Exhibit No. 7

MAWC – Exhibit 7
Jeffrey T. Kaiser
Direct Testimony
File No. WA-2021-0376

Exhibit No.:	
Issues:	Eureka Acquisition
Witness:	Jeffrey T. Kaiser
Exhibit Type:	Direct
Sponsoring Party:	Missouri-American Water Company
Case No.:	WA-2021-0376
Date:	November 5, 2021

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. WA-2021-0376

DIRECT TESTIMONY

OF

JEFFREY T. KAISER

ON BEHALF OF

MISSOURI-AMERICAN WATER COMPANY

Exhibit No. 7
Date 1/20/22 Reporter BJB
File No.

AFFIDAVIT

I, Jeffrey T. Kaiser, under penalty of perjury, and pursuant to Section 509.030, RSMo, state that I am Vice President of Operations for Missouri-American Water Company, that the accompanying testimony has been prepared by me or under my direction and supervision; that if inquiries were made as to the facts in said testimony, I would respond as therein set forth; and that the aforesaid testimony is true and correct to the best of my knowledge and belief.

Jeffrey T. Kaiser

November 5, 2021
Dated

DIRECT TESTIMONY
JEFFREY T. KAISER
MISSOURI AMERICAN WATER COMPANY
CASE NO.: WA-2021-0376

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DIRECT TESTIMONY

JEFFREY T. KAISER

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Jeffrey T. Kaiser, and my business address is 727 Craig Road, Creve Coeur MO 63141.

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

A. I am employed by Missouri-American Water Company ("MAWC", "Missouri-American" or the "Company") as Vice President of Operations.

Q. Please summarize your educational background and business experience.

A. I received a Bachelor of Science degree in civil engineering from Washington University in St. Louis, Missouri in 1986. I am a registered professional engineer in the states of Missouri and Indiana. I have over 35 years of experience in the water and wastewater design and construction industry. From 1986 until April 2018, I held various roles of increasing responsibility for large nationally based engineering firms including positions as project engineer, senior engineer, project manager, and office/ branch manager. In these roles, the primary focus of my work was the water and wastewater industry. In these roles, I was involved in or oversaw the completion of numerous planning, design, and construction projects, ranging in size and scope from small sewer and water main extension projects to water and wastewater system planning studies, and the design and construction administration of treatment plant improvement projects of up to $280 million in value. In April of 2008 I was employed by American Water Works Service Company (the Service Company) to serve as the Director of Engineering for Illinois American Water Company,

Iowa American Water Company, and Lake Water Company. In January 2017, my position changed to Director of State Procurement, overseeing the purchasing of all state subsidiaries of American Water. In November 2019, I became an employee of MAWC serving as the Director of Engineering for MAWC, and in February of 2021 I was named the Vice President of Operations, the position I currently hold.

Q. What are your current employment responsibilities?

A. I am responsible for the Company's water and sewer operations across the State of Missouri, including field services, production, maintenance, water quality, environmental compliance and safety. My oversight includes ensuring that our operations team continues to provide high quality water and sewer service and meets MAWC's operational targets.

Q. Have you previously testified before the Missouri Public Service Commission?

A. Yes, I testified as a witness in MAWC's general rate proceeding - WR-2020-0344. I have also filed testimony in matters before this Commission.

Q. What is the purpose of your direct testimony in this proceeding?

A. The purpose of my Direct Testimony is to sponsor schedules and provide testimony in support of Missouri American's acquisition of the Eureka Water and Wastewater systems. Specifically, to discuss the general scope and size of the existing infrastructure, MAWC's plans for improvements, and the benefits that both the citizens of Eureka and MAWC's current customers will receive from this acquisition.

II. EUREKA WATER SYSTEM

Q. Please generally describe the Eureka water system.

A. The City of Eureka water system serves approximately 4,100 water customers. The water system includes six (6) wells, eight (8) booster pump stations, seven (7) storage tanks, and

the water distribution system. The water distribution system includes approximately 58.8 miles of water main ranging in size from 2-inch to 12-inch, 642 fire hydrants, and associated valves and fittings.

Q. Does MAWC plan any investments in the Eureka water system?

A. Yes.

Q. What are MAWC's plans regarding the Eureka water system?

A. One of the most critical issues facing Eureka, and a main driver for the City to explore the proposed change in water system ownership, is a water supply that has significant aesthetic problems. The existing wells, although meeting basic water quality standards, provide a water that has very high hardness, chloride levels, and total dissolved solids (TDS). This water creates a large amount of corrosion as well as precipitation of solids in household fixtures and appliances in a very short period of time. In addition, citizens generally seem to find the water to be of poor taste. To address these issues, MAWC plans to construct a 20-inch transmission main approximately 5 miles long to transfer water from MAWC's existing St. Louis County service area to the Eureka system. This pipeline will allow MAWC to provide the higher-quality water supply from our St. Louis County distribution system and address the aesthetic problems in the Eureka water supply as sought by the City of Eureka.

Q. How did MAWC arrive at this approach?

A. MAWC has the capacity available in its system to meet the needs of Eureka, and the pipeline, at an estimated cost of $9 million, is the lowest long term cost approach to meeting the water needs of the City.

Q. Were other options considered?

A. Yes. Other alternatives, such as increased treatment levels at Eureka's wells, had been explored by Eureka and their engineering consultants. The proposed improvements for the well treatment systems, with a capital cost of over $10 million, included the addition of reverse osmosis treatment systems to the wells. This option also includes significant increases to operations and maintenance costs for the wells. The engineering report, prepared by Bartlett and West Engineers, addressing this issue is attached as **Schedule JK-1**.

Q. You mentioned the existing wells, will they be used in the future?

A. Yes.

Q. What will be their role?

A. Once MAWC can supply the Eureka system with water from MAWC's St. Louis County water system, the existing wells in Eureka will be placed in a standby mode to serve as a back up to the single pipeline from St. Louis County. Similar to back-up power generation at MAWC's other treatment plants or pump stations, the wells and associated equipment will be available for use should the pipeline be taken out of service due to a breakage, damage, or other incident which may interrupt water service to these approximately 4100 customers.

Q. Is this important?

A. Yes. The proposed pipeline will be of a relatively large diameter and likely installed in an area with limited access. Any damage to the pipeline could result in service interruptions to the water system that may require some time to repair. Without this back-up capability, the City of Eureka could be left without a water supply while repairs are coordinated and completed. If the wells were not used as a standby source, MAWC would need to consider

a second pipeline or other redundant source of supply for the area.

Q. Will any of the equipment at the well sites be utilized under normal (non-emergency) operations?

A. Yes. Much of the equipment at the wells sites will continue to be used daily as part of the normal distribution system operations. Of the six (6) active well sites in Eureka, three (3) of them also include water storage tanks and booster pump stations that make up a large portion of the assets on these sites. Three additional sites without active wells also include water storage tanks and booster pump stations. These storge tanks and the booster pump stations will continue be used for the day-to-day operations of the Eureka water system after the completion of the pipeline from the St. Louis County system. In addition to the storage tanks and booster pump stations, these sites have ancillary equipment such as chlorine storage and feed systems, pressure monitors, SCADA controls, and standby power generators which will be necessary for the ongoing operations of the Eureka distribution system.

Q. Are any other investments in the Eureka water system anticipated?

A. Yes. MAWC will be replacing the existing customer meters in the Eureka system with meters compatible with MAWC's AMI system immediately after taking responsibility for the system. These meter changes will eliminate monthly meter reading duties, while providing a higher level of customer usage information for both internal analytical use as well as customer information and notifications. MAWC will also be extending our Supervisory Control and Data Acquisition System (SCADA) to the various tank and booster station sites to allow the Eureka system to be monitored and controlled remotely as part of the St. Louis County system. Other investments typical to MAWC's water

systems such as the replacement of broken or outdated valves and hydrants, facility safety and security improvements, water main replacements, and related distribution system and pump station work similar to that routinely completed in other MAWC systems will also occur into the future.

III. EUREKA WASTEWATER SYSTEM

Q. Please generally describe the Eureka wastewater system.

A. The City of Eureka wastewater system serves about 4100 wastewater customers. The wastewater treatment plant is a three-cell aerated lagoon plant with a design flow of 2.8 million gallons per day, according to the MDNR Operating Permit. The wastewater collection system includes ten (10) sewer lift stations, approximately 62.5 miles of sewer main ranging in size from 4-inch to 48-inch, and 1,452 manholes.

Q. Does MAWC plan any investments in the Eureka wastewater treatment system?

A. Yes.

Q. What are MAWC's plans in regard to the Eureka wastewater treatment system?

A. The treatment plant is currently in need of repairs to its aeration system piping and some minor investment to operate within its design parameters. The most significant issue is leaking airlines, which supply the aeration system within the treatment lagoon. MAWC believes this system can be repaired for a relatively low cost along with other issues currently impacting the treatment process. In addition, the Missouri Department of Natural Resources (MDNR) will include more strict limits for ammonia levels in the next National Pollution Discharge Elimination System (NPDES) permit issued for the treatment plant. These new discharge limits may require modifications to the existing treatment process or the addition of new treatment systems. Once the above-mentioned repairs to the existing

treatment process are complete and the plant is operating properly, MAWC will be better able to assess the plant's capability to meet anticipated operating permit limits for ammonia. This is because MAWC has found in the past that revisions to how a plant is operated can make a difference in ammonia levels and result in different approaches than what might have been assumed prior to such operation.

Q. How did MAWC arrive at this approach?

A. MAWC has gained considerable experience operating wastewater treatment lagoons across Missouri and has worked very closely with the MDNR in similar situations. Our experience indicates that treatment lagoons, specifically multiple cell lagoons, can have the capability to provide some level of advanced treatment if operated in a manner that properly controls the treatment environment within the lagoons. MDNR has generally indicated a willingness to work with MAWC in these circumstances and allow MAWC adequate time to improve and evaluate the treatment process prior to making significant modifications to the plant facilities.

Q. Were other options considered?

A. Only to an extent. Until the plant is operating properly, it is not possible to assess its capacity for ammonia removal or determine the improvements necessary to meet future discharge limits. However, should the plant not be capable of meeting the anticipated discharge limits, MAWC will be prepared to implement improvements up to and including the addition of an advanced treatment system for nutrient removal. This could include a variety of measures ranging from further treatment within the existing lagoons, the addition of mechanical and/or chemical treatment process following the lagoons, or replacement of the plant with a mechanical treatment system capable of meeting the treatment

requirements.

Q. Does MAWC plan any investments in the Eureka wastewater collection system?

A. Yes.

Q. What are MAWC's plans regarding the Eureka wastewater collection system?

A. After taking ownership of the Eureka Wastewater System, MAWC will complete improvements at several wastewater pump stations. Some of these improvements will be completed quickly while others will be completed over several years. Short range improvements will range from minor control, monitoring, and safety improvements to pump station replacements. Longer term improvements will range from pump and control system replacements to total pump station replacements as is typical with MAWC's other wastewater collection systems. In addition to the pump stations, MAWC plans to regularly monitor and inspect portions of the collection system to identify sources of inflow and infiltrations (I&I) as well as any other defects such as tree root invasion, solids deposition, pipe failure, or other flow restricting conditions which need to be addressed. MAWC anticipates the need to line and/or replace portions of the sewer system and manholes on a recurring basis similar to the infrastructure replacement activities normally undertaken in other MAWC wastewater collection systems.

Q. How did MAWC arrive at this approach?

A. MAWC developed this anticipated approach to the operation and anticipated investments to the collection system based upon inspection of the pump stations, review of records and discussions with Eureka staff during MAWC's due diligence efforts, as well our experience operating more than 70 wastewater systems across the state.

IV. BENEFITS OF THE EUREKA ACQUISITION

Q. What benefits resulting from the proposed acquisition will there be for Eureka?

A. The most significant benefit for the citizens of Eureka will be MAWC's ability to provide an improved water supply that does not harm their appliances and plumbing fixtures, and which will be operated and maintained by an experienced and dedicated staff. This need was expressed by the public in a several information meetings prior to the vote to sell the water and wastewater systems. Moreover, the City will be able to invest the proceeds from the sale of these assets into other areas of local control that will positively impact the citizens.

Q. Will there be any operational benefits for MAWC's existing customers that result from the proposed acquisition?

A. Yes. The existing treatment and distribution system within St. Louis County has the capacity to absorb the demand of the Eureka customers with little modification, due in large part to the existing storage capacity within the Eureka system. This will result in a more cost-effective use of the St. Louis County treatment and distribution system investments and operations.

V. CONCLUSION

Q. Please summarize your testimony?

A. MAWC and the City of Eureka have come to an agreement to transfer the assets of the water and wastewater system. Both parties, and the majority of residents voting in Eureka believe this acquisition will benefit the residents of Eureka from both the capacity and capability of MAWC to effectively manage the systems and from the City's ability to effectively convert these assets into other community benefits.

Q. Does this conclude your direct testimony?

A. Yes.

CITY OF EUREKA, MISSOURI
WATER DISTRIBUTION SYSTEM EVALUATION

December 28, 2018

PREPARED FOR:

CITY OF EUREKA
EUREKA, MISSOURI

PREPARED BY:

Bartlett & West
Driving Community and Industry Forward, Together.

1719 Southridge Drive, Suite 100
Jefferson City, MO 65109

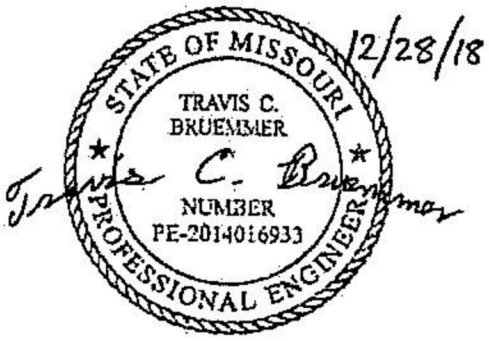
Travis Bruemmer, PE
Project Engineer

Project Number 19500.004

December 28, 2018

CITY OF EUREKA, MISSOURI

WATER DISTRIBUTION SYSTEM EVALUATION



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Project Number 19500.004

Date: December 28, 2018

To: City of Eureka, Missouri

From: Bartlett & West, Inc.

Re: Water Distribution System Evaluation

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Appendices

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Section 1. EXECUTIVE SUMMARY

The City of Eureka contracted with Bartlett & West for a water distribution system analysis. A system upgrade is in need and the City has been presented with several options to solve the current issues their water supply is having. They have been approached in relation to joining the Jefferson County Public Sewer District, who is proposing construction of a new water treatment plant that would serve various entities in the surrounding area, and by Missouri American Water Company who would buy their system and supply the City with water from an outside source or could provide bulk supply. The City of Eureka's water system is currently comprised of several service/pressure zones and are served by multiple wells located within the system. The system also includes several ground storage tanks for water storage.

To determine if the City's system would distribute successfully if an outside water source was introduced, the following data was provided by the City. Flow data from wells and water treatment plants, booster stations, pumping rate information, pump curves, dimensions, elevations, maps showing pipelines of current system and pressures were all supplied to compose a hydraulic model. Once the provided data was inputted into the hydraulic model, scenarios could be performed to see how the water flowed throughout the system and what factors would change pressures and flow.

Upon completion of the hydraulic model, it was determined that all the piping is connected, and the storage tanks have about the same overflow elevation; so theoretically, one outside water source could supply to all users. Section 5 explores what upgrades would be necessary to make the system work given the options presented to the City.

Section 2. INTRODUCTION

The City of Eureka's water system is at a state where additional treatment is of interest for their well water. They have been presented with the options of upgrading the current system or allowing an outside source to provide water to the over 10,000 residents in Eureka. Existing system facilities are discussed in Section 3, a hydraulic model representing the distribution system and demand is shown in Section 4 and the Recommended Improvements are explained in Section 5.

2.1. Recommended Improvements

Scenario 1: Installing a trunk line coming in from the East side of the City and running along the Interstate to accommodate a supply from Missouri American.

Scenario 2: Installing a trunk line coming in from the South and running it along Highway 109 to accommodate a supply from Jefferson County Public Sewer District.

Scenario 3: Updating water treatment system for each well and keeping current distribution system and looking at two alternatives.

- Shutting Well 6 off and filling Legends tank with the rest of the system.
- Maximizing Well 9's water in distribution system.

Section 3. EXISTING WATER DISTRICT FACILITIES

The City of Eureka's water system involves six (6) wells, seven (7) tanks, eight (8) booster stations and 3,600 connections to service the 10,000 residents. Appendix A shows a map of existing facilities and the zones are represented in a map in Appendix B.

This water system is monitored and controlled through a SCADA system. It tracks pressures, tank levels, pumps, fluoride levels, chlorine residuals, hardness levels, softening cycles and discharge. Pressure zones are maintained and adjusted as needed by opening and closing valves, along with starting and stopping well operation.

3.1. Supply Facilities

Currently six (6) wells feed into the distribution system to supply water to residents. These 6 wells are deep wells ranging from 500 feet deep to 1,235 feet deep. Each well has its own pump that is used to fill storage tanks or distribute directly into the system. Chlorine contact times take place in the pipe or in the tank before reaching users. Table 3-1 shows additional details on each well.

Table 3-1. Well Details

MoDNR Well ID	Eureka Well ID	Location	Depth (ft)	Ground Elevation (MSL)	Current Pumping Rate (gpm)	2017 Average Monthly Flow (gpm)	2017 Max Monthly Flow (gpm)	2017 Total Flow (gpm)
Well No. 5	Well No. 1 (Howerton)	533 Howerton Ln.	500	507	830	11,949,421	23,249,000	144,220,000
Well No. 6	Well No. 5 (Drewel)	Drewel Park	645	449	860	12,282,737	22,842,000	142,623,000
Well No. 7	Well No. 6 (Legends)	503 Vista Hills Ct.	1,235	605	460	11,013,684	15,880,000	133,591,000
Well No. 8	Well No. 8 (Viola)	687 Viola Ln.	865	600	680	9,361,947	12,601,000	109,953,000
Well No. 9	Well No. 9 (Arbors)	739 Brewster Rd.	635	664	800	1,117,882	3,170,000	10,244,000
Well No. 10	Well No. 10 (Ashton)	1414 West Main St.	695	490	480	6,748,526	13,312,000	80,072,000

3.2. Storage Facilities

Water is stored in seven (7) tanks scattered throughout the City. Six (6) hold 500,000 gallons and one (1) holds 250,000 gallons. Legends, the large Viola and Arbors tanks are located next to their corresponding well. Forby, Niehoff, Brock and small Viola tanks fill up from the Howerton, Drewel and Ashton Wells (Wells No. 1, 5 and 10). Water is pumped out of them with the booster station to the system. Chlorine contact time for water treatment is achieved in the Legends tank, large Viola tank and Arbors tank. All the tanks have approximately the same overflow elevation. Table 3-2 shows additional details on each tank.

Table 3-2. Tank Details

Tank Name	Location	Dimensions		Gross Volume (gal)	Approximate Ground Elevation	Approximate Overflow Elevation
		Height (ft)	Diameter (ft)			
Arbors	739 Brewster Rd.	20	69	500,000	629	649
Forby Road	360 Forby Rd.	40	46	500,000	605	645
Legends	503 Vista Hills Ct.	40	47	500,000	608	648
Niehoff/Augustine	765 Niehoff Dr.	60	37	500,000	591	651
Brock/Palisades	109 Brock Rd.	40	46	500,000	606	646
Small Viola	687 Viola Ln.	32	33	250,000	615	647
Large Viola	687 Viola Ln.	32	52	500,000	615	647

3.3. Distribution Facilities

The water is distributed through the system by gravity or booster stations that pressurize the waterlines. There are eight (8) booster stations located around the City. The booster systems are generally composed of an emergency high flow pump, at least one volume pump and a jockey pump for low flows. Most of the volume pumps run automatically and are dependent on pressure settings. Wells 1, 5, and 10 supply the main zone of the system and operate together to fill the Brock Tank, Niehoff Tank, Forby Tank and the small Viola Tank. Well 6 feeds directly into the Legends Tank, Well 8 feeds directly into the large Viola Tank and Well 9 feeds directly into the Arbors Tank. Water from these tanks is pumped to the distribution zone via adjacent booster stations. In addition, the large Viola Tank can fill the small Viola Tank. The wells are all connected to the SCADA system for operational control. Wells and pump stations throughout the system can be turned on and off as needed to adjust to system demands and help maintain required pressures and tank levels. A map showing the approximate system pressures of the distribution system can be found in Appendix C. Table 3-3 shows additional details of the system's booster stations.

Table 3-3. Booster Station Details

Existing Facilities- Booster Station Pumps

Name	Location	Typical Source	No. of Volume Pumps	Design Flow and Head	Type of Pump	No. of Jockey Pumps	Suction (psi)	Discharge (psi)	Average Month (gallons)	Average Day (gallons)	Peak Month (gallons)	Peak Day (gallons)
Arbors	739 Brewster Rd.	Well 9	4	490 gpm 266 ft	Variable speed		5	95	1,240,429	3,398	3,115,000	103,833
Forby	360 Forby Rd.	Wells 1, 5 & 10	2	80 gpm 155 ft	Variable speed		20	61	1,352,789	3,706	1,891,000	63,033
Legends	503 Vista Hills Ct.	Well 6	2	1,000 gpm 280 ft	Variable speed	1	12	112	-	-	-	-
Niehoff/Augustine	765 Niehoff Dr.	Wells 1, 5 & 10	3		Variable speed		20	60	918,579	2,517	1,495,000	49,833
Palisades/Brock	109 Brock Rd.	Wells 1, 5 & 11	2	75 gpm 263.7 ft	Variable speed	1	20	108	-	-	-	-
Large Viola	687 Viola Ln.	Well 8	2	600 gpm 158 ft	Variable speed		12	62	-	-	-	-
Small Viola	687 Viola Ln.	Wells 1, 5 & 10	2		Variable speed		10	110	2,339,000	6,408	6,108,000	203,600
Emerald View	4589 Emerald View Ct.		2	96.4 gpm 144 ft	Variable speed		45	108	670,200	1,836	670,200	22,340

Section 4. MODEL DEMAND

A skeleton model was created of the City's water distribution system in the WaterGEMS hydraulic modeling software by Bentley Systems to analyze pressure zones and varying scenarios. Data provided by the City was used to draw the water system. Tank dimensions, pump curves and elevations were required to help analyze the system and properly run the model. The maps provided in this report are images from the water model. No large users were involved in the average customer demand analysis, only the 10,000 residents.

To ensure the system could handle water demand for most scenarios, average day, peak day and peak demand over a 24-hour time period were determined and simulated in the water model. Table 4-1 presents a summary of 2017 and 2018 (through October) of the City's average day and peak day water use.

Table 4-1. Water Production Summary

City of Eureka, MO
2017 & 2018 System Water Production
Summary

2017	
Yearly Total (gpd)	619,337,838
Average (gpd)	1,696,816
Peak Day (gpd)	3,549,000
Peak Date	July 13, 2017
Peak Day Over 24 hrs (gpm)	2,465
Peak to Avg. Day Ratio	2.09

2018*	
Yearly Total (gpd)	552,307,000
Average (gpd)	1,816,799
Peak Day (gpd)	3,680,000
Peak Date	July 26, 2018
Peak Day Over 24 hrs (gpm)	2,556
Peak to Avg. Day Ratio	2.03
*Jan.-Oct. Data Only	

Table 4-2 shows total gallons produced for each month during the year 2017. A daily average was estimated by taking the year's total divided by 365 (days) and divided again to find average gallons per minute. These values were then divided by the number of nodes in the water model to simulate demand throughout the system.

Table 4-2. Average Water Demand Per Node Analysis

City of Eureka Average Water Demand Analysis	
Month	Water Produced (Gallons)
January 2017	40,076,000
February 2017	34,512,000
March 2017	36,983,000
April 2017	37,984,000
May 2017	49,576,000
June 2017	69,018,000
July 2017	86,534,000
August 2017	74,206,000
September 2017	65,359,000
October 2017	52,890,000
November 2017	36,025,000
December 2017	36,175,000
Total	619,338,000
Number of Water District System Nodes	520
Average Daily Water Produced (GPD)	1,696,816
Average Water Produced (GPM)	1,178.3
Single Average Water Demand Per Node (GPD)	3,263
Model Input - Single Average Water Demand Per Node (GPM)	2.266

Table 4-3 summarizes the factors for each demand scenario used in the water model. The peak month factor was calculated by dividing peak month well production by average month well production, and the peak day factor was determined by multiplying the peak month factor by 1.25; a common factor. Then, the peak hour factor was determined by further multiplying the peak day factor by 1.5, a common diurnal pattern factor. These factors allowed us to see how the model functions on an average demand day compared to a peak demand day, and what changes may be needed to accommodate demand.

Table 4-3. Hydraulic Model Node Summary

City of Eureka

Demand Scenario	Factor	Demand Per Node (GPM)
Average	1.00	2.266
Peak Month	1.68	3.807
Peak Day	2.10	4.759
Peak Hour	3.15	7.138

Section 5. RECOMMENDED IMPROVEMENTS

5.1. Recommended Improvements Descriptions

This analysis assumes that all tanks, wells, pumps and pipes present are in good working condition. Any addition of pipe is for the purpose of achieving desired pressure values as needed if an outside water source were to be introduced. For Scenarios 1 and 2, an extended period simulation was conducted. To mimic extreme conditions, the peak value of the peak month was used and multiplied by 1.25.

5.1.1. Scenario 1

An outside source coming in from the East provided by Missouri American to connect to a new trunk line that runs along I-44. In addition, constructing a new 12" line bored under I-44. The distribution system is all connected, some valves would have to be opened and some valves would have to be closed to help maintain the required pressures for the varying zones. A map of the proposed scenario is in Appendix D.

5.1.2. Scenario 2

An outside source coming in from the South provided by Jefferson County Public Sewer District to connect to a new trunk line that runs along Highway 109. In addition, constructing a new 12" line bored under I-44. The distribution system is all connected, some valves would have to be opened and some valves would have to be closed to help maintain the required pressures for the varying zones. A map of the proposed scenario is in Appendix E.

5.1.3. Scenario 3

This scenario includes upgrading treatment methods at existing wells along with additional improvements instead of bringing water in from an outside source. One option evaluated would be taking Well 6 off-line and use the other 5 wells to fill the Legends tank. Well 9 currently has the best finished water quality and lowest current usage. The existing system is adequate to supply demand, however, to maximize utilization of Well 9 into the system a check valve or other yard piping modifications may need to be installed at the Arbors plant site. For the short term, the existing crossing is adequate to supply demand. A map of the proposed scenario is in Appendix F.

5.2. Estimated Cost for Recommended Improvements

Opinions of estimated project cost have been developed for each scenario 1, scenario 2 and scenario 3. These opinions are based on the following:

- Approximation of pipe needed to be upgraded or newly installed determined by water modeling software to achieve desirable results.
- Average price per quantity of the varying sizes of pipe to be upgraded or installed.

Each scenario is summarized in Table 5-1 and details are included in Appendix G.

Total project costs and construction costs provided herein are made on the basis of Engineer's experience and qualifications and represent the engineer's best judgment. The Engineer cannot and does not guarantee that bids or actual total project or construction costs will not vary from the estimate of the preliminary cost opinion. This estimate is intended to assist in budgetary assessment and does not guarantee that actual project costs will not exceed or be lower than the amounts stated in this opinion.

Table 5-1. Overall Distribution Project Cost Summary

Scenario	Overall Distribution Project Estimate
1	$3,000,000
2	$1,670,000
3	$210,000

APPENDIX A

EXISTING DISTRICT FACILITIES MAP