

EXHIBIT V

**BEFORE THE
PENNSYLVANIA PUBLIC UTILITY COMMISSION**

AQUA PENNSYLVANIA, INC.

DOCKET NO. A-2022-3026132

AQUA STATEMENT NO. 2

**DIRECT TESTIMONY OF
BRENNAN T. KELLY, P.E.**

**With Regard To
Description of the System
Aqua's Technical Fitness
Environmental Compliance**

October 2022

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1 **I. INTRODUCTION**

2 **Q. Please state your name and business address.**

3 A. My name is Brennan T. Kelly. My business address is 762 West Lancaster Avenue, Bryn
4 Mawr, Pennsylvania 19010.

5
6 **Q. By whom are you employed and in what capacity?**

7 A. I am employed by Aqua Pennsylvania, Inc. (“Aqua”), as a Senior Project Engineer.

8
9 **Q. Please provide a brief description of your education and work experience.**

10 A. I received a Bachelor’s of Science Degree (B.S.) in Mechanical Engineering in 1989 from
11 Villanova University, a Master’s Degree in Environmental Engineering (M.E.E.) in 1992
12 from Drexel University, and a Master’s Degree in Business Administration from Villanova
13 University in 2004. I have worked in various engineering roles and have over 30 years of
14 experience in environmental engineering related to municipal and industrial water
15 treatment and operations. I have worked at Aqua since 2007 in roles related to water
16 treatment and distribution facilities including planning, design, start-up, and operations.
17 Prior to Aqua, I worked as an engineer for American Water Works Company, Inc., a
18 publicly traded water utility, and Whitman, Requardt & Associates LLP, a consulting
19 engineering firm. I am a Registered Professional Engineer in Pennsylvania and Maryland.

20
21 **Q. Have you previously testified before the Pennsylvania Public Utility Commission**
22 **(“PUC” or the “Commission”)?**

23 A. No.

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1 **Q. What is the purpose of your Direct Testimony?**

2 A. The purpose of my Direct Testimony is as follows: (1) to provide a general description of
3 the Municipal Authority of the Borough of Shenandoah (“MABS”) water system (the
4 “System”); (2) to explain how the System will be integrated into Aqua’s operations; (3) to
5 describe Aqua’s technical fitness to run the System; and (4) to discuss the benefits of the
6 transaction.

7
8 **Q. Are you sponsoring any Exhibits with the Company’s filing?**

9 A. Yes. Attached to my Direct Testimony as Appendix A is a copy of the 2018 Pennsylvania
10 Department of Environmental Protection (“DEP”) Drinking Water Outreach Assistance
11 Program Assessment and Recommendations for MABS.

12

13 **II. OVERVIEW OF AQUA AND THE SYSTEM**

14 **Q. Please provide a general overview of Aqua.**

15 A. Aqua owns and operates 11 surface water treatment plants (“WTP”), approximately 300
16 wells, and approximately 6,000 miles of main throughout Pennsylvania. Aqua has
17 approximately 600 employees bringing extensive expertise in providing water service to
18 citizens of Pennsylvania. Aqua’s Roaring Creek Division has two water systems in close
19 proximity to the Borough of Shenandoah (“Shenandoah” or “Borough”) and the System
20 allowing for operational efficiencies arising from the transaction.

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1 **Q. Please provide a description of the System.**

2 A. The Borough is located in the northern part of Schuylkill County, Pennsylvania and the
3 majority of the Borough is served by the public water system. The System is a treatment
4 and distribution system owned by MABS that distributes water to the Borough, portions of
5 West Mahanoy Township, and to several customers in Butler Township, Girardville
6 Borough, and Mahanoy Township. Untreated raw water for the System is supplied via a
7 series of four dams (Ringtown No. 6, Ringtown No. 5, Raven Run No. 3, and Raven Run
8 No. 2). The water flows by gravity mains from Ringtown No. 6 to Ringtown No. 5, which
9 is pumped via Pump Station No. 5 to Raven Run No. 3 which in turn feeds Raven Run No.
10 2. Raw water from Raven Run No. 2 flows by gravity main to the MABS WTP for
11 treatment and distribution through the System. The System operates under Water
12 Allocation Permit – Permit No. WA54-44C – issued by DEP. The System also operates
13 under National Pollution Discharge Elimination System (“NPDES”) Permit No.
14 PA0062758 – issued by DEP.

15

16 **Q. Please provide a description of the System.**

17 A. The MABS WTP was constructed in 1993 and consists of the Main Treatment Building,
18 the High Service Pump Station (“HSP Station”), and an 850,000-gallon Ground Storage
19 Tank. Raw water to the WTP comes from a series of four (4) earthen reservoirs as
20 described above, and more fully described in the Direct Testimony of Mr. Matthew J.
21 Marchisello. The WTP has a treatment capacity of 3.1 million gallons. The WTP produces
22 approximately 574-million-gallons of potable water per year (1.57 million gallons per day
23 (“MGD”)) to approximately 2,900 customers. The treatment train consists of: four (4)

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1 Adsorption Clarifiers; four (4) Mixed Media Filters; six (6) Sludge Drying Beds; and an
2 Inclined Plate Settler for sludge collection. The chemical treatment systems used are:
3 Lime, Alum, Sodium Hydroxide, Activated Carbon, Potassium Permanganate and Zinc
4 Orthophosphate, and Chlorine Gas for disinfection. The Main Treatment Building also
5 includes a laboratory for water quality testing, personnel offices, and a conference room.
6 Emergency power is available to the WTP and the HSP Station via a 400-kilowatt Onan
7 diesel-powered standby generator.

8 The WTP is equipped with a Supervisory Control & Data Acquisition (“SCADA”)
9 system that: monitors instrumentation (flow meters, pressure sensors, water quality
10 analyzers); provides automated and manual control of equipment (Pumps, blowers,
11 valves); and provides alarm notification and lock-out protection as necessary.

12 The HSP Station consists of three (3) end-suction centrifugal pumps (two pumps
13 @ 100-gpm, one pump @ 500-gpm) that push finished water into the distribution system.
14 The HSP Station also includes two (2) split-case horizontal wash water pumps for filter
15 backwashing. The distribution system consists of four (4) water storage tanks – the WTP
16 Ground Tank (850,000-gallons); Turkey Run Tank (150,000-gallons); Kehly Run Tank
17 (1,000,000-gallons); and Swatara Road Standpipe (500,000-gallons). The System also
18 consists of four (4) booster stations, four (4) pressure zones, two (2) pressure-reducing
19 stations, and approximately 50-miles of distribution main. The distribution and
20 transmission piping are summarized in the Engineering Assessment included as Exhibit D
21 to the Application.

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1 **Q. Please provide the elevations for the MABS WTP, dams, pump stations and the**
2 **Requested Territory.**

3 A. MABS WTP: elevation generally varies between EL 1,539.

4 Ringtown No. 5: EL 1,100.

5 Ringtown No. 6: EL 1,148.

6 Raven Run No. 2: EL 1,575.

7 Raven Run No. 3: EL 1,608.

8 Pump Station No. 5: EL 1,053.

9 Pump Station No. 7: EL 1,585.

10 WTP Tank: EL 1,519.

11 Kehly Run Tank: EL 1,434.

12 Turkey Run Elevated Tank: EL 1,378.

13 Swatara Standpipe: EL 1,782.

14 Turkey Run Booster Station: EL 1,214.

15 WTP Pump Station: EL 1,542.

16 Requested Territory: Area elevations vary generally from:

- 17 • EL 1,000 to EL 1,050 along the western boundary.
- 18 • EL 1,116 to EL 1,214 along the southern boundary.
- 19 • EL 1,083 to EL 1,148 along the northern boundary.
- 20 • EL 1,280 to EL 1,608 along the eastern boundary.

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1 **Q. Please state the approximate time of the installation of the component facilities of the**
2 **System.**

3 A. The MABS WTP began construction in 1993 and was completed in 1995. The construction
4 included conventional treatment with absorption clarifiers and multimedia filters. The
5 850,000-gallon storage tank was also constructed on the plant site during initial
6 construction. Raven Run Dam Nos. 2 and 3 were constructed in approximately 1885,
7 Ringtown Dam No. 5 was constructed in approximately 1914, and Ringtown Dam No. 6
8 was constructed in approximately 1920.

9 The majority of the MABS System was originally constructed between the late
10 1800s and the 1970s. While MABS has replaced some mains within the System, a majority
11 of the pipe is original installation. The majority of the pipe is unlined cast iron, but there is
12 also transite and ductile iron pipe materials. The average age of the pipe in the MABS
13 System is approximately 86 years old.

14
15 **Q. Is Aqua planning any capital projects over the next 10 years for the System?**

16 A. Yes. Aqua reviewed the System and has identified capital improvement needs for
17 distribution mains, pump stations, emergency power, storage tanks, and dams based on
18 facility conditions observed, facility age, and safety. Aqua estimates that it will invest
19 approximately \$23 million over the next 10 years. Approximately \$13 million of that
20 investment will be for distribution main replacement.

21 Upgrades to pump stations include pump replacement, electrical and mechanical
22 replacement, emergency generator replacement, as well as facilities upgrades. Distribution
23 system main rehabilitation and replacement will occur based on an assessment of pipe age

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1 and condition. Mr. Marchisello will address issues concerning the dams in his Direct
2 Testimony.

3
4 **Q. Do you foresee any other projects that would be required in the immediate future?**

5 A. Replacement and upgrade of facilities will continue beyond Aqua’s 10-year capital plan
6 based on facility age and expected facility life span. Additional capital may be necessary
7 as Aqua begins to operate the system.

8
9 **Q. Please state the actual number of MABS customers by class and gallons**
10 **treated.**MABS has 2,900 customers. A breakdown of consumption by class for the
11 calendar year ended December 31, 2021 is below.

Service Area	Residential	Commercial	Industrial	Public	Total
Customers	2,652	203	5	39	2,899
Gallons	95,885,419	15,796,000	19,125,000	22,861,000	153,637,419

12
13
14 **III. ENVIRONMENTAL COMPLIANCE**

15 **Q. Does the Application include Public Water Supply (“PWS”) Permits?**

16 A. Yes. The PWS permits for the MABS WTP are included with the Application as Exhibit
17 M1.

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1 **Q. Does the Application include a NPDES permit?**

2 A. Yes. The NPDES discharge permit for the MABS WTP is included in the Application as
3 Exhibit M2.

4

5 **Q. Does the Application include a Water Allocation permit?**

6 A. Yes. The Water Allocation permit for the MABS WTP is included in the Application as
7 Exhibit E.

8

9 **Q. Does the Application include Consumer Confidence Reports (“CCRs”)?**

10 A. Yes. CCRs for the MABS System for the past five (5) years are included as Exhibits N1
11 through N5.

12

13 **Q. Are there any violations issued to MABS by the DEP in the last five (5) years?**

14 A. Yes. A list of violations issued by DEP to MABS, as well as responses from MABS
15 addressing the violations, is included as Exhibit O to the Application. To Aqua’s
16 knowledge, MABS has no other violations within the last five (5) years other than those
17 listed and included with the Application.

18

19 **Q. Have there been any Consent Assessments of Civil Penalty (“CACP”) entered into by
20 MABS and the DEP?**

21 A. No. There are no current CACPs entered into by the MABS and the DEP.

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1 **Q. Please state if there are any current environmental compliance issues for the System.**

2 A. The Company is aware that there are potentially lead service lines, both customer and
3 company owned, within the System. Please refer to the Direct Testimony of Mr. Stephen
4 Clark for a discussion of lead service lines. Please also refer to the Direct Testimony of
5 Mr. Marchisello for a discussion of the MABS dams.

6 Additionally, the System has high unaccounted for / non-revenue water (“NRW”).
7 In 2018, DEP, through its Drinking Water Outreach Assistance Program, issued a report
8 concerning NRW for the System (see Appendix A to my Direct Testimony). The general
9 assessment of the report concluded that MABS is experiencing high losses and made
10 recommendations to MABS for addressing those losses.

11 While MABS has taken some steps to address water losses in the System, including
12 replacing the large production flow meters in the System and some residential water
13 meters, Aqua would look to measure NRW by performing a system audit. As noted above,
14 the System produced 574 million gallons from the WTP, and billed consumption for 2021
15 was approximately 154 million gallons, which indicates that through main replacement and
16 other improvements Aqua will be able to reduce NRW in the System. The System will
17 also come under Aqua’s meter replacement program to exchange aged meters.

18

19 **Q. Are there any noncompliance issues pending with the United States Environmental**
20 **Protection Agency (“EPA”)?**

21 A. No.

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1 **Q. Please state the estimated number of future connections for the System for the next**
2 **five (5) years.**

3 A. MABS does not anticipate any new connections in the next five (5) years.
4

5 **Q. Is there present System capacity to meet the demands of current and future**
6 **customers?**

7 A. Yes. Water Allocation Permit (WA 54-44C) grants MABS a not to exceed Annual Average
8 daily withdrawal of 2.05 MGD from the combined reservoir sources. The WTP has a
9 permitted treatment capacity of 3.1 MGD. In 2021 Average Day Demand (consumption)
10 by all customers (residential, commercial, industrial etc.) was approximately 420,924
11 gallons per day (153,637,419 gallons / 365 days). MABS does not anticipate any new
12 connections in the next five (5) years. Thus, the allocation, WTP capacity and available
13 tank storage; including the 850,000 gallon storage tank at the WTP, the 1,000,000 gallon
14 Kehly Run storage tank, the 500,000 gallon Swatara standpipe, and the 150,000 gallon
15 Turkey Run storage tank; ensure the System will have adequate capacity to meet current
16 and future customer demands.
17

18 **IV. INTEGRATION OF THE SYSTEM, TECHNICAL FITNESS, AND PUBLIC**
19 **BENEFIT**
20

21 **Q. Please state how many miles the System is from Aqua's existing service territory.**

22 A. The System's distance from Aqua's existing service territory is as follows:

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Buyer's Plant	Location	Approximate Distance to MABS (miles)
Girardville System	Girardville, PA	0
Eagle Rock System	Hazleton, PA	5
Mt. Carmel System	Mt. Carmel, PA	6
Roaring Creek Division Office	Shamokin, PA	14

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16

Q. Will the System be physically interconnected with Aqua’s system or be operated as a standalone system?

A. Aqua plans to interconnect the MABS System to Aqua’s Roaring Creek system, which will add redundancy to the System and allow Aqua to react to emergency water situations. Please refer to the Direct Testimony of Mr. Stephen Clark for a discussion of Aqua’s plans to interconnect.

Q. Please describe how Aqua will integrate the operation of the System into its current operations.

A. The operation of the System will be managed from Aqua’s Roaring Creek Division office in Shamokin, PA. Management, customer service, regulatory compliance, engineering, financial, and ancillary services will also be provided seamlessly from our Southeastern Division office, in Bryn Mawr, PA. Aqua plans to offer employment to the MABS employees as set forth in Schedule 7.03 to the Asset Purchase Agreement, included with the Application as Exhibit B.

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1 **Q. Will other Aqua employees assist in the operation of the System, if needed?**

2 A. Yes. Aqua has approximately 100 licensed water plant operators which may be called
3 upon to assist in the operations of the System. These operators are also supported by Aqua
4 employees proficient in engineering and field service functions, as well as electricians,
5 mechanics, lab staff, and instrument technicians which will benefit customers.

6
7 **Q. Does Aqua plan any physical, operational, and managerial changes after closing?**

8 A. As mentioned above, there are planned capital improvements for the System, including
9 planned interconnection with Aqua's Roaring Creek Division, and Aqua plans to offer
10 employment to 10 MABS employees. The MABS System will be operated from Aqua's
11 Roaring Creek Division office. There are no other planned physical, operational, and
12 managerial changes at this time.

13
14 **Q. Is the System similar to other systems owned and operated by Aqua?**

15 A. Yes. The MABS System includes a 3.1 MGD capacity WTP and four (4) dams. Aqua
16 owns and operates 16 dams throughout its footprint (9 high hazard and 7 low hazard dams),
17 and has three (3) treatment plants similar in size and nine (9) WTPs, overall, with a
18 treatment processes similar to the MABS WTP.

19
20 **Q. Do you believe that Aqua is technically fit to own and operate the System?**

21 A. Yes.

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1 **Q. Please describe the Company’s technical fitness and how the Company can provide**
2 **quality and reliable service to MABS water customers.**

3 A. Aqua is a Class A utility that already has certificates of public convenience to operate
4 throughout the Commonwealth and has acquired many systems in the last three (3)
5 decades. Aqua will provide quality and reliable service to the MABS water customers
6 given the Company’s operational expertise as well as engineering support local to the
7 System. Aqua has expertise in troubleshooting mechanical equipment as well as water
8 treatment processes. Aqua also has expertise in operating water treatment and distribution
9 systems. Aqua strives to ensure the treatment, transmission and distribution systems which
10 the Company owns provide continuous safe and reliable service. Aqua has worked with
11 the Commission and statutory advocates to acquire and improve troubled water systems
12 (e.g., Sun Valley Water system, Docket No. A-2017-2626577). In addition, Aqua was
13 appointed receiver for the James Black Water Service Company (Belle Aire Acres) and the
14 Twin Lakes Utilities, Inc. water systems.¹ Aqua has provided operations service and
15 improvements to those systems to ensure quality and reliable service.

16
17 **Q. Does Aqua have emergency preparedness measures in place?**

18 A. Yes. Aqua currently has emergency preparedness measures in place in order to ensure
19 security and continued service in emergency circumstances all of which have been
20 reviewed by the Commission.

¹ See PUC Docket Nos. M-2019-3012563 and P-2020-3020914, respectively.

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1 **Q. Please explain Aqua’s safety programs.**

2 A. Aqua maintains safety programs that entail basic safety training in all the major categories
3 which operators and operations management personnel are required to complete, including
4 but not limited to:

- 5 • Confined Space Training
- 6 • Back and Lifting Safety
- 7 • Work Zone Traffic Control
- 8 • Excavation Safety Awareness
- 9 • Fall Protection Training
- 10 • Hazard Communication
- 11 • Personal Protective Equipment
- 12 • Emergency Egress, Exits and Fire Safety
- 13 • Electrical Safety Training
- 14 • Control of Hazardous Energy | Lockout Tagout
- 15 • Respiratory Protection
- 16 • Hearing Conservation

17 Aqua’s safety program and procedures provide public benefits in that the MABS customers
18 will have a leader in the water industry providing service.

19

20 **Q. Can Aqua provide adequate water supply, treatment, storage and distribution**
21 **capacity to meet present and future customer demands?**

22 A. Yes. As stated above, through the existing facilities, and supplemented by the planned
23 interconnection to Aqua’s system, Aqua can provide adequate supply, treatment, storage
24 and distribution capacity for present and future customers. Aqua will continue to make
25 improvements to the System to ensure any future customer demands are met.

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1 **Q. Please summarize why you believe it is in the public benefit for Aqua to own and**
2 **operate the System.**

3 A. My explanation of Aqua's current operations, the System's similarity to other systems
4 operated by Aqua, the System's proximity to Aqua's existing service territory, and the
5 additional expertise and support that will be provided by Aqua as an experienced water
6 utility all support that it is in the public interest for Aqua to own and operate the System.

7

8 **V. CONCLUSION**

9 **Q. Does this conclude your Direct Testimony?**

10 A. Yes, it does. However, I reserve the right to supplement my Direct Testimony as additional
11 issues and facts arise during the course of this proceeding.

**PA DEP Drinking Water Outreach Assistance Program
Non-Revenue Water Management Technical Assistance to
Municipal Authority of the Borough of Shenandoah, PA**

Assessment and Recommendations by George Kunkel, P.E. DEP PSII

INTRODUCTION

Pennsylvania Department of Environmental Protection (DEP) assisted the Municipal Authority of the Borough of Shenandoah, PA (MABS) in compiling a standard American Water Works Association (AWWA) water audit using AWWA's Free Water Audit Software. Included are observations and recommendations for MABS to improve their Non-revenue Water (NRW) management.

COMPILING THE WATER AUDIT

DEP staff met with MABS leadership and staff on November 14, 2017 to assist MABS in compiling their data into the AWWA Free Water Audit Software. After the data was compiled, the Software calculated performance indicators, which showed a very high level of water loss in MABS. MABS provided data for many of the water audit components, but some of the data has generated questions. The AWWA Free Water Audit Software calculated a composite Data Validity Score (DVS) of 53 for MABS water audit. The DVS quantifies the audit data quality. A DVS value of 53 is in the lower end of the middle tier of DVS values, suggesting that opportunity exists to improve the completeness and validity of the water audit data. In some cases, relatively minor recordkeeping improvements can generate more representative, and higher quality, water audit data, and generate a higher DVS.

ASSESSMENT OF THE MABS WATER AUDIT RESULTS

Key findings of the 2016 MABS water audit are presented below. Because some of the data input into the water audit was based on estimates, the validity of the results should be considered approximate.

- ◆ Treated water supplied volume of 571.763 million gallons (mg).
- ◆ Authorized consumption (billed and unbilled): 155.65 mg. The average billed monthly residential consumption rate of 3,010 gallons/customer is roughly 28% less than the value of 4,208 gal/cus/month from a well-known research study¹, suggesting under-registration of residential water meters. Larger commercial/industrial water meters may also have issues.
- ◆ Water Losses of 416.113 mg: including apparent (customer) losses of 47.013 mg and real (leakage) losses of 369.1 mg.
 - Apparent loss performance indicator: 43.41 gal/service connection/day. This value is greater than the highest value of 38.59 gal/conn/day from a list of 153 water utilities studied by the author in an independent study.² Thus, potentially a large revenue loss is occurring in the metering and billing processes of MABS.
 - Real loss performance indicator: 340.83 gal/service connection/day. This value is greater than the highest value of 204.99 gal/conn/day from a list of 147 water utilities studied by the author.² It's Infrastructure Leakage Index (ILI) of 16.66 is well above the high value of 8.52 for utilities in the PA study².

¹ Residential End Uses of Water, Version 2, Water Research Foundation (2016)

² Report on the Evaluation of Water Audit Data for Pennsylvania Water Utilities, NRDC, (2016)

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Assessment and Recommendations by George Kunkel, P.E. DEP PSII

The cost impact of apparent losses is \$552,401 in uncaptured revenue, which represents 29% of the total revenue for 2016 of \$1,902,642. This significant revenue loss is likely due to both customer meter under-registration and customer billing system issues in 2016 which caused under-billing and missing revenue. Revenue loss is calculated by applying to the apparent loss volume by the value of Customer Retail Unit Cost (CRUC) for MABS of \$11.75 / 1,000 gallons. This value of CRUC exists in the mid-range of data from 151 PA water utilities. MABS installed a new customer billing system in 2017 and it appears to have improved billing operations and revenue capture. MABS can continue this progress by focusing on customer meter replacement.

The cost impact of real losses is \$154,963 of excessive treatment and pumping costs paid by MABS. This cost is derived by multiplying the volume of real (leakage) losses by the Variable Production Cost (VPC) of \$419.84 per million gallons, which is a moderately cost rate and below the median value of \$525.00 for 129 PA water utilities. The costs of leakage losses are significant and are equivalent to 67% of the variable production costs (electric power for pumping and treatment chemical costs) of \$232,848.

General Assessment of MABS Water Loss Standing

MABS is challenged in operating an aging water distribution system and dated customer meter population. It has been hampered by a problematic customer billing system but acted to install a new billing system in 2017, which has begun to restore efficient billing operations and increased revenue capture. MABS is experiencing very high losses (apparent and real) and has questionable accountability stemming from the integrity of production volumes due to aging flowmeters and questions in production volume data management. MABS has opportunity to improve in the key areas of accountability (production flowmetering), apparent loss control (metering and billing operations) and leakage management. A host of recommendations are listed below for consideration by MABS. The recommendations are grouped as short-term and long-term to provide a priority to these actions.

Short-term recommendations for MABS (for action in 6-12 months)

To both improve the validity of the water audit as a decision-guiding tool, and to better control losses, MABS can consider undertaking a variety of activities over the next several years. In this vein, a series of recommendations are offered, with short-term recommendations listed below.

1. Evaluate the feasibility of conducting a Reservoir Drop Test to confirm production flowmeter accuracy: Review the Drop Test procedure provided by DEP and conduct this test if possible. Be aware that the configuration of piping may result in the Drop Test confirming the combined accuracy of both the two production flowmeters (gravity and high service).
2. Consider hiring a consultant to conduct pipeline flow measurement to confirm the measured volumes from the production flowmeter, as well as the three flowmeters installed in the water distribution system. The data from these measurements can be used to confirm the level of customer water demand in the system and assist leakage investigations.

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Municipal Authority of the Borough of Shenandoah, PA**

Assessment and Recommendations by George Kunkel, P.E. DEP PSII

3. Better validate the water production volumes, “other” volumes and “unaccounted-for” water volumes reported to DEP. Conduct further investigation into the occurrence of repetitive production flow values that appear on many consecutive days in 2016 on the Water Allocation Daily Water Report. Review the method by which “other” and “unaccounted-for” water volumes are calculated.
4. Review how the flow data from the three distribution system flowmeters are archived and utilized; specifically, to see if they can be used to implement a flow balancing check against the production flows.
5. Review controls used to regulate and monitor storage tank levels and make any needed improvements to reduce the likelihood of storage tank overflows.
6. If blow-offs or drains exist on any distribution system pipelines, inspect these to ensure that the valves on these appurtenances are fully closed and not wasting water.
7. Document information on repairs of leaks and water main breaks in an electronic format. DEP is providing a spreadsheet software tool to MABS for this purpose. Take particular note of how many leaks are occurring on customer service lines.
8. Arrange to have an acoustic leak detection survey conducted on the entire system annually sometime in the March-May period by a professional leak detection service provider.
9. Record customer meter information (meter type, make, year installed) along with customer account data in an electronic billing system, meter management system, or spreadsheet software. Continue replacing water meters to the extent possible until a full meter change-out project can be conducted.
10. Create a form to document water consumed in fire hydrant flushing operations. Document the time that the hydrant is opened and the time it is closed and calculate the duration of flushing. Obtain an estimated flowrate from the Operator Field Guide (250 gallons per minute is a good approximation) or measure the flow with a field device such as a pitot blade and multiply the flowrate by the duration to get an estimate of the amount of water flushed out of the hydrant. The volumes flushed from all hydrants should be added to get a total volume for the year. DEP is working to develop a standardized form and guidance for water utilities to capture data from fire hydrant water usage.

Long-term recommendations (for action in 12-36 months)

1. Continue to compile the AWWA standard water audit on an annual basis. *It is recommended for PA DEP to again assist MABS in compiling the annual water audit for 2017.*
2. As part of the 2017 water audit, carry out a more detailed and accurate calculation of the Customer Retail Unit Cost (CRUC) by assessing water consumption data for each class of service and meter size.

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Municipal Authority of the Borough of Shenandoah, PA**

Assessment and Recommendations by George Kunkel, P.E. DEP PSII

3. Plan for the replacement of the two production flowmeters (gravity and high service). These flowmeters are believed to be over twenty years old and likely have not be reliably tested for accuracy for many years.
4. As included in current planning, continue to pursue with priority the replacement of all customer water meters that have not already been replaced in recent years.
5. As an enhanced project conducted in conjunction with customer meter population, install an Advanced Metering Infrastructure (AMI) system for improved customer meter reading efficiency, improved customer service capabilities, and cost-saving advantages. At that time, convert all accounts to monthly meter reading and monthly billing.
6. Install 2-3 permanent pressure sensors in the water distribution system and link them to the SCADA System.
7. Recommend establishing written policy and a flyer/notice to customers to inform them of their ownership and responsibility for a portion of the service line supplying their building. If improved documentation of leak events finds that many leaks are indeed occurring on service lines, a strategy should be considered for improved management of customer service lines, such as a service line warranty or insurance program.