Exhibit No.:		
Issues:	Residential Usage/Customer Fixture Specifications Future Declining Use Declining Use Impact on Revenue	
Witness:		Gregory P. Roach
Exhibit Type:		Direct
Sponsoring Party:		Missouri-American Water Company
Case No.:		WR-2015-0301 SR-2015-0302
Date:		July 31, 2015

MISSOURI PUBLIC SERVICE COMMISSION

CASE NO. WR-2015-0301
CASE NO. SR-2015-0302

DIRECT TESTIMONY

OF

GREGORY P. ROACH

ON BEHALF OF

MISSOURI-AMERICAN WATER COMPANY

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-2015-0301 CASE NO. SR-2015-0302**

AFFIDAVIT OF GREGORY P. ROACH

Gregory P. Roach, being first duly sworn, deposes and says that he is the witness who sponsors the accompanying testimony entitled "Direct Testimony of Gregory P. Roach"; 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.

Gregory P. Roach

Gregory P. Roach

State of Indiana
County of Johnson
SUBSCRIBED and sworn to
Before me this 20th **day of** July **2015.**

Dakota M Rose

Notary Public

My commission expires: May 19, 2022

DAKOTA M. ROSE
Notary Public, State of Indiana
Johnson County
Commission # 653738
My Commission Expires
May 19, 2022

DIRECT TESTIMONY
GREGORY P. ROACH
MISSOURI-AMERICAN WATER COMPANY
CASE NO. WR-2015-0301

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DIRECT TESTIMONY

GREGORY P. ROACH

I. INTRODUCTION

Q. PLEASE STATE YOUR NAME AND BUSINESS ADDRESS.

A. My name is Gregory P. Roach. My business address is 555 E. County Line Road, Suite 201, Greenwood, IN 46143.

Q. BY WHOM ARE YOU EMPLOYED?

A. I am employed by the American Water Works Service Company, Inc. ("Service Company") as the Manager of Revenue Analytics. My responsibilities include leading the Revenue Analytics group, whose main area of focus is the analysis and forecasting of system delivery, customer usage and revenue for the Service Company affiliates, including the Missouri-American Water Company ("MAWC").

Q. WHAT IS THE PURPOSE OF YOUR TESTIMONY IN THIS PROCEEDING?

A. The purpose of my testimony is to support and validate the significant and continuing trend of declining water usage by MAWC's residential customers.

Q. COULD YOU PLEASE DESCRIBE YOUR BUSINESS EXPERIENCE IN THE UTILITY INDUSTRY?

A. I have over 25 years of experience working in the electric, gas and water utility sectors as both consultant and utility employee. I began my career with Public Service Indiana ("PSI" now Duke Energy) in January of 1980, where my responsibilities were focused on transforming PSI's load forecasting processes from time series to econometric based models. In May of 1982, I accepted the position of Senior Economist with the management consulting firm of R. W. Beck and Associates ("Beck") (now part of Science Applications International Corporation, "SAIC"). I received numerous promotions through my career with Beck to the eventual position of Principal Economist. During the course of my career at Beck, I was responsible for the management of all rates/regulatory, load forecasting and financing feasibility client engagements managed by the Indianapolis office. As such, I delivered testimony on behalf of agency, municipal and co-op clients throughout the United States related to cost of service, rate design, load forecasting, system planning, electric and gas production plant economic feasibility, revenue requirement pro-forma adjustments, production cost optimization and cost of capital to state regulatory commissions and the Federal Energy Regulatory Commission. In May of 1991, I took the position of Principal Economist with the regulatory management consulting firm of SVBK Consulting Group ("SVBK"). In that position I was responsible for all consulting engagements executed from the Indianapolis regional office on behalf of SVBK's national utility clients. In addition to the regulatory matters to which I testified while at SVBK, I offered testimony related to merger & acquisition cost reductions/synergies, large power pool generation and transmission dispatch strategies, power pool generation/transmission pricing schemes, price elasticity sales adjustments and retail rate impact of specific power/transmission pooling cost minimization arrangements and payments. In July 1993, I became owner and president of a retail operations holding company with three franchise store outlets. In that position I was responsible for all management, operation, sales and financial functions of the firm. In November 1998, I sold the retail holding company to begin operations of the Roach Consulting Group, Ltd as Principal Consultant. In that position, I advised industrial and utility clients related to business intelligence systems, enterprise/manufacturing resource planning systems, customer information systems as well as general accounting systems. I also appeared as an expert witness providing testimony related to economic and punitive damages in personal injury and wrongful death legal proceedings. In July 2011, I joined the Service Company as Manager of Rates and Regulation, supporting Indiana-American Water and Michigan-American Water Company. In August of 2014, I accepted the position of Manager of Revenue Analytics with the Service Company were I provide analytical support to all the American Water affiliated companies.

Q. PLEASE DESCRIBE YOUR EDUCATIONAL BACKGROUND.

A. I graduated from Indiana University in 1980 with a Bachelor of Arts degree in Economics and Political Science. I graduated from Butler University in 1982 with a Master's Degree in Economics.

Q. HAVE YOU PREVIOUSLY TESTIFIED BEFORE THE MISSOURI PUBLIC SERVICE COMMISSION, OTHER REGULATORY AGENCIES, OR CIVIL COURTS RELATED TO UTILITY MATTERS?

A. This is my first opportunity to testify before this Commission. I have testified in numerous regulatory proceedings before the Indiana Utility Regulatory Commission, the Public Utilities

Commission of Ohio, the Public Service Commission of West Virginia, the Public Service Commission of Louisiana, Council of the City of New Orleans, the Public Utility Commission of Texas, the Arkansas Public Service Commission, the Common Pleas Court of Ohio, and the Federal Energy Regulatory Commission.

III. MAWC RESIDENTIAL CUSTOMER DECLINING WATER USE

Q. PLEASE DESCRIBE THE WATER USE TREND OF MAWC'S RESIDENTIAL CUSTOMERS?

A. There is a continuing annual decline of water use across all MAWC districts, ranging from 508 gallons per customer per year (gpcy) in the St. Joseph district to 1,424 gpcy in the Brunswick district. In the Company's largest district, St. Louis County, the rate of decline is 1,137 gpcy, or approximately 3.1 gallons per customer per day (gpcd).

Q. WHAT DO YOU BELIEVE IS THE CAUSE OF THIS DECLINE?

A. This decline can be attributed to several key factors, including but not limited to: increasing prevalence of low flow (water efficient) plumbing fixtures and appliances within residential households, conservation efforts of the customers, conservation programs implemented by the federal government, state government, MAWC and other entities, and price elasticity.

Q. PLEASE EXPLAIN WHAT YOU MEAN BY THE PREVALENCE OF LOW FLOW FIXTURES AND APPLIANCES.

A. Plumbing fixtures such as toilets, showerheads, and faucets available to consumers today are more water efficient than they were in the past. Similarly, appliances such as dishwashers and washing machines are also more water efficient. When a customer replaces an older toilet, washing machine, or dishwasher with a new unit, the new unit will likely use less water than the one it replaced. When new homes are built, they include water efficient fixtures, and every time a customer remodels or installs new appliances in his or her kitchen, bathroom or laundry room, he or she will consume less water in the future.

Q. HOW MUCH WATER DO THE NEW FIXTURES AND APPLIANCES SAVE?

A. The Energy Policy and Conservation Act of 1992 and 2005 ("EPAct92" and "EPAct05" respectively) mandated the manufacture of water efficient toilets, showerheads and faucet fixtures. For example, a toilet manufactured after 1994 uses 1.6 gallons per flush, compared to a pre-1994 toilet which uses 3.5 to 7 gallons per flush. In fact, toilets using only 1.28 gallons per flush or less are now becoming more prevalent in the marketplace. Replacing an old toilet with a new one can save from 2 to nearly 6 gallons per flush. The potential scope of replacing these fixtures is significant as the United States Environmental Protection Agency ("USEPA") estimates that there are more than 220 million toilets in the U.S.,[1] and that approximately 10 million new toilets are sold each year for installation in new homes and businesses or replacement of aging fixtures in existing homes and businesses.[2]

The Energy Independence & Security Act of 2007 (Public Law 110–140) ("EISA") will further reduce indoor water consumption. EISA established stringent efficiency standards for dishwashers and clothes washers. Dishwashers manufactured after 2009 and clothes washers manufactured after 2010 must use 54% and 30% less water, respectively. All other factors being equal, a typical residential household in a new home constructed in 2015, with

[1] US EPA, Water Sense Tank-Type High-Efficiency Toilet Specification Supporting Statement, February 9, 2007.

[2] D&R International, Plumbing Fixtures Market Overview: Water Savings Potential for Residential and Commercial Toilet and Urinals, September 30, 2005.

water efficient toilets, clothes washers, dishwashers and other fixtures, would use approximately 35% less water for indoor purposes than a non-retrofitted home built prior to 1994. Schedule GPR-1, pages 1-3 of 12 provides additional detail about the expected impact of water efficiency measures on residential water consumption.

Q. PLEASE ELABORATE ON SOME OF THE OTHER FACTORS CAUSING THE DECLINE IN RESIDENTIAL CONSUMPTION.

A. Programs to raise customer awareness and interest in the benefits of conserving water and energy continue to increase. For example, WaterSense is a USEPA voluntary partnership programs that seek to protect the future of our water supply by offering people a simple way to use less water with water-efficient products, new homes, and services. EnergyStar is another USEPA voluntary partnership that helps businesses and individuals save money and protect our climate through superior energy efficiency. These programs specifications, as well as others, are detailed in Schedule GPR-1, pages 4-12 of 12. This listing is a reproduction of the Alliance for Water Efficiency Water Products Standard Matrix which was updated in March 2010. In addition, as Missouri-American president Frank Kartmann describes, MAWC offers several programs that encourage customers to use water efficiently. As awareness of water and energy efficiency increases, customers may decide to replace a fixture or appliance even before it has broken. Additionally, customers may further reduce consumption by changing their household water use habits in other various ways. Missouri-American's residential customers in the St. Louis County district have reduced their base usage by approximately 3.5 gallons per customer per day on average. A

3.5 gallon per day decrease can be achieved by subtle changes in customer behavior. For instance, here are some ways a customer can reduce 3.5 gallons per day:

- Taking a shower that is 1 minute shorter per day;
- Two flushes per day with a newer replacement low-flow toilet fixture vs. an older toilet;
- Running the dishwasher 5 times per week instead of 7; or
- Turning off the water for approximately 1 minute while brushing your teeth.

In addition, there is some negative price elasticity that contributes to a reduction in usage as rates increase and usage declines in response to those price increases.

III. MAWC RESIDENTIAL CUSTOMER USAGE TREND ANALYSIS

Q. **PLEASE DESCRIBE THE METHODOLOGY OF YOUR TRENDING ANALYSIS.**

A. An analysis was undertaken of monthly customer consumption by MAWC's residential customers over the past ten years. In order to calculate the usage per customer trend, a three-step calculation was performed. I have attached graphs of the calculations described below. These graphs are attached as Schedules GPR-2, Pages 1-3 of 3.

1) Monthly water sales data were totaled and divided by the number of customers to yield the average usage per customer. For graphing purposes, the time variable in months was plotted on the x-axis, and the consumption per customer variable was plotted on the y-axis. (Note that water sales data lag behind actual consumption by approximately one month for customers on a monthly meter reading cycle). See Schedule GPR-2, Page 1 of 3.

2) Average annual residential consumption, expressed in gallons per customer, was calculated for each year from 2005 through 2014. For each year, a single point, representing the average monthly usage for that year was plotted, see Schedule GPR-2, Page 2 of 3.

3) A "best-fit" linear regression trend line was created using the 10 year annual average usage per residential customer history; see Schedule GPR-2, Page 3 of 3.

Q. WHAT ARE THE RESULTS OF YOUR ANALYSIS?

A. MAWC has experienced a substantial and continuing decline in residential water consumption over the period covered by the historical data set. The regression analysis projects a continuing annual decline of 1,194 gallons per residential customer per year; this is an annual decrease of 1.94% per year, or approximately 3.4 gallons per residential customer per day ("gpcd").

Q. IS WATER USAGE IMPACTED BY WEATHER?

A. Yes. The system level regression analysis that I have conducted trends base usage over time without attempting to normalize for weather. Base usage is defined by the residential average use per customer measured over the period of February through April of each year when there isn't any appreciable outdoor usage of water typically associated with weather related affects. In other words, my methodology studies the trending decline of base usage over time having removed the effects of weather which are captured by the exclusion of non-base usage from the data set and hence my analysis. Knowing that weather can be a factor influencing short-term customer usage patterns, MAWC witness Dunn performed an analysis which averages weather and, in effect, removes weather variations as a factor in predicting future usage.

The results of Mr. Dunn's analysis and mine align very closely. This provides a high degree of confidence that the drivers described earlier in my testimony are the predominant causes of the decline in water consumption by MAWC residential customers. Furthermore, Mr. Dunn's analysis reinforces our conclusion that, under average weather conditions, the water consumption decline is predictable and will continue into the foreseeable future.

Q. **HAVE YOU STUDIED WATER CONSUMPTION TRENDS FOR OTHER AMERICAN WATER SUBSIDIARIES BESIDES MAWC?**

A. Yes.

Q. ARE THE RESULTS OF MR. DUNN'S ANALYSIS CONSISTENT WITH YOUR ANALYSIS IN OTHER STATES?

A. Yes. We have studied the residential consumption patterns for other American Water state operating systems located in climates and geographies similar to Missouri. It has become clear that the trend experienced by MAWC is very similar to the trends being experienced in other states. The results are shown on Schedule GPR-3. The Schedule illustrates that nearby states in the American Water footprint have experienced a decline in residential consumption per customer averaging 2.0% per year over the last 10 years. Clearly the estimated Missouri system wide reduction in residential customer usage per annum of 1.9% falls close to this average. Further, Mr. Dunn's district level analysis indicates reductions in residential usage per customer ranging from -0.96% (St. Joseph) to -3.15% (Brunswick) over the same period of analysis. These rates of decline estimated for certain MO districts by Mr. Dunn appear reasonable and are well within the bounds of the comparable rates of decline for the MAWC system in total and similar states in the American Water footprint.

Q. IS THIS TREND BEING OBSERVED ACROSS THE INDUSTRY, BEYOND MAWC AND OTHER AMERICAN WATER COMPANIES?

A. Yes. According to the 2010 Water Research Foundation ("WRF") report, "many water utilities across the United States and elsewhere are experiencing declining water sales among households." (WRF Report, p. 1)[3] The report further states: "A pervasive decline in household consumption has been determined at the national and regional levels." (WRF Report, p. xxviii).

IV. MAWC CUSTOMER DECLINING WATER USE – FORECASTS

Q. DO YOU EXPECT THE MAWC CUSTOMER DECLINING USAGE TREND TO CONTINUE IN THE FUTURE?

A. Yes. It is clear that water efficient fixtures and other drivers such as conservation education and price elasticity will continue to drive further efficiency into residential usage per customer. In fact, the trend is well established and continues to impact water usage on the MAWC system as well as most water utilities across the United States. The rate of the continued trend is dependent on the pace of fixture replacement within the MAWC service footprint as well as being influenced by the broadening acceptance of a conservation ethic through: raised customer and business awareness programs, government conservation policy and similar behavior modification related programs. Water usage declines when a resident changes from an older, less efficient fixture, to a new, efficient fixture. According to the 2010 American Housing Survey, 90% of homes in the Missouri service area were built prior

[3] Coomes, Paul et al., North America Residential Water Usage Trends Since 1992 – Project #4031. (Water Research Foundation, 2010)

to 1994.[4] These homes were constructed with toilets, washing machines, and dishwashers that are more water-intensive than newer fixtures and appliances now on the market. As turnover of household fixtures and appliances continues to occur over time, residential usage will continue to decline accordingly. The regulations mandating water efficient washing machines and dishwashers are relatively new. Given the life expectancy of appliances, it is likely that the replacement of existing appliances, and the corresponding reduction in water used, will continue to occur over time for the indefinite future.

According to a recent AWWA Journal article, technology is now available for newer, more water efficient products that further improve on Energy Policy Act levels, and now there is a growing movement to codify these more stringent specifications. The recent introduction of progressive code modifications—such as the International Code Council's ("ICC's") International Green Construction Code ("IGCC") and the International Association of Plumbing and Mechanical Officials ("IAPMO") Green Plumbing and Mechanical Code Supplement (2011) support uniform implementation of increased water efficiency standards."[5] AWWA research also indicates that this decline in water consumption will continue. An article in the June 2012 issue of the AWWA Journal entitled "Insights into declining single-family residential water demands" states: "Reduced residential demand is a cornerstone of future urban water resource management. Great

[4] U.S. Census Bureau, Selected Housing Characteristics. 2010 American Community Survey 5-Year Estimates (2006-2010), *http://factfinder2.census.gov/faces/nav/jsf/pages/index.xhtml.

[5] Hoecker, Jay and Bracciano, David. Tampa Bay Water. "Passive Conservation: Codifying the use of Water-Efficiency Technologies" February 2012, Journal AWWA. 104:2.

progress has been made in the last 15 years and the industry appears poised to realize further demand reductions in the future."[6]

The regulations mandating water efficient washing machines and dishwashers are relatively new. Given the life expectancy of appliances, it is likely that the replacement of existing appliances, and the corresponding reduction in water used, will continue to occur over time for the next fifteen years or more.

Q. HAVE THE CUSTOMERS OF MAWC RECEIVED ANY BENEFIT FROM REDUCED WATER USAGE BY RESIDENTIAL CUSTOMERS?

A. Yes. Residential customers share in numerous benefits from reduced usage. There are environmental and operational benefits from lower water usage by residential customers. Reduced usage helps maintain source water supplies. Diversions from supply sources are lessened, leaving more water for passing flows, environmental benefit, or drought reserve. Reductions in power consumption, chemical usage, and waste disposal not only reduce water utility operating costs but also provide environmental benefits such as reduced carbon footprint and waste streams. Furthermore, reduced water usage by residential customers also reduces energy consumption within the customer's home, for instance, through lower hot water heating needs. In addition, on a case-specific basis, reduced water usage has the potential to enable the utility to delay or downsize a capacity addition. In systems where demand is approaching the capacity of water supplies or treatment facilities, the water saved through efficient usage by customers can be a preferred alternative to a supply-side expansion, with a resulting lower cost to customers.

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[6] DeOreo, William and Mayer, Peter. American Water Works Association Journal. Vol. 104. Issue 6. http://apps.awwa.org/WaterLibrary/showabstract.aspx?an=JAW_0076117. June 2012.

Over the long term, reduced usage per residential customer has helped lower operating costs, and has helped avoid some capacity-related needs. These savings and avoided costs have benefitted customers through the ratemaking process.

Q. PLEASE DESCRIBE HOW DECLINING USAGE AND WATER CONSERVATION ACTIVITIES CAN RESULT IN AVOIDED CAPITAL COSTS.

A. As discussed previously, the decline in residential water consumption has been steadily progressing since the 1990's. Base water consumption for the average MAWC per residential customer is approximately 28% lower than it was 20 years ago. Without the development of high-efficiency water fixtures and appliances and water conservation programs, residential customers might still be using 30% more water than they do today. As a result to these ongoing reductions in water usage, the water utility industry has avoided the need to build supply, treatment, and transmission facilities to meet those now avoided additional usage demands.

Q. IS THE RESIDENTIAL WATER CONSUMPTION RATE SHOWING ANY SIGNS OF BOTTOMING OUT?

A. Residential water consumption in the MAWC service territory shows no signs of reaching bottom any time soon. New water efficiency technology and water efficiency regulations are expected to continue to drive water use downward even more in the future. As explained by the American Council for Energy Efficiency

> Home appliance manufacturers and energy efficiency advocates have recently agreed to improved efficiency standards and tax policies for

> refrigerators, freezers, clothes washers, clothes dryers, dishwashers, and room air conditioners. This agreement could save enough energy to meet the total energy needs of 40 percent of American homes for one year and the amount of water necessary to meet the current water needs of every customer in the City of Los Angeles for 25 years.[7]

These higher efficiency dishwasher and clothes washer standards were effective in January 2013 and January 2015 respectively, including providing tax incentives for consumer purchases. Therefore, consumers will be achieving an even higher level of water-use efficiency (i.e., lower usage) than the Federal regulations mandated in the Energy Policy Act of 1992.

Q. HAVE YOU PERFORMED ANALYTICS THAT GIVE VISIBILITY TO POTENTIAL FUTURE TERM OF THE OBSERVED DECLINING USE TREND FOR MAWC?

A. Yes, I have. Reviewing Schedule GPR-4, Page 1 of 1, I have developed estimates of the impact of the Water Sense / Energy Star usage specifications on a example family of four occupants' water usage. Generally, the model applies the typical usage per capita[8] times the estimated reduction for specific appliance usage from the pre-regulatory standard generally in place until 1994 to the Water Sense/Energy Star usage specifications generally in effect since 2010/2011 respectively, times the number of users in the household (4 in this example) annualized. I them summed the various usage reductions for the example family of four

7 American Council for Energy Efficiency, Major Home Appliance Efficiency Gains to Deliver Huge National Energy and Water Savings and Help to Jump Start the Smart Grid, http://aceee.org/press/2010/08/major-home-appliance-efficiency-gains-deliver-huge-natio. Date Accessed: 8/7/2012.

8 Source: Handbook of Water Use and Conservation, Amy Vickers, May, 2001

across all fixtures that could be replaced to get an average total usage reduction for the family of four. My analysis indicates that a typical family of four would see an approximate 54,315 annual gallon reduction in usage due to fixture replacement at the Water Sense/Energy Star specifications.

Q. WHAT DOES THE ESTIMATED 54,315 GALLON ANNUAL REDUCTION IN USAGE FOR A FAMILY OF FOUR IMPLY RELATED TO THE POTENTIAL TERM OF THE ESTIMATED DECLINING USE TREND YOU HAVE ESTIMATED FOR THE MAWC?

A. Dividing the total estimated annual usage decline for the MAWC of 505.638 MM Gallons by the annual estimated annual usage decline for the example family of four of 54,315 gallons, implies that 9,309 residential customers, or 2.2%, of the test year average of 423,483 residential customers, would need to make these fixture changes to account for the estimated total annual residential declining usage. Further, taking the reciprocal of the 2.2% of residential customers needed to account for the annual usage decline implies a theoretical term of 45 years to fully convert the installed fixture base to the Water Sense/Energy Star usage specifications, all other factors remaining equal.

Q. CONCEPTUALLY HOW MANY ADDITIONAL YEARS COULD THE ESTIMATED DECLINING USE TREND FOR MAWC CONTINUE?

A. Based on the historical data that we have available for MAWC, the current declining use trend has been evident since the year 2000. To date, that trend has progressed for 15 consecutive years. Given the implied theoretical term of the trend at 45 years, all factors staying the same, the trend could continue for an additional 30 years.

Q. HAVE YOU PERFORMED AN ANALYSIS THAT SUPPORTS OR ILLUSTRATES THE POTENTIAL FOR SUCH DECLINING USE TREND CONTINUING TO IMPACT USAGE ON THE MAWC SYSTEM?

A. Yes, I have, by analyzing usage per customer in the Joplin district, pre- and post- the devastating tornado of May 22, 2011 ("Joplin Tornado").

Q. PLEASE DESCRIBE HOW THE JOPLIN TORNADO PROVIDED EVIDENCE OF FUTURE DECLINING WATER USE.

A. The impact of the Joplin Tornado was an immediate reduction of MAWC customer connections in the Joplin district by approximately 3,060 customer connections (14.4% of the May 2011 Joplin residential total) when comparing June 2011 to May 2011. Given that the devastation caused by an EF5 tornado to residential housing is nearly absolute, it follows that a certain percentage of the Joplin district residential housing stock would require complete rebuilding before being inhabited again. Such rebuilding would conform to the water use standards that are discussed earlier in my testimony and detailed in Schedule GPR-1.

Q. PLEASE DESCRIBE YOUR ANALYSIS OF THE PRE- AND POST-2011 JOPLIN TORNADO RESIDENTIAL CUSTOMER USAGE.

A. We developed and compared the results of regression models that estimated the base residential usage per customer trend for the 10 years leading up to and including 2011 and a similar regression model that estimated the base residential usage per customer trend for the period of 2012-2015. Based on the results of those two independently constructed regression models, we can see the impact on residential average customer usage due to the rebuilding housing stock to the enhanced post 2007-2011 water use standards. A significant change in Joplin average residential customer usage following the May 2011 tornado would support the concept that there are numerous opportunities for continued residential customer base average usage reductions going into the future on the MAWC system.

Q. PLEASE DESCRIBE THE STATISTICAL RESULTS OF YOUR ANALYSIS OF THE PRE- AND POST-2011 JOPLIN TORNADO RESIDENTIAL CUSTOMER USAGE.

A. The results of the analysis are in the table below:

Table GPR-1
Missouri-American Water Co.
Joplin Declining Use Analysis
Usage Trend Pre / Post-2011 Tornado

Measure	Prior to 2011	Post 2011
R-Square	0.855	0.987
Usage Trend	-2.02%	-2.77%

Table GPR-1 illustrates the results of the regression analysis of average base usage per customer both pre- and post the Joplin Tornado. It is clear from the statistical results of that regression analysis that the Joplin district usage per customer trend has accelerated given that residential customers have rebuilt using water use fixtures that meet or exceed the contemporary water efficiency standards thus effectively replacing older less efficient fixtures as part of the rebuilding process. The results show that the decline in the base residential usage per customer data series has increased from an annual rate of -2% to -2.8% due to the reconstruction of approximately 2,500 (13.8%) residential dwellings since May 2011 in the Joplin district. This is an approximate 37% acceleration of the rate of decline in Joplin post May 2011. This acceleration of the trend is illustrated graphically on Schedule GPR-5.

Q. WHAT DO THE RESULTS OF THE PRE- AND POST-2011 JOPLIN TORNADO REVEAL ABOUT MAWC RESIDENTIAL CUSTOMER'S USAGE SUGGEST ABOUT FUTURE WATER USAGE DECLINES?

A. The statistical results from the Joplin Tornado, when combined with the results of the theoretical family of four usage analysis outlined in Schedule GPR-4, offer compelling empirical evidence as to the potential scope and duration of continued reductions in customer water use patterns appears to be quite significant. First, based on the increase in customer connections in the Joplin district beginning in June 2011 to the present, the rebuilding of homes in the Joplin district resulted in a 37% acceleration of the annual usage per customer reduction from approximately -2% to approximately -2.8%. Second, those 2,500 rebuilt customer dwellings experienced an approximately 3,200 gallon annual usage reduction or roughly an 8.4% reduction in usage from their 2011 pre Joplin Tornado levels. That 3,200 gallon average residential usage reduction by the rebuilt customers is nearly equal to the loss of an entire months' worth of water sales to a typical MAWC Joplin residential customer (based on average usage in Joplin post 2011).

Q. WHAT IS YOUR CONCLUSION RELATED TO THE CONTINUATION OF REDUCTIONS IN RESIDENTIAL WATER USAGE ON THE MAWC SYSTEM?

A. Residential water use reductions will continue to be significant well into the foreseeable future for the MAWC system.

Q. HAVE YOU ANALYZED THE IMPACT OF REDUCED WATER USAGE ON MAWC WATER SALES AND REVENUES AS COMPARED TO LEVELS AUTHORIZED IN CASE NO. WR-2011-0337?

A. Yes I have. Table GPR-2 below is a summary Schedule GPR-6. Table GPR-2 illustrates that MAWC has been under its allowed Total Revenue and Water Sales levels set in Case WR-2011-0337 (the "2011 Rate Case") in 3 out of the 4 years comprising the post-case period of 2012 to 2015. Only during the extended drought year of 2012 did MAWC experience Water Sales and Revenue levels in excess of those authorized by the 2011 Rate Case. More specifically, for the period of 2012 through 2015, MAWC will be under its allowed revenue for the period by approximately $42.6 million. Similarly, for that same period, MAWC will be under its allowed total water sales by approximately 5.1 billion gallons. The inability of MAWC to meet its allowed revenue from the 2011 Rate Case is linked directly to water usage reductions that have been instrumental in attributing to the 5.1 billion gallon short fall in total sales levels set in the 2011 Rate Case. As a result MAWC has made pro forma adjustments to its water sales volumes in this case to account for reduced water usage impacting recovery of its allowed revenue level.

Table GPR-2
Missouri American Water Co.
Actual Revenue/Water Sales Compared to Allowed
(2012-2015)

	2012**	2013	2014	2015***	2012-2015
MAWC Total Annual Revenue	279,467,636	264,778,072	270,239,218	266,369,812	
Total Allowed Revenue*	265,856,142	276,498,635	289,598,802	291,518,793	
Revenue Recovery to Allowed (Under)/Over	**13,611,494**	**(11,720,563)**	**(19,359,584)**	**(25,148,981)**	**(42,617,634)**
MAWC Total Annual Water Sales	64,866,438	58,083,752	56,927,384	56,979,050	
Total Allowed Water Sales*	60,512,361	60,512,361	60,512,361	60,512,361	
Water Sales to Allowed (Under)/Over	**4,354,077**	**(2,428,610)**	**(3,584,977)**	**(3,533,311)**	**(5,192,822)**

* Per State of Missouri Public Service Commission Order WR-2011-0337, Issued March 7, 2012, adjusted for subsequent ISRIS Filings.

** Summer 2012 historically warm and dry; 4th driest summer since 1895, warmest summer since 1895 NOAA/NCDC

*** 2015 Annualized based on average ratio of YTD/Annual for the period 2010-2014

Q. HOW HAS MAWC FACTORED THE OBSERVED TREND IN RESIDENTIAL CUSTOMER USAGE INTO ITS PRO FORMA TEST YEAR REVENUES IN THIS CASE?

A. The development of MAWC's revenue requirement, including the adjustment to test year data to reflect the observed trend in residential customer usage as well as normalized weather, will be addressed by the Direct Testimony of Ms. Jeanne Tinsley.

Q. DOES THIS CONCLUDE YOUR TESTIMONY?

A. Yes, it does.

The following regulations are listed in the "*Energy Independence & Security Act of 2007,*" Public Law 110–140 – Dec. 19, 2007:

1. A top-loading or front-loading standard-size residential clothes washers manufactured on or after January 1, 2011 shall have a water factor of not more than 9.5. (water factor is equal to gallons/cycle/cubic feet)

2. Dishwashers manufactured on or after January 1, 2010, shall—
   a. for standard size dishwashers (≥ 8 place settings + six serving pieces) not exceed **6.5 gallon per cycle**; and
   b. for compact size dishwashers (< 8 place settings + six serving pieces) not exceed **4.5 gallons per cycle**.

TABLE 1
Flow rates from typical fixtures and appliances before and after Federal Standards

Type of Use	Pre-Regulatory Flow*	New Standard (maximum)	Federal Standard	Year Effective	WaterSense / ENERGY STAR Current Specification+ (maximum)
Toilets	3.5 gpf	1.6 gpf	**U.S. Energy Policy Act**	1994	**1.28 gpf**
Clothes washers**	41 gpl (14.6 WF)	Estimated 26.6 gpl (9.5 WF)	**Energy Independence & Security Act of 2007**	2011	**Estimated 16.8 gpl (6.0 WF)**
Showers	2.75 gpm	2.5 gpm	**U.S. Energy Policy Act**	1994	**2.0 gpm**
Faucets***	2.75 gpm	2.5 gpm (1.5 gpm)	**U.S. Energy Policy Act**	1994	**1.5 gpm at 60 psi**
Dishwashers	14.0 gpc	6.5 gpc for standard; 4.5 gpc for compact	**Energy Independence & Security Act of 2007**	2010	**4.25 gpc for standard; 3.5 gpc for compact**
Commercial Pre Rinse Spray Valves	1.8 to 6 gpm	1.6 gpm	**U.S. Energy Policy Act of 2005**	2006	**1.28 gpm**

* Source: *Handbook of Water Use and Conservation*, Amy Vickers, May 2001
** Average estimated gallons per load and water factor (see calculations)
*** Regulation maximum of 2.5 gpm at 80 psi, but lavatory faucets available at 1.5 gpm maximum (see calculations)
+Source: http://www.epa.gov/watersense/ and http://www.energystar.gov websites

ABBREVIATIONS USED	
gpcd	gallons per capita per day
gpf	gallons per flush
gpl	gallons per load
gpm	gallons per minute
gpc	gallons per cycle
WF	water factor, or gallons per cycle per cubic feet capacity of the washer (the smaller the water factor, the more water efficient the clothes washer)

TABLE 2
Daily indoor per capita water use from various fixtures and appliances in a typical single family home before and after Federal Regulations

Type of Use	Pre-Regulatory Standards Amount** (gpcd)	Post-Regulatory Standards Amount** (gpcd)	Savings from Pre-Reg	Water Sense/ Energy Star Amount** (gpcd)	Additional Savings from Post-Reg
Toilets	17.9	8.2	54%	6.5	21%
Clothes washers*	15	9.8	35%	6.2	37%
Showers	9.7	8.8	9%	7.1	19%
Faucets	14.9	10.8	28%	8.1	25%
Dishwashers*	1.4	0.65	54%	0.43	34%
Total Indoor Water Use	**58.9**	**38.3**	**35%**	**28.3**	**26%**

Note: List only includes common household fixtures and appliances and excludes leaks and "other domestic uses" in order to be conservative.

*Regulatory Standards effective in 2010 and 2011. For calculations of amount in gpcd, refer to the calculation below.
**Source: *Handbook of Water Use and Conservation*, Amy Vickers, May 2001

CALCULATIONS

Clothes washer (pre-regulatory):

Number of times clothes washer used everyday *	= 0.37 loads per day
Clothes washer water use rate range *	= 39 gpl to 43 gpl
Average water use rate	= **41 gpl**
Water usage per capita	= 41 gpl * 0.37 loads/day
	= **15 gpcd**
Water factor (WF) as gallons/cycle/cu. ft	= 41 gpl / 2.8 cu. ft (assuming capacity of an average washer to be 2.8 cu. ft, most washers range between 2.7 – 2.9 cu. ft)
	= **14.6**

Clothes washer (new standard):

Number of times clothes washer used everyday *	= 0.37 loads per day
New regulatory standard	= **9.5 WF**
	= 9.5 gallons/per cycle/cubic feet

	= **26.6 gpl** (Assuming capacity of an average washer to be 2.8 cu. ft, most washers range between 2.7 – 2.9 cu. ft)
Therefore, new usage per capita	= 26.6 gpl * 0.37 loads/day
	= **9.8 gpcd**
Clothes washer (WaterSense/Energy Star):	
Number of times clothes washer used everyday *	= 0.37 loads per day
New regulatory standard	= **6 WF**
	= 6 gallons/per cycle/cubic feet
	= **26.6 gpl** (Assuming capacity of an average washer to be 2.8 cu. ft, most washers range between 2.7 – 2.9 cu. ft)
Therefore, new usage per capita	= 16.8 gpl * 0.37 loads/day
	= **6.2 gpcd**

Dishwasher:	
Number of times dishwasher used everyday*	= 0.10 times
New regulatory standard	= **6.5 gallons/per cycle** (for standard dishwashers only)
Therefore, new usage per capita	= 6.5 gallons/per cycle * 0.1
	= **0.65 gpcd**
Dishwasher (WaterSense/Energy Star):	
Number of times dishwasher used everyday*	= 0.10 times
New regulatory standard	= **4.25 gallons/per cycle** (for standard dishwashers only)
Therefore, new usage per capita	= 4.25 gallons/per cycle * 0.1
	= **0.43 gpcd**

Faucet:	
Actual faucet flow during use*	= 67% rated flow
Rated flow*	= **1.5 gpm** to **2.5 gpm**
Frequency of faucet use*	= 8.1 min/day
Range of usage per capita	= 8.1 gpcd to 13.5 gpcd
Assume average of range for estimated gpcd	= **10.8 gpcd**

Faucet (WaterSense/Energy Star):	
Actual faucet flow during use*	= 67% rated flow
Rated flow*	= **1.5 gpm**
Frequency of faucet use*	= 8.1 min/day
Usage per capita	= 8.1 gpcd
Assume average of range for estimated gpcd	= **8.1 gpcd**

*Source: *Handbook of Water Use and Conservation,* Amy Vickers, May, 2001

National Efficiency Standards and Specifications for Residential and Commercial Water-Using Fixtures and Appliances

Adapted from information provided by the U.S. EPA Office of Water, the Alliance for Water Efficiency, and other sources)

Fixtures and Appliances	EPAct 1992, EPAct 2005, "Energy Independence and Security Act of 2007" *(or backlog NAECA updates)*		WaterSense® or Energy Star®		Consortium for Energy Efficiency	
	Current Standard	Proposed/Future Standard	Current Specification	Proposed/Future Specification	Current Specification	Proposed/Future Specification
Residential Toilets	1.6 gpf[1]	1.28 gpf/ 4.8 Lpf proposed by efficiency advocates for tank-type only	Tank-type toilets: WaterSense = 1.28 gpf (4.8L) with at least 350 gram waste removal + LA Spec.		No specification	
Residential Lavatory (Bathroom) Faucets	2.2 gpm at 60 psi[2]	1.5 gpm/ 5.7 Lpm proposed by efficiency advocates	WaterSense = 1.5 gpm maximum & 0.8 gpm minimum at 20 psi		No specification	
Residential Kitchen Faucets				None proposed at this time	No specification	
Residential Showerheads	2.5 gpm at 80 psi		WaterSense = 2.0 gpm		No specification	
Residential Clothes Washers	MEF ≥ 1.26 ft^3/kWh/cycle *No specified water use factor Note: MEF measures energy consumption of the total laundry cycle (wash + dry). The higher the number, the greater the energy efficiency	Energy Independence and Security Act of 2007 specified effective in 2011: MEF ≥ 1.26 ft^3/kWh/cycle WF ≤ 9.5 gal/cycle/ft^3 Also specified: DOE shall publish final rule by Dec 31, 2011, determining if standards will change effective 1/1/2015.	Energy Star (DOE) effective July 1, 2009: MEF ≥ 1.8 ft^3/kWh/cycle WF ≤ 7.5 gal/cycle/ ft^3	Energy Star (DOE) To be effective Jan 1, 2011: MEF ≥ 2.0 WF ≤ 6.0 gal/cycle/ft^3	Tier 1: MEF ≥ 1.80 ft^3/kWh/cycle; WF ≤ 7.5 gal/cycle/ft^3 Tier 2: MEF ≥ 2.00 ft^3/kWh/cycle; WF ≤ 6.0 gal/cycle/ft^3 Tier 3: MEF ≥ 2.20 ft^3/kWh/cycle; WF ≤ 4.5 gal/cycle/ft^3	

[1] EPAct 1992 standard for toilets applies to both commercial and residential models.
[2] EPAct 1992 standard for faucets applies to both commercial and residential models.

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gpf: gallons per flush
kWh: kilowatt hour
MEF: modified energy factor
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Updated March 2010
Koeller/Dietemann

National Efficiency Standards and Specifications for Residential and Commercial Water-Using Fixtures and Appliances

Adapted from information provided by the U.S. EPA Office of Water, the Alliance for Water Efficiency, and other sources)

Fixtures and Appliances	**EPAct 1992, EPAct 2005, ''Energy Independence and Security Act of 2007''** ***(or backlog NAECA updates)***		**WaterSense® or Energy Star®**		**Consortium for Energy Efficiency**	
	Current Standard	**Proposed/Future Standard**	**Current Specification**	**Proposed/Future Specification**	**Current Specification**	**Proposed/Future Specification**
Standard Size and Compact Residential Dishwashers[3]	*Standard models*: Energy Independence and Security Act of 2007 specified: effective 1/1/2010: Standard Size: 355 KWh/year (.62 EF + 1 watt standby) WF ≤ 6.5 gallons/cycle Compact Size: 260 kWh WF ≤ 4.5 gallons/cycle EF is the number of cycles the machine can run for each kWh of electricity	Also specified by the Act: DOE shall publish final rule by 1/1/2015 determining if dishwasher standards will change effective 1/1/2018.	Energy Star (DOE) Effective since July 1, 2009 Standard Size: 324 kWh/year WF ≤ 5.8 gallons/cycle Compact Size: 234 kWh/year WF ≤ 4.0 gallons/cycle kWH/yr is replacing EF since it includes the cycles the machine can run for each kWh, but also includes up to 8 kWh/yr of standby power (when the machine isn't cycling)	Energy Star effective July 1, 2011: Standard Size: 307 kWh/yr 5.0 gallons per cycle Compact Size: 222 kWh/yr 3.5 gallons per cycle	*Effective Aug. 11, 2009:* *Standard models*: EF; maximum kWh/year Tier 1: EF ≥ 0.72 cycles/kWh; and 307 max kWh/year; 5.0 gallons per cycle Tier 2: EF ≥ 0.75 cycles/kWh; 295 max kWh/year; 4.25 gallons per cycle *Compact models*: Tier 1: EF ≥ 1.0 cycles/kWh; 222 max kWh/year; 3.5 gallons per cycle	Could adjust Tiers after July 1, 2011 when new Energy Star becomes effective

[3] ***Standard models*:** capacity is greater than or equal to eight place settings and six serving pieces; ***Compact models*:** capacity is less than eight place settings and six serving pieces

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Fixtures and Appliances	EPAct 1992, EPAct 2005 *(or backlog NAECA updates)*		WaterSense® or Energy Star®		Consortium for Energy Efficiency	
	Current Standard	Proposed/ Future Standard	Current Specification	Proposed/Future Specification	Current Specification	Proposed /Future Specification
Commercial Toilets	1.6 gpf[4]/6.0 Lpf Except blow-out fixtures: 3.5-gpf/13 Lpf Note: Some states prohibit blow-out at 3.5 gpf	1.28 gpf/ 4.8 Lpf proposed by efficiency advocates for tank-type only	Tank-type only: WaterSense at 1.28 gpf (4.8L) with at least 350 gram waste removal + LA Spec.	Flushometer valve/ bowl combinations: WaterSense specification in development. No release date promised.	No specification	
Commercial Urinals	1.0 gpf	0.5 gpf/ 1.9 Lpf proposed by efficiency advocates	WaterSense = 0.5 gpf/1.9Lpf (flushing urinals only)		No specification	
Commercial Faucets	Private faucets: 2.2 gpm at 60 psi[5] Public Restroom faucets: 0.5 gpm at 60 psi[5] Metering (auto shut of) faucets: 0.25 gallons per cycle[6]			WaterSense draft specification now under consideration	No specification	

[4] EPAct 1992 standard for toilets applies to both commercial and residential models.
[5] In addition to EPAct requirements, the American Society of Mechanical Engineers standard for public lavatory faucets is 0.5 gpm at 60 psi (ASME A112.18.1-2005). This maximum has been incorporated into the national Uniform Plumbing Code and the International Plumbing Code for all except private applications, private being defined as residential, hotel guest rooms, and health care patient rooms. All other applications subject to the 0.5 gpm/1.9 Lpm flow rate maximum.
[6] Metering faucets not subject to flow rate maximum

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Updated March 2010
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Adapted from information provided by the U.S. EPA Office of Water, the Alliance for Water Efficiency, and other sources)

Fixtures and Appliances	EPAct 1992, EPAct 2005 *(or backlog NAECA updates)*		WaterSense® or Energy Star®		Consortium for Energy Efficiency	
	Current Standard	Proposed/ Future Standard	Current Specification	Proposed/Future Specification	Current Specification	Proposed /Future Specification
Commercial Clothes Washers (Family-sized)	MEF ≥ 1.26 ft^3/kWh; WF ≤ 9.5 gal/cycle/ft^3	New standards under development: DOE scheduled final action: January 2010; Rulemaking process postponed by DOE in 2008; began again in Dec. 2009.	Energy Star (DOE) MEF ≥ 1.72 ft^3/kWh/cycle; WF ≤ 8.0 gal/cycle/ft^3		Adopted Jan 1, 2007 (Note: this spec covers only normal capacity family washers, NOT large capacity commercial washers) Tier 1: 1.80 MEF 7.5 gal/cycle/ft^3 Tier 2: 2.00 MEF 6.0 gal/cycle/ft^3 Tier 3: 2.20 MEF 4.5 gal/cycle/ft^3	

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Fixtures and Appliances	EPAct 1992, EPAct 2005 *(or backlog NAECA updates)*		WaterSense® or Energy Star®		Consortium for Energy Efficiency	
	Current Standard	Proposed/ Future Standard	Current Specification	Proposed/Future Specification	Current Specification	Proposed /Future Specification
Commercial Dishwashers	No standard		Energy Star (EPA) using NSF/ANSI standards for water use and ASTM standards for energy use Effective **10/11/2007** *Under counter*: Hi Temp: 1.0 gal/rack; <= 0.90 kW; Lo Temp 1.70 gal/rack <= 0.5 kW *Stationary Single Tank Door*: Hi Temp: 0.95 gal/rack; <= 1.0 kW Lo Temp: 1.18 gal/rack; <= 0.6 kW *Single Tank Conveyor*: Hi Temp: 0.70 gal/rack; <= 2.0 kW; Lo Temp: 0.79 gal/rack; <= 1.6 kW *Multiple Tank Conveyor*: Hi Temp: 0.54 gal/rack; <= 2.6 kW Lo Temp: 0.54 gal/rack; <= 2.0 kW		No specification	

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National Efficiency Standards and Specifications for Residential and Commercial Water-Using Fixtures and Appliances

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Fixtures and Appliances	EPAct 1992, EPAct 2005 *(or backlog NAECA updates)*		WaterSense® or Energy Star®		Consortium for Energy Efficiency	
	Current Standard	Proposed/ Future Standard	Current Specification	Proposed/Future Specification	Current Specification	Proposed /Future Specification
Automatic Commercial Ice Makers[7]	Effective 1/1/2010: Energy and condenser water efficiency standards vary by equipment type on a sliding scale depending upon harvest rate and type of cooling (see link to additional information at end of this table)		Energy Star (EPA) Energy and water efficiency standards vary by equipment type on a sliding scale depending upon harvest rate and type of cooling (see link to additional information at end of this table). Water cooled machines excluded from Energy Star		Energy and water (potable and condenser) standards are tiered and vary by equipment type on a sliding scale depending upon harvest rate and type of cooling (see link to additional information at end of this table)	
Commercial Pre-rinse Spray Valves (for food service appli-cations)	Flow rate ≤ 1.6 gpm (no pressure specified; no performance requirement)		No specification	Proposed Energy Star specification abandoned after standard established in EPAct 2005; WaterSense specification in development in conjunction with Energy Star	No specification (program guidance recommends 1.6 gpm at 60 psi and a cleanability requirement)	

[7] Optional standards for other types of automatic ice makers are also authorized under EPAct 2005.

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Fixtures and Appliances	EPAct 1992, EPAct 2005 *(or backlog NAECA updates)*		WaterSense® or Energy Star®		Consortium for Energy Efficiency	
	Current Standard	Proposed/ Future Standard	Current Specification	Proposed/Future Specification	Current Specification	Proposed /Future Specification
Commercial Steam Cookers[8]	No standard		Energy Star (EPA) *Electric*: 50% cooking energy efficiency; idle rate 400–800 Watts *Gas*: 38% cooking energy efficiency; idle rate 6,250–12,500 British thermal units/hour *No specified water use factor		*Electric*: 50% cooking energy efficiency; idle rate 400–800 Watts *Gas*: 38% cooking energy efficiency; idle rate 6,250–12,500 British thermal units/hour Water Use Factor (for both electric and gas models): Tier 1A: ≤ 15 gal/hr Tier 1B: ≤ 4 gal/hr	

[8] Idle rate standards vary for 3-, 4-, 5-, and 6-pan commercial steam cooker models.

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National Efficiency Standards and Specifications for Residential and Commercial Water-Using Fixtures and Appliances

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Information/materials on EPAct 2005/NAECA standards:

Schedule for development of appliance and commercial equipment efficiency standards:
http://www.eere.energy.gov/buildings/appliance_standards/2006_schedule_setting.html

Commercial Clothes Washers and Dishwashers (agenda/presentations at 4/27/06 DOE public meeting on rulemaking):
http://www.eere.energy.gov/buildings/appliance_standards/residential/home_appl_mtg.html

Automatic Commercial Ice Maker Standards:
http://www.eere.energy.gov/buildings/appliance_standards/pdfs/epact2005_appliance_stds.pdf (Page 18)

Pre-rinse Spray Valves
http://www.eere.energy.gov/buildings/appliance_standards/pdfs/epact2005_appliance_stds.pdf (Page 10)

Information/materials on WaterSense specifications:

Toilets
http://www.epa.gov/watersense/products/toilets.html

Urinals
http://www.epa.gov/watersense/products/urinals.html

Bathroom Lavatory Faucets
http://www.epa.gov/watersense/products/bathroom_sink_faucets.html

Information/materials on Energy Star specifications:

Residential Clothes Washers
http://www.energystar.gov/index.cfm?c=clotheswash.pr_crit_clothes_washers

Commercial Clothes Washers
http://www.energystar.gov/index.cfm?fuseaction=clotheswash.display_commercial_cw

Residential Dishwashers
http://www.energystar.gov/index.cfm?c=dishwash.pr_dishwashers

Commercial Dishwashers
http://www.energystar.gov/index.cfm?c=new_specs.comm_dishwashers

Automatic Commercial Ice Makers
http://www.energystar.gov/index.cfm?c=new_specs.ice_machines

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Commercial Steam Cookers
http://www.energystar.gov/index.cfm?c=steamcookers.pr_steamcookers

Information/materials on CEE specifications:

Residential Clothes Washers
http://www.cee1.org/resid/seha/rwsh/rwsh-main.php3

Residential Dishwashers
http://www.cee1.org/resid/seha/dishw/dishw-main.php3

Commercial, Family-Sized Clothes Washers
http://www.cee1.org/com/cwsh/cwsh-main.php3

Commercial Ice-Makers
http://www.cee1.org/com/com-ref/ice-main.php3; Spec Table: http://www.cee1.org/com/com-kit/ice-specs.pdf

Pre-rinse Spray Valves
http://www.cee1.org/com/com-kit/prv-guides.pdf

Commercial Steam Cookers
http://www.cee1.org/com/com-kit/sc-hc-specs.pdf

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psi: pounds per square inch
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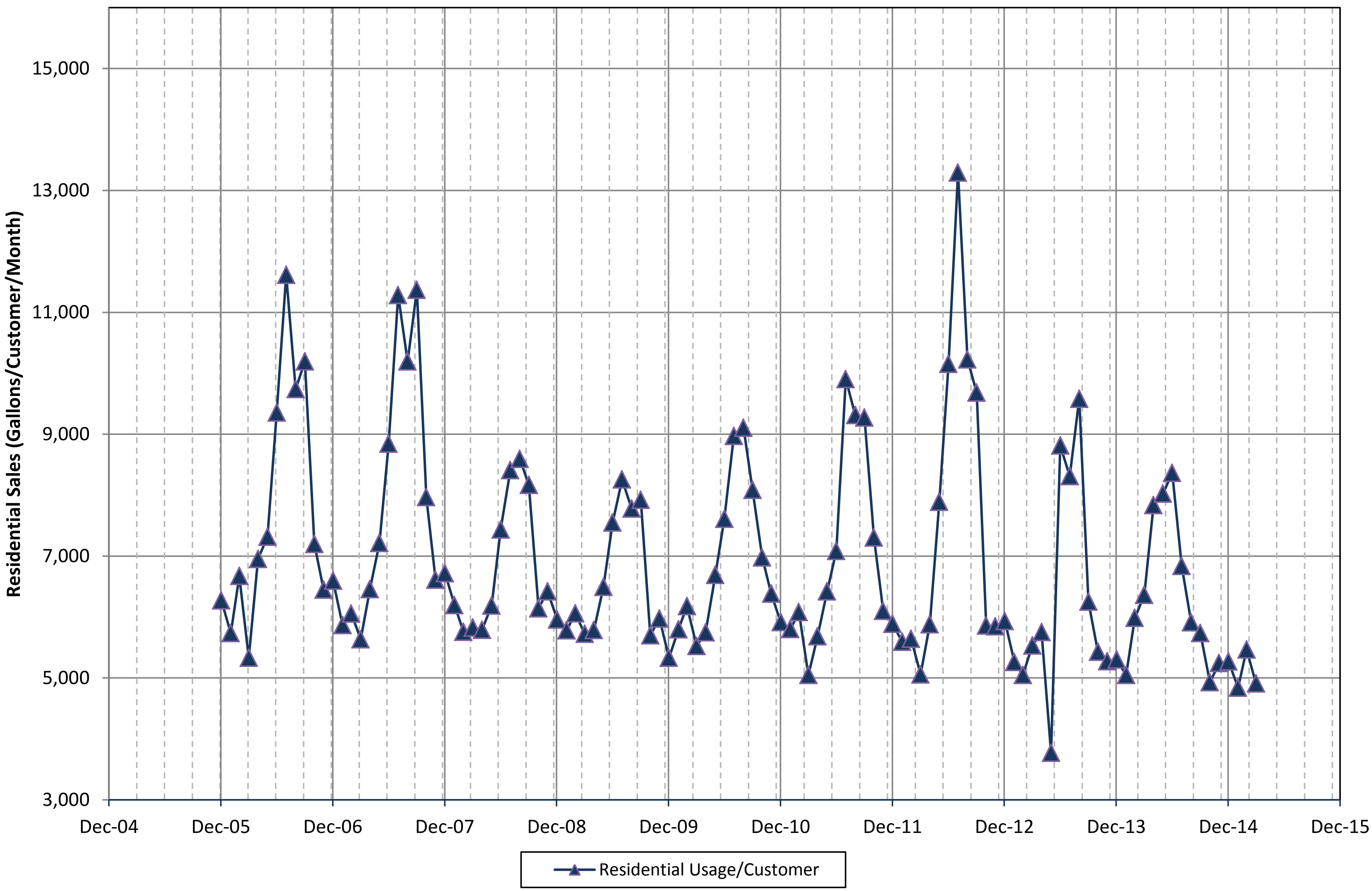
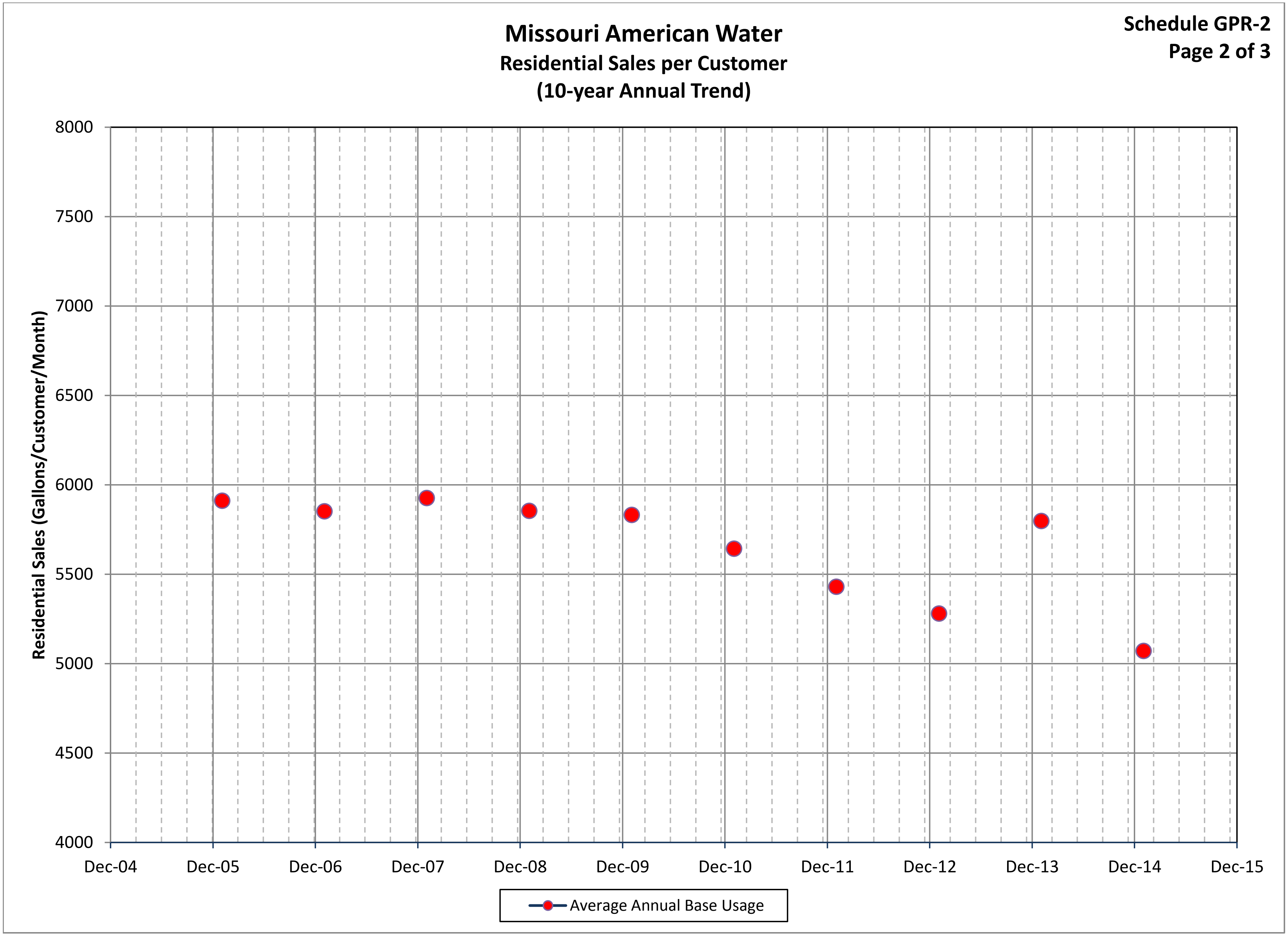
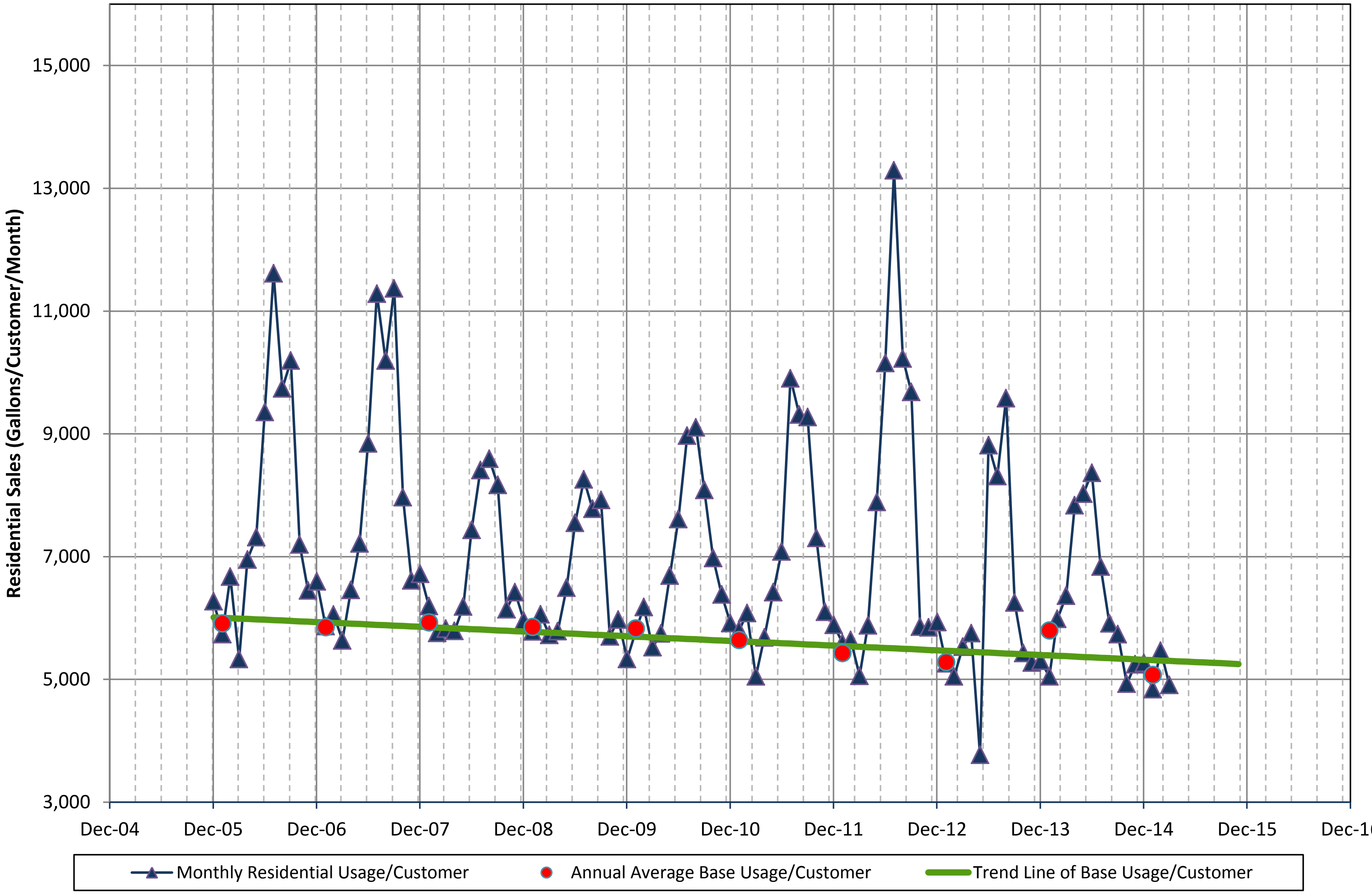
Missouri American Water
Residential Sales per Customer
(10-year Annual Trend)




Missouri American Water
Residential Sales per Customer
(10-year Annual Trend)
Residential Sales (Gallons/Customer/Month)
8000
7500
7000
6500
6000
5500
5000
4500
4000
Dec-04
Dec-05
Dec-06
Dec-07
Dec-08
Dec-09
Dec-10
Dec-11
Dec-12
Dec-13
Dec-14
Dec-15
Average Annual Base Usage

Missouri American Water
Residential Sales per Customer
(10-year Annual Trend)



Residential Water Usage Forecasts Based on 10 year history

Based on Winter Usage Trends except where noted below

State	Annual Decline (GPCY)*** 10-year (2006-2015)	Rate of Decline 2012-2013 (%)*** 10-year (2006-2015)
California*	-4,773	-4.3%
Illinois	-829	-1.7%
Indiana	-798	-1.7%
Iowa	-1,235	-2.9%
Kentucky	-816	-1.9%
Maryland**	-1,192	-2.8%
Missouri	-1,194	-1.9%
New Jersey (SA1)	-1,293	-2.3%
New Jersey (SA2)	-1,293	-2.3%
New York	-1,529	-2.4%
Pennsylvania	-1,008	-2.1%
Tennessee	-798	-1.7%
Virginia	-1,120	-2.9%
West Virginia	-428	-1.1%
Michigan++	-1,017	-2.4%
Weighted Average (w/o CA)	-1,039	-2.0%
Weighted Average (w/ CA)	-1,241	-2.1%

Notes:

*California used the Annual Average Method for trending using a 10 yr (2006-2015) history

**MD used the Annual Average Method for trending using a 10 yr (2006-2015) history

++ MI Analyses presented were performed using an annual average method for a 10 year duration only

Missouri American Water Co.
Reasonableness of Consumption Decline Calculation
1,194 Gallons Per Customer Per Year

Illustrating: Replacement of Clothes Washing, Toilet, Fixtures and Dishwashers Based on Family of Four

Washer:

Old: Usage per load - gallons	41	Average Use Per Capita Per Day	0.37
New: Usage per load - gallons	17	Average Loads per week - 4 People	10
Usage decline	24	Savings per week	251
		Savings per year - Gallons	**13,037**

Toilet:

Old: Usage per flush - gallons	3.5	Flush per person per day	5
New: Usage per flush - gallons	1.3	Household number	4
Usage decline	2.2		
		Flush per day per household	20
		Flush per year per household	7,300
		Savings per year - Gallons	**16,206**

Fixtures (Showers):

Old: Gallons/min flow	2.75	Flow Minutes Per Person Day	8
New: Gallons/min flow	2.00	Household Number	4
Usage Decline	0.75		
		Total Flow Minutes Per Day	32
		Total Flow Savings Per Day	24
		Savings per year - Gallons	**8,870**

Fixtures (Faucets):

Old: Gallons/min flow	2.75	Flow Minutes Per Person Day	8
New: Gallons/min flow	1.50	Household Number	4
Usage Decline	1.25		
		Total Flow Minutes Per Day	32
		Total Flow Savings Per Day	41
		Savings per year - Gallons	**14,783**

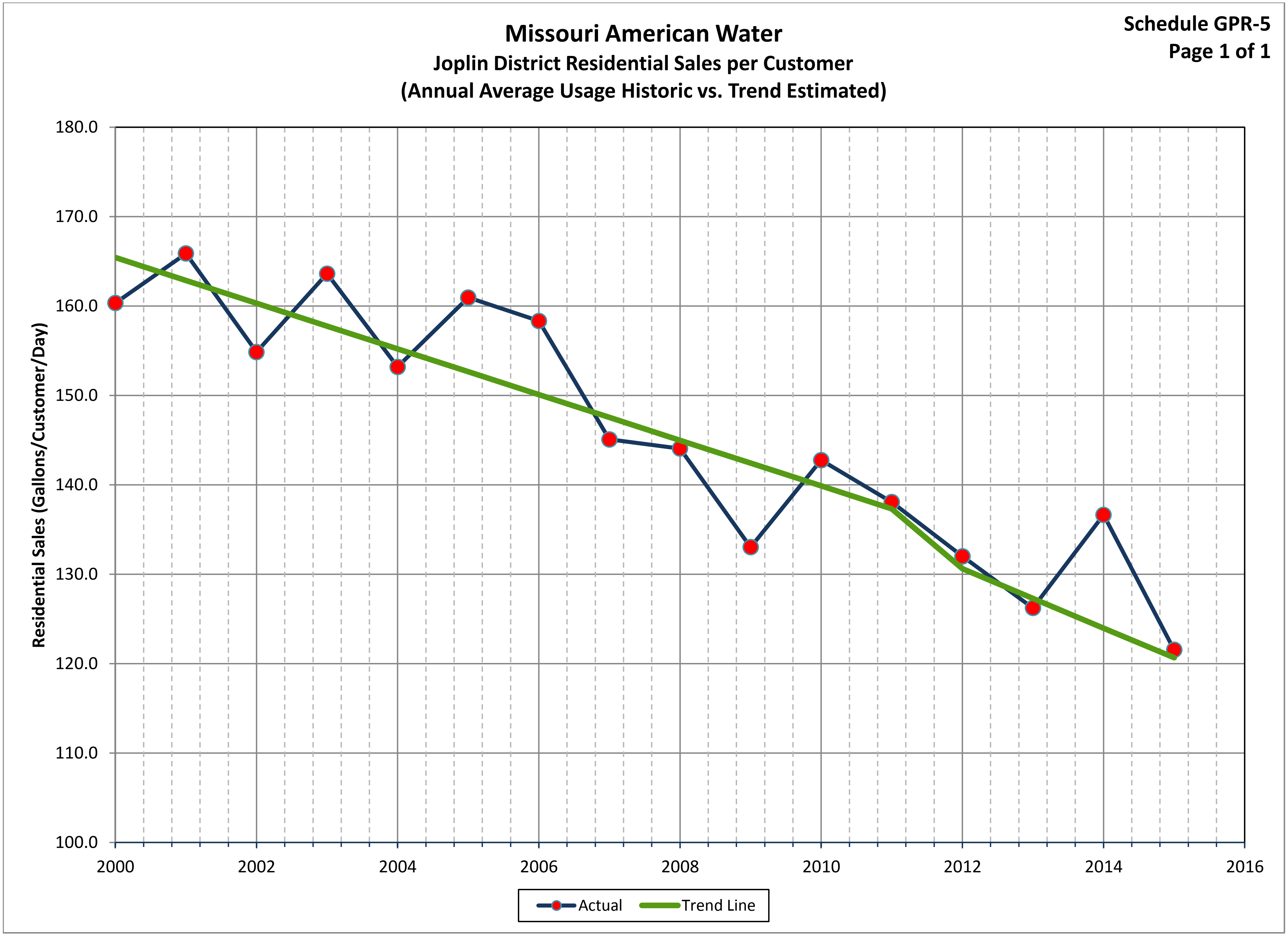
Dish Washer:

Old: Gallons/cycle	14	Average Use Per Capita Per Day	0.10
New: Gallons/cycle	4	Average Loads per week - 4 People	3
Usage decline	10	Savings per week	27
		Savings per year - Gallons	**1,420**

Total Impact of All Appliances:

Total Calculated Annual MOAW Decrease in Usage (Gallons)	505,638,205
Divided by: Total Estimate Water Usage Savings For Family of Four (Gallons)	**54,315**
Implied Number of Toilet, Clothes Washer, Fixture and Dish Washer Changes Accounting For Annual Usage Reduction WVAW (Number of Customers)	**9,309**
MOAW - Average Number of Residential Customers	423,483
Maximum number of Customers in a single year contributing to decline	**2.20%**

*1 Source: Handbook of Water Use and Conservation, Amy Vickers, May, 2001
*2 Source: www.home-water-works.org, A project of the Alliance for Water Efficency, 2011.


Missouri American Water
Joplin District Residential Sales per Customer
(Annual Average Usage Historic vs. Trend Estimated)
Residential Sales (Gallons/Customer/Day)
180.0
170.0
160.0
150.0
140.0
130.0
120.0
110.0
100.0
2000
2002
2004
2006
2008
2010
2012
2014
2016
Actual
Trend Line

Missouri American Water Company
Allowed Sales and Revenue Compated to Annual Actual
(2010 - 2015)

Measure	2010	2011	2012	2013	2014	2015***	2012-2015
MAWC Total Revenue - Actual	224,608,260	242,414,295	279,467,636	264,778,072	270,239,218	266,369,812	
Case No. WR-2011-0337 Allowed Revenue*		261,866,275	261,866,275	261,866,275	261,866,275	261,866,275	
Commission Order, Case Number WO-2012-0401 Issued 9/20/12, Eff 9/25/12	3,989,867		3,989,867	3,989,867	3,989,867	3,989,867	
Commission Order, Case Number WO-2013-0406 Issued 6/7/13, Eff 6/21/13	5,827,176			5,827,176	5,827,176	5,827,176	
Commission Order, Case Number WO-2014-0055 Issued 11/13/13, Eff 12/14/13	4,815,317			4,815,317	4,815,317	4,815,317	
Commission Order, Case Number WO-2014-0237 Issued 5/28/14, Eff 5/30/14	4,113,382				4,113,382	4,113,382	
Commission Order, Case Number WO-2015-0059 Issued 12/17/14, Eff 12/31/14	8,986,785				8,986,785	8,986,785	
Commission Order, Case Number WO-2015-0211 Issued 6/17/15, Eff 6/27/15	1,919,991					1,919,991	
Total Allowed Revenue By Year		261,866,275	265,856,142	276,498,635	289,598,802	291,518,793	
Revenue Recovery Compared to Allowed (Under)/Over		(19,451,980)	13,611,494	(11,720,563)	(19,359,584)	(25,148,981)	(42,617,634)
MAWC Total Annual Water Sales (000s Gallons)	60,275,921	61,244,732	64,866,438	58,083,752	56,927,384	56,979,050	
Case No. WR-2011-0337 Allowed Water Sales (000s Gallons)*		60,512,361	60,512,361	60,512,361	60,512,361	60,512,361	
Water Sales Compared to Allowed (Under)/Over (000s Gallons)		732,371	4,354,077	(2,428,610)	(3,584,977)	(3,533,311)	(5,192,822)

* Per State of Missouri Public Service Commission Order WR-2011-0337, Issued March 7, 2012, Adjusted for Subsequent ISRIS Filings.
** Summer 2012 historically warm and dry; 4th driest summer since 1895, warmest summer since 1895 NOAA/NCDC
*** 2015 Annualized based on average ratio of YTD/Annual for the period 2010-2014