Exhibit No.:	
Issues:	Capital Investment Program, Description of Plant Additions, Risks of Furnishing Public Water and Sewer Service
Witness:	Bruce W. Aiton
Exhibit Type:	Direct
Sponsoring Party:	Missouri-American Water Company
Case No.:	WR-2017-0285 SR-2017-0285
Date:	June 30, 2017

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. WR-2017-0285
CASE NO. SR-2017-0286

DIRECT TESTIMONY

OF

BRUCE W. AITON

ON BEHALF OF

MISSOURI-AMERICAN WATER COMPANY

DIRECT TESTIMONY
BRUCE W. AITON
MISSOURI-AMERICAN WATER COMPANY
CASE NO. WR-2017-0285
CASE NO. SR-2017-0286

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BEFORE THE PUBLIC SERVICE COMMISSION

OF THE STATE OF MISSOURI

IN THE MATTER OF MISSOURI-AMERICAN WATER COMPANY FOR AUTHORITY TO FILE TARIFFS REFLECTING INCREASED RATES FOR WATER AND SEWER SERVICE	)))))	**CASE NO. WR-2017-0285** **CASE NO. SR-2017-0286**

AFFIDAVIT OF BRUCE W. AITON

Bruce W. Aiton, being first duly sworn, deposes and says that he is the witness who sponsors the accompanying testimony entitled "Direct Testimony of Bruce W. Aiton"; that said testimony and schedules were prepared by him and/or under his direction and supervision; that if inquiries were made as to the facts in said testimony and schedules, he would respond as therein set forth; and that the aforesaid testimony and schedules are true and correct to the best of his knowledge.

Bruce W. Aiton

State of Missouri
County of St. Louis
SUBSCRIBED and sworn to
Before me this 6th **day of** June **2017.**

Mary Beth Hercules
Notary Public

My commission expires:

MARY BETH HERCULES
Notary Public - Notary Seal
STATE OF MISSOURI
St. Louis County
My Commission Expires April 26, 2020
Commission # 96546828

DIRECT TESTIMONY

BRUCE W. AITON

I. INTRODUCTION

Q. Please state your name and business address.

A. My name is Bruce Aiton, and my business address is 727 Craig Rd., 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 Director of Engineering.

Q. Please describe your educational background and work experience.

A. I received a Bachelor of Science degree in civil engineering from California State University Sacramento. I am a registered professional engineer in the state of California. I have over 29 years of experience in the water and sewer design and construction 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 sewer system planning studies and the design and construction administration of treatment plant improvement projects of up to $90 million. I began working for American Water in August of 2009 and became the Director of Engineering for MAWC, in February 2017, the position I currently hold.

Q. Are you a member of any industry or professional organizations?

A. Yes. I am a member of the American Water Works Association and the Water Environment Federation.

Q. What are your current employment responsibilities?

A. I am responsible for managing the planning, design and construction of water and sewer capital investment projects for all of MAWC's systems and facilities, including the development and updating of the statewide Geographic Information System ("GIS") and developer related services. My responsibilities include ensuring MAWC's compliance with state and federal requirements related to the planning for and delivery of the capital investment program; coordinating the procurement of all project design and construction services; providing comprehensive system planning for use in developing system needs and projecting capital spending; and supporting MAWC operations staff in performing plant/system troubleshooting.

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

A. The purpose of my testimony is three-fold. First, I discuss generally MAWC's capital investment planning process and describe MAWC's need for significant capital investment. Second, I describe and support the water and sewer utility plant and equipment that the Company has placed in service or will place in service from February 2016 through May 2019, highlighting significant capital projects for each period. Third, I describe some of the risks associated with: (1) maintaining safe and adequate water quantity and water quality and complying with applicable drinking water and environmental regulations associated with owning and operating facilities for supplying water to the public; (2) complying with all of the environmental

regulations that apply to owning and operating facilities for furnishing sewer service to the public; and (3) the challenges increased climate variability creates for water and sewer utilities. Ms. Buckley's direct testimony discusses why investors' perceptions of such risks should be considered in establishing a reasonable rate of return on equity for the Company in this case.

Q. Are you sponsoring any schedules as part of your direct testimony in this proceeding?

A. Yes. I am sponsoring the following: Strategic Capital Expenditure Plan ("SCEP") for 2018 through 2022. The SCEP also includes 2017 data for recurring projects and larger investment projects where a portion of the project may carry over into 2018.

II. MAWC'S CAPITAL INVESTMENT PROGRAM

Q. Please explain the Company's capital investment planning and governance process.

A. The Company uses a standardized Capital Investment Management ("CIM") process to manage all of its capital investments. MAWC conducts planning studies that forecast necessary improvement projects and prioritize those projects within the study area. All capital investment programs and projects are then prioritized within an overall strategic planning process, utilizing drivers associated with various asset investment strategies (such as safety, regulatory compliance, capacity, customer satisfaction, etc.), to formulate a five-year Strategic Capital Expenditure Plan ("SCEP"). More detailed design engineering is conducted, and implementation plans are developed for those projects that are contained in the SCEP. The Company's annual capital construction plan is based upon projects and programs contained in the SCEP. On an annual basis,

main replacement projects are prioritized on a state-wide basis. Numerous factors are considered when determining funding allocations for infrastructure investment, such as current and future service needs, assessments of the physical condition of existing plant, economic and risk factors, performance characteristics, regulatory compliance, and the potential to coordinate with municipalities and other utilities in joint improvement projects. The CIM governance process provides for formal approvals and consistent controls that optimize the effectiveness of asset investment. By having a good project planning, budget and ongoing review process, MAWC is able to manage a wide variety of projects within the overall cost of its plant construction budget.

Q. How much capital investment is the Company seeking to recover in this case?

A. The Company has invested or plans to invest $492.6 million in its water and sewer facilities since its last rate case. The level of investment sought in this case is significantly higher than in past cases. We are seeking a future test year that reaches out to mid-2019, which is approximately 18 months beyond the traditional Missouri-American historical test year/true up period. Of the total $492.6 million investment, over half, approximately $250 million, would not be part of this rate case under Missouri-American's historical test year and true up period.

Q. Does this mean that customers are disadvantaged by the use of the future test year?

A. No, not at all. The future test year investment will actually be used, useful and serving customers during the first year that the rates become effective. Furthermore, as I discuss later in my testimony, rate recovery on a significant part the investment that would have been collected through the ISRS process, will, instead be collected in base

rates under the future test year and will not be collected through the ISRS. With the approval of a future test year, the ISRS will not resume until the conclusion of the first year of new rates.

III. DESCRIPTION OF PLANT ADDITIONS

Q. Please describe MAWC's plant additions.

A. The projects that comprise the Company's plant additions in this case vary from what may be characterized as small, routine, recurring, projects, such as the installation of individual distribution mains and services and hydrants, to substantially larger discrete projects, such as the Platte County (Parkville) water treatment plant ("WTP"); safety and reliability upgrades at water production facilities; emergency power generation equipment; water storage tank projects; and system acquisition improvements, which I discuss, along with other projects, below.

Q. What is amount of MAWC's planned investment in this case is for the replacement of water and sewer distribution and collection mains and services?

A. MAWC plant additions in this case include approximately $247 million for water and sewer infrastructure replacement for pipes that are near the end of their useful lives. From the perspective of long-term sustainable customer service and water rates, replacing pipes that are near the end of their useful life in a systematic responsible manner will result in lower costs to customers over time as compared with deferring needed replacements and addressing problems, such as leaks and main breaks, as they arise. Planned pipe replacements are much less costly on a unit cost basis than the costs of increasing pipe breaks, service disruptions, property damages, health risks from

potential drinking water contamination exposure during pipe breaks, related community opportunity costs related to community health and economic development, and the steep increase in future pipe replacements resulting from prior deferrals of the replacements.

Q. Will the main replacement projects have any impact on operation and maintenance costs?

A.. In the absence of main replacement, the number of main breaks and associated repair costs will increase and operation and maintenance O&M costs will increase accordingly. As MAWC has increased spending on main replacements, the trend in annual number of main breaks has decreased. While weather, system demands and pumping pressure, and other factors can contribute to main breaks, the age of the mains is typically a common factor. The main replacement program will help to mitigate the increase in breaks the Company would otherwise expect as the mains continue to age and deteriorate.

Q. What amount of MAWC's plant additions in this case would be eligible for recovery through the ISRS outside of this rate case?

A. Over $100 million of water and sewer infrastructure replacement investment between January 2018 and May 2019 would be eligible for recovery through the Infrastructure System Replacement Surcharge ("ISRS") outside of this rate case. The future test year simply takes into account investment that will be made, and avoids recovering the associated cost through ISRS. As I noted, with the approval of a future test year in this case, the Company will not seek ISRS eligible plant recovery until after the future test year.

Q. How are you presenting MAWC's plant additions in your testimony?

A. Plant additions included in this case are separated into two groups for discussion purposes. The first includes plant investment from February 2016 through the current test year (12 months ending May 31, 2018). The second includes investment during the future test year (12 months ending May 31, 2019).

A. MAWC Plant Additions through Current Test Year

Q. Please summarize total plant additions for MAWC through the current test year.

A. MAWC invested approximately $68 million in its water and sewer facilities during the balance of calendar year 2016. MAWC is planning to invest an additional $230.2 million in plant beginning in 2017 through the period ending May 2018. This includes approximately $96 million of ISRS eligible investment, $47 million from January 2016 through June 2017 and another $49 million from July 2017 through May 2018.

The balance of the investment as further described below is the completion of several large projects to ensure adequacy and resiliency of the water and or sewer treatment facilities and additional investment to further enhance its hardware, software platforms and applications, and related systems.

Below is a description of significant projects.

2016

St. Louis Central WTP NPDES (I17-020034) $1,566,647

The St. Louis Central WTP needed to modify their filter and waste discharge handling in order to comply with new regulations related to lime discharge into the Missouri

River. A dilution method and pH adjustment capacity were added to the treatment process prior to discharge into the Missouri River.

St. Louis Central WTP Electric Station Replacement (I17-020072) $1,354,950

The St. Louis Central WTP Electric Station was the primary pumping station to provide water and pressure into a large portion of the St. Louis County distribution systems. The pumps and electrical components were beyond their useful life. A new structure was constructed, along with a new discharge and intake pipe. New electrical control and supply panels were also installed along with new pumps and a variable frequency drive ("VFD"). This project ensures continued reliability of our pumping capacity and capability and improves energy efficiency.

2017 through May 2018

St Louis Central WTP Generators Phase 1 (I17-020110) $13,800,000

The St. Louis Central WTP is the largest plant in the state. The loss of power in the fall of 2016 that resulted in a "boil water" advisory for approximately 90,000 customers demonstrates the need for emergency generators to ensure power is available to treat water and supply system pressure, thereby providing reliable service to our customers. It is bad enough when customers are without electricity, but the loss of potable water at the same time is an added burden. We are working hard to ensure and improve our reliability. MAWC is installing a quantity of four, 3 megawatt generators and accompanying electrical controls and switch gear, which will allow it to supply average day demand in the event of a power outage.

Meramec River Crossing (I17-020116) $3,700,000

Flooding of the Meramec River during December of 2015 eroded the embankment, exposing a previously buried 16-inch pipe that crossed the river. The exposure of the pipe poses a risk to the reliability of the system. MAWC is undertaking a project to relocate the pipe to a deeper location by drilling through the bedrock below the river bottom to prevent damage to the pipe and to protect this area of the system in the future. The project will be complete in the fall of 2017 and, therefore, is not reflected in the attached 2018-2022 SCEP.

Replace Platte County (Parkville) WTP (I17-040003) $30,300,000

The Platte County WTP was established in the late 1800's and is well past its useful life. The Company discussed the need to replace the treatment plant in the last rate filing and has now begun the construction of a new plant to serve the community. The new plant is slightly larger (5MGD v the existing 3.5MGD) to accommodate anticipated growth in the community. The Company is aware of a 700 residential home development currently being constructed in the area served by this plant.

Jefferson City-WTP Improvement Project (I17-120002) $9,700,000

The Jefferson City WTP has needed a significant upgrade for many years. The project replaces a lime system originally installed in 1963 that is beyond its useful life and in poor condition. The upgrade will enhance the plant's ability to treat the variability of the influent from the river, resulting in improved and more consistent water quality. The project also adds a pre-sedimentation basin that adds a level of redundancy and improves the reliability of the plant.

St. Louis Advanced Metering Infrastructure ("AMI") (RP-17-J) $13,700,000

MAWC has begun to add AMI to the system in St. Louis County. The AMI radio antennae are added to existing meters or incorporated into new meters replaced due to length of service timing. The primary drivers for deploying AMI in St. Louis County are to increase meter reading efficiencies and effectiveness and to transition our customers from quarterly to monthly billing. The operational and customer benefits of AMI are further described in the direct testimony by Company Witness Clarkson.

Technology and Innovation ("T&I") Investments (RP-17-K) $16,400,000

The T&I investments include upgrades and enhancements to our foundational technology, as well as new technology that integrates with existing systems that the Company can leverage to enhance its service to customers. Some examples include upgrading customer service infrastructure to make customer information more easily accessible in the field to better serve our customers and enhancing our GIS platform.

B. MAWC Future Test Year Plant Additions

Q. Please describe the significant capital projects planned for completion during the future test year.

A. MAWC is planning to invest an additional $194 million in plant during the twelve months ending May 31, 2019. This investment includes buried infrastructure replacement, several large projects to ensure adequacy and resiliency of the water and/or sewer treatment facilities, and additional investment to further enhance its hardware, software platforms and applications, and related systems.

The significant capital projects planned for completion during the future test year are

as follows:

St. Louis Central WTP Settling Basin Concrete Replacement (I17-020136) $1,000,000

The St. Louis Central WTP has large settling basins where the solids from the lime softening process are allowed to settle. The concrete liner of these basins has large holes and breaks in the concrete. The liner has developed large voids behind the liner and results in loss of water through absorption into the soil. Replacement of the liner will support more effective operation of the plant and avoid potential contamination of the water.

St. Louis Central WTP Electric Feed "A" Switchgear (I17-020134) $2,000,000

The plant has two parallel feeds that allows the Company to switch feeds in the event of a disruption in service with one of the feeds. While the switchgear for Feed "B" was recently replaced, the electrical switchgear for Feed "A" was installed over fifty years ago. We plan to replace it to maintain a safe work place and to help ensure uninterrupted power supply to the plant.

St Louis North WTP West Basin Secondary Flocculation (I17-020143) $3,500,000

The North WTP West Basin was installed in 1955. While the equipment has been maintained, the flocculation equipment is beyond its' useful life and in need of replacement. Replacing the electrical, mechanical and controls equipment will improve the reliability and effectiveness of the flocculation process, and the resulting water quality.

St Louis North WTP East Intake Switchgear (I17-020097) $2,500,000

The switchgear at the North WTP East Intake is being replaced to ensure safe and

reliable service. The switchgear is aged causing parts to no longer be available and puts employees at risk in the event that panels need to be opened. If the switchgear fails the plant may be without water which could result in limited service for customers.

St Louis Distribution - Stratman #2 Tank Roof Replacement (I17-020149) $2,550,000
Stratman #2 is one of two eleven million gallon tanks within our distribution system in St. Louis county. The structural members supporting the roof have become corroded over the years and the roof structure needs to be replaced to ensure the tank continues to be available to serve customers within that area.

St. Joseph - River Crossing to Elwood (I17-030013) $6,800,000
There is only one pipe line crossing the Missouri River to feed the small community of Elwood, MO. In recent years the pipe feeding this area of the state has become exposed by the waters of the Missouri River. The existing pipe is intended to remain in service with the new pipe providing redundancy and mitigating the risk of service interruption if the existing exposed pipe were to fail.

Warrensburg - Cayhill Loop Main Enterprise to Hwy 13 (I17-060002) $1,200,000
The project is to install pipe to improve hydraulic performance to a western part of the system. The project will improve pressure and capacity within the system.

Warrensburg - Ozone Generator Replacement (I17-060002) $1,800,000
The well water supplying Warrensburg has taste and odor issues requiring ozonation of the water as part of the treatment process. Without ozone generators, customers in Warrensburg would experience taste and odor issues, diminishing the aesthetic quality

of the water service they currently receive from the Company.

Jefferson City WTP Improvements (I17-120002) $2,150,000

Several key components of the Jefferson City WTP are beyond their useful lives and need to be replaced. This project will replace the clarifier in Basin 2, replace the flocculation drive equipment and several valves in the pipe gallery. The project will improve the reliability and efficiency of the plant.

Hickory Hills Sewer Treatment Plant (I17-440001) $1,500,000

Hickory Hills is a small community near California, MO that MAWC acquired at the request of the State. The lagoon waste treatment facility is located in a flood area and has had spills into the creek during high rain events. This project will replace the existing lagoon with a facility no longer susceptible to high rain events and thereby protect the environment and public.

Maplewood Lagoon - Ammonia Limits (I17-260002) $2,150,000

As discussed below the change in effluent limits has resulted in many of the small lagoon systems owned by MAWC to be challenged to meet the new lower discharge limits. This project is the replacement of an existing lagoon system with a small packaged sewer treatment plant to enable the plant to consistently meet the discharge limits requirements.

T&I Investments (RP-17-K) $8,600,000

The T&I investments include upgrades and enhancements to our foundational technology, as well as new technology that integrates with existing systems that the

Company can leverage to enhance its service to customers. Some examples include enhancing customer service applications and systems, leveraging technology for field operations, and implementing meter data management.

St. Louis AMI (RP-17-J) $9,500,000

MAWC is continuing AMI implementation in St. Louis County through the future test year.

Joplin-Raise Fourth Street Tank (I17-110016) $1,000,000

This project will raise the base elevation level of the Fourth Street tank located in our Joplin system. The area around the Fourth Street Tank has experienced some pressure issues and raising the existing tank is the most efficient way to add pressure to that portion of the system.

Emerald Point Well and Tank Project (I17-340001) $1,500,000

This project is the installation of a new well and storage tank in the Emerald Point area of Table Rock Lake. The existing well is undersized and as a single well does not provide the community with adequate redundancy for a reliable supply.

Little Muddy Interceptor (I17-400003) $2,305,200

Portions of the Arnold sewer collection system are at or near capacity and experience high infiltration and inflow (I&I). This project upsizes and replaces approximately 4500 ft of the existing interceptor pipe in the collection system, mitigating the potential for overflow or back up events.

IV. RISKS OF FURNISHING PUBLIC WATER AND SEWER SERVICE

A. Public Water Service

Q. Please provide an overview of the risks associated with furnishing safe and adequate water quantity and water quality and complying with drinking water and environmental regulations that apply to MAWC's water supply facilities and operations.

A. Water supply utilities are subject to a complex array of regulations at the federal, state and local levels with respect to water quantity, water quality and other environmental aspects of their facilities and operations. MAWC's surface water and groundwater sources are subject to run off from upstream sources that can lead to possible contamination and resulting treatment challenges like cryptosporidium or an unexpected chemical release upstream. All while needing to meet the requirements imposed by programs administered by the Missouri Department of Natural Resources ("DNR").

Drinking water quality is addressed by a combination of federal regulation established under the Safe Drinking Water Act of 1973 coupled with state regulation under the Missouri Safe Drinking Water Act codified at Chapter 640 of the Missouri Revised Statutes. The federal act established the EPA as the federal regulatory authority on drinking water. Under that authority, EPA has created standards for contaminant levels in drinking water and a series of mandatory treatment method standards, coupled with monitoring and reporting requirements, and public notification mandates in the event of contaminant level or treatment method noncompliance. The EPA has granted

primacy to the Missouri DNR Division of Environmental Quality, which administers the federal regulatory standards, as found in Title 10, Division 60 of the Code of State Regulations. In recent years there has been an increase in public concern over water quality standards and regulation. This increase has led to growth and increased stringency in EPA and state drinking water research and regulation.

The following is a brief summary of some of the key risk issues associated with current and prospective regulation of water quantity, quality and other environmental aspects of water supply system operations:

As the result of conditions that arose in Flint, Michigan and other jurisdictions across the country, increased scrutiny is being placed at all levels concerning lead concentrations in water systems and potential adoption of more stringent requirements under the federal "Lead and Copper Rule." The lead issue typically arises not from constituents in source water, but rather from the leaching of lead from older pipes and joints into the water as it passes through household service lines and plumbing. While providing centralized treatment that adjusts the pH can, in many cases, help minimize lead corrosion, the fact is that the plumbing in many older communities (such as those throughout much of MAWC's service territory) are older lead pipes or contain the type of copper and galvanized pipes with solder joints where lead contamination is an increased risk.

In anticipation of Long Term Revisions to the Lead and Copper Rule, the EPA released in October 2016, a whitepaper that provides examples of regulatory options to improve the existing rule. The EPA's Lead and Copper Rule Revisions White Paper contains a

series of alternatives, including mandates that water systems establish lead service line replacement programs (i.e., programs to replace customer lines from the utility's mains into the house), requiring efforts to proactively work with customers to "encourage them to share appropriately in fully removing [lead service lines] …." EPA acknowledges the "substantial economic, legal, technical, and environmental justice challenges" presented by this proposal. The white paper also examines options for more stringent corrosion control treatment requirements. Many of the options in the white paper, if adopted, could impose significant additional capital investment requirements and increased operating expenses on all water systems.

EPA has continued to make its regulations concerning disinfection byproducts more stringent. Disinfection byproducts are produced by the interaction of disinfection agents (such as chlorine) with constituents (such as organic compounds) that naturally occur in source water. The Stage 2 Disinfectants and Disinfection Byproducts Rule ("Stage 2 DBPR") adopted in 2006, coupled with increasingly stringent disinfection regulations, requires a very careful balancing of treatment processes and source water monitoring to meet the twin goals of killing microbes (such as giardia and E. coli) while avoiding unacceptable concentrations of disinfection byproducts such as Chlorite, Bromate, Trihalomethanes, and Halogenic acetic acids.

B. Public Sewer Service

Q. Please provide an overview of the risks that environmental regulation pose for MAWC as the owner and operator of public sewer systems.

A. Like the provision of public water supply service, the operation of sewer collection and

treatment systems entails a range of environmental regulatory risks. Sewer operations are also regulated at both the federal and state levels pursuant to a number of statutes and voluminous regulations. At the federal level, sewer systems are regulated pursuant to the Clean Water Act and numerous regulations adopted by the EPA under that law, which programs are administered by various divisions of the Missouri DNR pursuant to regulations adopted in furtherance of setting standards for the construction and operation of sewer treatment systems. In recent years, the Missouri DNR has reclassified 90,000 miles of previously unclassified streams to the existing 25,000 miles for a total of 115,000 miles and added 2,120 lakes and reservoirs to the list of covered waterways. These classification changes significantly broaden the areas that sewer treatment facilities must now consider for purposes of complying with the Missouri DNR's discharge regulations, thereby, requiring significant changes in the treatment process which requires additional investment.

The significant risks associated with operating sewer systems include the following:

Effluent limitations imposed on sewer treatment plant ("STP") discharges are stringent and can become more stringent over time. The Clean Water Act requires sewer systems to obtain and comply with National Pollutant Discharge Elimination System ("NPDES") permits, which, in Missouri, are issued by the Water Pollution Control Branch of the Missouri Clean Water Commission. NPDES permits establish stringent effluent limits based upon the stricter of: (1) technology-based effluent limits; and (2) water quality based effluent limits.

As just one example, the NPDES permit issued for Cedar Hills STP system sets more stringent effluent limits for a series of parameters, particularly lowering ammonia limits

due to changes in classification of the receiving stream.

Thus, more stringent effluent limits may be imposed when technology evolves or stream conditions and discharge requirements change, engendering requirements for significant capital improvements and/or increased operating costs for enhanced treatment performance. Every 3-5 years, NPDES permits are up for renewal, and in any such renewal, more stringent limits may be triggered.

Other potential liability risks from sewer system operations arise from backups, overflows or releases that may occur from the collection system onto private property or into the environment. As an example, some sewer system operators have been confronted with claims under the federal Comprehensive Environmental Response, Compensation and Liability Act ("CERCLA") for cleanup of contamination that occurred when sewer containing "hazardous substances" leaked from sewer lines into soils or groundwater. While not as extreme, liabilities resulting from sewer backups into buildings or other unplanned discharges are an inherent part of sewer system risks.

C. Challenges of Climate Variability

Q. Does climate variability pose additional risks for water supply and sewer system utilities such as MAWC?

A. Yes. Whatever the debate may be concerning the causes of climate variability, water supply and sewer utilities face the reality of climatic variability and attendant stresses on water resources. Although climate models for the Midwestern U.S. generally predict overall annual precipitation amounts to remain similar to average historical experience, increasingly intense storms and repeated, extended dry periods are anticipated. That

means we can expect more droughts of varying degrees of severity and more frequent and intense high-flow events and floods – which impact water and sewer utilities.

Water supply systems are fundamentally resource-dependent and, therefore, the effects of climate variability pose a significant on-going risk and create challenges with regard to maintaining a reliable water supply during the full range of potential future conditions, including even what might be assumed to be "normal" periods. The safe yields of water supply sources have historically been evaluated based on historical climatic patterns, data from so called "droughts of record" or dry period frequency analysis. However, changing climatic conditions suggest that historical hydrologic data (which in many cases only reflect 50-100 years of rainfall and stream flow measurement collection – a quite short period in geologic or climatic time) may not accurately predict future conditions. Thus, the calculated safe yield of streams, reservoirs and groundwater wells are put in question as the effects of climate variability are experienced across northeastern United States. Thus, in response to climate variability, water supply systems must address the risks posed to the reliability and resilience of their sources. While droughts are the major challenge for water supply systems, heavy precipitation and high-flow events are the concern of both water and sewer systems. As mentioned previously, sewer systems of all types are impacted by storm water – directly in the case of combined sewer systems and indirectly (but nevertheless significantly) by I&I in "sanitary only" systems. The prediction of increased intensity of strong storms and high rainfall events in the Midwestern United States portends challenges to sewer systems which must in turn cope with and treat higher peak flows while avoiding exceedance of effluent limitations and reducing the

potential for untreated overflows.

Q. Does this conclude your direct testimony?

A. Yes, it does.