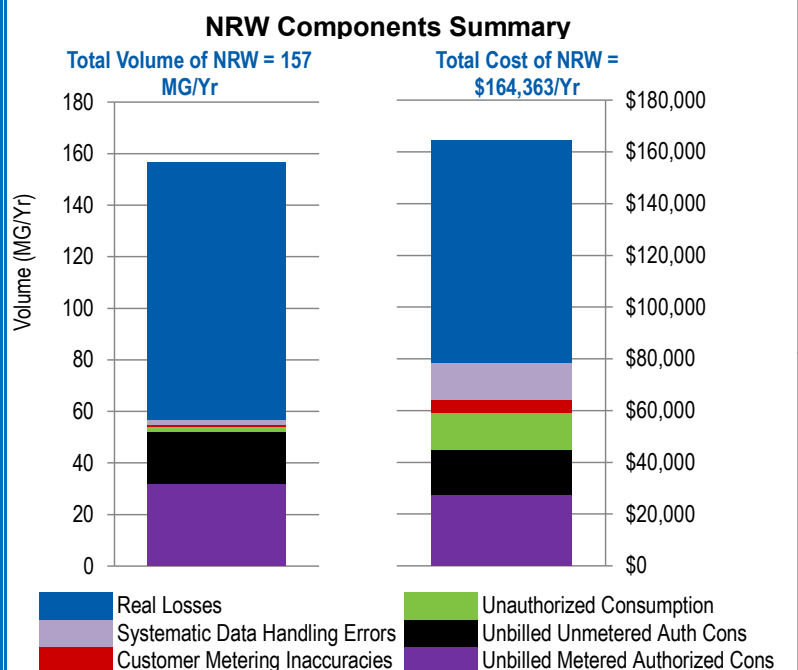
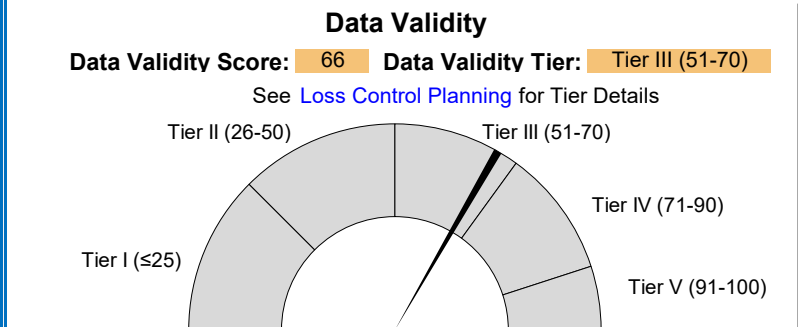
| aop | Criteria Question | Select Best-Fit Answers to All Visible Questions | |
|---|---|--|----------|
| aop.1 | Which best describes checks on the boundary integrity for the system's pressure zone(s)? | Normally-closed boundary valves between zones have been confirmed within the past 3 years to be fully closed | |
| aop.2 | Which best describes how one-time pressure readings (i.e. from hydrants) are collected? | Collected annually during routine system flushing and/or hydrant testing | |
| aop.3 | Which best describes where continuous pressure data (via temporary data loggers or permanent telemetry) is collected? | At zone boundary conditions only (i.e. supply entry points, PRVs, booster stations) | |
| aop.4 | Which best describes how continuous pressure data is collected? | Temporary data logger(s) deployed, adequately capturing seasonal variation during the year | |
| aop.5 | How was the input derived? | Calculated from field data as a simple average | Limiting |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 7 | |

[go to input](#) **Customer Retail Unit Charge (CRUC) - Data Grading Criteria** [go to notes](#)

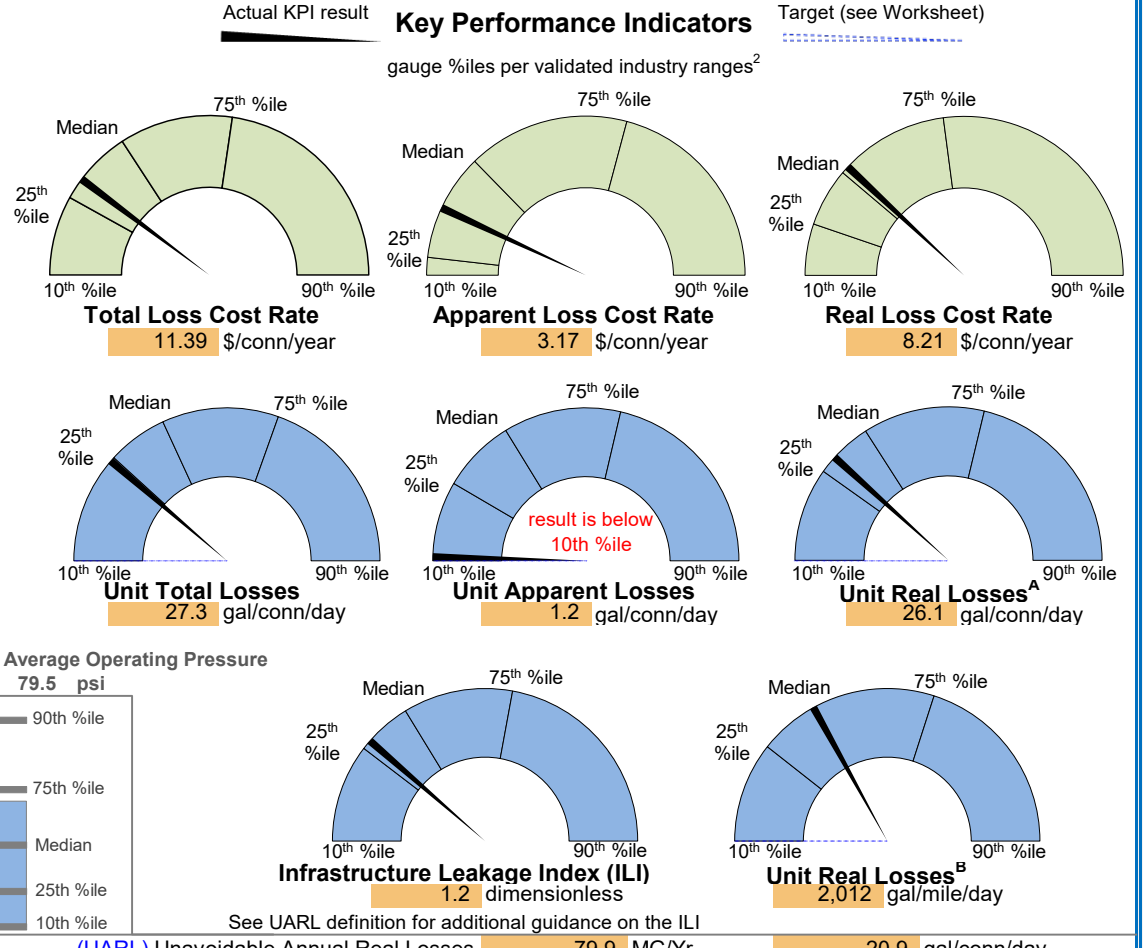
| cruc | Criteria Question | Select Best-Fit Answers to All Visible Questions | |
|---|--|---|----------|
| cruc.0 | Was any metered consumption billed on a volumetric basis in the audit period? | Yes | |
| cruc.1 | Which best describes the use and reliability of the current rate structure? | Customer bill calculations have been checked to confirm the rate structure is correctly implemented | |
| cruc.2 | Choose the option that best describes how the input was derived | A volume-weighted average of all rates was calculated | |
| cruc.3 | Is there any additional volumetric revenue the utility receives that depends on water meter readings, such as sewer? | No | |
| cruc.4 | Has the input derivation been reviewed by someone with expert knowledge in the M36 methodology? | No | Limiting |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 9 | |

[go to input](#) **Variable Production Cost (VPC) - Data Grading Criteria** [go to notes](#)

| vpc | Criteria Question | Select Best-Fit Answers to All Visible Questions | |
|---|---|--|----------|
| vpc.1 | Choose the option that best describes how the input was derived | Only one source of water exists, which was the basis for the input derivation | |
| vpc.2 | Choose the option that best describes which short-run marginal costs have been included in the input, using the definitions below for reference. Short-run marginal costs can include the following: - chemicals + power for treatment, typically applicable if the utility is producing/treating water - power for distribution, typically applicable if pumps exist in the distribution network - water acquisition costs, typically applicable if the utility is purchasing water or incurs any extraction costs for withdrawing from a source Some short-run marginal costs may not be applicable. The auditor should analyze the system characteristics to determine which costs are applicable for inclusion in the VPC input derivation. See also the latest AWWA M36 Manual for further guidance. | All applicable short-run marginal costs are included | |
| vpc.3 | Choose the option that best describes which long-run marginal costs have been included in the input, using the definitions below for reference. Long-run marginal costs can include the following: - water treatment residuals management, typically applicable if solids are produced from water treatment process - accelerated wear & tear on dynamic equipment, typically applicable if pumps exist for treatment and/or distribution, or any other equipment exists that wears out as a function of use instead of time (i.e. filter media, chemical dosing pumps, uv disinfection bulbs, etc) - payouts for damage claims from main and service line breaks, typically applicable if damage claims are paid by the utility - accelerated expansion of supply capacity, typically applicable if the utility is at or nearing supply capacity, or scarcity costs in water scarce areas - full cost pricing that includes all lifecycle costs and externalities (internalized or not) Some long-run marginal costs may not be applicable. The auditor should analyze the system characteristics to determine which costs are applicable for inclusion in the VPC input derivation. See also the latest AWWA M36 Manual for further guidance. | Long-run marginal costs have been evaluated for applicability, and all applicable costs are included | |
| vpc.4 | Has the input derivation been reviewed by someone with expert knowledge in the M36 methodology? | No | Limiting |
| FINAL DATA GRADE FOR THIS AUDIT INPUT: | | 9 | |



| | Volume MG/Yr | Value \$/Yr | Basis of Valuation |
|--------------------------|--------------|-------------|--------------------|
| Apparent Losses | 4.5 | \$33,273 | CRUC |
| Real Losses | 99.9 | \$86,072 | VPC |
| Unbilled Authorized Cons | 52.2 | \$45,017 | VPC |
| Non-Revenue Water | 156.6 | \$164,363 | Blended |



See UARL definition for additional guidance on the ILI
(UARL) Unavoidable Annual Real Losses 79.9 MG/Yr 20.9 gal/conn/day

- #### Guidance Information for Key Performance
- The eight indicators shown are the recommended suite per the AWWA Water Loss Control Committee 2020 Position on KPIs¹.
 - A suite of KPIs is necessary, as no single KPI can holistically 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.
 - Percentiles (%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.

Table 1 Source: AWWA Water Loss Control Committee Report (2020)¹, with naming conventions updated
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 | | |
| Attribute | Apparent Loss Volume | Calculated by Free Water Audit Software | ✓ | | | | ✓ | Assess loss level | Utility, Regulators |
| | Apparent Loss Cost | Calculated by Free Water Audit Software | ✓ | | | | ✓ | Assess cost loss level | Utility, Regulators |
| | Real Loss Volume | Calculated by Free Water Audit Software | ✓ | | | | ✓ | Assess loss level | Utility, Regulators |
| | Real Loss Cost | Calculated by Free Water Audit Software | ✓ | | | | ✓ | Assess loss cost level | Utility, Regulators |
| | Unavoidable Annual Real Loss (UARL) | Calculated by Free Water Audit Software | ✓ | | | | ✓ | Reveal theoretical technical low level of leakage | Utility, Regulators |
| Volume | Unit Apparent Losses (vol/conn/day) | Strong and understandable indicator for multiple users. | ✓ | ✓ | ✓ | ✓ | ✓ | Used for performance tracking and target-setting | Utility, Regulators |
| | Unit Real Losses ^A (vol/conn/day) | Strong and understandable indicator for multiple users. | ✓ | ✓ | ✓ | ✓ | ✓ | Used for performance tracking and target-setting | Utility, 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 | Utility, 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 useful for planning and assessment of cost efficiency of water loss reduction and control interventions and programs. | ✓ | | | ✓ | ✓ | 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 (value/conn/year) New KPI | | ✓ | | | ✓ | ✓ | | Utilities, Regulators, Customers |
| Validity | Data Validity Tier (DVT) | Strong indicator of water loss audit data quality, if data has been validated. Tier provides guidance on priority areas of activity. | ✓ | ✓ | | ✓ | ✓ | Assess caliber of data inputs of the water audit | Regulators, Utilities |

AWWA Free Water Audit Software
Water Balance



Water Audit Report for: **Columbia Water Company**

Audit Year: **2020**

Jan 01 2020 - Dec 31 2020

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

FWAS v6.0

American Water Works Association.
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| | | Water Exported (WE) (corrected for known errors) | Billed Water Exported | | | | Revenue Water (Exported) |
|---|---------------------|---|------------------------|---------------------------------|--|-------------------------|--------------------------|
| | | 0.000 | | | | | 0.000 |
| Volume from Own Sources (VOS) (corrected for known errors) | System Input Volume | Water Supplied | Authorized Consumption | Billed Authorized Consumption | Billed Metered Consumption (BMAC) (water exported is removed) | Revenue Water | |
| | | | | 762.459 | 762.459 | | 762.459 |
| 919.100 | 919.100 | 919.100 | 814.696 | Unbilled Authorized Consumption | Billed Unmetered Consumption (BUAC) | Non-Revenue Water (NRW) | |
| | | | | 52.237 | 0.000 | | 762.459 |
| | | | | Apparent Losses | Unbilled Metered Consumption (UMAC) | 156.641 | |
| | | | | 4.528 | 31.724 | | |
| | | | | Water Losses | Unbilled Unmetered Consumption (UUAC) | | |
| | | | | 104.404 | 20.513 | | |
| Water Imported (WI) (corrected for known errors) | | | | Real Losses | Systematic Data Handling Errors (SDHE) | | |
| 0.000 | | | | 99.876 | 1.906 | | |
| | | | | | Customer Metering Inaccuracies (CMI) | | |
| | | | | | 0.715 | | |
| | | | | | Unauthorized Consumption (UC) | | |
| | | | | | 1.906 | | |
| | | | | | Leakage on Transmission and/or Distribution Mains | | |
| | | | | | Not broken down | | |
| | | | | | Leakage and Overflows at Utility's Storage Tanks | | |
| | | | | | Not broken down | | |
| | | | | | Leakage on Service Connections | | |
| | | | | | Not broken down | | |