FINAL

REPORT ON THE MANAGEMENT AND OPERATIONS OF ASHLAND'S WATER AND WASTEWATER SERVICES

Presented to the
Ashland City Manager
and the
Ashland Board of Commissioners

December 15, 2018

Prepared by BlueWater Kentucky

BlueWater Kentucky

EXECUTIVE SUMMARY

The City of Ashland retained BlueWater Kentucky in November 2017 to conduct a comprehensive review of the utility capital program with specific focus on water distribution system performance. After review of the compliance record, operations, and performance of the water distribution system it is the author's professional opinion that Ashland has not adequately reinvested in its drinking water system over the past 25 years and should take corrective action to address failing water assets.

The following observations are provided:

1. Ashland has not consistently complied with drinking water regulations in recent years, specifically in the area of maintaining adequate chlorine residuals in the distribution system and failure to comply with the EPA Disinfection By-Product Rule. The inability to meet drinking water regulations is directly related to aging facilities at the water treatment plant (filtration, backwash, chemical feed, SCADA control systems) and the amount of unlined cast iron and galvanized iron piping in the distribution system.

2. Ashland has a pipe failure rate of five times the industry average (Folkman-Utah Study 2018) and EPA recommended best practice. Ashland averages 240 main breaks per year (for 303 miles of pipe) and approximately 90 service line leaks per year. Small diameter pipe (2" and smaller) pipe fails at 20 times the EPA recommended best practice. This is due to the extensive use of unlined galvanized piping that corrodes internally and externally.

3. Ashland's water system exhibits high water loss. Ashland has reported 40 to 50 percent non-revenue water since 2013. The average non-revenue water for Kentucky municipal water systems is 29 percent. The water industry best practice is 15 percent or less. An examination of the existing master meter at the water plant in the spring of 2018 revealed the meter has been over-measuring the volume by approximately 15 percent. With an adjustment for the inaccurate meter, Ashland's water loss improved to 39.5 percent in FY 2018, however 39.5 percent is significantly higher than the industry best practice of 15 percent.

4. The extensive use of cast iron and galvanized iron piping by Ashland not only leads to high failure rates, but also contributes to high chlorine demand, high water loss, discolored water, extensive water service interruptions and traffic delays during main breaks repairs.

5. The American Water Works Association (AWWA) recommends an annual water main replacement rate of at least one percent of the distribution system (assumes 100 year life). Prior to FY 2017, Ashland did not annually budget for water main replacement. Beginning in FY 2017, Ashland initiated funding for water main replacement with $200,000 in FY 2017, $400,000 in FY 2018, and $740,000 in FY2019. With 303 miles of distribution water main, Ashland needs to replace a minimum of three miles per year at an estimated budget of $1.6 million to achieve the AWWA recommended replacement rate.

6. Ashland has not raised water rates to fully recover costs of operations, depreciation <u>and</u> capital infrastructure investment. The average annual increase since 2013 is 2.7 percent, and adequate amount to cover annual operating and maintenance costs but insufficient to cover capital improvements. Industry best practice is to raise utility rates annually to adequately fund operations <u>and</u> capital improvements.

Ashland is "behind the curve" on investing in aging water infrastructure. A dedicated 20-year program will be required to address the water infrastructure deficiencies. The drinking water system needs a level of investment and commitment similar to the Long Term Control Plan for wastewater, funded at $42.5 million. Revenue to fund a Water Improvement Plan will need to be generated through water rate increases or a dedicated drinking water surcharge.

The recommended funding approach for the proposed annual main replacement program is a volumetric surcharge to generate sufficient revenue to replace water mains at a minimum of 1 percent annually, with a three-year phase-in to achieve a replacement rate of 2 percent annually, as follows:

- $1.20 per 1000 gallons generates $1.6 million annually to replace 3.0 miles per year (1.0%)
- $1.80 per 1000 gallons generate $2.4 million annually to replace 4.5 miles per year (1.5%)
- $2.40 per 1000 gallons generates $3.2 million annually to replace 6.0 miles per year (2.0%)

Under this proposal, the monthly residential water bill for 5,000 gallons would increase as follows:

- FY 2020 - $6.00 per month to fund a 1.0% replacement rate
- FY 2021 - $9.00 per month to fund a 1.5% replacement rate
- FY 2022 - $12.00 per month to fund a 2.0% replacement rate

A drinking water surcharge, similar to the CSO sewer surcharge, is recommended as an effective method to assure funds are properly managed and invested in drinking water infrastructure. Some Federal/State grants and low interest loan funds may also be available to fund a portion of the investment needed. The surcharge revenue should be deposited into a dedicated drinking water infrastructure reserve to fund water system capital improvements.

The drinking water surcharge should be established with flexibility to fund reinvestment in aging water treatment, storage, pumping, distribution and transmission assets. The main replacement program should be one element of a comprehensive Water Improvement Program for asset replacement and renewal. Ashland should also conduct a Cost of Service Rate Study to assure revenues are adequate to cover operating, depreciation and capital expenses. Once water and wastewater rates are adjusted to cover the cost of service, an annual Consumer Price Index (CPI) adjustment should be implemented to assure operating expenses are covered and avoid rate shock to customers.

In addition to funding a Water Improvement Program, Ashland should develop performance metrics for operations and capital program execution. This will assure progress is being made with the investments to address underperforming infrastructure. Ashland should establish key performance indicators (KPIs) for regulatory compliance, reduction in water main failures, reduction in water loss, water quality, customer service and operating efficiency. Annual goals and five year targets should be established and annually reported by the City Manager to the Ashland City Commissioners.

1.0 BACKGROUND AND APPROACH

BlueWater Kentucky was retained by the City of Ashland in December 2017 under a professional services contract to review the management and operations of the city's water and wastewater utility. The results of this management review are documented in this "Report on the Management and Operations of Ashland's Water and Wastewater Services," referred to herein as the "Management Report."

The scope of work included a review of the following areas:

- Water and wastewater organizational structure and leadership,
- Budgets (capital and operating), planning and reporting documents,
- Annual capital improvement program for water (distribution, pumping, storage),
- Organizational challenges and opportunities.

The Management Report included a review of compliance with environmental regulations for both drinking water and wastewater; a review of water distribution system performance (water loss, breaks, leaks, metering); and a review of organizational capacity to address areas of concern and suggest new practices to improve the delivery of water and wastewater services.

The Management Report is organized into four sections: Background and Approach, Observations, Main Replacement Model, and Recommendations. The information included in the Management Report was obtained by review of various documents, onsite inspection of facilities, and interviews with Ashland staff.

The documents reviewed include the following:

- FY 2016, 2017, 2018 annual budgets (capital and operating),
- FY 2019 proposed annual budgets (capital and operating),
- Drinking water compliance records,
- Sanitary Survey reports,
- Water loss reports,
- Distribution main break and leak history,

- Depreciation schedules,
- Water and Wastewater Rate Review by HDR Engineers.

The site visits, facility inspection, and interviews occurred over a five month period from November 2017 to April 2018, with a summary as follows:

- November 14-15, 2017 – site visit to Ashland, Kentucky, included interviews and meetings with City Manager, accounting, engineering, and operations staff. Facility site visits included the water treatment plant, storage tanks, pump stations, distribution center, and construction sites.
- December 14-15, 2017 – site visit to Ashland, Kentucky, included interviews and meetings with key management, accounting, engineering, and operations staff. Presentation of scope of work to mayor and Ashland City Commissioners. Review main break/leak data and water loss reports. Facility site visits included the water treatment plant, storage tanks, pump stations, distribution center, and construction sites.
- March 14-15, 2018 – site visit to Ashland, Kentucky, included interviews and meetings with key management, human resources, accounting, engineering, and operations staff. Review of main break and leak data to develop water main replacement model. Review pipe samples from main break repairs.
- April 10-11, 2018 – site visit to Ashland, Kentucky, included meetings with the Mayor, City Commissioners, City Manager, and City Engineer. Facility site visits included the distribution pressure zones, storage tanks, pump stations, and Brady industrial development site.

Interviews and meetings were held with the following people during the site visits from November 2017 to April 2018.

- Mayor Steve Gilmore,
- City Commissioners Amanda Clark, Marty Gute, Matt Perkins, Pat Steen,
- City Manager Michael Graese,
- City Engineer Ryan Eastwood,
- Finance and accounting – Tony Grubb and Michelle Veach,
- Human resources – Sean Murray,

- Engineering and technical staff,
- Water plant and distribution supervisors, operators, and staff.

The purpose of this Management Report is to provide the City of Ashland an independent review of the management and operations of the water and wastewater utility and include observations and recommendations to improve the quality of service provided to the community.

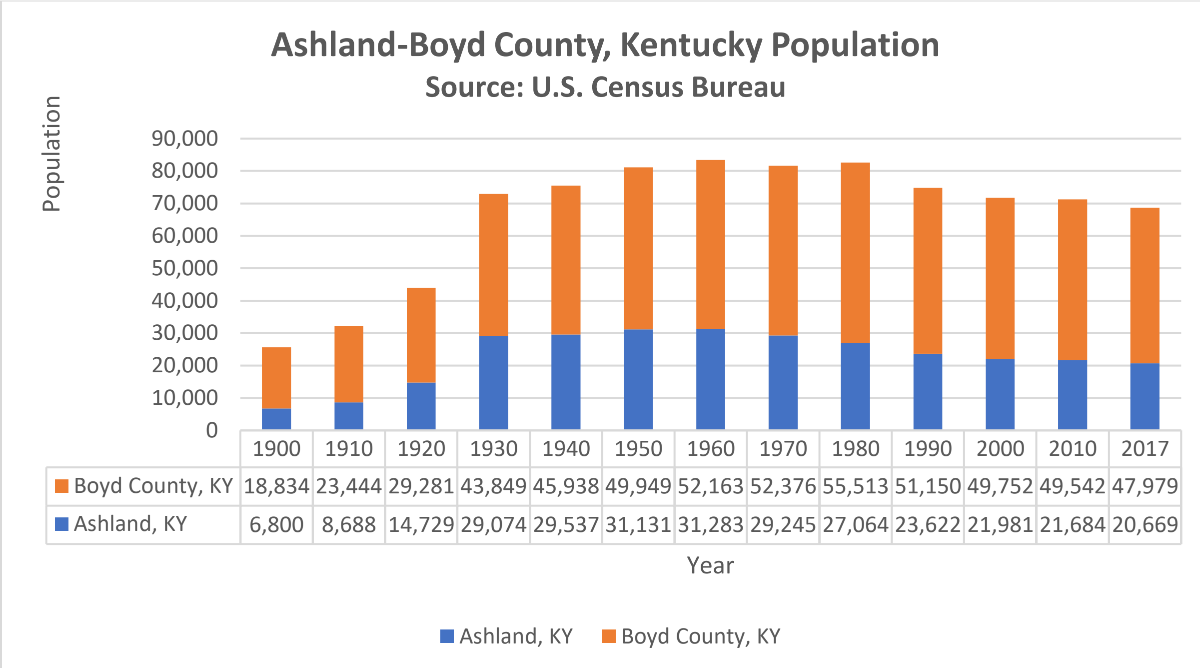
2.0 OBSERVATIONS

Following the review of documents, site visits, and meetings with key personnel, BlueWater Kentucky was able to document observations regarding the planning/finance/budget process; organizational structure, management, and staffing; operational performance; and capital improvement program of Ashland Water and Wastewater Utility. Observations are as follows:

Ashland Water System History

Ashland's public water system was chartered in 1894 as the Catlettsburg, Kenova and Ceredo Water Company. In 1920, the City of Ashland acquired the water system, which then grew rapidly from 1920 to 1940. After a slow growth period during World War II, the system grew at a moderate pace from 1950 to 1980. Since 1980, Ashland's water system has seen very little growth. Some limited growth has occurred in Boyd County outside the Ashland city limits, with service to adjacent counties. Over the past 30 years, Ashland's water demand has decreased due to the industrial decline, a decrease in population, and the steady increase in low flow plumbing fixtures, water conservation, and water efficiency measures.

Ashland's population peaked in 1960 with 31,283 people, while Boyd County's population peaked in 1990 with 51,150 people. In 2017, Ashland's population was estimated at 20,669, and Boyd County's population was estimated at 47,979.



	1900	1910	1920	1930	1940	1950	1960	1970	1980	1990	2000	2010	2017
Boyd County, KY	18,834	23,444	29,281	43,849	45,938	49,949	52,163	52,376	55,513	51,150	49,752	49,542	47,979
Ashland, KY	6,800	8,688	14,729	29,074	29,537	31,131	31,283	29,245	27,064	23,622	21,981	21,684	20,669

Exhibit 2-1. Ashland – Boyd County Population, 1900-2017, U.S. Census Bureau

At the time of this report in 2018, Ashland serves approximately 14,000 customers in Ashland, Catlettsburg, and Boyd County, Kentucky, an area with an estimated population of 42,000. The water system includes approximately 300 miles of water main, 1,300 fire hydrants, 12 storage. The service area is shown in Exhibit 2-2.

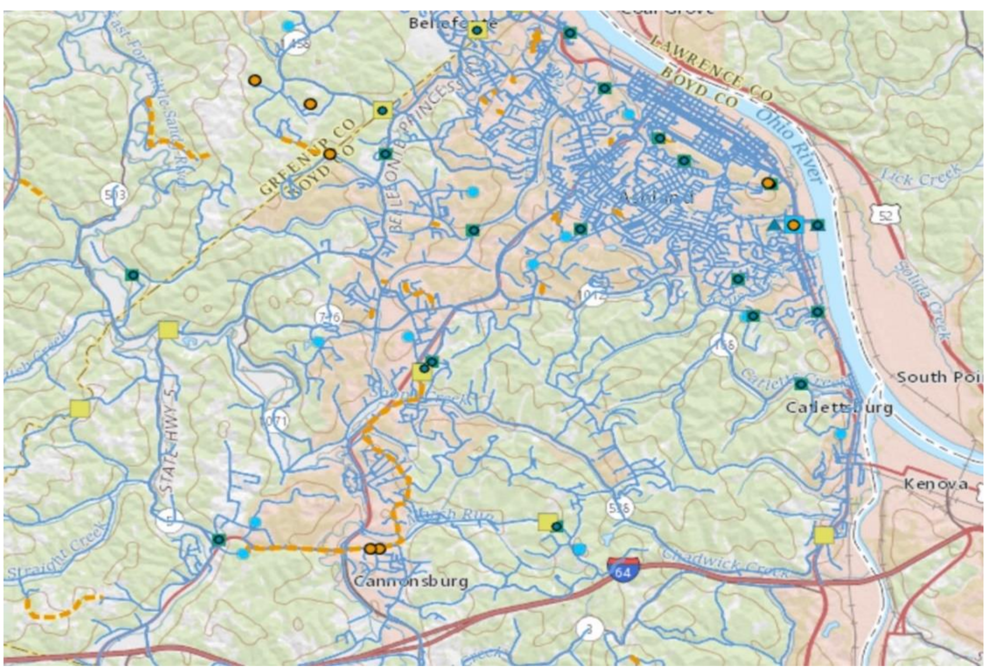


Exhibit 2-2. Ashland Water System (Source: KY WRIS)

Planning, Finance, Budget Process, and Rate Capacity

1. The City of Ashland develops annual operating and capital budgets by reviewing prior and current year performance compared to budgets. Operating and capital needs are identified by department heads and are submitted to the finance department. The finance department compiles the budget and submits to the City Manager for final review and recommendation to the city commission for approval. Workshops are held with the city commissioners to educate them on key initiatives and challenges. Ashland operates on a July to June fiscal year, and budgets are approved prior to the beginning of the fiscal year on July 1.

2. The City Engineer annually reviews the operating and capital needs for water and wastewater services and develops a list of capital improvements in areas of water/wastewater treatment, water storage, water pumping, water distribution, wastewater collection, equipment/vehicles, buildings, and facilities. Capital investment needs are prioritized on an annual basis and submitted to the City Manager for review. The capital budget requests are prioritized, and the list is typically reduced to fit within the available city funds.

3. HDR Engineers conducted a Water and Sewer Rate Review in 2015. The 2015 HDR Rate Review utilized the AWWA M1 Base/Extra Capacity method in reviewing Ashland's water and sewer rates and provided the following observations and recommendations:

   Water:

   a. The cost of providing water service to customers in the "test year" (Appendix K of HDR Rate Review) to customers was approximately $275,228 higher than total water revenue ($10,114,053 revenue compared to $10,389,281 costs), or approximately 2.7 percent higher than revenue,

   b. Residential and commercial revenue of $8,659,588 was $156,067 below the cost of service of $8,815,655 (1.8% below cost of service),

   c. Wholesale revenue of $1,454,465 was $119,160 below the cost of service of $1,573,626 (7.6% below cost of service),

   d. Inside city residential/commercial revenue of $3,694,362 was $613,849 below the cost of service of $4,308,211 (14.2% below cost of service),

   e. Outside city residential/commercial revenue of $4,965,225 was $457,782 higher than the cost of service of $4,507,444 (10.2% higher than cost of service),

   f. The HDR Rate Review estimated a $907,478 decrease in revenue (198 million gallons) from the closure of the AK Steel Plant by 2016 and an increase of

$93,695 in revenue from new water sales (45 million gallons) to the Big Sandy Water District,

g. The 2015 Cost of Service review includes $953,089 for depreciation and amortization of water assets,

h. <u>HDR recommended Ashland reinstitute annual CPI adjustments for water rates to compensate for the loss in water revenue from the closure of the AK Steel Plant.</u>

Sewer:

a. The cost of providing sewer service to customers in the “test year” (Appendix L of HDR Rate Review) was approximately $787,959 lower than the 2015 total sewer revenue ($5,835,259 revenue compared to $5,047,300 costs), or approximately 15.6 percent lower than revenue,

b. Retail sewer customers (inside city) revenue of $3,077,542 was $2,970 below the cost of service of $3,080,512 (0.1% below cost of service),

c. County bulk collection of sewage revenue of $1,955,614 was $75,359 higher than the cost of service of $1,880,255 (4.0% higher than cost of service),

d. Hauled Wastewater revenue totals $802,103,

e. Ashland identified a potential $709,103 reduction in revenue from the Big Run waste hauling anticipated in 2016, that would adversely impact Ashland total sewer revenue and create a deficit in the cost of service operations. (Note: Ashland continues to provide waste hauling from Big Run in 2018),

f. On January 1, 2015, Ashland increased the monthly CSO surcharge to $3.50 per customer, an increase from the initial $2.50 CSO surcharge of $2.50 per customer initiated on April 1, 2011. The CSO surcharge funds Ashland’s $42.5 million Long Term Control Plan,

g. The 2015 Cost of Service review includes $1,136,442 for depreciation and amortization of sewer assets,

h. <u>HDR recommended Ashland reinstitute annual CPI adjustments for sewer rates to compensate for the potential loss in sewer revenue from the Big Run waste hauling operations.</u>

4. Ashland reviews their water and wastewater rate structure annually and raises rates on a periodic basis. The 2018 average residential water bill for 5,000 gallons is $30.47 for inside the city and $47.81 for outside the city. The proposed rate increase for January 2019 is 3.2

percent, raising the average monthly water bill for 5,000 gallons to $31.45 for inside city customers. Exhibit 2-3 illustrates a 12-year history of water rate increases and the average monthly water bill for 5,000 gallons for inside the Ashland City limits. The average annual increase over the past 7 years (2013-2019) has been 2.7 percent. Water rates were not increased in 2016 and 2018.

5. The average monthly water bill for 5,000 gallons in Kentucky is $39.75 (Canon and Canon 2018 Water Rate Survey). Kentucky water rates have increased 2.75 percent annually since 2012 and Ohio water rates have increased 3.5 percent annually since 2012.

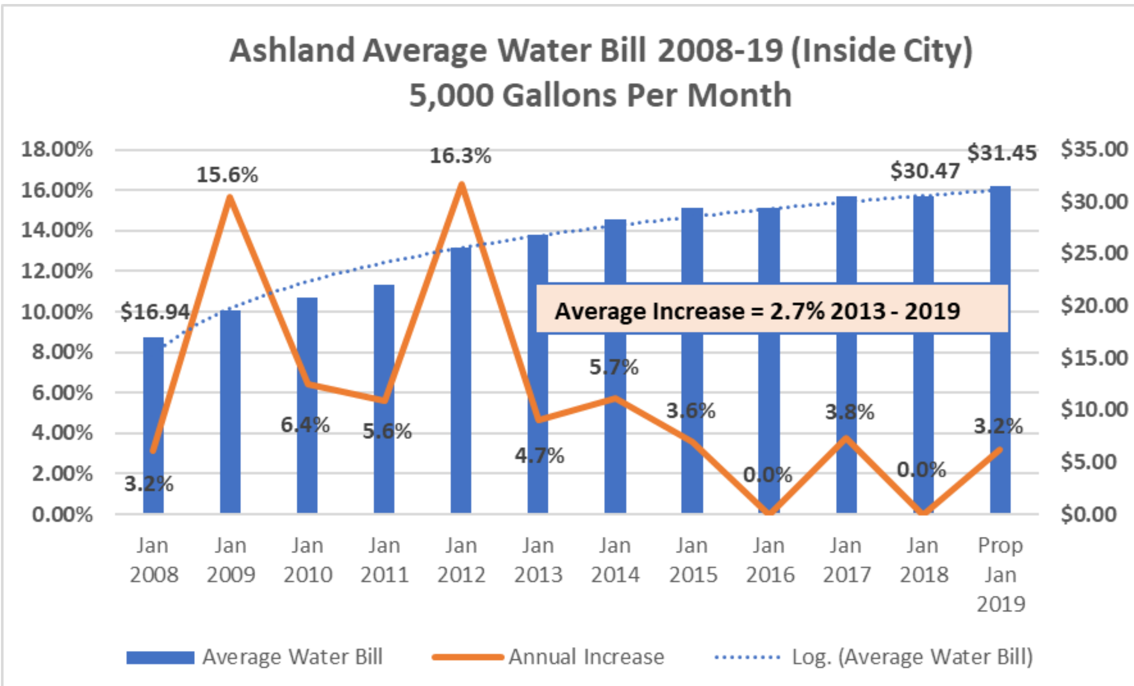


Exhibit 2-3. Ashland Water Rates 2008-2019

6. Ashland's water and wastewater utility revenue has been essentially flat over four of the last five years as shown in Exhibit 2-4. Utility operating expenses have increased an average of 2 percent since FY 2014 as shown in Exhibit 2-5. Water sales over the same five year period have declined an average of 1 percent annually since FY 2013 as shown in Exhibit 2-6. As a result, water rate increases have not been able to keep pace with the rise in operating costs and declining water sales.

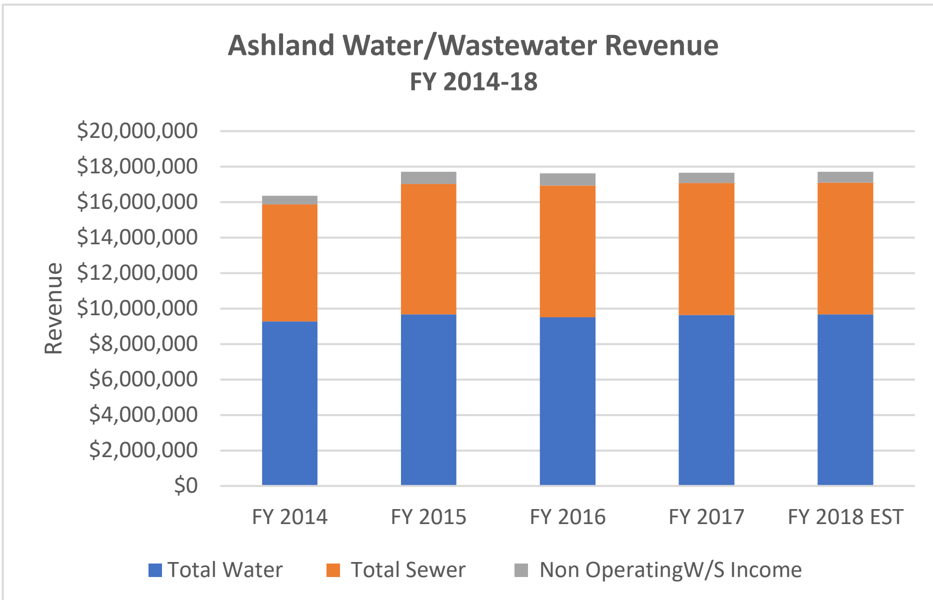


Exhibit 2-4. Ashland Water and Sewer Utility Revenue, FY 2014-2018

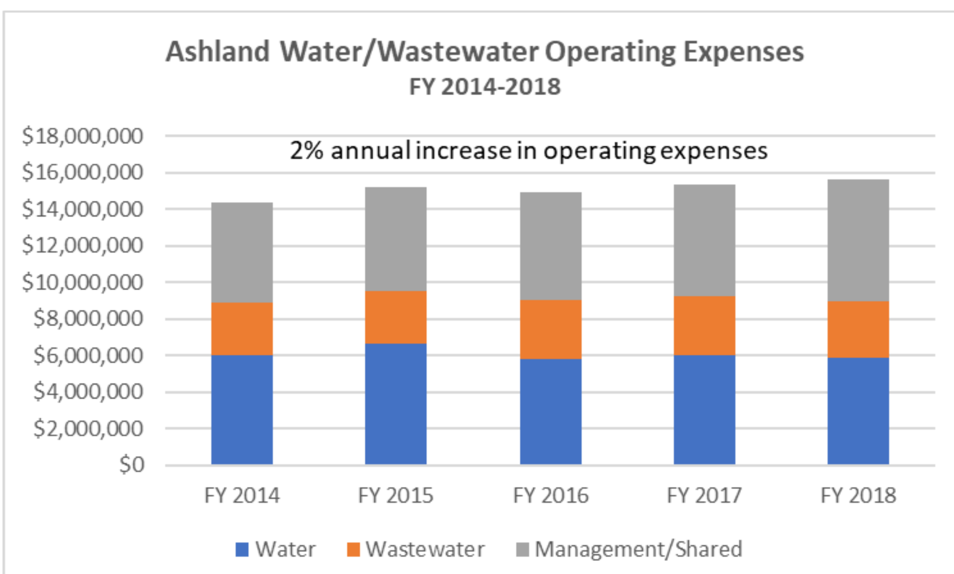


Exhibit 2-5. Ashland Water and Wastewater Utility Operating Expenses, FY 2014-2018

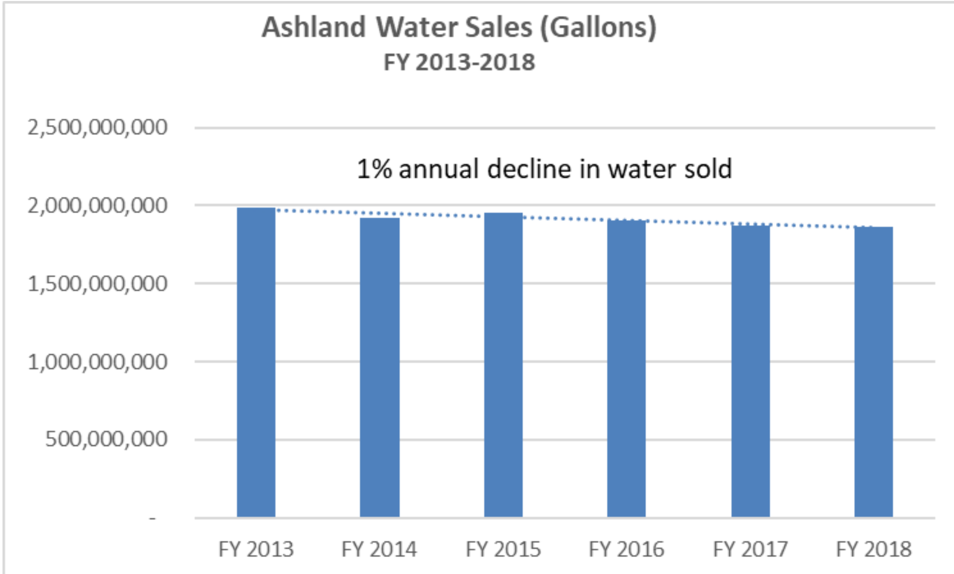


Exhibit 2-6. Ashland Water Sales 2013-2017

7. Ashland is currently under an Agreed Order (executed 2007) to comply with the Clean Water Act. The Agreed Order includes a Long Term Control Plan (LTCP) implemented over 15 years (2010-2025) to address sewer overflows at an estimate of $42.5 million. The LTCP is on schedule with Phase I, Phase II, Phase III, and Phase IV complete. Phase V will begin in FY2019. The LTCP is funded through a monthly wastewater surcharge of $3.50 per customer that generates adequate funding for the LTCP. The wastewater revenue and CSO surcharge revenue has increased slightly over the last 5 years and is shown in Exhibit 2-7.

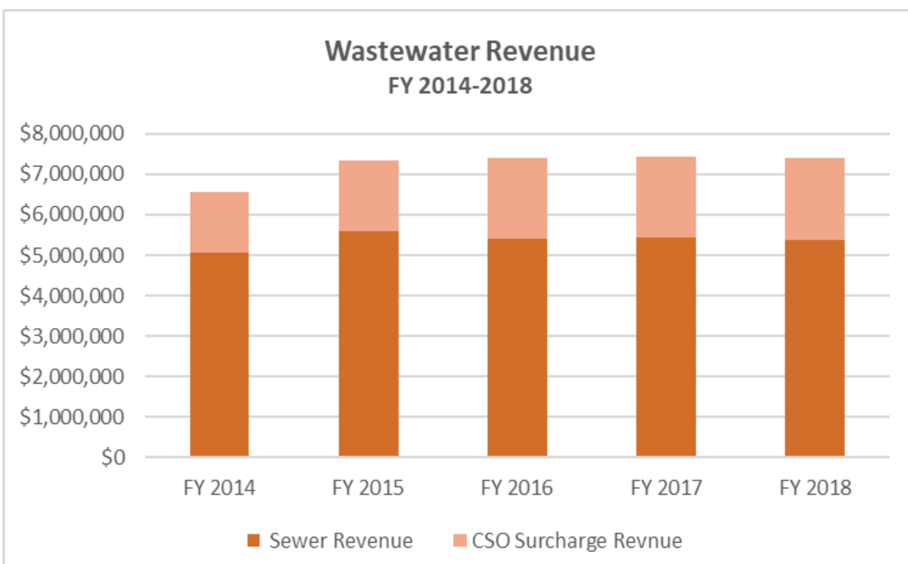


Exhibit 2-7. Ashland Wastewater and CSO Surcharge Revenue, 2013-2017

8. Ashland currently does not have a long-term (10 to 20 years) Capital Improvement Plan (CIP) for drinking water. Progressive utilities develop a 10 to 20 year CIP to address regulatory requirements, aging infrastructure, service levels, system growth, equipment and technology needs. The CIP is used to develop 10-year pro-forma income/expense projections, future revenue requirements and rate increases. The CIP is reviewed annually in preparation of the budget and updated every five years.

9. Ashland currently depreciates assets over a five to 50-year period, using the following categories:

    - Utility plants in service 5 to 50 years,
    - Buildings and improvements 5 to 20 years,
    - Operating equipment 3 to 10 years,
    - Automotive equipment 3 to 7 years,
    - Office furniture and equipment 3 to 20 years,
    - Infrastructure 20 to 30 years

10. Utility depreciation expenses for water and wastewater have increased slightly over the last 5 years as shown in Exhibit 2-8. Annual water and wastewater utility depreciation was $2.04 million in FY 2018.

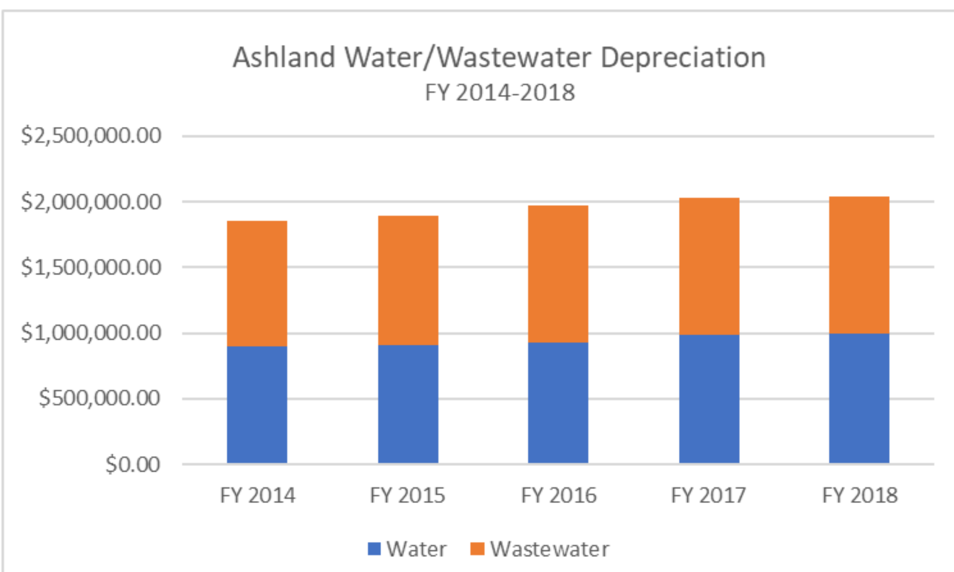


Exhibit 2-8. Ashland Water and Wastewater Utility Depreciation, FY 2014-2018

11. The 2016 Median Household Income (MHI) in Ashland was $39,742, compared to the Boyd County MHI of $44,140, and state of Kentucky MHI of $46,659, allowing Ashland to be eligible for low interest loans and grants from various federal and state programs (KIA State Revolving Fund Loans/Grants, Rural Development Loans/Grants) for water and sewer capital improvement projects.

12. Ashland provides retail water service to the city of Ashland and Boyd County, including Catlettsburg and several adjacent communities on a wholesale basis, including Cannonsburg, Flatwoods, Russell, Kenova, and Big Sandy Water District.

13. Ashland water sales have declined steadily over the past 40 years due to a combination of water conservation, low flow plumbing fixtures, the loss of industry (AK Steel Westworks Foundry and AK Steel Coke Plant), and economic cycles (recessions in 1973-75, 1981-82, 2007-09).

Organizational Structure, Management, and Staffing

1. Ashland is organized using a City Manager structure, with the City Manager reporting to the Mayor and City Commissioners. The organizational chart is show in Exhibit 2-9.

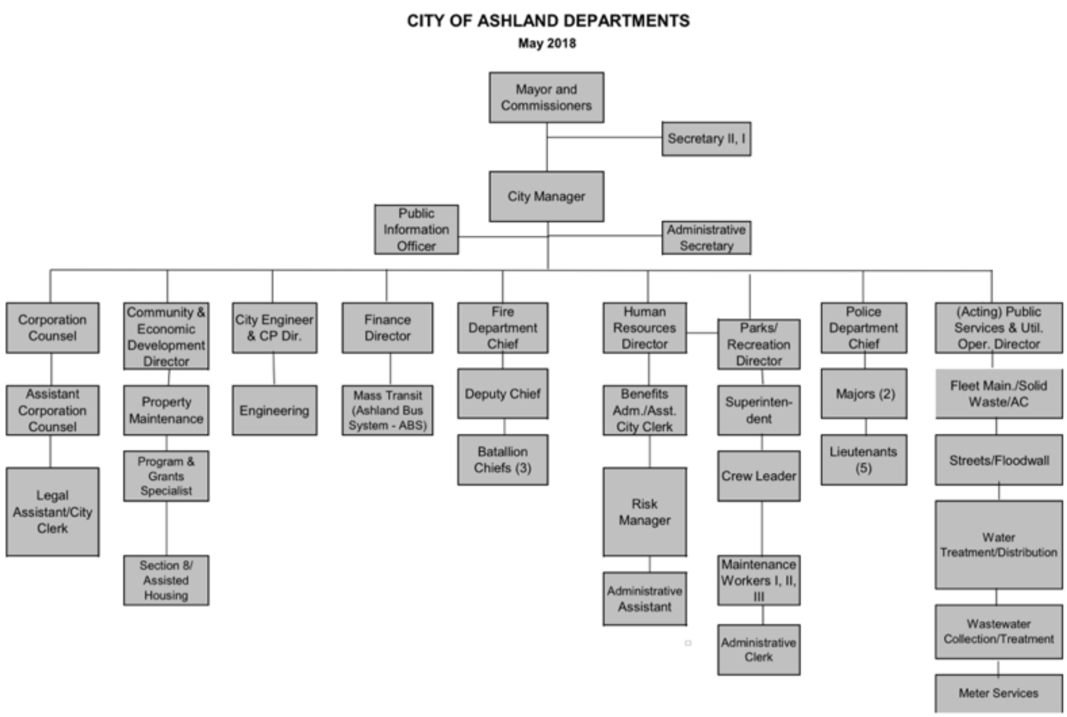


Exhibit 2-9. Ashland City Manager Organization

2. In 2018, the City Manager requested a change in senior leadership to address resource gaps in operations and engineering. The duties of the City Engineer were recommended to be divided into two roles reporting to the City Manager. The City Engineer would be responsible for managing the water and wastewater Capital Improvement Program and all engineering functions of the city. The Public Services and Utility Operations Director would be responsible for the operations of water, wastewater, fleet, solid waste, animal control, streets, and floodwall. This organizational change would allow the City Engineer to focus on engineering design and implementation of the city's annual capital program for water, wastewater, fleet, and streets. The Public Services Director position has been posted and interviews are underway. In the interim, the City Engineer is serving a dual role of managing both operations and capital improvements.

3. The technical staff resources are limited, with the recent retirements of two experienced engineering technicians. The city will require additional engineering and technical resources to implement the capital program. These resources can be added through staff additions, contract employees, or consultants.

4. Currently in FY2018, the staff time involved with executing the annual capital program (design, inspection, equipment and construction) is categorized as an operating expenditure. An opportunity exists to track internal labor, material, and equipment costs associated with construction or replacement of capital assets. This will reduce operating expenses and allow capital costs to be depreciated over of the life of the assets.

5. In some instances, Ashland is experiencing difficulty in attracting qualified applicants for some managerial, technical and operating positions due to the robust economy and the current level of compensation and benefits provided by the city. The strong economy and changes in the Kentucky Retirement System benefits may limit Ashland's ability to attract qualified candidates in the future.

6. Currently, Ashland budgets for required regulatory training for employees (operator and equipment training). Budget limitations, however, have reduced training opportunities for best practices, operational improvements, and professional development. Progressive utilities actively participate in regional conferences and workshops (AWWA and Rural Water) to enhance employee knowledge and implement utility best practices.

7. Ashland participates in the County Employees Retirements System (CERS) and the employer participation rate increased from 17.06 percent to 21.48 percent of employee labor effective July 1, 2018. This will increase Ashland's utility water and wastewater CERS contribution approximately $168,600 in FY2019. This additional expense is currently not included in water and wastewater rates and will be included in the next cost of service rate study.

Water Treatment

1. Ashland entered into an Agreed Order with the Kentucky Environmental Protection Cabinet (KyEPC) on December 29, 2015, to address violations of the Stage 2 Disinfection Byproducts (DBP) Rule, the inability to adequately maintain chlorine residual in the distribution system, and other sampling and reporting violations. A Corrective Action Plan was submitted to and accepted by the KyEPC on March 14, 2016. Subsequently, the compliance deadlines for addressing DBPs was extended to May 31, 2018. Ashland is now in compliance with the DPB Rule, with four consecutive quarters (May 2017 to May 2018) of Total Trihalomethanes (TTHM) and Haloacetic Acids (HAA) being below the regulatory requirement of 80 micrograms per liter and 60 micrograms per liter, respectively. Exhibit 2-10 shows the recent history of THM and HAA monitoring, Reporting and health based Violations (exceeding Maximum contaminant Level-MCL)

Ashland Disinfection By Product Violations					
Year	TTHM Reporting and Monitoring	TTHM MCL	HAA5 Reporting and Monitoring	HAA5 MCL	Total Violations
2014		2			2
2015	1	4	1		6
2016	1	2	1	2	6
2017	1	2			3
Total	3	10	2	2	17

Exhibit 2-10 Ashland Disinfection Byproduct Formation History, 2014-17

2. Although Ashland is now in compliance with the DBP Rule, the levels of THMs and HAAs vary with water temperature, and DBPs typically increase in the third quarter (July to September) of the year. In August 2018 Kentucky Division of Water performed a Comprehensive Performance Evaluation (CPE) of Ashland's water treatment plant and determined that the leading cause of chlorine demand is Total and Dissolved Organic Carbon (TOC and DOC) in the source water prior to treatment. Distribution system chlorine residuals average only three days compared to several weeks in most systems. The large amount of unlined cast iron and galvanized iron in the distribution system also contributes to bio-film growth and high chlorine demand. Due to the ongoing need to balance the requirements for maintaining

chlorine residual and minimize disinfection byproducts, Ashland will continue to be at risk of non-compliance in these two areas.

3. Ashland upgraded the water filter system in 2015-2016 with new media, Leopold IMS filter cap, and air scour backwash to improve filtration and reduce DBP formation. The system has continued to underperform to expectations, and the engineering consultant, filter supplier, and Ashland staff are working cooperatively to address the filter performance issues. Ashland is evaluating the benefits of adding GAC filter technology to improve water quality, reduce DBP formation, reduce chlorine demand, and reduce taste and odors resulting from source water algae blooms.

4. The water treatment plant Supervisory Control and Data Acquisition (SCADA) system is outdated and in need of upgrade. Some components of the SCADA system are obsolete or non-functional, and replacement parts are not available. A new SCADA system will allow more efficient operations of the treatment plant, improve ability to achieve regulatory compliance, and allow system operators to optimize water quality. In the fall of 2017, Ashland retained GRW Engineers to conduct a SCADA system assessment and provide recommendations for upgrade. The GRW evaluation includes three options and GRW recommends Alternative #2. There are advantages to Alternative #3 at a $153,000 premium, including a dedicated Windows server, a dedicated control room, added security in the new room, and less impact on operations during construction. The three alternatives include:

    - Alternative #1 - $992,907 – Base system (open area),
    - Alternative #2 - $1,079,131 – Enhanced system (open area),
    - Alternative #3 - $1,232,259 – Enhanced system in new (secure control area)

5. The treatment operations staff experiences significant daily challenges with operations of the plant due to the age of the system, an outdated control system, inadequate experience/training with new technology and regulatory expectations, and the underperforming filters. Water quality and the ability to meet EPA drinking water regulations will continue to be a challenge without investment in the treatment plant, SCADA system, and operator training.

Distribution Systems Performance

1. As of 2017, Ashland has approximately 303 miles of water pipe, serving a population of approximately 42,000 through 14,000 customer service connections. Ashland has a large inventory of cast iron and galvanized iron pipe that was installed prior to 1980. Sixty-three percent of the pipe is 6-inch and smaller in diameter. Exhibit 2-11 illustrates the inventory of pipe by size.

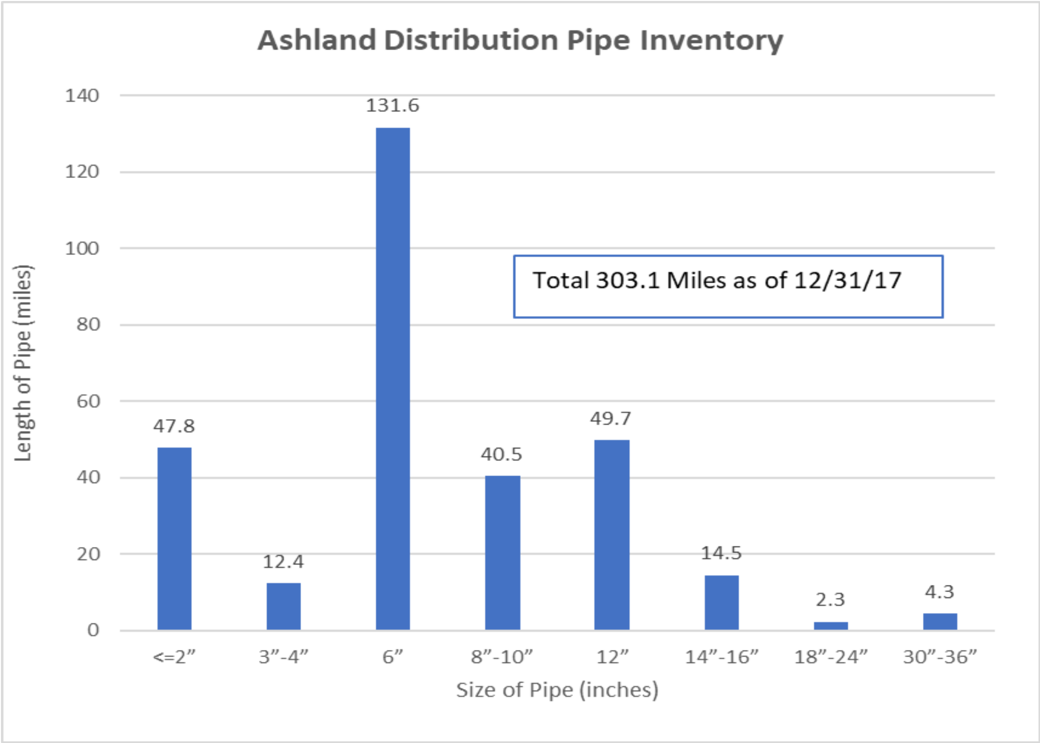


Exhibit 2-11 Ashland Water System by Pipe Size

2. Ashland does not have detailed records of pipe inventory by size, location, and type of pipe. From an analysis of industry trends, availability of pipe materials, and field observations during repairs, it can be concluded Ashland’s inventory of pipe includes a large percentage of unlined cast iron and galvanized iron piping. A significant portion of Ashland’s water system piping is assumed to be unlined cast iron and galvanized pipe.

3. Cast iron and galvanized iron corrodes both internally and externally. Extensive corrosion leads to pipe failures, discolored water, and increased chlorine demand. Exhibit 2-12 shows photos of unlined cast and galvanized iron pipe samples from Ashland’s water distribution system.

6" Unlined Cast Iron Pipe

2" Unlined Galvanized Pipe

Exhibit 2-12. Ashland Unlined Cast Iron and Galvanized Pipe Exhibiting Severe Corrosion

4. Ashland experiences a significant number of water main failures (breaks and leaks) due to the corrosion of ductile iron, cast iron, and galvanized iron pipes. These pipes often have failures within the same 18-foot length of pipe, as shown in Exhibit 2-13. The silver sleeves on the ductile iron pipe are stainless steel repair bands. Exhibit 2-14 shows the number of main breaks and service leaks repaired from 2012 to 2017.

Exhibit 2-13. Ductile Iron Pipe (installed circa 2000) with Multiple Failures and Repair Sleeves (16 repair bands in 120 feet of pipe)

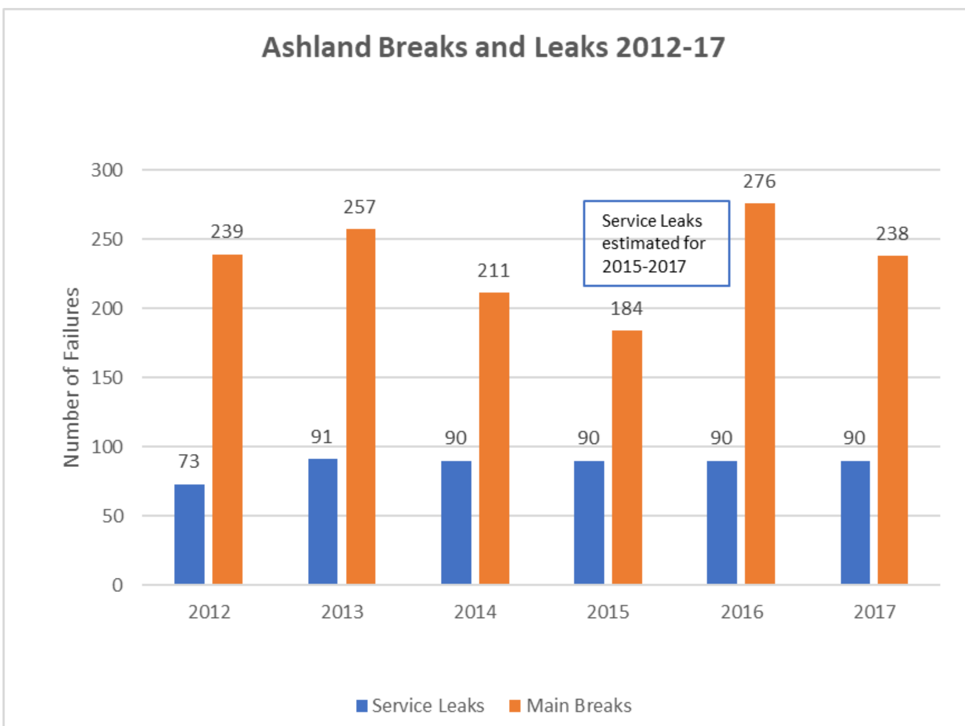


Exhibit 2-14. Annual Number of Main Breaks and Service Leaks

5. Ashland began recording more detailed information on pipe failures beginning in 2016, including failure by date, location, and size of pipe. Exhibit 2-15 illustrates pipe failures by month, and Exhibit 2-16 illustrates pipe failure by size. Note that cold winters with water temperatures dropping below 40 degrees contribute to water main breaks. Ashland also experiences higher main breaks during summer months of June through August, when summer water demands increase operating pressures. The preliminary data analysis in Exhibit 2-16 shows that nearly 70 percent of failures occur on 2” galvanized and 6” cast iron pipe.

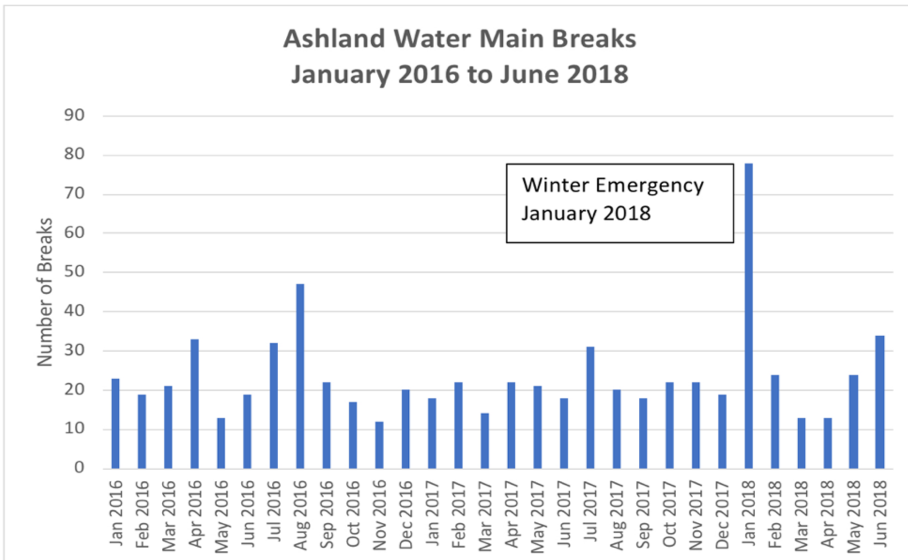


Exhibit 2-15. Ashland Pipe Failures by Month (2016-18)

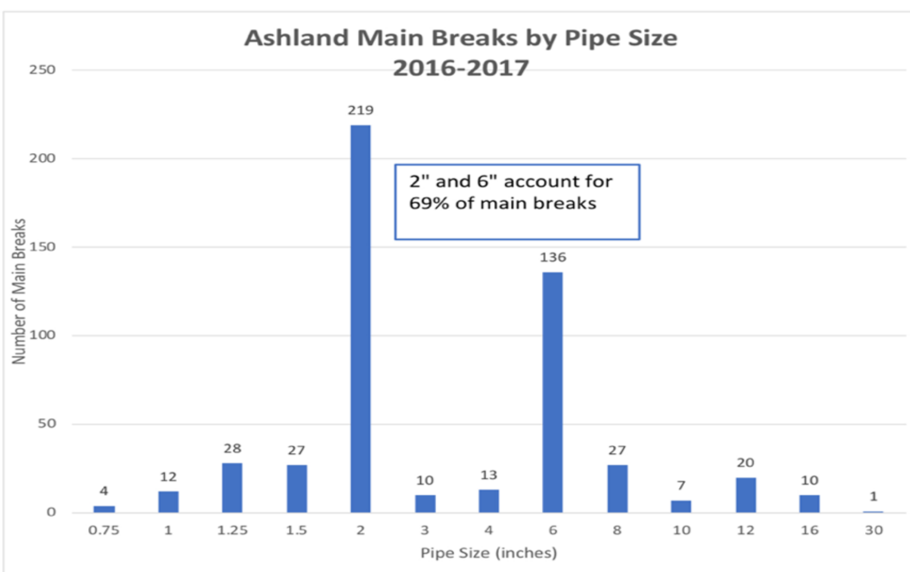


Exhibit 2-16. Ashland Main Breaks by Pipe Size (2016-17)

6. Water main failure rates vary significantly among water utilities due to a variety of reasons, including system size, weather, geography, material type, age, water pressure, water temperature, rainfall, water chemistry, soil conditions, depth of bury, backfill materials, installation methods, and replacement rates. The industry benchmark for distribution system performance (integrity, reliability, and repair costs) is a performance metric known as Main Break Frequency, measured as the number of breaks per 100 miles of pipe. Ashland's water main break frequency is 78.5 breaks per 100 miles of pipe. Exhibit 2-17 shows break frequency from 2012 to 2017, and Exhibit 2-18 shows the break frequency by size of pipe for 2016-2017. Small diameter 2" galvanized pipe has the higher failure rate. (the Ashland break data set includes only two years of detailed data by location and pipe size, a minimum of five years of data is recommended to determine trends.)

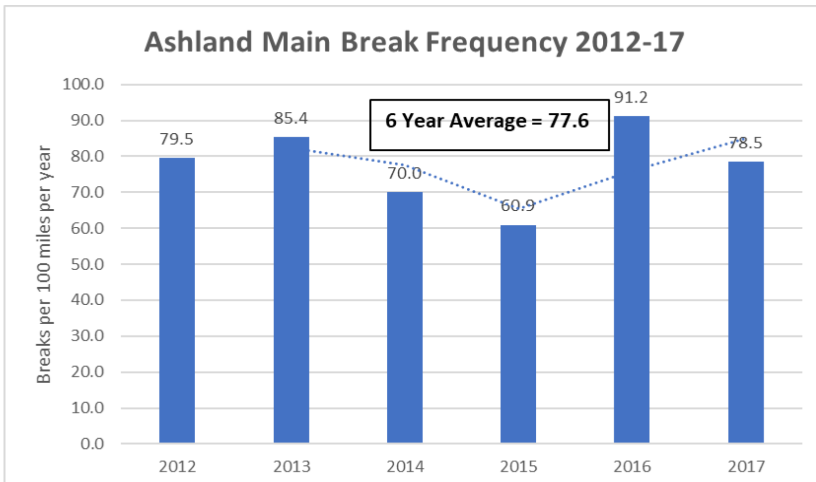


Exhibit 2-17. Ashland Main Break Frequency by Year (2012-2017)

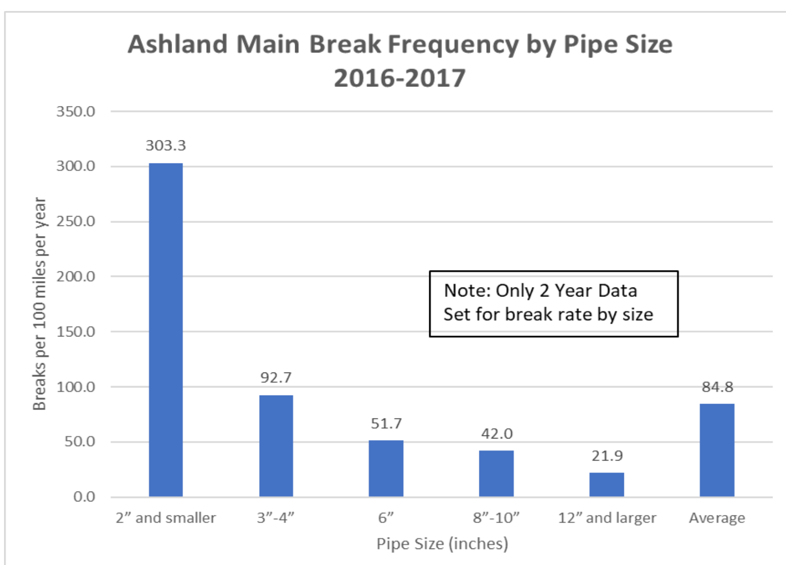


Exhibit 2-18. Ashland Main Break Frequency by Pipe Size (2016-2017)

7. A recent report prepared by Greater Cincinnati Water Works compared water main failure rates among 10 mid- and large-size cities in the United States. The 10-city average failure rate is approximately 19.5 failures per 100 miles of pipe per year, as shown in Exhibit 2-19. In addition, the U.S. EPA Partnership with Safe Water has established a best practice distribution system performance indicator of 15 breaks per 100 miles of pipe per year. Ashland's failure rate of 77.6 breaks per 100 miles of pipe per year is approximately four times the 10-city average and five times the EPA best practices guideline.

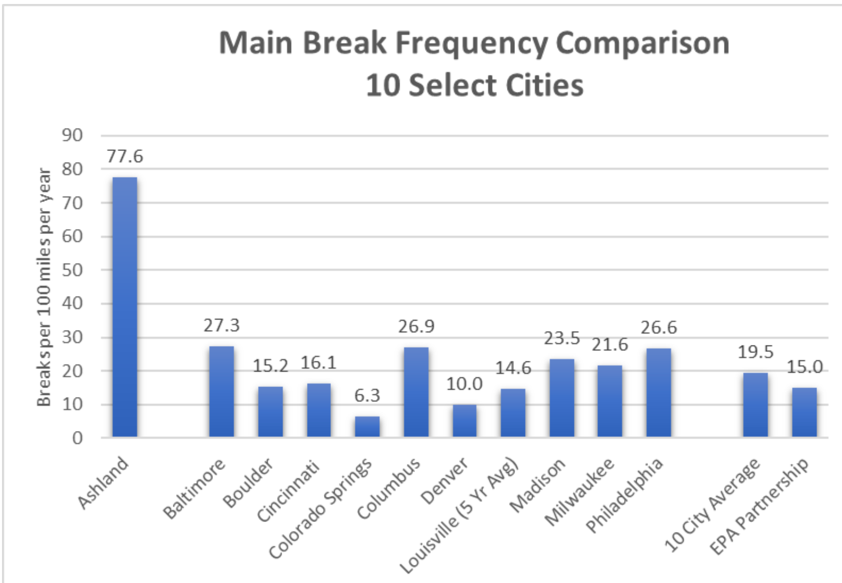


Exhibit 2-19. Water Main Failure Rates in 10 Select Cities (Source Cincinnati Water)

8. The American Water Works Association and the Water Research Foundation have conducted a number of investigations and have determined that a minimum replacement rate of 1 percent per year is recommended for water systems. Water systems that experience higher failure rates exceeding 20 breaks per 100 miles may need to replace 2 to 5 percent annually.

9. Kentucky drinking water systems do not generally track distribution system performance as measured by water main failure rates (main break frequency). Louisville Water Company (LWC) has an extensive water main failure database dating back to 1963 and includes over 40,000 break records. In 1992, LWC initiated a comprehensive main replacement in Rehabilitation Program (MRRP) to address 600 miles of unlined cast-iron pipe with an objective to reduce the annual failure rate from 33 breaks per 100 miles per year in 1989 to less than 20 breaks per 100 miles by 2012 and ultimately achieve the Partnership for Safe Water target of 15 breaks per 100 miles per year. The program is considered a national model and annual water main break rates were reduced to 12.7 breaks per 100 miles by 2017. LWC currently has approximately 4,200 miles of transmission and distributions main. Exhibit 2-20 provides a summary of LWC failure rates following an investment of over $200 million since 1985 in replacement and rehabilitation of distribution water mains.

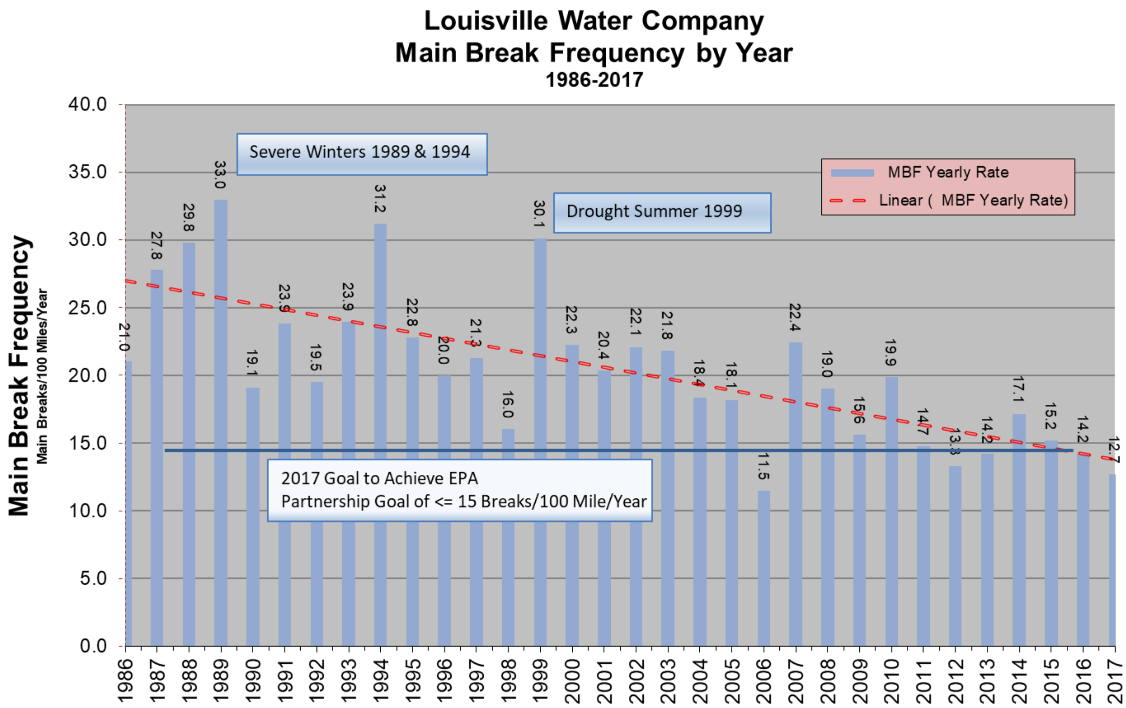


Exhibit 2-20. Louisville Water Main Failure Rates

10. Northern Kentucky Water District (NKWD) initiated a Water Main Replacement program that approved by the Kentucky Public Service Commission in 1999. NKWD serves approximately 300,000 people through 80,000 service connections supplied by 1,300 miles of distribution piping. NKWD currently (2017) has a water main failure rate of approximately 24 breaks per 100 miles of distribution piping and invests approximately $5 to $6 million annually with an annual goal to replace 1 percent of the distribution system. The program is funded from depreciation and supplemented with bond issues to fund a 20-year capital improvement program. Appendix A includes a summary of the NKWD Main Replacement Program.

11. Dr. Steven Folkman of Utah State University published *Water Main Break Rates in the US and Canada: A Comprehensive Study* in March 2018. The study included a survey of 281 water systems with nearly 200,000 miles of pipe serving approximately 53 million people. Some major highlights of the Utah State Study included:

    - Cast iron, ductile iron and PVC pipe are the predominant pipe material types used by the utilities in the survey, representing approximately 67 percent of the pipe inventory,

- Water main breaks have increased 27 percent since the last survey, from an average of 11.0 breaks per 100 mile per year in 2012 to 14.0 breaks per 100 miles per year in 2018 (possibly due to a larger number of participants in the survey),

- Cast iron pipe failure rates average 34.0 breaks per 100 miles per year in the 2018 survey, compared to 24.4 breaks per 100 miles per year in the 2012 survey (an increase of 43 percent),

- The average age of failing water lines is 50 years,

- Cast iron pipe failures are the highest among pipe materials surveyed and cast iron pipe in corrosive soils fails 20 times the break rate of cast iron in low corrosive soil,

- PVC pipe has the lowest failure rate among pipe materials surveyed, at 2.3 breaks per 100 miles per year. Ductile iron pipe failure rate is 5.5 breaks per 100 miles per year,

- 45 percent of utilities surveyed perform some type of condition assessment of their water mains,

- Utilities surveyed report an average replacement rate of 0.8 percent, equivalent to a 125 year service life,

- Best practice establishes a replacement rate of 1.0 to 1.6 percent replacement rate for a useful life of 60 to 100 years,

- Average system pressures of utilities surveyed were 69 psi and a maximum of 119 psi.

By comparison, Ashland's water main failure rate averages 78 breaks per 100 miles per year. The majority of Ashland's water system is believed to be cast iron for larger diameters (6" and larger) and galvanized iron for smaller pipes (4" and smaller). Ashland's failure rate is 5.5 times the average failure rate of 14 breaks per 100 miles per year and 2.3 times the average cast iron failure rate identified in the Folkman-Utah State University study. The high failure rate is attributed to the continued use of cast and galvanized iron, the near zero rate of pipe replacement, and corrosive soils in Ashland and Boyd County.

Water Loss (Non-Revenue Water)

1. The North American water industry measures water system efficiency by measuring water loss in the distribution system. The American Water Works Association (AWWA) has published a best practices manual, *M36 Water Audits and Loss Control Programs*. The methodology uses a water loss balance of inputs and outputs to water distribution system, including both metered water and non-metered water. Appendix B provides a

summary of EPA's Water Audits and Water Loss Control for Public Water Systems (2013) using the AWWA M36 Standard of Practice. Exhibit 2-21 illustrates the IWA/AWWA Water Loss balance.

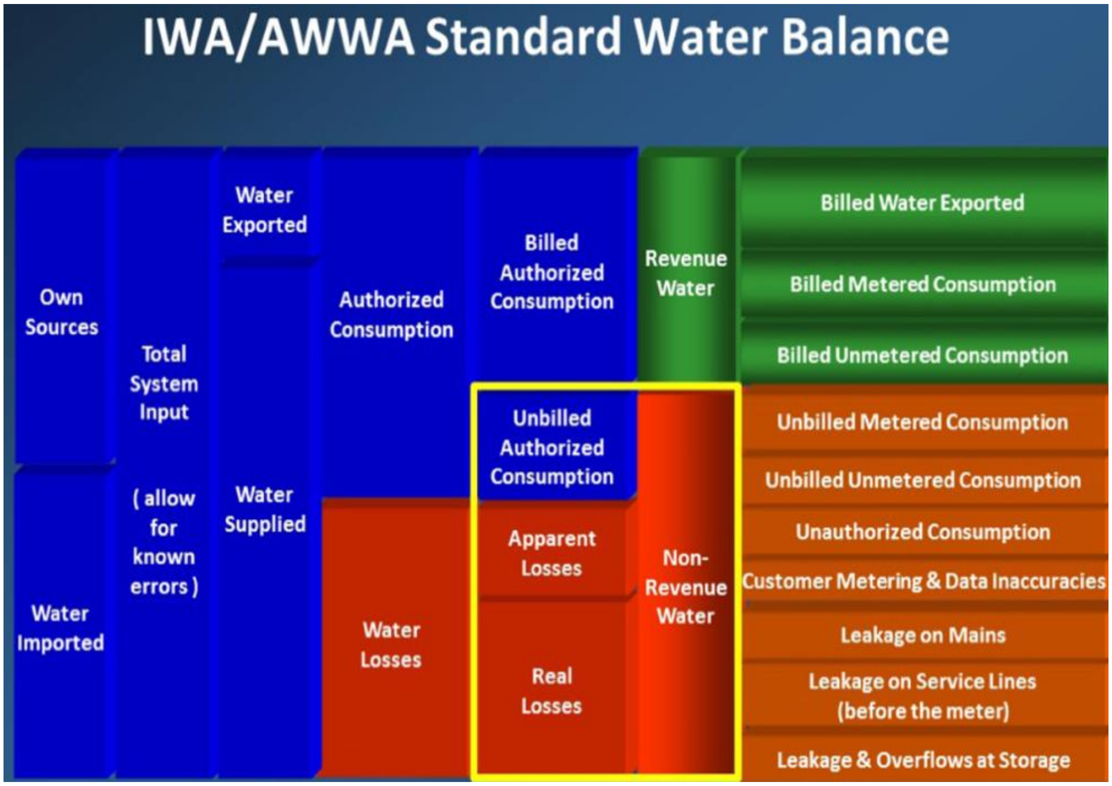


Exhibit 2-21. IWA/AWWA Water Balance and Audit Process

2. Ashland experiences a very high rate of non-revenue water (water loss), exceeding 40 percent over the past five years. This high water loss is attributed to a number of factors, including water main breaks and leaks, service line leaks, inaccurate meters, water system flushing, and possible water theft. The water industry best practice recommends utilities achieve a 15 percent or less of non-revenue water (> 85 percent metered). Exhibit 2-22 illustrates Ashland's water loss history, and Exhibit 2-23 illustrates water loss in Kentucky's top 10 cities, including Ashland.

3. Ashland's water treatment plant measures water produced with Venturi meters. In May of 2018, Ashland evaluated the accuracy of the existing plant Venturi meters and determined the plant Venturi meter is over measuring total plant flow by an average of 15 percent (varies with flow range). With this assessment, the FY 2018 plant production volume has been adjusted down by 15 percent. This resulted in a reduction of reported water loss for FY 2018 from 48.6 percent to 39.5 percent. This water loss rate is higher than the Kentucky Municipal City Average of 23.4 percent and the industry best practice of 15 percent.

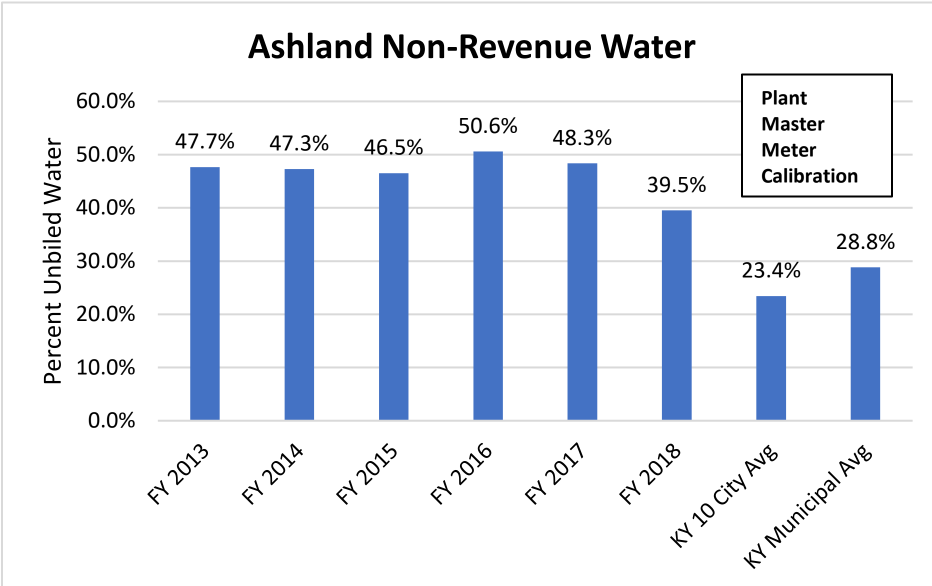


Exhibit 2-22. Ashland Non-Revenue Water for the Period 2012 to 2017

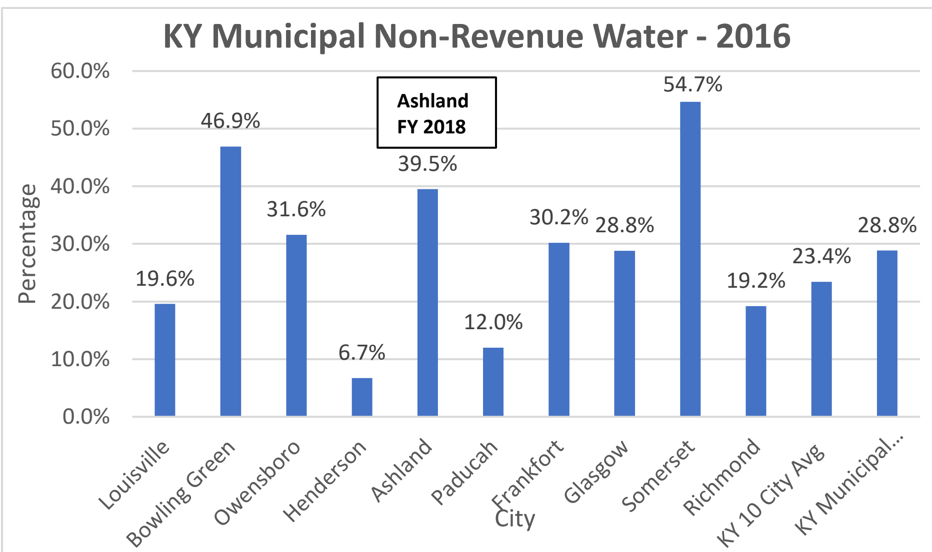


Exhibit 2-23. Water Loss for 10 Largest Kentucky Cities

4. Ashland experiences high water loss (averages 40 percent non-revenue water) compared to similar municipal water systems in Kentucky. The following contribute to Ashland's high water loss:

   a. Currently Ashland maintains 18 pressure zones that vary in pressure from a low of 30 psi to over 150 psi. Ashland's service area covers a wide range of elevations, including hills and valleys that contribute to the number of pressure zones. With the variation in terrain, higher water pressures contribute to water loss. A consolidation of pressure zones may reduce water main breaks, water loss and operating costs.

b. Ashland has a high water main and service line failure rate (4X average), and excessive water main breaks and service line leaks contribute to lost (unmetered) water. Water main repairs also require extensive hydrant flushing during and after repairs to maintain water quality.

c. In 2015, Ashland replaced all small meters (1" and smaller) with new Automated Meter Reading (AMR) meters. Approximately 60 percent of large meters (>1") have been replaced with AMR meters through 2017. The meter testing program was suspended in 2014 and will be reactivated upon completion of the AMR metering project. With a new, right-sized meter inventory, meter inaccuracy is not likely a major contributor to water loss at this time.

d. System flushing is typically not metered, leading to higher non-revenue water.

Capital Improvement Program (Water and Wastewater)

1. The Ashland wastewater system is currently under a federal consent decree which is funded through a monthly wastewater surcharge of $3.50 per customer. This revenue stream is adequate to fund the remaining portion of the Long Term Control Plan to address sewer overflows.

2. The Ashland drinking water system is currently negotiating an agreed order with the Enforcement Division of the Environmental Protection Cabinet to address violations of the Disinfection Byproduct Rule and maintaining chlorine residuals in the distribution system. Chlorine demand is high due to the age of the water system, the condition of the pipes (unlined cast iron and galvanized iron), and an inability to manage water storage and circulation during summer high-demand periods. Higher chlorine demand and source water organics (Total and Dissolved Organic Carbon) contribute to the formation of disinfection byproducts (haloacetic acids and trihalomethanes), especially during summer periods of higher air and water temperatures. The agreed order will require corrective action to address these two issues.

3. Ashland has not made significant investments in replacing its water distribution infrastructure. Exhibit 2-24 Illustrates the annual capital expenditure budget (CAPX) and funds budgeted for main replacement over the past five years. The $740,000 main replacement capital budget for FY 2019 will provide for approximately 1.5 to 2.0 miles of replacement or nearly one percent of the system. Approximately 50 percent of the FY 2019 main replacement program will be performed with in-house crews, with the balance performed by external contractor. In-house design, crew labor and equipment costs are included in the operating budget and materials are included in the capital budget. Main

replacement work performed by contractors will be capitalized, and includes construction labor, material and equipment. With this approach the $740,000 capital budget will provide an equivalent main replacement value of approximately $1.1 million, Average Cost for 6" to 8" replacement is $100 per foot, but will vary with pipe size, number of service connections, restoration methods (paving, concrete, dirt) and traffic control.

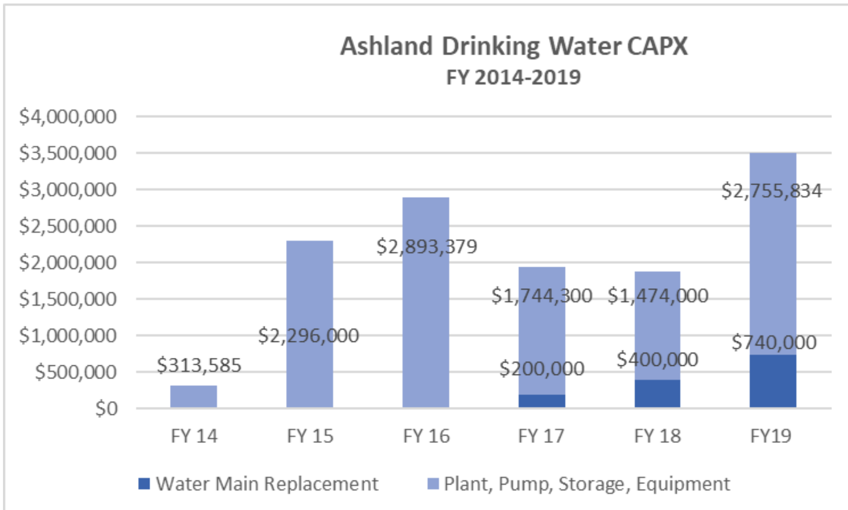


Exhibit 2-24. Ashland Annual CAPX Main Replacement Budget, FY 2014-19

4. The $740,000 capital budget for materials in FY 2019 will provide a total main replacement value of approximately $1.1 million, allowing 1.5 to 2.0 miles of replacement. The Ashland City Engineer has developed a proposed list of main replacement candidates that includes approximately 2.5 miles of main replacement at an estimated cost of $987,855, as shown in Exhibit 2-25. The FY 2019 program includes abandoning 5,000 feet of 6-inch water main in US Route 23 and transferring services to the existing 12-inch water main. These projects were selected from review of the main break history, condition of the pipe, and hydraulic capacity. This project priority list is a good start towards building a sustainable main replacement program with a minimum of one percent annual replacement rate.

FY 2019 Proposed Water Main Replacement Projects

LOCATION	Existing Size (inches)	Proposed Size (inches)	Length (feet)	Average Cost Per Foot	Estimated Replacement Cost ($)
Ashland - 3rd Circle Prospect	2	6	900	$99.00	$89,100
Ashland - Gartrell Court	2	6	250	$99.00	$24,750
Ashland - S. 29th S. Rogers to Robin Lynn	6	8	2,400	$110.00	$264,000
Ashland - Us 23 (47th - 10th St Catlettsburg) abandon 6" and connect to existing 12"	6	0	5,000	$33.00	$165,000
Ironville - Forrestdale Ct.	2	4	770	$99.00	$76,230
Summitt - Bybee Rd.	6	6	2,000	$99.00	$198,000
Westwood - Dalton	2	4	830	$99.00	$82,170
Westwood - Hoods Creek at Maggard	2	4	495	$99.00	$49,005
Westwood - McClure	2	4	400	$99.00	$39,600
Total FY 2019			13,045	Feet	$987,855
			2.5	Miles	

Exhibit 2-25. FY 2019 Priority Main Replacement Projects

5. Ashland is currently implementing its Long Term Control Plan (LTCP) for Combined Sewer Overflows of the collection system to comply with the Clean Water Act. The LTCP has five phases. Phase I had a budget of $7.0 million and was completed between 2010 and 2012. Phase II has a budget of $3.0 million and was completed between 2011 and 2014. Phase III had a budget of $220,000 and was completed in 2014. The Phase IV budget is $4.0 million for the separation of sanitary and storm sewers in 29th Street with a completion expected in 2018. Phase IV at an estimated $28.3 million budget, will begin in FY 2019 and will be completed by 2025. The total LTCP budget is $42.5 million and is funded through a monthly customer surcharge of $3.50 per customer, that generates approximately $2.0 million annually.

6. The approved FY 2019 Capital Budget is included in Appendix C. The FY 2019 Capital Budget totals $4.86 million for both water ($3,495,834) and wastewater ($1,370,500). The FY2019 drinking water Capital Budget of $3.5 million is an 87 percent increase over the FY 2018 funding level of $1.87 million. The FY 2019 Capital Budget is summarized as follows and shown in Exhibit 2-26:

Water by Category:	
Water Production	$ 950,000
Water Pumping	$ 152,000
Water Storage	$ 664,834
Water Main Replacement	$ 740,000
Buildings/Facilities	$ 672,500
Vehicles and Equipment	$ 316,500
Total Water	**$ 3,495,834**
Wastewater by Category:	
Wastewater Treatment	$ 403,000
Wastewater Collection – Rehab/Replace	$ 482,500
Wastewater Collection – Pumping	$ 85,000
Wastewater Collection – CSO	$ 400,000
Total Wastewater	**$ 1,370,500**
Total Water/Wastewater	**$ 4,866,334**

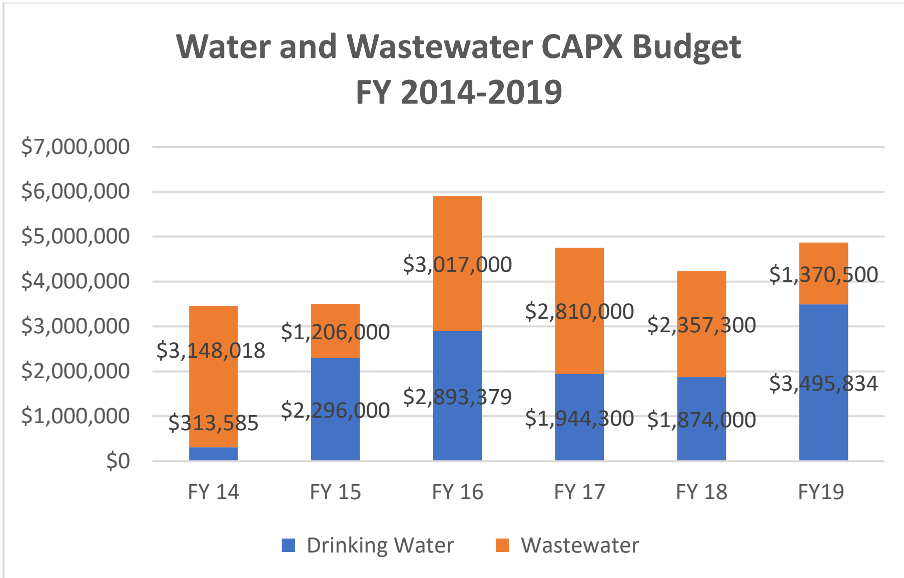


Exhibit 2-26. Ashland Annual Water and Wastewater Capital Budget, FY 2014-19

3.0 MAIN REPLACEMENT PROGRAM

BlueWater Kentucky developed a main replacement model to assist Ashland with developing a method to evaluate various investment scenarios in replacing water distribution assets. From a review of Ashland's water distribution inventory, a pipe inventory was created by size and length. The inventory is shown in Exhibit 3-1.

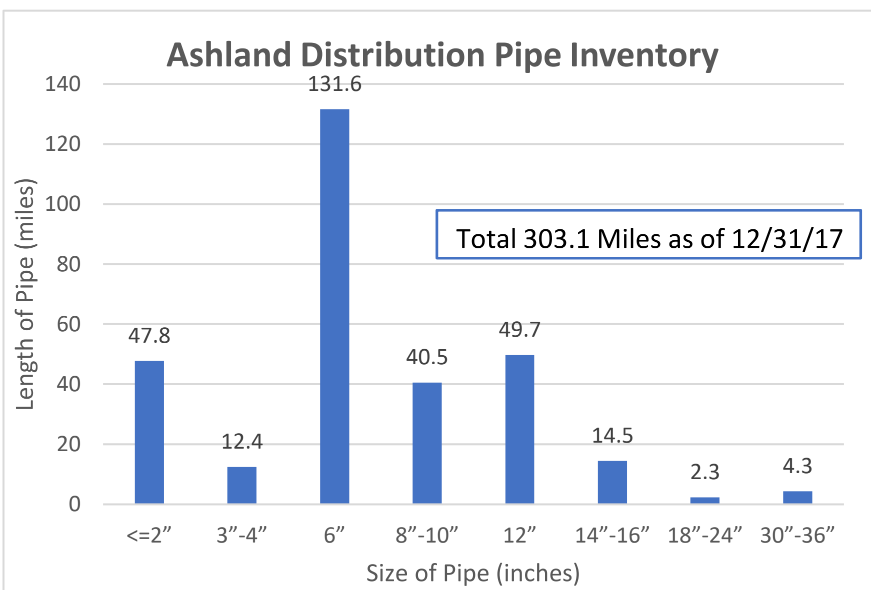


Exhibit 3-1. Ashland Water Distribution Pipe Inventory

In addition to pipe inventory, water main failure rates were examined. Prior to 2016, only annual records of water main breaks and service leaks were recorded, as shown in Exhibit 2-8. Beginning in 2016, Ashland began collecting more detailed information on breaks and leaks, including the date, location, size of pipe, etc. Exhibit 3-2 shows a sample of data collected for March 2017.

Date	Address	Street	Cross Street	Pipe Size
03/01/17		RACE ST		1.25
03/02/17		SMITH	SHUTE	6
03/02/17		20TH ST	FRONT	6
03/08/17		LOGTOWN RD	EAST PARK DR	12
03/08/17		EAST PARK DR	INDUSTRIAL PRKWY	12
03/16/17		EAST PARK	VETERANS CEMETERY	4
03/16/17	327	28TH ST	ASHLAND	2
03/20/17	511	ST RT 716		6
03/21/17		MAIN	GRIFFITH	6
03/27/17	7428	TWIN FORK		2
03/28/17		18TH	FRONT	6
03/30/17	2043	3RD CIRCLE		2
03/30/17	2328	GREENUP AVE		2

Exhibit 3-2. Ashland Water Main Break Database Attributes

This limited database allows a macro model to be developed that correlates water main failures with pipe size. Typically, a database of five to 10 years of data (or more) is needed to accurately develop a main replacement model that forecasts future failure rates and projected annual budget needs based on replacement rates and current unit costs for main replacement. The cost assumptions are shown in Exhibit 3-3.

Main Size	Budget Cost/Foot
4” and Smaller	$90.00
6” to 10"	$100.00
12” and Larger	$120.00

Exhibit 3-3. Water Main Replacement Unit Costs

For this study, a preliminary analysis was performed with the following assumptions:

- A general pipe inventory by size provided by Ashland,
- Two years (2016-17) of water main break data,
- A projection of failure rates using only two years of data by pipe size,

- A discount rate of 4 percent,
- A 20-year planning period,
- An assumption that the water main failure rate for each pipe replaced will not fail for the remainder of the planning period (20 years),
- Replacement cost estimates as shown in Exhibit 3-3.

It is noted that this is a very preliminary evaluation, using limited data. This approach, however, is a beginning to understand the magnitude of investment needed to dramatically reduce failure rates compared to current levels.

The model was run with five replacement rate (miles per year) scenarios to achieve a failure rate of 30 breaks per 100 miles per year (from average of 235 breaks to 90 breaks per year). While the industry best practice is achieving a failure rates less than 20 breaks per 100 miles per year, a target failure rate of 30 is used for the purposes of this evaluation. With additional failure data collected over the next five years, a revised target should be considered to achieve a failure rate less than 20 breaks per 100 miles per year.

The scenarios to achieve a break rate of 30 breaks per 100 miles per year (< 90 breaks annually) include:

- Scenario 1 – 0.5 Percent Replacement Rate (200-year expected life),
- Scenario 2 – 1 Percent Replacement Rate (100-year expected life),
- Scenario 3 – 2 Percent Replacement Rate (50-year expected life),
- Scenario 4 – 3 Percent Replacement Rate (33-year expected life),
- Scenario 5 – Hybrid 2 Percent Replacement Rate (best value through replacement optimization of high failure 6” and smaller water mains).

Exhibit 3-4. Water Main Replacement Scenarios

Exhibit 3-4 provides a graphical representation of the five replacement scenarios and the results from the model. From a review of the model results, Scenario #5 using a hybrid replacement of pipe at a 2 percent annual rate will achieve the 30-main-break-per-year target by 2039. The best value for Ashland is to focus the replacement priority on 4" and smaller pipe, using the following guidelines:

- Target 4.0 percent annual replacement of 4" and smaller pipe (2.4 miles of 60 miles),
- Target 2.0 percent annual replacement of 6" to 8" pipe (4.2 miles of 172 miles),
- Target 0.5 percent annual replacement of 10" and larger pipe (0.35 miles of 71 miles),
- Averages 2.0 percent annual replacement of 303 miles or approximately 6.1 miles per year.

The mix of pipe replacement by size will vary from year to year to balance the needs of replacement due to failure and the need for hydraulic capacity. In some cases, pipe sizes should be increased to provide additional hydraulic capacity or grid ties installed to improve water quality.

Due to the very limited data set, Ashland should continue to collect detailed water main break and leak data by location and revise the model on an annual basis. At least five years of break and leak data are needed to provide an accurate forecast of water main and service line failures based on annual replacement rates and investment.

Ashland has also kept limited annual records on service line failures for the last five years (see Exhibit 2-14. Ashland repairs approximately 90 service line leaks annually. With approximately 14,000 customers and an estimated 100 miles of service line (assumes average service length of 40 feet), Ashland's service line failure rate is approximately 90 per 100 miles of service line, a similar order of magnitude as the water main failure rate. Many of the small diameter service lines (less than 4") are galvanized iron and corrode in the same manner as water mains. Therefore Ashland should include service line replacement with the annual main replacement program.

From the analysis, it is recommended that Ashland establish an annual Main Replacement Program (MRP) with the following schedule to achieve a 2 percent replacement rate by FY2022:

- FY 2020 – $1.6 million to replace 3.0 miles annually (1.0% of system),
- FY 2021 – $2.4 million to replace 4.5 miles annually (1.5% of system),
- FY 2022 – $3.2 million to replace 6.0 miles annually (2.0% of system).

The final FY 2019 Capital Budget approved by the Ashland Board of Commissioners included $740,000 for main replacement. This budget allocation for design, construction labor, equipment, and materials will provide funding to replace between 1.5 and 2.0 miles of water main and service lines, or approximately 0.5 to 0.67 percent of the system.

The FY 2019 project priority list developed by the City Engineer is shown in Exhibit 3-5. This project priority list includes approximately 2.5 miles of water main replacement and water main abandonment at an estimate cost of approximately $1.0 million. This priority replacement list was selected from review of main break history, condition of the pipe, and hydraulic capacity. At mid-year (January 2019), Ashland should review the execution and expenditures of the capital program and reallocate unused funds to main replacement where feasible. Completion of the FY 2019 will provide a good foundation for the initial phase of a robust annual MRP.

Exhibit 3-5 also provides a future priority list of main replacement projects for FY2020-2023. This priority list should be reviewed annually and adjusted for changes in water main failure rates, water quality, system reliability, pipe condition, traffic disruptions, paving schedules, neighborhood priorities and re-development. The total five year program need (FY 2019-2023) identified by the Ashland City Engineer totals $7.97 million for replacement of approximately 14.2 miles of pipe (2.8 miles per year). A minimum of 3 miles per year should be budgeted annually. Ashland should establish an annual goal to achieve 6.0 miles (2%) of replacement per year through program optimization, efficiencies, and economies of scale as the program ramps up to maturity. A 2 percent annual replacement rate should achieve the long term (20 year) objective to reduce annual failures to less than 30 breaks per 100 miles per year (approximately 90 breaks per year).

FY 2019 Proposed Water Main Replacement Projects					
LOCATION	Existing Size (inches)	Proposed Size (inches)	Length (feet)	Average Cost Per Foot	Estimated Replacement Cost ($)
Ashland - 3rd Circle Prospect	2	6	900	$99.00	$89,100
Ashland - Gartrell Court	2	6	250	$99.00	$24,750
Ashland - S. 29th S. Rogers to Robin Lynn	6	8	2,400	$110.00	$264,000
Ashland - Us 23 (47th - 10th St Catlettsburg) abandon 6" and connect to existing 12"	6	0	5,000	$33.00	$165,000
Ironville - Forrestdale Ct.	2	4	770	$99.00	$76,230
Summitt - Bybee Rd.	6	6	2,000	$99.00	$198,000
Westwood - Dalton	2	4	830	$99.00	$82,170
Westwood - Hoods Creek at Maggard	2	4	495	$99.00	$49,005
Westwood - McClure	2	4	400	$99.00	$39,600
Total FY 2019			13,045	Feet	$987,855
			2.5	Miles	

Future Priority List of Main Replacement Projects (FY2020-2023)					
LOCATION	Existing Size (inches)	Proposed Size (inches)	Length (feet)	Average Cost Per Foot	Estimated Replacement Cost ($)
Ashland - 29th (transmission line from Belmont to Blackburn) replace 6" with 12"	6	12	6,200	$132.00	$818,400
Ashland - Automobile Alley	2	6	1,400	$99.00	$138,600
Ashland - Belmont (tranmission line) replace 6" with 12"	6	12	4,600	$132.00	$607,200
Ashland - Dawes St. To Harrod St.	6	12	1,325	$99.00	$131,175
Ashland - Dixon Road	6	12	2,600	$125.00	$325,000
Ashland - Douglass Street	2	6	1,200	$99.00	$118,800
Ashland - Dysard Hill	2	6	380	$99.00	$37,620
Ashland - Dysard Hill	2	4	328	$99.00	$32,472
Ashland - Dysard Hill	4	4	150	$99.00	$14,850
Ashland - Hampton	2	6	1,500	$99.00	$148,500
Ashland - Hilton (1600 Block)	1	6	900	$99.00	$89,100
Ashland - Joel St.	2	6	791	$99.00	$78,309
Ashland - Monroe St.	2	6	650	$99.00	$64,350
Ashland - Monroe St.	6	6	1,600	$99.00	$158,400
Ashland - Oakview Road	16	16	6,000	$132.00	$792,000
Ashland - Robinhood	6	6	2,100	$99.00	$207,900
Ashland - Simpson (transmission line) replace 8" with 16"	8	16	3,000	$132.00	$396,000
Ashland - Slim St.	2	6	650	$99.00	$64,350
Ashland - Sword St.	2	6	600	$99.00	$59,400
Ashland - US 23 (39th to 43rd)	16	16	2,100	$159.50	$334,950
Ashland - Windslow Road	2	6	2,000	$99.00	$198,000
Catlettsburg - 36th St. & Floodwall 2" to 6" Upgrade	2	4	570	$99.00	$56,430
Catlettsburg - 38th St.	2	4	860	$99.00	$85,140
Catlettsburg - Bryan Dr.	2	4	3,000	$99.00	$297,000
Catlettsburg - Ewing Ln.	2	4	1,200	$99.00	$118,800
Catlettsburg - Mitchell St.	2	4	500	$99.00	$49,500
Catlettsburg - Robin Ln.	2	4	680	$99.00	$67,320
Catlettsburg - Rocky Alley	2	4	500	$99.00	$49,500
Catlettsburg - Sycamore St.	6	6	360	$99.00	$35,640
Catlettsburg - Watkins	2	4	610	$99.00	$60,390
Catlettsburg -Summit Alley	2	4	550	$99.00	$54,450
Ironville - Nunley Ct.	2	4	440	$99.00	$43,560
Summitt - Hicks Rd. 2' To 6" Upgrade	2	6	290	$99.00	$28,710
Summitt - Thurbury Dr.	2	4	340	$99.00	$33,660
Summitt - W. Van Bibber Dr.	2	4	1,800	$99.00	$178,200
Westwood - 2nd St.	2	4	1,200	$99.00	$118,800
Westwood - 3rd St.	2	4	780	$99.00	$77,220
Westwood - Chippewa	2	4	1,500	$99.00	$148,500
Westwood - Fosson St.	2	4	800	$99.00	$79,200
Westwood - Hamilton Ave.	2	4	700	$99.00	$69,300
Westwood - Linda Ln.	2	4	500	$99.00	$49,500
Westwood - McConnell St.	2	4	860	$99.00	$85,140
Westwood - Mills Blvd.	2	4	300	$99.00	$29,700
Westwood - Newsome St.	2	4	1,400	$99.00	$138,600
Westwood - Price St.	2	4	330	$99.00	$32,670
Westwood - Price St. (behind houses)	2	4	330	$82.50	$27,225
Westwood - Unrue St.	2	4	765	$99.00	$75,735
Westwood - Verna Ave	2	4	770	$99.00	$76,230
Total FY 2020-2023			62,009	Feet	$6,981,496
			11.7	Miles	

Total FY 2019-2023 (5 Years)			75,054	Feet	$7,969,351
			14.2	Miles	

Exhibit 3-5. FY 2019-2023 Water Main Replacement Projects

To achieve efficiencies and economies of scale, Ashland should phase in the MRP. The program should consider the following elements to achieve maximum efficiency and effectiveness:

- Fund the annual program through a dedicated infrastructure renewal surcharge, similar to the wastewater surcharge. A $1.20 per 1,000 gallon per month surcharge per customer will generate approximately $1.6 million per year. The surcharge would apply to retail customers and the methodology for funding is shown in Appendix D.

- Phase in the infrastructure surcharge over three years, as follows:

  - ✓ FY 2020 - $1.20 per 1000 gallons ($6.00 per month for 5,000 gallons)
  - ✓ FY 2021 - $1.80 per 1000 gallons ($9.00 per month for 5,000 gallons)
  - ✓ FY 2022 - $2.40 per 1000 gallons ($12.00 per month for 5,000 gallons)

- The infrastructure surcharge should be reviewed with a cost of service rate study to validate the methodology and assumptions for consumption, customer count and impact on large volume customers. The surcharge could be established using an equivalent meter for industrial customer accounts.

- Perform 40 to 60 percent of the main replacement work with in-house dedicated crews and the balance with contractors. Adjust allocation annually based on resource availability and performance,

- Establish performance metrics to compare in-house crews with contractors, including performance measures for cost, quality, and customer service (through survey),

- In-house crew work (including project management labor, engineering design labor, construction labor, equipment, materials) should be included in the capital budget and depreciated annually,

- Establish standard specifications and contract documents for replacement work,

- Perform inspection of contract work to assure specifications and quality standards are met,

- Scope of work should include complete renewal on a block by block basis, including replacement of pipe, valves, hydrants, service lines, and meters,

- Establish standards for pipe, valve, hydrant, service line, meter, backfill, and pavement restoration,

- Hire adequate engineering and technical staff for design and inspection of main replacement work. Consider part-time, retired employees to assist with design and inspection as a cost effective alternative to full time staff or consulting labor,

- Develop an internal and external communication program to educate employees and public on the value of water main renewal, including earned media, social media, newsletters, presentations to civic organizations, and neighborhood project meetings,

- Establish Replacement Program Metrics to measure success of program and report annually to Board of Commissioners, including:

  - ✓ Annual miles of pipe and service line replaced or abandoned, and customers impacted
  - ✓ Annual costs compared to budget allocation
  - ✓ Annual and cumulative main failures (breaks and leaks) eliminated with replacement
  - ✓ Annual system main failures (breaks and leaks) and failure rate
  - ✓ Improvement in water quality (chlorine, bacteria, discolored water) and hydrant performance (fire flow, National Fire Protection Association (NFPA) hydrant flow rating, Insurance Service Office (ISO) rating)
  - ✓ Improvement in distribution system water loss (non-revenue water)

4.0 RECOMMENDATIONS

BlueWater Kentucky provides the following recommendations to the Ashland City Commissioners, City Manager and City Engineer. These recommendations have been developed after six months of reviewing management, operations, maintenance, and engineering areas of Ashland Utilities (water and sewer), herein referred to as "Utility."

These recommendations will require additional resources (financial, human, equipment, tools, materials, methods) and time to implement. The recommendations are identified as High, Medium, Low, and Ongoing to assist management in determining priority of implementation.

High Priority – an immediate need to correct a deficiency to assure public health, regulatory compliance, and/or the financial stability of the Utility. Corrective action should begin within three to 12 months.

Medium Priority – an intermediate need to address an issue that impacts the water quality or the managerial, financial, or technical performance of the Utility. Corrective action should begin within one to three years.

Low Priority – an action recommended to improve the operating efficiency of the Utility. Corrective action should be taken in three to five years.

Ongoing – current practice of the Utility that should continue.

Overall, 44 recommendations are provided to the Ashland Board of Commissioners. This includes ten (10) **High Priority**, twenty-three (23) **Medium Priority**, and eight (8) **Low Priority** recommendations three (3) practices are identified as **Ongoing** and should continue. Implementation of these recommendations will require additional funds, currently not budgeted, and the timing and scope of work must be adjusted based upon available budget, revenues, and resources.

<u>Finance/Rates</u>

1. Water rates should be reviewed annually, and a comprehensive rate analysis and cost of service study should be completed every three to five years, using the AWWA M34 Standard. Ashland should conduct a Cost of Service study in 2019 and include funding for an annual program to replace aging infrastructure (plant, pumps, storage, and pipelines). **High Priority, 3-12 months.**

   The cost of service rate analysis should include the following elements:

   a. Review the water/wastewater depreciation schedule for asset classes and revise schedule as needed,

   b. Establishing an infrastructure replacement reserve to supplement depreciation,

   c. Funding of an annual replacement program through a rate increase or a dedicated infrastructure surcharge,

   d. Examination of the fixed meter charge to include a portion of distribution costs, to stabilize fixed revenue and reduce variable revenue,

   e. Consider a variable meter charge by size of meter, using AWWA equivalent meter units,

   f. Review the current four rate blocks and consider a declining rate for high volume industrial customers,

   g. Establishing a separate rate class for combined domestic/fire service to fully recover cost of service,

   h. Consider establishing a System Growth Reserve using a System Development Charge for new service connections, with a policy of “growth pays for growth”.

2. Pursue grants and low interest loans for capital water and sewer projects from state and federal agencies, including: Kentucky Infrastructure Authority, Rural Development, Kentucky Economic Development, and other grant/loan agencies. Ashland may be eligible for Rural Development funding for retail service areas under 10,000 population (i.e. Westwood, Catlettsburg and areas of Boyd County outside city limits of Ashland). **Medium Priority, 1-3 years.**

3. Provide a monthly operating report to City Commissioners, including year-to-date key performance metrics for comparison to prior year. **Medium Priority, 1-3 years.**

4. Develop a five-year pro-forma of Utility income and expenses and a five to 10-year Capital Plan (also referred in this report as a Water Improvement Program), these can be included in scope for Cost of Service Study. **Medium Priority, 1-3 years.**

<u>Capital Improvement/Asset Management</u>

5. Enhance the database on water pipe and service line failures to identify priority pipes for replacement. The data collection should include: failure location date and type, pipe type, diameter, age, depth, pressure, and backfill material. The information should be reported daily though the work management system. Statistical analysis will allow prioritization of pipe replacement, based on failure frequency and severity. **High Priority, 3-12 months.**

6. The FY 2019 capital budget includes 2.5 miles of main replacement/abandonment at an estimated $1.5 million. Continue to phase-in capital funding of annual Main Replacement Program from 1.0 to 2.0 percent of the distribution pipe inventory, approximately six miles per year. Phase-in the replacement program as follows: **High Priority, 1-3 years**.

    a. FY 2020 - $1,600,000 for 3.0 miles (1.0% of system),

    b. FY 2021 – $2,400,000 for 4.5 Miles (1.5% of system),

    c. FY 2022 – $3,200,000 for 6.0 Miles (2.0% of system),

    d. In FY 2022, examine the results and benefits of the program and adjust accordingly (with a goal of reducing main break frequency from 78 to less than 30 by 2040),

    e. FY 2022 to FY 2038 – Maintain annual Main Replacement Program at $3.2 million (6 miles) per year until water main failure rate drops below 30 breaks per 100 miles per year (less than 90 main breaks per year), then adjust annual funding to ultimately achieve target of 20 breaks per 100 miles per year (less than 60 breaks per year),

    f. The mix of annual replacement pipe will vary by size, location, failure rate, and secondary factors such as pacing schedules or other related infrastructure work in the community. The program should be built to allow flexibility to the changing city priorities from year to year,

g. Fund the annual Main Replacement Program with a volumetric surcharge of $1.20 per 1,000 gallons. Phase the funding as follows:

    - ✓ FY 2020 - $1.20 per 1000 gallons ($6.00 per month for 5,000 gallons)
    - ✓ FY 2021 - $1.80 per 1000 gallons ($9.00 per month for 5,000 gallons)
    - ✓ FY 2022 - $2.40 per 1000 gallons (12.00 per month for 5,000 gallons)

h. Review the infrastructure surcharge with a cost of service rate study to validate the methodology and assumptions for consumption, customer count and impact on large volume customers. The surcharge could be established using an equivalent meter for industrial customer accounts.

7. Provide adequate engineering and technical staff for design and inspection for the Main Replacement Program. Design resources can be added to staff or the additional design work can be contracted to engineering consultants. Consider part-time, retired employees to assist with design and inspection as a cost-effective alternative to full time staff or fees for consulting services. **High Priority, 3-12 months**.

8. Establish distribution performance metrics and establish goals (five to 20 years) and provide monthly/annual reports of progress toward goals in the following areas: **High Priority, 3-12 months**.

    a. Main break frequency (breaks per 100 miles per year)
    b. Service line leak frequency (leaks per 100 miles per year)
    c. Service outage (outages per 1,000 customers)
    d. Hydrant ratings (flow)/ISO fire ratings
    e. Average age/remaining useful life (years)
    f. Water loss (percent non-revenue water-unmetered)
    g. Water quality (chlorine, turbidity, DBP, etc.)

9. Update and calibrate the hydraulic model for planning, design, and operations of the distribution system (perform by internal or consulting resources). Evaluate pressure management within pressure zones to determine impact of high pressure and pressure variations on main breaks and water loss. Evaluate pressure zones, pumping, and storage. Utilize hydraulic model to conduct distribution water quality analysis to improve water quality and minimize Disinfection Byproducts. Utilize hydraulic model to determine pipe, pump, and storage improvements to reliably serve Braidy Industries**. High Priority, 3-12 months.**

10. Issue an RFP for Engineering Services and establish an engineer of record for master planning, hydraulic modeling/planning, and overall program management. **Medium Priority, 1-3 years.**

11. Develop a 10-year Capital Improvement Plan (CIP) for drinking water, wastewater, and storm water. Include the following elements in the 10-year CIP: **Medium Priority, 1-3 years.**

    a. Drinking water source water, treatment, pumping, storage, distribution, metering, SCADA, information systems
    b. Wastewater collections, storage, treatment, pumping, biosolids
    c. Storm water collection and flood protection
    d. Technology, laboratory, fleet, and other utility assets

12. Issue an RFP for Engineering Services to provide design and construction services in areas of water, wastewater, and storm water. Multiple engineers can be retained on a five-year cycle to provide the services needed where staff resources are not adequate. **Medium Priority, 1-3 years.**

13. Conduct a storage tank assessment, including hydraulics, inspection, condition assessment, and painting. Re-size and retrofit tanks as needed to include mixing and circulation to retain chlorine residual and reduce levels of disinfection byproducts and decommission unused tanks. Annually budget for tank painting/recoating, providing a 15 to 20-year cycle of rehabilitation. **Medium Priority, 1-3 years.**

14. Conduct a programmatic condition assessment of water and wastewater assets, including the following**: Medium Priority, 1-3 years**.

    a. Review compliance with the Safe Drinking Water Act, with specific focus on distribution chlorine residuals, reducing disinfection byproducts, and revised Lead and Copper rule (anticipated by 2020),

    b. Review compliance with the Clean Water Act consent decree, including areas of treatment, sewer overflows, collections, inflow and infiltration, and bio-solids,

    c. Monitor compliance with storm water regulations and flood protection facilities.

15. Enhance existing annual hydrant inspection/exercising program and valve exercising program, as budget funds become available, including: **Medium Priority, 1-3 years.**

    a. Annual exercising of hydrants, including flow testing,

    b. Exercising all transmission valves on a three-year cycle,

c. Exercising all distribution valves on a five- to seven-year cycle.

16. Continue to invest and enhance the GIS mapping system of distribution assets, including water mains, valves, hydrants, pressure regulating valves, storage tanks, pump stations, and other major appurtenances. Utilize the GIS to build an asset management system of distribution assets, including install date, size, type, and manufacturer. **Medium Priority, 1-3 years**.

17. Evaluate current condition of vehicles and equipment and develop a plan to replace aging equipment and purchase new equipment to meet operational needs. **Low Priority, 3-5 years.**

18. Evaluate current business hardware and software (billing, accounting, customer information, word processing, spreadsheet, etc.) and upgrade as needed to improve efficiency and customer satisfaction. **Low Priority, 3-5 years.**

19. Evaluate communication equipment, including land phone, mobile phones, and radio equipment, for replacement as needed. **Low Priority, 3-5 years.**

20. Evaluate unused assets and sell or lease to generate additional income. **Low Priority, 3-5 years.**

<u>Water Treatment and Delivery</u>

21. Implement the action steps identified in the 2018 Agreed Order with the Kentucky Department for Environmental Protection to address areas of non-compliance, including maintaining chlorine residual in the distribution system and for wholesale customers and maintaining compliance with the EPA Disinfection Byproduct Rule. **High Priority, 3-12 months.**

22. Initiate the SCADA Control System upgrade at the water treatment plant. Three alternatives were identified by GRW Engineers and the best value provided to Ashland is Alternative #3 at an estimated cost of $1.2 million. This alternative provides the best combination of security and technology with construction adjacent to the existing control room, thereby minimizing disruption of operations during construction. Project also requires installation of equipment at an estimated $1.3 million. Total project cost estimate of $2.5 million. **High Priority, 3-12 months.**

23. Evaluate the current management of pressure zones and storage in the distribution system with a calibrated hydraulic model. Consider reconfiguring pressure zones to reduce pressures less than 100 psi and minimize pressure surges. Consider installation of pressure management technology to reduce pressure surges and associated pipe line and service line breaks/leaks. Opportunity to include this with scope for hydraulic modeling in Recommendation #9. **Medium Priority, 1-3 years**.

24. As water loss declines, begin implementation of a planned distribution flushing program to maintain distribution water quality. Purchase flushing and metering equipment as budget allows to properly account for water distribution flushing. **Medium Priority, 1-3 years.**

25. Pursue EPA's Partnership for Safe Water Program for Water Treatment and Distribution to assure high quality water is delivered to customers. Develop plan to achieve Level 3 performance in three to five years. **Medium Priority, 1-3 years.**

26. Develop and budget an annual preventive maintenance program for plant, pump, and storage facilities. **Low Priority, 3-5 years.**

<u>Wastewater Collections and Treatment and Stormwater Management</u>

27. Evaluate progress in meeting all phases of the CSO Long Term Control Plan, including schedule, budget, and performance objectives. **Medium Priority, 1-3 years.**

28. Evaluate the impact of NPDES Permitting and Municipal Separate Storm Sewer (MS4) system regulations on stormwater management. Map 20% of storm system annually and inspect 20% of storm outfalls annually. **Medium Priority, 1-3 years.**

29. Evaluate infrastructure needs for wastewater treatment and collection systems beyond the scope of the CSO Long Term Control Plan. Develop a 10 to 20-year Facility Plan for needed improvements for the period 2025 to 2045. **Low priority, 3-5 years.**

<u>Water Loss, Metering, Billing</u>

30. Develop a comprehensive Water Loss Program (with internal or external resources) using the methodology defined in the EPA and AWWA M36 Water Audit and Loss Control Program (Appendix B). Establish a long term goal (10-15 years) to achieve 20 percent (or less) water loss as measured by non-metered water. Charter a Water Loss Team with representatives operations, engineering, finance, customer service; rotate leadership of Water Loss Team. **High Priority, 3-12 months (initiate within 1 year, requires 3 to 5-year program to be resourced).**

    Consider the following elements in the Water Audit and Loss Program, using a combination of both internal and external (contract/consultant) resources:

    a. Identify (or hire) staff person to serve as a program champion for water loss and send management, engineering, operations staff to be trained on water loss methods, water audits and best practices,

b. Enhance current leak detection program with new technology and external resources where beneficial to reduce water loss,

c. Periodically test and calibrate source water and finished water meters at production facilities to assure accuracy within AWWA standards, consider installing new plant meters to accurately measure water production,

d. Utilize the District Metered Area approach and install zone meters (temporary or permanent) on large pressure zones to assist in identifying areas of large water loss,

e. Evaluate the pressure zones for excessive pressure (> 100 psi) and consider sub zones or storage to improve pressure management,

f. Install automatic controls on Pressure Regulating Valves to improve pressure management in pressure zones with large pressure variations,

g. Purchase digital pressure data loggers and support tools to assist with troubleshooting pressure variations,

h. Utilize the automated meter reading (AMR) system in evaluation of water loss,

i. Implement a comprehensive meter testing program using AWWA standards,

j. Investigate water theft and unauthorized water usage and take appropriate action to account for all water deliveries to customers,

k. Review estimating methods for unmetered water use (flushing, breaks, leaks),

l. Collect data and establish the Infrastructure Leak Index (ILI) for Ashland's distribution system,

m. Review existing city ordinance and policies for water theft and unauthorized use, and update as needed to deter water theft,

n. Develop performance metrics for water loss and report monthly to City Manager and Commissioners on the progress to achieve annual targets.

31. Enhance billing system to improve billing, communications to customers regarding water/wastewater services. Utilize billing system as a communication medium for news to customers. **Medium Priority, 1-3 Years.**

32. Annually monitor the billing system to assure reliable transfer of data from meter reading to billing system. Conduct QA/QC audit following implementation of any changes in

water/wastewater rates or fees. Consider retaining a third party to evaluate accuracy and consistency of billing. **Ongoing**.

Management/Human Resources/Training

33. Budget for staff members to attend regional professional and technical conferences offered by Kentucky Rural Water and Kentucky-Tennessee AWWA. Participation in conference programs and committees will allow staff to learn best practices and implement new technology for operations of water and wastewater. **High Priority, 3-12 months (as budget allows).**

34. Evaluate staffing needs for operations and capital improvements. Capital Program resources (engineering staff and crews) are included in annual budget for water main replacement identified in Recommendation # 6. **Medium Priority, 1-3 years.**

    Consider the following:

    a. Reorganize the Utility operations and engineering (Public Works) into two separate departments reporting directly to the City Manager: a Public Services /Utility Operations Department (water/wastewater) and an Engineering Department. The Director of Public Services will manage day-to-day operations of the water and wastewater (and related) systems. The Director of Engineering/City Engineer will be responsible for implementing the water and wastewater capital program, provide technical support for operations, and perform all City Engineer duties,

    b. Hire a licensed civil engineer, reporting to the City Engineer, to serve as the program manager for all capital water and sewer projects. In-house design and construction resources should be capitalized as part of total project costs,

    c. Add support staff engineers/technicians/inspectors to design water line replacement projects as a more cost-effective alternative to consultants. In-house design and construction resources should be capitalized as part of total project costs,

    d. Create a dedicated four-person in-house capital construction crew to replace one mile of pipe per year. In-house design and construction resources should be capitalized as part of total project costs,

    e. Consider part-time or seasonal employees to assist with operations, maintenance, and capital work,

f. Evaluate the current staff and develop a succession plan for critical positions (plant manager, supervisors, office administration, etc.).

35. Review current employee performance review process and transition to an evaluation process to measure both competency and performance with specified, measurable goals tied to annual operating plans. **Medium Priority, 1-3 years**

36. Evaluate AWWA Effective Utility Management (EUM) as a quality management system to enhance the quality and service levels of the organization. **Low Priority, 3-5 years.**

37. Budget annually and assure plant and distribution operators maintain Kentucky Drinking Water certifications and continuing education requirements. **Ongoing.**

<u>Communications and Customer Service</u>

38. Review and update the Ashland website to include current information on water/wastewater utility services, including: rates, service rules, water quality, current projects, etc. **Medium Priority, 1-3 years**

39. Prepare quarterly communications to customers, by mail or bill stuffer, to communicate the activities of the Utility. **Medium Priority, 1-3 years**

40. Conduct a periodic survey of customers (every one to three years) to gauge the level of customer satisfaction with quality and service. **Medium Priority, 1-3 years**

41. Develop a monthly or quarterly water/wastewater utility newsletter to provide information to employees on operations, activities, and benefits. **Medium Priority, 1-3 years**

42. Consider creating a volunteer Customer Advisory Group (eight to 12 citizens) to provide input to the City Manager, Mayor and Commissioners on service levels, quality, and policy. The Customer Advisory Group should meet two to four times a year and provide observations and recommendations to the Commission. **Medium Priority, 1-3 years**

43. Use focus groups for select topic areas, including water quality, system reliability, customer service, water projects, etc. **Low Priority, 3-5 years**.

44. Continue use of social media accounts (Facebook and Twitter) to promote the activities and news of the Utility. **Ongoing**

Appendix E includes a summary of the recommendations with a priority and estimated cost range identified for each recommendation. Twenty-one (21) recommendations are practices that can be integrated into existing operational processes and absorbed into existing operating budgets.

Six (6) recommendations are new operational practices or activities that will require additional resources beyond the capacity or knowledge of the current staff. Eleven (11) recommendations involve studies that can be amortized as an operational expense over the life of the study, typically five to 10 years. Two (2) recommendations (SCADA and Billing System) are categorized as capital improvements that will have an asset life of 10 to 50 years. The annual main replacement program is recommended to be phased-in over three years from FY 2020 at $1.6 million to FY 2022 at $3.2 million. The cost estimate to implement all 44 recommendation is summarized below. The 44 recommendations are prioritized over a five year period and management should determine which recommendations should be implemented based on operational priority and available funding.

- 21 new activities to be absorbed into operating budget
- 6 new operational activities to include in operating budget - $202,000 annually
- 11 studies to be amortized - $425,000 over 5 to 10 years
- 2 capital projects (SCADA and Billing System) - $4,000,000
- Annual main replacement program – Phase-in $1.6 million to $3.2 million annually

4.0 CONCLUSIONS

The City of Ashland retained BlueWater Kentucky in November 2017 to conduct a comprehensive review of the utility capital program with specific focus in the area of drinking water treatment and distribution. After review of the compliance record, operations, and performance of the water distribution system it is the author's professional opinion that Ashland has not adequately re-invested in its drinking water system over the past 25 years.

Over the past 10 years, Ashland has focused on compliance with the Clean Water Act to reduce sewer overflows into the Ohio River. The city is to be commended for implementation of its $42.5 million Long Term Control Plan to address sewer overflows, however the commitment to the wastewater system has come at the expense of investment in the water treatment plant and aging distribution system.

The lack of drinking water investment is indicated by the following observations of poor system performance.

1. The inability of Ashland to consistently achieve drinking water regulations, specifically in the area of maintaining adequate chlorine residuals in the distribution system and failure to comply with the EPA Disinfection By-Product Rule. The inability to meet drinking water regulations is directly related to aging facilities at the water treatment plant (filtration, backwash, chemical feed, SCADA control systems); the inflexibility in managing system wide storage and pressure zones; and the amount of unlined cast iron and galvanized iron piping in the distribution system.

2. Ashland has a pipe failure rate of 5.5 times the industry average (Folkman Study 2018) and 5 times the industry best practice recommended by EPA. Ashland averages 240 main breaks per year (for 303 miles of pipe) and 90 service line leaks per year. Small diameter pipe (2" and smaller) pipe fails at 20 times the EPA recommended best practice. This is due to the extensive use of unlined galvanized piping that corrodes internally and externally.

3. Ashland exhibits high water loss. Ashland has reported 40 to 50 percent non-revenue water since 2013. The average non-revenue water for Kentucky municipal water systems is 29 percent. The industry best practice is 15 percent or less. An examination of the existing master meter at the water plant in the spring of 2018 revealed the meter has been over measuring the volume by 15 to 20 percent. A new master meter and modified piping configuration will be required to validate a more accurate measure of flow. Even with a positive adjustment, Ashland's water loss is higher than the industry best practice of 15 percent.

4. The extensive use of cast iron and galvanized iron piping by Ashland not only leads to high failure rates, but also contributes to high chlorine demand, high water loss, discolored water, extensive water service interruptions and traffic delays during main breaks repairs.

5. The lack of annual investment in water main replacement until FY 2017 when $200,000 was budgeted.

6. Water rates are generally raised annually (average of 2.7 percent annually since 2013) to cover operations, however rates are not adequate to cover re-investment in capital infrastructure. Best practice is to raise utility rates annually to avoid getting "behind the curve" on infrastructure replacement.

Ashland is well "behind the curve" on investing in aging water infrastructure. A dedicated 20-year program will be required to address the infrastructure deficiencies. The drinking water system needs a level of investment and commitment similar to the Long Term Control Plan for wastewater, funded at $42.5 million. Annual water utility depreciation of $1.0 million is not adequate to correct the deficiencies in the drinking water system. Revenue to fund a Water Improvement Plan will need to be generated through water rate increases or a dedicated drinking water surcharge.

The recommended approach to fund the annual main replacement program is a monthly volumetric sur
charge to generate sufficient revenue to replace water mains at a minimum of 1 percent annually, with a three-year phase-in to achieve a replacement rate of 2 percent annually, as follows:

- $1.20 per 1000 gallons generates $1.6 million annually to replace 3.0 miles per year (1.0%)
- $1.80 per 1000 gallons generate $2.4 million annually to replace 4.5 miles per year (1.5%)
- $2.40 per 1000 gallons generates $3.2 million annually to replace 6.0 miles per year (2.0%)

The typical residential customer uses 5,000 gallons per month, so the typical monthly residential water bill would include a monthly surcharge as follows (as shown in Appendix D):

- FY 2020 - $6.00 per month for 5,000 gallons (funds a 1.0% replacement rate)
- FY 2021 - $9.00 per month for 5,000 gallons (funds a 1.5% replacement rate)
- FY 2022 - $12.00 per month for 5,000 gallons (funds a 2.0% replacement rate)

A drinking water surcharge, similar to the CSO sewer surcharge, is recommended as an effective method to assure funds are properly managed and invested in drinking water infrastructure. Some Federal/State grants and low interest loan funds may also be available to fund a portion of the investment needed.

In addition to funding an annual main replacement program, Ashland should develop performance metrics for operations and capital program execution. This will assure progress is being made with the investments to address underperforming infrastructure. Ashland should establish key performance indicators (KPIs) for regulatory compliance, reduction in water main failures, reduction in water loss, water quality, customer service and operating efficiency. Annual goals and five year targets should be established and annually reported by the City Manager to the Ashland City Commissioners.

Finally, an Action Plan should be developed by the City Engineer to address the recommendations in this Report. An annual review should be conducted with documentation of progress, status and results in addressing the recommendations.

4.0 BLUEWATER KENTUCKY

BlueWater Kentucky, LLC is a management consulting firm providing professional services to the water industry. Greg Heitzman, P.E. formed BlueWater Kentucky in 2016 after serving as a Chief Executive Officer with Louisville Water Company and Louisville Metro Sewer District. Mr. Heitzman has 35 years experience in the water sector, in areas of planning, management, engineering, leadership, business strategy, asset management, and best practices. Currently, Mr. Heitzman serves as Chair of the KY-TN Section AWWA.

BlueWater Kentucky

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APPENDIX A
Northern Kentucky Water District

Summary of Main Replacement Program

September 2018

This report provides a summary of the Northern Kentucky Water District (NKWD) Main Replacement Program. The information was gathered from Amy Kramer, Vice President of Engineering, Production & Distribution (859-991-1617) and Kyle Ryan, Engineering Manager (859-426-2713) in a conference call on May 1, 2018 and from Richard Harrison, retired Vice President of Engineering, Production & Distribution of NKWD.

NKWD was established in 1997 with the merger of the Campbell and Kenton County Water Districts. NKWD serves approximately 80,000 customers (estimated 300,000 population) from 3 water treatment plants with a capacity of 64 million gallons per day. The system includes 16 pump stations, 20 storage tanks and 1,300 miles of water main. NKWD serves all of Campbell and Kenton counties plus a portion of Boone, Grant, and Pendleton counties in Northern Kentucky.

NKWD initiated its main replacement program in 1999. The annual program is funded from depreciation and debt Issued for a 20 year capital improvement program approved by the Kentucky Public Service Commission. In 2005, NKWD retained Black and Veatch Engineers to develop a main replacement model using the following criteria:

Functional parameters (50% weighting)

- Main breaks/leaks
- Discolored water complaints
- Water quality/blow offs

Physical Parameters (20% weighting)

- Pipe Size
- Pipe age
- Pipe material type
- Corrosive soils

Impact Parameters (30% weighting)

- Paving
- Road classification
- Fire flow

Currently, NKWD budgets $5 to $6 million per year for main replacement. Approximately 50% of the projects are coordinated with city redevelopment and street paving schedules to avoid cutting of newly paved streets. NKWD's goal is to annually replace 1 percent of the distribution system (1,300 total miles), but the current budget of $5 to $6 million provides funding of 7 to 9 miles of replacement, about 0.5 to 0.7 percent replacement rate.

From 1999 to 2017 (21 years), NKWD has replaced approximately 113 miles of water main or 8.7 percent of the distribution (an average of 0.5 percent per year). The cumulative cost of the program to replace 113 miles is $69.5 million, or $116 per foot (not adjusted for time value of money). Exhibit A-1 illustrates the program history of miles replaced and annual costs from 1999 to 2017. The cumulative miles replaced and cumulative cost is shown in Exhibit A-2.

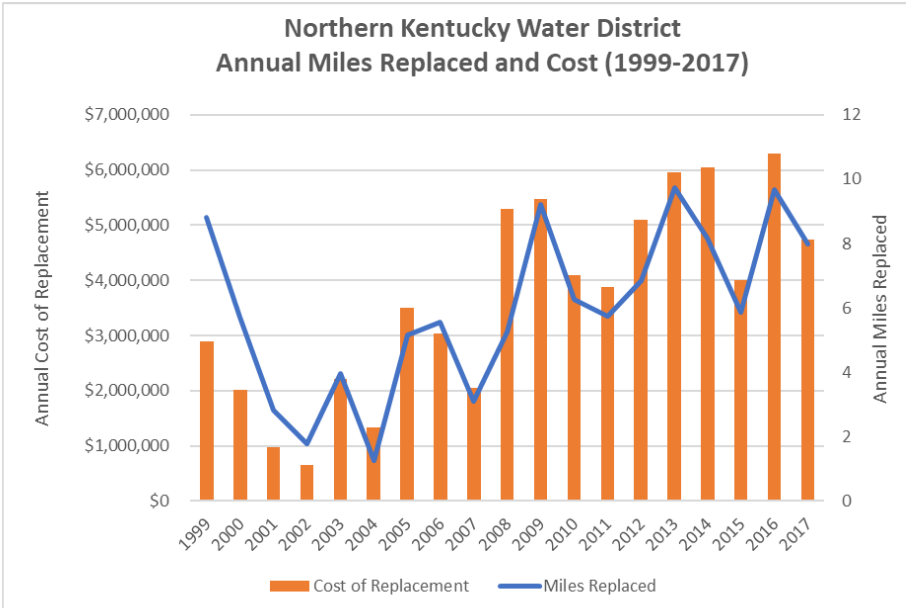

Exhibit A-1, NKWD Annual water Mains Replacement and Cost

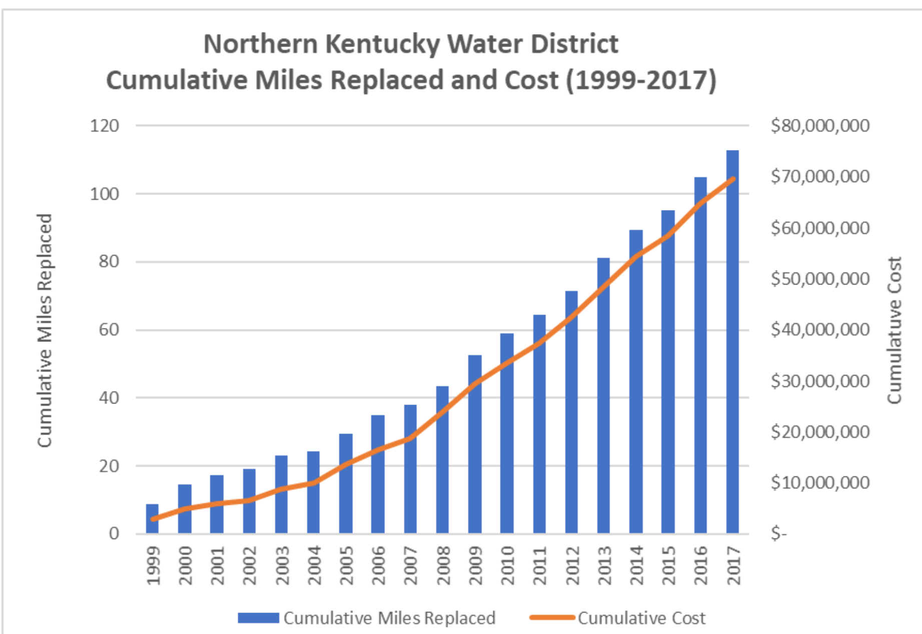

Exhibit A-2. NKWD Cumulative Water Main Replaced and Cost

In 2017, NKWD experienced 393 water main failures (318 breaks and 118 leaks), a failure rate of 30 breaks and leaks per 100 miles per year. The main break frequency has declined from 50.7 breaks per 100 miles per year in 1999 to 24.4 breaks per 100 miles per year in 2017 after a sustained, 21 replacement program averaging 0.5 percent annual replacement rate. Exhibit A-3 illustrates the main break frequency from 1999-2017

NKWD currently uses PVC C-900 DR 18 pipe for service pressures less than 125 psi and ductile iron for service pressures exceeding 125 psi. Copper tubing (Type K) is used for small diameter service lines from water main to meter.

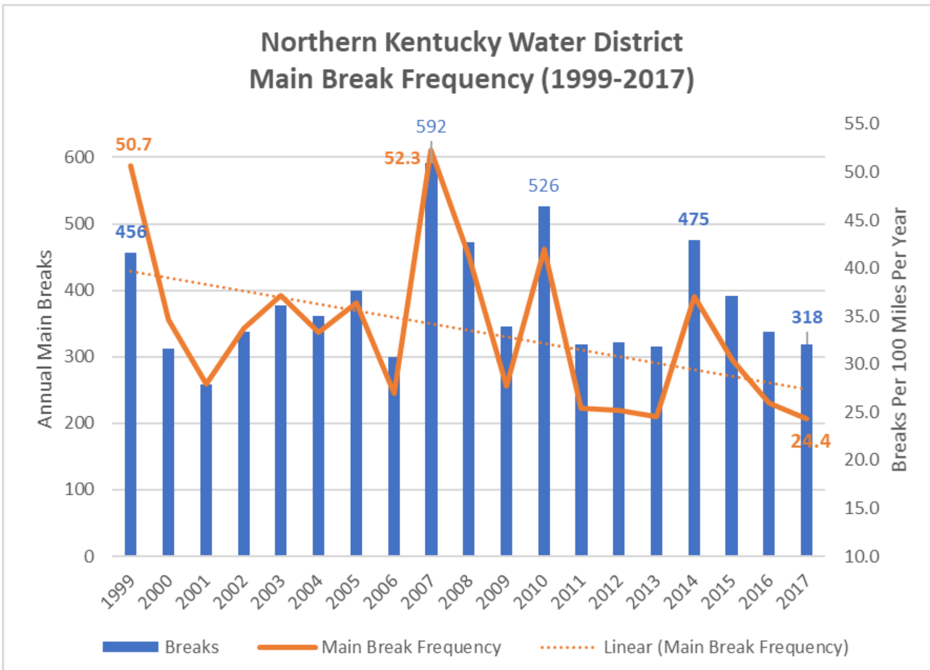

Exhibit A-3. NKWD Water Main Breaks and Break Frequency

APPENDIX B
EPA WATER AUDITS AND WATER LOSS CONTROL FOR PUBLIC WATER SYSTEMS (July 2013)

EPA United States Environmental Protection Agency

WATER AUDITS AND WATER LOSS CONTROL FOR PUBLIC WATER SYSTEMS

This document provides an introduction to water loss control and information on the use of water audits in identifying and controlling water losses in public water systems. **Water audits** are the first step in a three-step process for controlling water loss. A water audit is followed by **intervention** to identify losses and implement solutions and then by an **evaluation** of intervention measures and the needs for further improvement. This document is intended for small and medium-sized water systems, as well as state programs and technical assistance providers that regulate or support these systems.

Introduction

The Water Loss Problem

Public water systems face a number of challenges including aging infrastructure, increasing regulatory requirements, water quantity and quality concerns and inadequate resources. These challenges may be magnified by changes in population and local climate. It has been estimated that:

- The United States. will need to spend up to $200 billion dollars on water systems over the next 20 years to upgrade transmission and distribution systems.[i]
- Of this amount, $97 billion (29 percent) is estimated to be needed for water loss control.[ii]
- Average water loss in systems is 16 percent - up to 75 percent of that is recoverable.[ii]

A water loss control program can help water systems meet these challenges. Although it requires an investment in time and financial resources, management of water loss can be cost-effective if properly implemented. The time to recover the costs of water loss control is typically measured in days, weeks, and months rather than years.[ii] A water loss control program will also help protect public health through reduction in potential entry points for disease-causing pathogens.

Understanding Water Use and Water Loss

Much of the drinking water infrastructure in the United States has been in service for decades and can be a significant source of water loss through leaks. In addition to leaks, water can be "lost" through unauthorized consumption (theft), administrative errors, data handling errors, and metering inaccuracies or failure. The International Water Association (IWA) and the American Water Works Association (AWWA) have developed standard terminology and methods to assist water systems in tracking water losses and in performing water audits. The standard terminology includes the terms authorized consumption, real loss, apparent loss and non-revenue water that are used in this document.

- **Authorized Consumption** is water that is used by known customers of the water system. Authorized consumption is the sum of billed authorized consumption and unbilled authorized consumption and is a known quantity. It also includes water supplied to other water systems.

1

- **Real Losses,** also referred to as physical losses, are actual losses of water from the system and consist of leakage from transmission and distribution mains, leakage and overflows from the water system's storage tanks and leakage from service connections up to and including the meter.
- **Apparent losses**, also referred to as commercial losses, occur when water that should be included as revenue generating water appears as a loss due to unauthorized actions or calculation error. Apparent losses consist of unauthorized consumption, customer metering inaccuracies, and systematic data handling errors in the meter reading and billing processes.
- **Non-Revenue Water** (NRW) is water that is not billed and no payment is received. It can be either authorized, or result from apparent and real losses. Unbilled Authorized Consumption is a component of NRW and consists of unbilled metered consumption and unbilled un-metered consumption.

What are the Benefits of a Water Loss Control Program?

A water loss control program helps to identify real or physical losses of water from the water system and apparent losses, the water that is consumed but not accounted for. Real losses represent costs to a water system through the additional energy and chemical usage required to treat the lost water. Apparent losses represent a loss of revenue because the water is consumed but not accounted for and thus not billed. Once a water system identifies these real and apparent losses through a water loss control program, it can implement controls to reduce them. This can reduce the need for costly upgrades and expansions due to population growth and increased demand. By reducing the amount of water lost, the recovered water can be sold to consumers, generate revenue and meet water demands. In some cases this can reduce the need to find additional sources. *Water loss control programs are often the most economical solution to increasing demand, especially in the short term.*[i]

What Does a Water Loss Control Program Look Like?

A water loss control program consists of three major steps (see Figure 1). The critical first step is the ***water audit***. A *water audit* identifies and quantifies the water uses and losses from a water system. The ***intervention*** process addresses the findings of the *water audit* through implementation of controls to reduce or eliminate water losses. The ***evaluation*** step uses performance indicators to determine the success of the chosen intervention actions. Utilizing the standard terminology and the three steps of a water loss control program, systems can determine their baseline water use and loss, prioritize and implement water efficiency projects and operational changes, and evaluate and continuously improve their water loss

Figure 1. Components of a Water Loss Control Program

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management.
Figure 2 provides a summary of the main data needs, action items and performance indicators for each step of a water loss control program. The following sections will go into more detail for each step.

Step 1 - Water Audit Data Needs

- Gathering information.
- Determining flows into and out of the distribution system based on estimates or metering.
- Calculating the performance indicators.
- Assessing where water losses appear to be occurring based on available metering and estimates.
- Analyzing data gaps.
- Considering options and making economic and benefit comparisons of potential actions.
- Selecting the appropriate interventions.

Step 2 - Intervention Action Items

- Gathering further information, if necessary.
- Metering assessment, testing, or a metering replacement program.
- Detecting and locating leaks.
- Repairing or replacing pipe.
- Operation and maintenance programs and changes.
- Administrative processes or policy changes.
- No further action is necessary.

Step 3 - Evaluation Performance Indicators

- Were the goals of the intervention met? If not, why not?
- Where does the system need more information?
- How often should the system repeat the *audit, intervention* and *evaluation* process?
- Is there another performance indicator the system should consider?
- How does the system compare to the last *audit, intervention* and *evaluation* process?
- How can the system improve performance?

Figure 2. Summary of Data Needs, Action Items, and Performance Indicators of a Water Loss Program

The Importance of Metering

Water meters, both at the source and the service connection, are very important for all aspects of the water supply operations and make accurate water auditing possible. They make it possible to charge customers based upon the quantities of water that the customers consume. They record usage and make billing fair for all customers. They can encourage conservation by making customers aware of their usage as well as help detect leaks and establish accountability. Meter records provide historic demand and customer use data that is used for planning purposes to determine future needs. Unmetered water systems will need to consider some level of system metering to address water loss in the system.

A variety of meters exist and each type has its advantages and disadvantages. There is no single type of meter that will accurately measure flow for all applications. To select the proper meter for a specific application, a variety of factors should be considered in order for the meter to satisfy the location requirements and conditions where it will be installed. More information about the types and applications of meters can be found in EPA's *Control and Mitigation of Drinking Water Losses in Distribution Systems,* EPA 816-R-10-019, November 2010. The document is available at: http://water.epa.gov/type/drink/pws/smallsystems/technical_help.cfm.

- ***Condition assessment*** tools include traditional external visual inspections (e.g., periodic walk-over and opportunistic inspections of exposed mains), internal visual inspection technologies (e.g., closed circuit television (CCTV) camera inspections), pit depth measurements, destructive testing (e.g., test coupons) and non-destructive testing (e.g., ultrasonic testing).
- ***Hydraulic modeling*** can be used to predict locations of leaks in a water system based on physical and operating data of the water system. Calibration of these models to actual field data is essential to obtain realistic and usable results.

Water Audit Resources

- AWWA provides Free Water Audit Software©, available at: http://www.awwa.org/Resources
- Georgia Department of Natural Resources, *Georgia Water System Audits and Water Loss Control Manual*, Version 1.0 (2011), available at: http://www.gaepd.org/Files_PDF/GaWaterLossManual.pdf.
- The Maryland Department of the Environment's *Developing and Implementing a Water Conservation Plan*, includes water audit worksheets and describes the development of a water conservation plan. The information is available at: http://www.mde.state.md.us/programs/Water/WaterConservation/Documents/www.mde.state.md.us/assets/document/water_cons/WCP_Guidance2003.pdf.
- The Texas Water Development Board's *Water Loss Audit Manual* (2008) includes a water audit worksheet. The manual and worksheets are available at: http://www.twdb.state.tx.us/conservation/municipal/waterloss/.
- The New Mexico Office of the State Engineer provides examples of water audits of public water systems using the IWA/AWWA process. Information is available at: http://www.ose.state.nm.us/wucp_accounting.html.

Step 2 – The Intervention Phase

Interventions are actions taken by a water system to identify the specific sources of water loss and implement solutions. These actions can include :[i]

- Preventive measures such as design standards and effective maintenance
  - Reliable construction and design standards allow a water system to maintain maximum structural integrity throughout its operating life. Once a water system has been constructed according to appropriate design standards, effective maintenance can help to ensure the system operates at optimal performance throughout its lifespan and ensure that repairs are made proactively.
- Meter installation, testing and replacement
  - Accurate metering is important for all phases of a water audit. Meters record usage and monitor demand, encourage conservation, help detect leaks and make it possible to charge customers for the water they use.

- Leakage management

- Detecting, pinpointing and repairing leaks generates event data that refines and confirms the water losses identified in the water audit.
  - Pressure management evaluates areas of excessive pressure and implements controls that reduce pressure to cut pressure-sensitive background leakage and reduce rupture rates.
- Pipe repair and replacement
  - Once a leak has been detected and located, the pipe can be repaired or replaced. Repairing and replacing pipes requires trained personnel, the right tools and the proper inventory of parts and materials.

Step 3 – The Evaluation Phase

The *evaluation* phase is important for ensuring an efficient and effective water loss control program. Comparison of the water system to industry benchmarks or past audits can document improvements in water loss control and allow a water system to track its progress. Use of performance indicators such as those mentioned above can help to ensure meaningful interpretations of the evaluation and to encourage continuous improvement. The evaluation will answer questions such as:

- Were the goals of the intervention met? If not, why not?
- Where do we need more information?
- How often should we repeat the *Audit, Intervention and Evaluation* process?
- Is there another performance indicator we should consider?
- How did we compare to the last *Audit, Intervention and Evaluation* process?
- How can we improve performance?

Benchmarking for Small Systems

Conducting a water audit allows a system to monitor its water loss performance over time and compare itself to other systems. This process is known as benchmarking and uses a collection of performance indicators to numerically evaluate different aspects of the water system. Performance indicators need to be consistent, repeatable and presented in meaningful standardized units. Some examples are breaks per mile of distribution main per year, gallons of water lost per service connection, and gallons of leakage per mile of distribution main per year. Because conditions at small systems can vary so greatly, benchmarking can become a difficult practice as many performance indicators may not be consistent or comparable across small systems. However, the basic steps of top-down water audits, metering and water loss control efforts can help small systems conserve their resources and improve their long term sustainability.

Resources

Performing a *water audit* and developing a complete water loss control program does not have to be overwhelming. By beginning with the basic steps and principles outlined in this document, any water system can begin the process of identifying and mitigating water losses. Additional resources available to assist water systems in performing *water audits* include the following:

- EPA Office of Ground Water and Drinking Water. http://www.epa.gov/drink/
- EPA Office of Water, Water Infrastructure*: Moving Toward Sustainability.* http://water.epa.gov/infrastructure/sustain/index.cfm
- Association of State Drinking Water Administrators. http://www.asdwa.org
- The Alliance for Water Efficiency . http://www.allianceforwaterefficiency.org
- American Water Works Association. http://www.awwa.org

Resources are also available to assist water system customers in conducting a water audit of their premises. These resources include the following:

- The Maryland Department of the Environment provides instructions on how to conduct a home water audit as well as a spreadsheet that calculates current use using customer entries. http://www.mde.state.md.us/programs/Water/WaterConservation/WaterAuditing/Pages/Programs/WaterPrograms/Water_Conservation/Water_Auditing/index.aspx
- Broward County Florida Water Services provides a worksheet for plumbing fixtures and appliances to calculate residential water use and provides average use for comparison. http://www.cob.org/documents/pw/environment/water-conservation/home-water-audit-worksheet.pdf
- The City of Corvallis, Oregon, Utilities Division provides information for residential customers on checking for leaks using the water meter, measuring or estimating flows in plumbing fixtures and measuring water used in landscaper irrigation. http://www.ci.corvallis.or.us/index.php?option=content&task=view&id=443&Itemid=384

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[i] U.S. Environmental Protection Agency. 2009. Drinking Water Infrastructure Needs Survey Fact Sheet , EPA 816-F-09-003. http://water.epa.gov/infrastructure/drinkingwater/dwns/factsheet.cfm.

[ii] Thornton, J., Sturm, R., Kunkel, G., *Water Loss Control Manual (2[nd] Edition)*, McGraw-Hill, 2008.

[iii] Texas Water Development Board, Water Conservation Task Force, *Water Conservation Best Management Practices Guide*, November 2004. http://savetexaswater.org/bmp/.

APPENDIX C

FISCAL YEAR 2019 CAPITAL BUDGET
WATER AND WASTEWATER UTILITY
July 1, 2018 to June 30, 2019

City of Ashland
Utility Fund / Fund 410
Capital Summary
Fiscal Year 2019

Ashland
A Proud Past, A Bright Future

Division	Account Number	Description	FY 2019 Approved Budget
Water Production	4104	SCADA program	600,000
	4104	Automated backwash, chemical flow pacing	150,000
	4104	Carbon pump system modifications	200,000
Water Distribution	4103	Mill Street improvements	570,000
	4104	Water main replacements	740,000
	4104	Providence Hill pump station building and pump	32,000
	4104	Baugess Drive pump station improvements	25,000
	4105	Catlettsburg Tank Coating	364,834
	4105	Pumps / Sprayers / Blowers	30,000
	4105	Chlorine analyzers (3)	22,500
	4105	Roberts Drive pump station upgrades	95,000
	4105	Summit tank painting	300,000
	4105	Brumfield Estates fiberglass building	20,000
	4106	WD crew truck	80,000
	4106	Flatbed tow truck	40,000
	4106	Trucks (3)	20,000
	4107	Diesel pump	37,500
	4107	Jack hammer for excavator	11,500
	4107	Broom brush for backhoe	15,000
	4107	Hydraulic track excavator	112,500
	4199	Fence repairs	30,000
		Total Water Capital	3,495,834
Wastewater Treatment	4104	Bridge tubes for clarifiers	33,000
	4104	Rebuild sludge pumps (3)	65,000
	4104	VFD / motors and aerators	50,000
	4104	Aerator blade	5,000
	4105	CSO - WWTP upgrade design, survey, land	250,000
Wastewater Collection	4104	Pipe Lining	362,500
	4104	Pipe Lining	100,000
	4104	Sewer main replacement - Dawes to Blackburn	20,000
	4104	Channel Grinders for 26th St Station	85,000
	4105	CSO - 29th St	400,000
		Total Wastewater Capital	1,370,500
		Total Utility Capital	4,866,334

APPENDIX D

MONTHLY SURCHARGE ESTIMATE
TO FUND ANNUAL MAIN REPLACEMENT PROGRAM

Surcharge per 1000 gallons/month not including wholesale water sales							
Year	Total Water Sold (gallons)	Wholesale (gallons)	Wholesale % of Total	Retail Water Sold (gallons)	Surcharge $1.20/1000	Surcharge $1.80/1000	Surcharge $2.40/1000
					$1.20	$1.80	$2.40
FY 2014	1,923,555,938	506,723,000	26.3%	1,416,832,938	$1,700,200	$2,550,299	$3,400,399
FY 2015	1,952,917,398	519,467,000	26.6%	1,433,450,398	$1,720,140	$2,580,211	$3,440,281
FY 2016	1,905,720,014	578,150,000	30.3%	1,327,570,014	$1,593,084	$2,389,626	$3,186,168
FY 2017	1,875,265,002	603,907,000	32.2%	1,271,358,002	$1,525,630	$2,288,444	$3,051,259
FY 2018	1,861,977,001	566,325,000	30.4%	1,295,652,001	$1,554,782	$2,332,174	$3,109,565
5 YR Average	1,903,887,071	554,914,400	29.1%	1,348,972,671	$1,618,767	$2,428,151	$3,237,534
				Rounded	$1.6 million	$2.4 million	$3.2 million
Average increase for Residential Customer using 5,000 gallons/month					$6.00	$9.00	$12.00
			Miles replaced @$100/Foot		3.07	4.60	6.13
			Percent of System (303 MILES)		1.01%	1.52%	2.02%

APPENDIX E

ASHLAND RECOMEMNDATIONS SUMMARY PRIORITY AND COST ESTIMATE

Rec #	Area	Priority	Budget Type	Estimate (Operating/Amortize/Capital)			Sourcing (Internal or External)
				Operating	Amortize (5 or 10 years)	Capital	
Finance and Rates							
1	Water rates should be reviewed annually, and a comprehensive rate analysis and cost of service study should be completed every three to five years, using the AWWA M34 Standard. Ashland should conduct a Cost of Service study in 2019 and include funding for an annual program to replace aging infrastructure (plant, pumps, storage, and pipelines).	High (3-12 months)	Amortize over 5 years		$70,000 to $90,000		External
2	Pursue grants and low interest loans for capital water and sewer projects from state and federal agencies, including: Kentucky Infrastructure Authority, Rural Development, Kentucky Economic Development, and other grant/loan agencies. Ashland may be eligible for Rural Development funding for retail service areas under 10,000 population (i.e. Westwood, Catlettsburg and areas of Boyd County outside city limits of Ashland).	Medium (1-3 Years)	Operating	Absorb in Operating Budget			Internal and External
3	Provide a monthly operating report to City Commissioners, including year-to-date key performance metrics for comparison to prior year.	Medium (1-3 Years)	Operating	Absorb in Operating Budget			Internal
4	Develop a five-year pro-forma of Utility income and expenses and a five to 10-year Capital Plan (also referred in this report as a Water Improvement Program), these can be included in scope for Cost of Service Study.	Medium (1-3 Years)	Operating	Include with Rec #1			Internal and External
Capital Improvement/Asset Management							
5	Enhance the database on water pipe and service line failures to identify priority pipes for replacement. The data collection should include: failure location date and type, pipe type, diameter, age, depth, pressure, and backfill material. The information should be reported daily though the work management system. Statistical analysis will allow prioritization of pipe replacement, based on failure frequency and severity.	High (3-12 months)	Operating	Absorb in Operating Budget			Internal
6	The FY 2019 capital budget includes 2.5 miles of main replacement/abandonment at an estimated $1.5 million. Continue to phase-in capital funding of annual Main Replacement Program from 1.0 to 2.0 percent of the distribution pipe inventory, approximately six miles per year. Phase-in the replacement program.	High (3-12 months)	Capital			FY 2020 - $1,600,000; FY 2021 - $2,400,000; FY 2022-38 - $3,200,000, annually	
7	Provide adequate engineering and technical staff for design and inspection for the Main Replacement Program. Design resources can be added to staff or the additional design work can be contracted to engineering consultants. Consider part-time, retired employees to assist with design and inspection as a cost-effective alternative to full time staff or fees for consulting services.	High (3-12 months)	Capital			Included in Capital Budget for Rec #6	Internal and External
8	Establish distribution performance metrics and establish goals (five to 20 years) and provide monthly/annual reports of progress toward goals.	High (3-12 months)	Operating	Absorb in Operating Budget			Internal
9	Update and calibrate the hydraulic model for planning, design, and operations of the distribution system (perform by internal or consulting resources). Evaluate pressure management within pressure zones to determine impact of high pressure and pressure variations on main breaks and water loss. Evaluate pressure zones, pumping, and storage. Utilize hydraulic model to conduct distribution water quality analysis to improve water quality and minimize Disinfection Byproducts. Utilize hydraulic model to determine pipe, pump, and storage improvements to reliably serve Braidy Industries.	High (3-12 months)	Amortize over 5 years		$45,000 to $50,000		External

APPENDIX E

ASHLAND RECOMEMNDATIONS SUMMARY
PRIORITY AND COST ESTIMATE

Rec #	Area	Priority	Budget Type	Estimate (Operating/Amortize/Capital)			Sourcing (Internal or External)
				Operating	Amortize (5 or 10 years)	Capital	
10	Issue an RFP for Engineering Services and establish an engineer of record for master planning, hydraulic modeling/planning, and overall program management.	Medium (1-3 Years)	Operating	Absorb in Operating Budget			Internal or External
11	Develop a 10-year Capital Improvement Plan (CIP) for drinking water, wastewater, and storm water.	Medium (1-3 Years)	Amortize over 10 years		$25,000 to $30,000		External
12	Issue an RFP for Engineering Services to provide design and construction services in areas of water, wastewater, and storm water. Multiple engineers can be retained on a five-year cycle to provide the services needed where staff resources are not adequate.	Medium (1-3 Years)	Operating	Absorb in Operating Budget			Internal or External
13	Conduct a storage tank assessment, including hydraulics, inspection, condition assessment, and painting. Re-size and retrofit tanks as needed to include mixing and circulation to retain chlorine residual and reduce levels of disinfection byproducts and decommission unused tanks. Annually budget for tank painting/recoating, providing a 15 to 20-year cycle of rehabilitation.	Medium (1-3 Years)	Amortize over 5 years		$25,000 to $30,000		External
14	Conduct a programmatic condition assessment of water and wastewater assets.	Medium (1-3 Years)	Amortize over 10 years		Include in Rec #11		External
15	Enhance existing annual hydrant inspection/exercising	Medium (1-3 Years)	Operating	$65,000 for one additional FTE			Internal
16	Continue to invest and enhance the GIS mapping system of distribution assets, including water mains, valves, hydrants, pressure regulating valves, storage tanks, pump stations, and other major appurtenances. Utilize the GIS to build an asset management system of distribution assets, including install date, size, type, and manufacturer.	Medium (1-3 Years)	Operating	Absorb in Operating Budget			Internal
17	Evaluate current condition of vehicles and equipment and develop a plan to replace aging equipment and purchase new equipment to meet operational needs.	Low (3-5 Years)	Operating	Absorb in Operating Budget			Internal
18	Evaluate current business hardware and software (billing, accounting, customer information, word processing, spreadsheet, etc.) and upgrade as needed to improve efficiency and customer satisfaction.	Low (3-5 Years)	Operating	Absorb in Operating Budget			Internal
19	Evaluate communication equipment, including land phone, mobile phones, and radio equipment, for replacement as needed.	Low (3-5 Years)	Operating	Absorb in Operating Budget			Internal
20	Evaluate unused assets and sell or lease to generate additional income.	Low (3-5 Years)	Operating	Absorb in Operating Budget			Internal
Water Treatment and Delivery							
21	Implement the action steps identified in the 2018 Agreed Order with the Kentucky Department for Environmental Protection to address areas of non-compliance, including maintaining chlorine residual in the distribution system and for wholesale customers and maintaining compliance with the EPA Disinfection Byproduct Rule.	High (3-12 months)	Operating	Absorb in Operating Budget			Internal
22	Initiate the SCADA Control System upgrade at the water treatment plant. Three alternatives were identified by GRW Engineers and the best value provided to Ashland is Alternative #3 at an estimated cost of $1.2 million. This alternative provides the best combination of security and technology with construction adjacent to the existing control room, thereby minimizing disruption of operations during construction. Project also requires installation of equipment at an estimated $1.3 million. Total project cost estimate of $2.5 million.	High (3-12 months)	Capital			$2,500,000	External

APPENDIX E

ASHLAND RECOMEMNDATIONS SUMMARY
PRIORITY AND COST ESTIMATE

Rec #	Area	Priority	Budget Type	Estimate (Operating/Amortize/Capital)			Sourcing (Internal or External)
				Operating	Amortize (5 or 10 years)	Capital	
23	Evaluate the current management of pressure zones and storage in the distribution system with a calibrated hydraulic model. Consider reconfiguring pressure zones to reduce pressures less than 100 psi and minimize pressure surges. Consider installation of pressure management technology to reduce pressure surges and associated pipe line and service line breaks/leaks. Opportunity to include this with scope for hydraulic modeling in Recommendation #9.	Medium (1-3 Years)	Amortize over 5 years		Included in Rec #9		External
24	As water loss declines, begin implementation of a planned distribution flushing program to maintain distribution water quality. Purchase flushing and metering equipment as budget allows to properly account for water distribution flushing.	Medium (1-3 Years)	Operating	$65,000 for one additional FTE			Internal
25	Pursue EPA's Partnership for Safe Water Program for Water Treatment and Distribution to assure high quality water is delivered to customers. Develop plan to achieve Level 3 performance in three to five years.	Medium (1-3 Years)	Amortize over 5 years		$15,000 to $20,000		Internal or External
26	Develop and budget an annual preventive maintenance program for plant, pump, and storage facilities.	Low (3-5 Years)	Operating	Absorb in Operating Budget			Internal or External
Wastewater Collections and Treatment and Stormwater							
27	Evaluate progress in meeting all phases of the CSO Long Term Control Plan, including schedule, budget, and performance objectives.	Medium (1-3 Years)	Operating	Absorb in Operating Budget			Internal
28	Evaluate the impact of NPDES Permitting and Municipal Separate Storm Sewer (MS4) system regulations on stormwater management. Map 20% of storm system annually and inspect 20% of storm outfalls annually.	Medium (1-3 Years)	Amortize over 5 years		$25,000 to $30,000		Internal or External
29	Evaluate infrastructure needs for wastewater treatment and collection systems beyond the scope of the CSO Long Term Control Plan. Develop a 10 to 20-year Facility Plan for needed improvements for the period 2025 to 2045.	Low (3-5 Years)	Amortize over 10-20 years		$80,000 to $100,000		External
Water Loss, Metering, Billing							
30	Develop a comprehensive Water Loss Program (with internal or external resources) using the methodology defined in the EPA and AWWA M36 Water Audit and Loss Control Program (Appendix B). Establish a long term goal (10-15 years) to achieve 20 percent (or less) water loss as measured by non-metered water. Charter a Water Loss Team with representatives operations, engineering, finance, customer service; rotate leadership of Water Loss Team. (initiate within 1 year, requires 3 to 5-year program to be resourced).	High (3-12 months)	Amortize over 5 years		$45,000 to $55,000		Internal or External
31	Upgrade billing system to improve billing, communications to customers regarding water/wastewater services. Utilize billing system as a communication medium for news to customers.	Medium (1-3 Years)	Capital			$1,000,000 to $1,500,000	Internal or External
32	Annually monitor the billing system to assure reliable transfer of data from meter reading to billing system. Conduct QA/QC audit following implementation of any changes in water/wastewater rates or fees. Consider retaining a third party to evaluate accuracy and consistency of billing.	Ongoing	Operating	Absorb in Operating Budget			Internal

APPENDIX E

ASHLAND RECOMEMNDATIONS SUMMARY
PRIORITY AND COST ESTIMATE

Rec #	Area	Priority	Budget Type	Estimate (Operating/Amortize/Capital)			Sourcing (Internal or External)
				Operating	Amortize (5 or 10 years)	Capital	
Management/Human Resources/Training							
33	Budget for staff members to attend regional professional and technical conferences offered by Kentucky Rural Water and Kentucky-Tennessee AWWA. Participation in conference programs and committees will allow staff to learn best practices and implement new technology for operations of water and wastewater. Designate 1% of Operating Labor Budget for Travel/Conference Fees and 1% of labor hours for training (20 hours per FTE per year).	High (3-12 months)	Operating	Absorb in Operating Budget			Internal
34	Evaluate staffing needs for operations and capital improvements. Capital Program resources (engineering staff and crews) are included in annual budget for water main replacement identified in Recommendation # 6.	Medium (1-3 Years)	Capital, included in Rec #6			Hire 1 Engineer ($120,000); 1 Technician ($75,000); Capital Crew ($300,000)	Internal
35	Review current employee performance review process and transition to an evaluation process to measure both competency and performance with specified, measurable goals tied to annual operating plans.	Medium (1-3 Years)	Operating	Absorb in Operating Budget			
36	Evaluate AWWA Effective Utility Management (EUM) as a quality management system to enhance the quality and service levels of the organization.	Low (3-5 Years)	Amortize over 5 years		$15,000 to $20,000		Internal or External
37	Budget annually and assure plant and distribution operators maintain Kentucky Drinking Water certifications and continuing education requirements.	Ongoing	Operating	Absorb in Operating Budget			
Communications and Customer Service							
38	Review and update the Ashland website to include current information on water/wastewater utility services, including: rates, service rules, water quality, current projects, etc.	Medium (1-3 Years)	Operating	$15,000 to $18,000			Internal or External
39	Prepare quarterly communications to customers, by mail or bill stuffer, to communicate the activities of the Utility.	Medium (1-3 Years)	Operating	$15,000 to $18,000			Internal or External
40	Conduct a periodic survey of customers (every one to three years) to gauge the level of customer satisfaction with quality and service.	Medium (1-3 Years)	Operating	$15,000 to $18,000			Internal or External
41	Develop a monthly or quarterly water/wastewater utility newsletter to provide information to employees on operations, activities, and benefits.	Medium (1-3 Years)	Operating	$15,000 to $18,000			Internal or External
42	Consider creating a volunteer Customer Advisory Group (eight to 12 citizens) to provide input to the City Manager, Mayor and Commissioners on service levels, quality, and policy. The Customer Advisory Group should meet two to four times a year and provide observations and recommendations to the Commission.	Medium (1-3 Years)	Operating	Absorb in Operating Budget			Internal
43	Use focus groups for select topic areas, including water quality, system reliability, customer service, water projects, etc.	Low (3-5 Years)	Operating	Absorb in Operating Budget			Internal
44	Continue use of social media accounts (Facebook and Twitter) to promote the activities and news of the Utility.	Ongoing	Operating	Absorb in Operating Budget			Internal