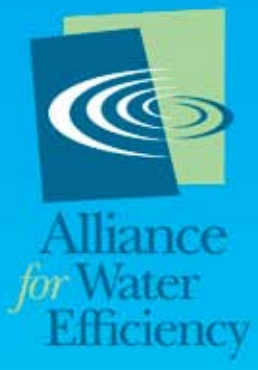
Water Conservation Keeps Rates Low in Gilbert, Arizona

Demand Reductions Over 20 Years Have Dramatically Reduced Capital Costs in the Town of Gilbert

JUNE 2017



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Acknowledgements

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This project was made possible by a grant from the Walton Family Foundation, the sponsorship of the Alliance for Water Efficiency, and the contributions of time, data, and energy from the staff at the Town of Gilbert. The Alliance for Water Efficiency would like to acknowledge the contributions of the following individuals in bringing this project to fruition and completion:

Town of Gilbert

- Eric Braun, *Water Resources Manager*
- Haley Paul, *Water Resources Coordinator*

Alliance for Water Efficiency

- Mary Ann Dickinson, *President & CEO*
- Chelsea Hawkins, *Program Planner*

Western Policy Research

- Anil Bamezai, PhD, *Principal*

Avoided Cost Overview

"Why do you ask me to conserve and then raise my rates?" asked a concerned Arizona customer at a public utility meeting. This is an important and reasonable question that customers across the U.S. are asking their water providers. The Town of Gilbert's Avoided Cost Analysis[1] answers this question through its examination of the overall impact of water conservation on water and wastewater rates. Water and wastewater system development fees and rates in Gilbert are actually significantly lower today than they would have been without Gilbert's achievements in water conservation.

The purpose of this avoided cost analysis is to quantify the impacts of water conservation and subsequent per capita demand reductions achieved in Gilbert over the past 20 years on the Town's water and wastewater rates.

The utility staff at the Town's Water Department used conservation to reduce per capita demand, thereby leveling off total production. In doing this, the Town's water supply has been extended decades into the future, and the Town is able to avoid purchasing additional water supplies, defer investing in new large-scale infrastructure projects, and scale down the size of new water and wastewater facilities.

In this study, utility staff worked with Peter Mayer of WaterDM, to carefully examine the impact of increased water conservation on the Town's water and wastewater rates. The utility staff reviewed water demand records, water rates, system development fees, and capital project costs from the past 20 years with the following question in mind:

What would the average water and wastewater rates be today if per-customer water demands had remained unchanged?

The Gilbert avoided cost analysis shows that system development fees and connection charges to new customers are 45% lower today than if per capita water demand had not been reduced. It also shows that water and wastewater rates and charges to customers are 5.8% lower today than if Gilbert customers had not decreased their per capita water use. Essentially, through conservation each water and wastewater customer has avoided the costs of acquiring, delivering and treating additional water supplies that would have been necessary to provide a reliable water supply to a growing population.

1 This avoided cost analysis approach was originally developed by WaterDM and the City of Westminster, Colorado, and was published in the April 2014 issue of the AWWA Journal. See Feinglas, S., C. Gray, and P. Mayer. 2014. Conservation efforts limit rate increases for Colorado utility. Journal AWWA, April 2014, 106:4, Denver, CO.

Changes in Water Use and Population

To explore the effects of increased conservation and demand management on water rates and system development fees, the utility staff first examined the historic water use patterns in Gilbert.[2] Figure 1 shows the entire history of potable water production in Gilbert from 1978 to 2016. This figure also charts the course of a desert Town that exploded with growth from 1990 to 2016.

The most remarkable aspect of Figure 1 is the stabilization of water production in Gilbert at about 16,000 million gallons annually from 2007 to 2016. Despite a growing population, Gilbert's potable production has held relatively steady over the past ten years. It is this trend in demand that motivated the avoided cost analysis presented in this report. The analysis describes the impact of this trend on customer water rates and system development fees.

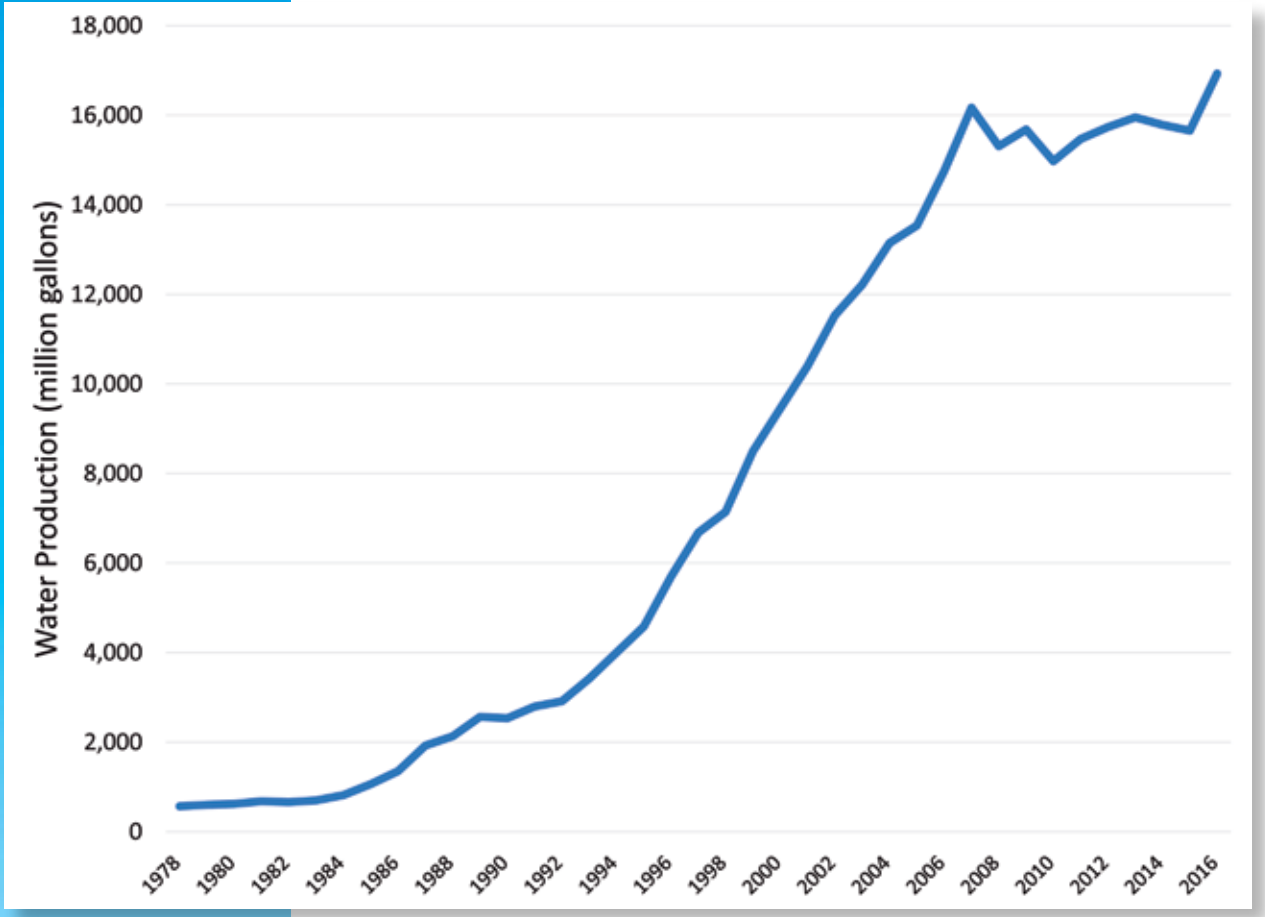


Figure 1: Water production, Town of Gilbert, AZ, 1978 – 2016

2 Data Sources: Town of Gilbert water production records provided by staff.

Gilbert's primary source of drinking water is surface water. Surface water is supplied to Gilbert's two water treatment plants by an extensive canal network from the Salt River Project (SRP) and the Central Arizona Project (CAP). Gilbert has been designated by the Arizona Department of Water Resources (ADWR) has having an assured water supply to meet the service area's current and projected near-term growth water demands for a period of 100 years. However, as long-term growth continues, a key challenge for Gilbert will be acquiring additional water supplies to meet build out demand. These water supplies are likely to be more difficult and more expensive to obtain than past water supply acquisitions.

Water production and population in Gilbert from 1978 to 2016 is presented in Figure 2. From 2005 to 2016, Gilbert's water production didn't change much even though the population increased by more than 73,000 people (40.2%) during the same period. Figure 2 also shows that from 1997 to 2015 the population of Gilbert grew from 75,144 to 247,542, an increase of 172,398 people (229%). The increases in population in the Gilbert service area make the changes in water production all the more remarkable. Water conservation gains have very nearly kept pace with population growth in Gilbert over the past 10 years.

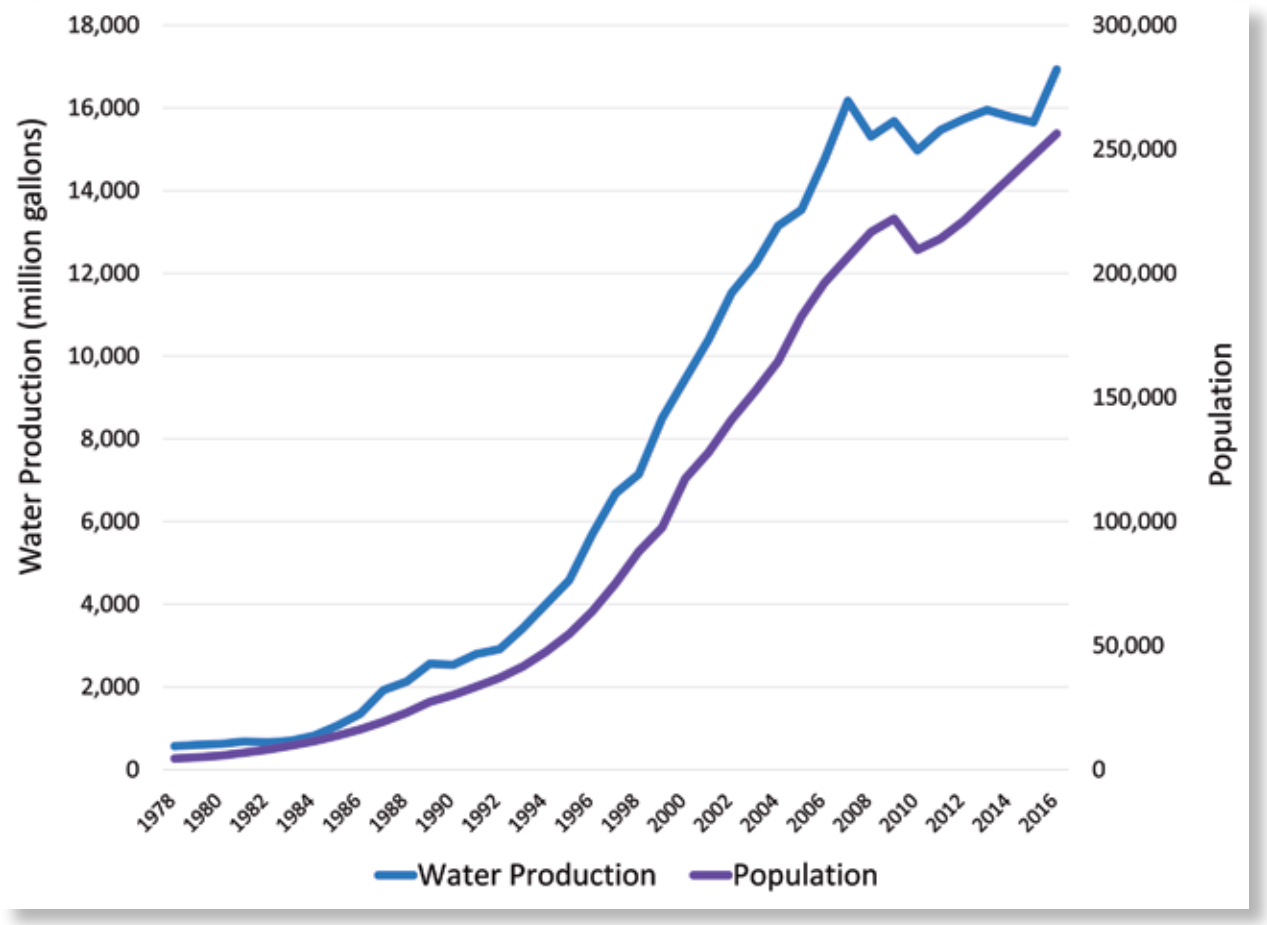


Figure 2: Water production and population, Town of Gilbert, AZ, 1980 – 2015

The water conservation achieved in Gilbert resulted from the combination of utility-sponsored conservation programs (which formally began in Gilbert in 2001), community outreach campaigns and tiered rate structures, smaller lot sizes with reduced turf grass square footage, as well as national plumbing code changes and technology improvements that have helped reduce total and per capita demands.

Figure 3 shows the system water use in Gilbert in gallons per capita per day (gcpd) from 1978 through 2016. The unmistakable declining trend started in 1986 and has continued for thirty years while the Town simultaneously experienced rapid development: a clear indication of steady improvements in water conservation over time.

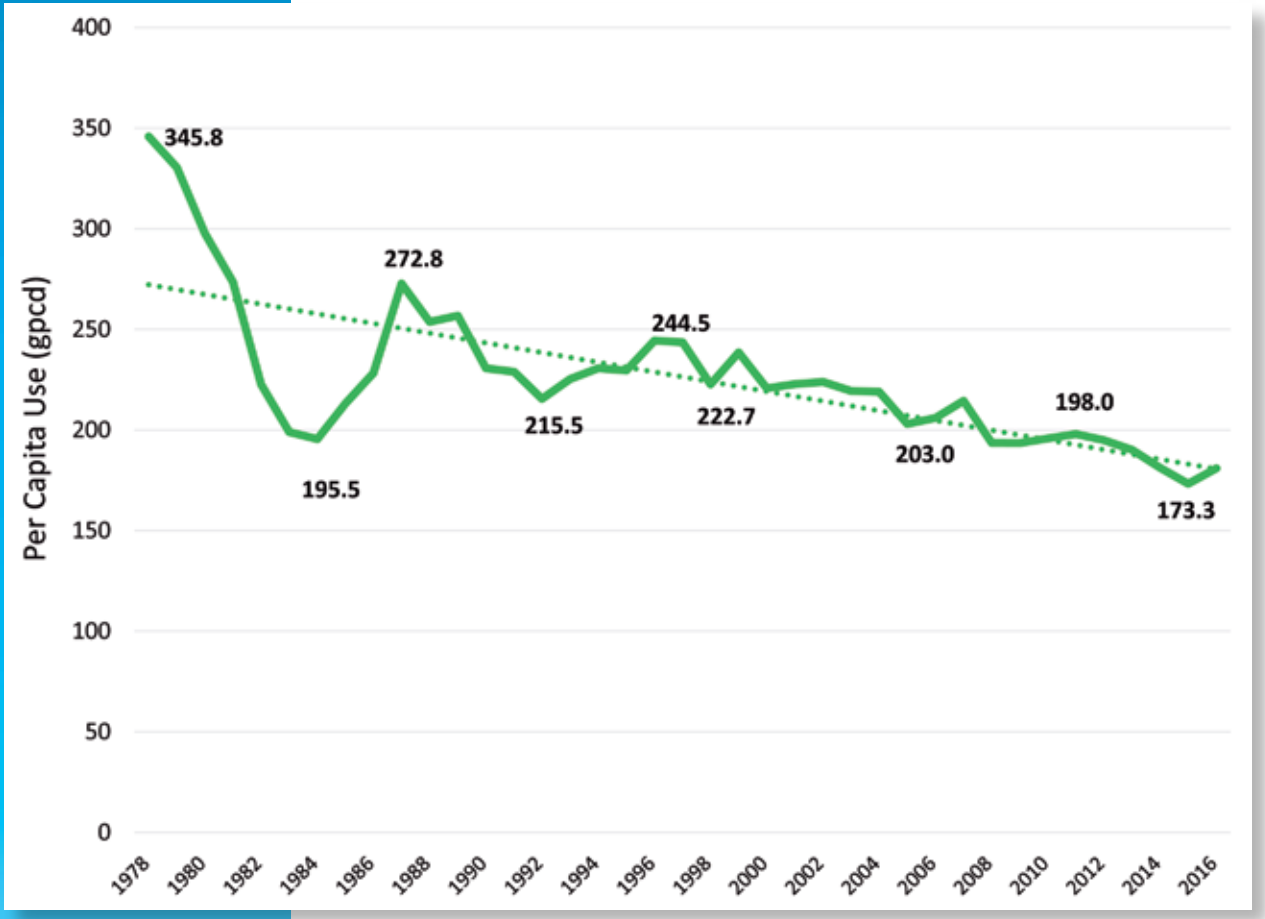


Figure 3: System per capita water use, Town of Gilbert, AZ, 1978 – 2016[3]

The conservation improvements in Gilbert shown in Figure 3 have been caused in no small part by increased conservation in Gilbert's largest demand sector: single-family residential. Implementing smaller lot sizes, reduced turf grass landscape preferences, and outdoor

3 System per capita water use is calculated as the total volume of water produced divided by the population served.

conservation, in addition to plumbing codes and standards, have helped drive down overall system demand and usage for this sector specifically.

Figure 4 shows the average monthly per capita use in five year increments starting in 1996 and concluding in 2016. There is a clear declining trend in per capita use in all months of the year over this 20 year time period. Large reductions in summertime per capita use indicate increased irrigation efficiency and reduced outdoor use.

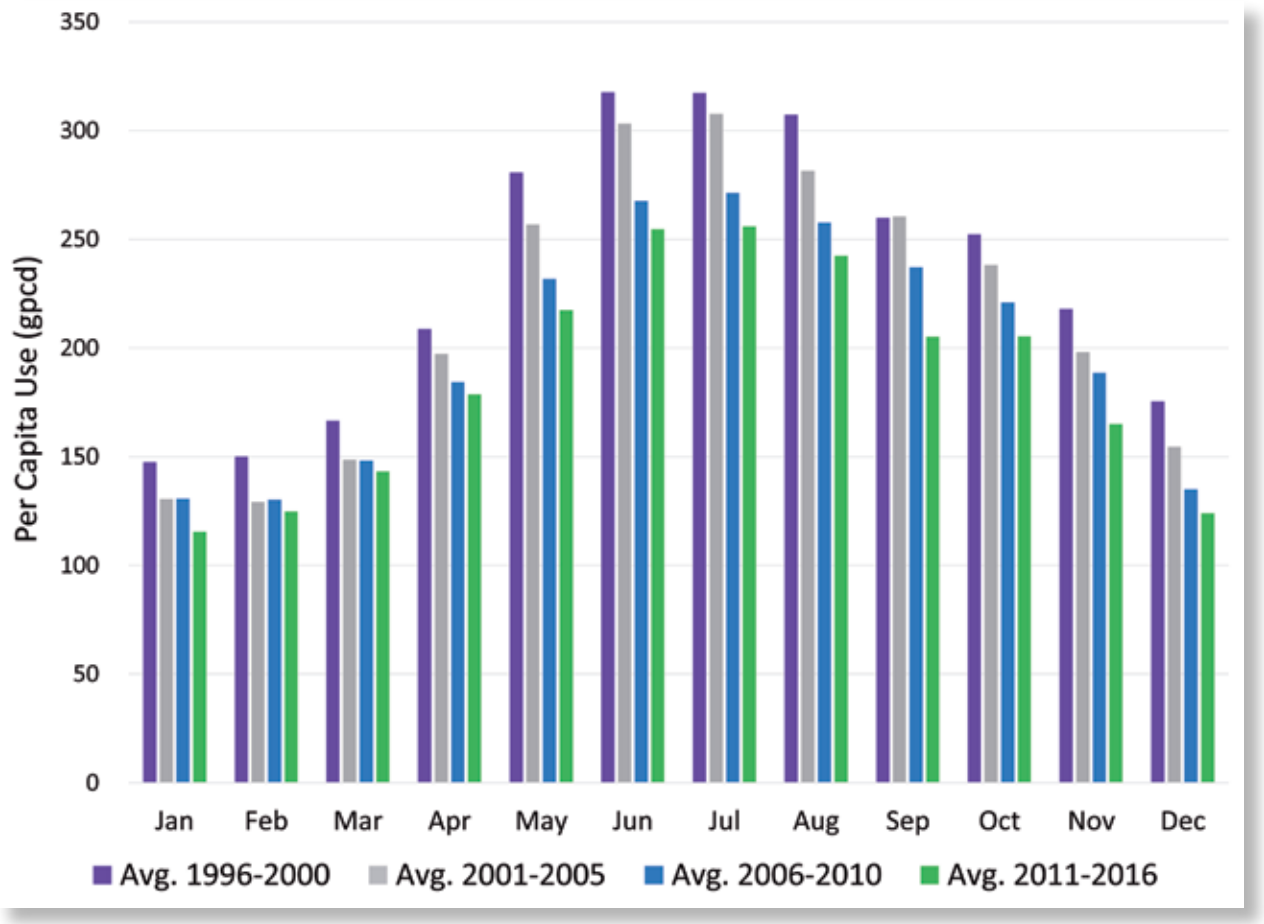


Figure 4: Average Monthly System per Capita Use, Town of Gilbert, AZ, 1996 – 2016

Figure 5 shows the percent change in per capita water use in each month from the 1996 – 2001 time period to the 2011 – 2016 time period. Per capita use in Gilbert declined between 14% and 29% over this time period. The largest percentage reductions occurred in December, January, and May indicating that both indoor and outdoor conservation are contributing to Gilbert's demand reductions. Given the rapid growth of the community, conservation improvements also reflect conservation that is "built in" to new homes and businesses as they join the Town's water and wastewater system, via building and plumbing codes.

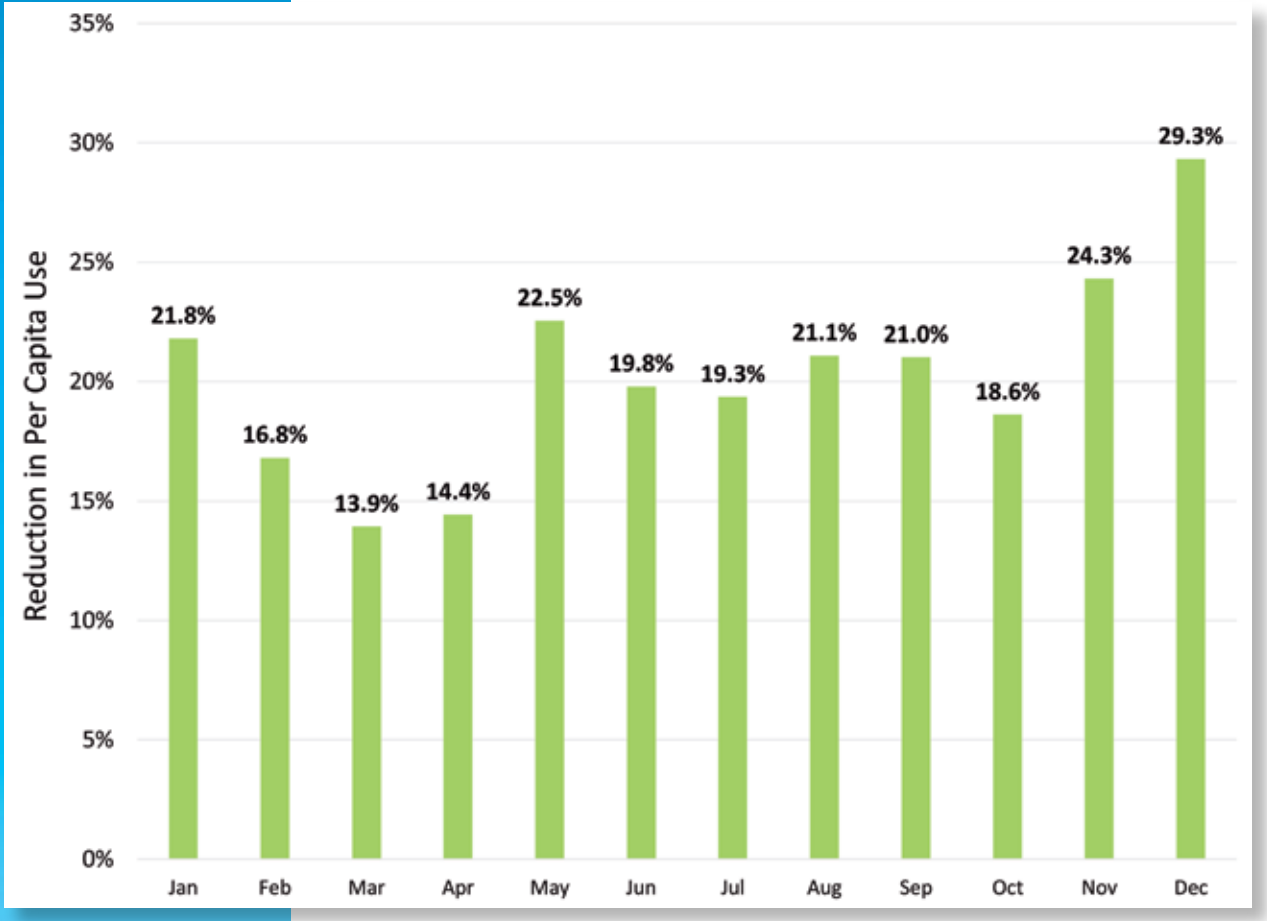


Figure 5: Reduction in average monthly per capita use, Town of Gilbert, AZ, 1996 – 2001 vs. 2011 – 2016

Figure 6 summarizes two key points of consideration for the avoided cost analysis: the change in per capita use and population in Gilbert between 1997 and 2015. Over this time period, population increased by 173,398, and per capita water use declined by 29%.

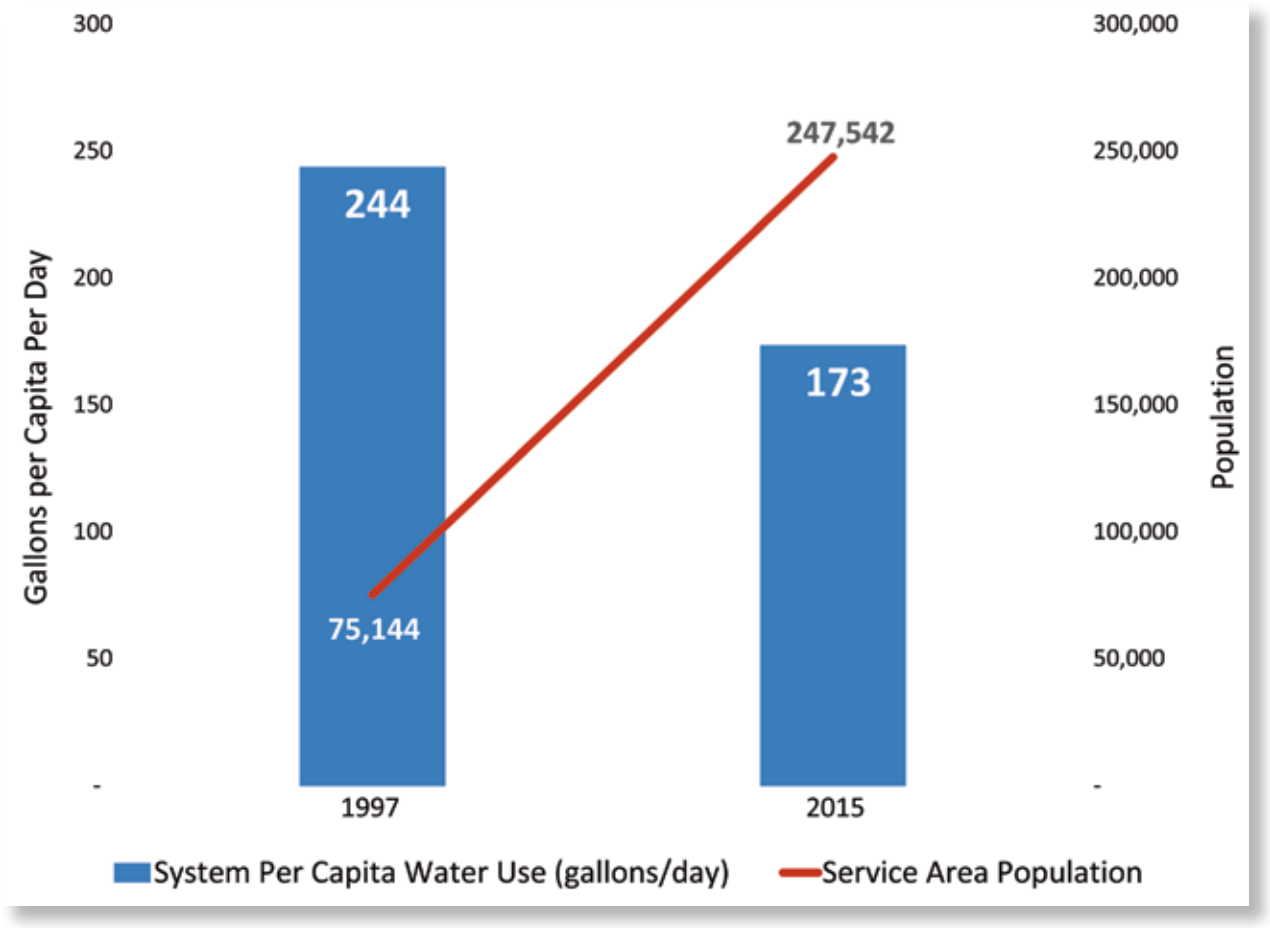


Figure 6: Town of Gilbert, AZ, per capita water use and service area population, 1997 vs. 2015

Wastewater Treatment

From 1997 to 2015, wastewater flows treated by Gilbert have followed the same general trends as the water demand curves shown in Figure 1 and Figure 2. In 1997, Gilbert treated an average of 5.4 million gallons of effluent per day (mgd). The population served in 1997 was 75,144. In 2015, with the population served at 247,542, Gilbert treated an average of 14.02 mgd.

During the same period, the per-person effluent volume declined by 21%. In 1997, the per capita wastewater treatment was 71.8 gpcd. By 2015, this had been reduced by 21% to 56.6 gpcd as shown in Figure 7.

The impacts of water conservation and the resulting reductions to per capita wastewater flows on rates were also included in this avoided cost analysis.

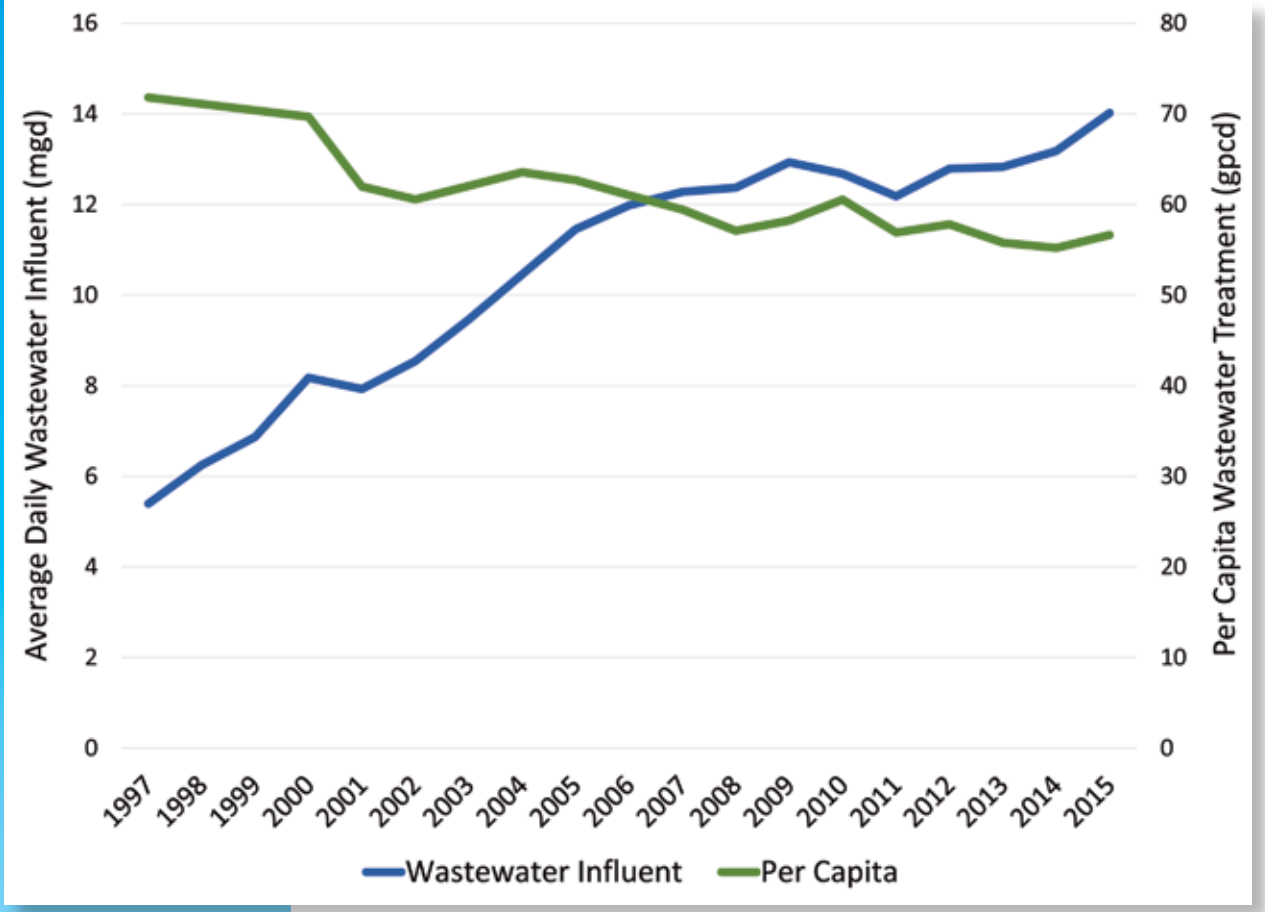


Figure 7: Average daily wastewater treatment and per capita, Town of Gilbert, AZ, 1997 – 2015

Gilbert Avoided Cost Analysis

Step 1: Select Baseline

The avoided cost analysis starts with reviewing the available utility data and selecting a baseline year. In this case it is 1997, after Gilbert had grown into a community of 75,000, but before the expansion of the Town in the 2000s. Reliable data were available from Gilbert going back farther, but this 20 year time span represents the period when water efficiency and growth both occurred. As shown in Table 1, in 1997 Gilbert's system wide per capita use was 244 gpcd and in 2015 it was 173 gpcd.

This is the key "what if" assumption in the analysis: What if water use patterns from 1997 had persisted and were unchanged today?

Table 1: Statistical comparison of Gilbert in 1997 vs. 2015

	1997	2015
Population	75,144	247,542
Water produced (kgal)	6,679,000	15,656,000
Water produced (AF)	20,497	48,046
Water produced (mgd)	18.3	42.9
Water system-wide gpcd	244	173
Wastewater treated (mgd)	5.4	14.0
Wastewater system-wide gpcd	71.8	56.6

With 1997 selected as the baseline, and fundamental water use and population statistics established, the next steps of the avoided cost analysis envision water use in Gilbert in the absence of water conservation.

Step 2: Hypothetical Water Demand and Wastewater Flow

In step 2 of the avoided cost analysis, a hypothetical water demand in Gilbert is calculated assuming the present day population uses 244 gpcd. This is the key "what if" assumption in the analysis: What if water use patterns from 1997 had persisted and were unchanged today?

For Gilbert, demand was projected from a 1997 baseline of 244 gpcd assuming that no conservation was implemented and historic per capita use continued to grow with population, unabated.

Under this hypothetical non-conserving scenario, average daily water demand in Gilbert in 2015 would be 60.3 mgd and the average daily wastewater flow would be 21.5 mgd.

Figure 8 shows a comparison of the actual water production and wastewater flow in 1997 and 2015, compared with the hypothetical production and flow that would exist under the non-conserving scenario. These hypothetical demands shown in Figure 8 form the basis of the avoided cost analysis.

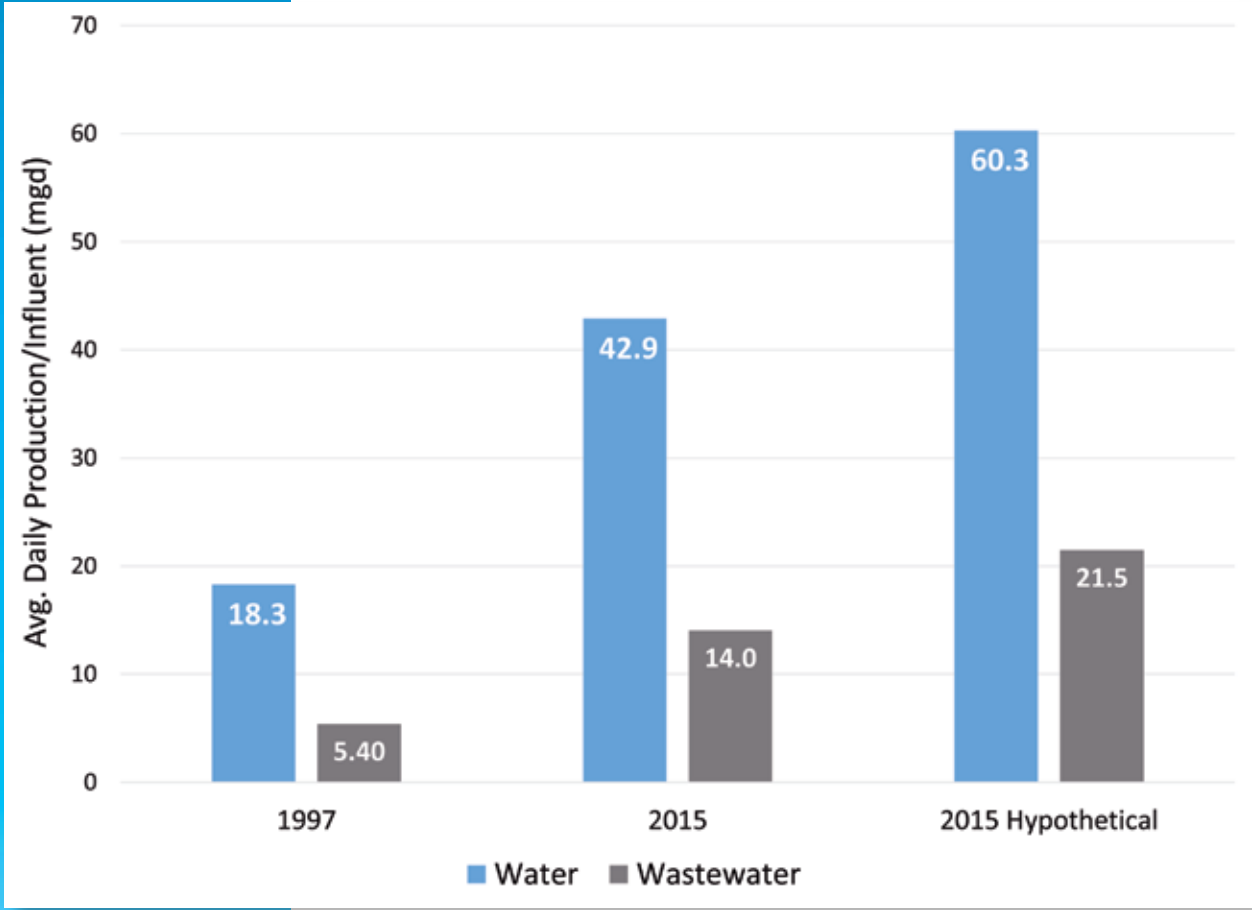


Figure 8: Daily production and flow, Town of Gilbert, AZ, 1997 – 2015, and 2015 hypothetical non-conserving

Step 3: Infrastructure and Operational Cost Assessments

The subsequent analysis steps answer the following questions:

1. ***What would it take to produce and deliver an average of 60.3 mgd potable water and to treat 21.5 mgd of wastewater?***
2. ***How much additional infrastructure would be required?***
3. ***How much additional operational costs would be added?***

In step 3, the additional water supply, treatment capacity, transmission capacity, and wastewater treatment and transmission capacity necessary to adequately serve the hypothetical non-conserving level of demand in Gilbert was determined. The costs of expanding Gilbert's infrastructure to deliver the water needed to meet the hypothetical additional demands were estimated using best available information from Gilbert staff and other experts on the cost of securing new supply and constructing new transmission and facilities. Gilbert's water and wastewater infrastructure have been expanded incrementally since 1997 and the assessment of additional water and wastewater infrastructure costs utilizes actual final construction and bonding costs from recent projects.

Water Infrastructure

Gilbert's current peaking factor is 1.7[4], and under the non-conserving scenario this same ratio of peak day to average day was assumed. The peaking factor of 1.7 was applied to the hypothetical average day demand of 60.3 mgd (Figure 8), to calculate a hypothetical peak day demand of 96 mgd.

Gilbert's primary source of drinking water is surface water. Surface water is supplied to Gilbert's two water treatment plants by an extensive canal network from the Salt River Project (SRP) and the Central Arizona Project (CAP). SRP manages a series of dams and reservoirs along the Salt River and Verde River watersheds, storing water for times of low rainfall and drought. Water collected in these reservoirs is released into SRP canals. CAP operates and maintains a 336 mile long canal system which carries Colorado River water from Lake Havasu, through Phoenix, to south of Tucson.

4 Peaking factor for a utility is calculated annually as the peak daily production divided by the average daily production.

The total estimated additional cost of water infrastructure required to meet the hypothetical non-conserving demand was set at $184 million.

Gilbert's 2015 peak day was about 73 mgd and the Town currently has the capacity to treat 101 mgd of potable water. Under the hypothetical, non-conserving scenario, Gilbert's peak in 2015 would have been 96 mgd, requiring Gilbert to have expanded water treatment capacity up to 123 mgd based on the standard planning approach to ensure 20% excess capacity in water treatment to meet demand fluctuations and growth.

Gilbert's most recent water treatment plant project was completed at a cost of $4,166,667 per mgd of rated capacity. Under the non-conserving scenario, Gilbert would need an additional 22 mgd of water treatment capacity at an estimated cost of $91.5 million.

Using Gilbert's current storage capacity to design ratio it was determined that additional pumping and transmission capacity for 19 mgd would be required to meet the hypothetical demand. The cost of expanding the transmission lines and pumping capacity for the additional hypothetical demand would cost an estimated $4.87 million per mgd[5] and $93.5 million in total.

The total estimated additional cost of water infrastructure required to meet the hypothetical non-conserving demand was set at $184 million. Because of Gilbert's policy requiring new growth to pay its own way, these costs fall entirely on customers purchasing water and wastewater connections to join the Town's systems.

Water Operations and Maintenance

The current variable costs in the water operations and maintenance budget is $10.3 million. This includes costs for commodities, vehicles, operations, maintenance, replacement, staffing, chemicals, energy, etc. Under the non-conserving scenario, it was estimated that Gilbert's operations and maintenance budget would be increased by 20% to $12.4 million, an increase of $2.1 million per year.[6]

Gilbert's comparatively small costs associated with implementing conservation over this time period are assumed unchanged under the hypothetical scenario in which per capita reductions were not achieved.

5 From page 6 of Gilbert's Infrastructure Master Plan prepared by TischlerBise (2016).
6 Assumes a proportional staff increase needed to staff additional treatment plant/capacity.

Wastewater Infrastructure

Under the hypothetical "non-conserving" scenario, Gilbert's wastewater treatment facilities would be treating 21.5 mgd of effluent on average. The current conveyance and treatment capacity of the Gilbert system is currently about 20 mgd. Under the non-conserving scenario it is assumed that an additional 7 mgd of capacity would be added to the system, bringing it up to 27 mgd, sufficient to handle the fluctuations of a 21.5 mgd average day demand.

Gilbert calculates the total cost of capacity in the wastewater system to be $17.2 million per mgd which represents the comprehensive cost of adding wastewater capacity including: land purchase, engineering, conveyance, treatment, etc. Under this cost analysis, adding 7 mgd to treat flows under the non-conserving scenario would result in a total capital cost of $118 million including principal and interest.

Under this cost analysis... the non-conserving scenario would result in a total wastewater infrastructure capital cost of $118 million.

Wastewater Operations

The current variable costs in the Gilbert wastewater operations and maintenance budget is $8 million. Under the non-conserving scenario, it was estimated that Gilbert's wastewater operations budget would grow by 20% to $9.6 million, a total increase of $1.6 million.[7]

7 Operations and maintenance cost estimates were provided by Eric Braun, Gilbert Water Department, from current budget documents.

System development fees in Gilbert are used to recover the cost of new water resources and infrastructure required to serve the new customer.

Step 4: Impact on Customer Rates

The goal of the final step in the analysis was to determine the impact the avoided costs discussed above have had on system development fees and customer water and wastewater rates in Gilbert.

In step 4, Gilbert's current system development fees and water and wastewater rates were adjusted to determine what customer charges would be required to cover the additional costs brought about by the purchase and delivery of additional water supply and infrastructure and the treatment of additional wastewater flows in the hypothetical demand scenario. The final result is a reasonable estimate of the hypothetical system development fees and water and wastewater rates and charges that would be necessary to cover all costs associated with a per capita water demand if it were unchanged from 1997.

Water and Wastewater Rates

In 2015, the average single-family home in Gilbert used approximately 144,000 gallons of water per year and paid a total combined water and wastewater bill of $620 per year.[8] However, under the hypothetical non-conserving scenario the average single-family home in Gilbert would have to pay $657 per year for the same service to cover all of the additional infrastructure, operations, and maintenance charges. This additional $37 per year represents a 6.1% increase over current water and wastewater rates.

Figure 9 is a pie chart which shows the contribution of each of the various cost components to the avoided $38 annual rate increase. Water treatment operations account for 50% of the total rate increase. Wastewater operations and maintenance account for 38.8% of the total, and additions to the water replacement fund account for 11.2% of the total.

8 As part of this analysis WaterDM prepared a water and wastewater rate calculator to develop these values using Gilbert's current rates.

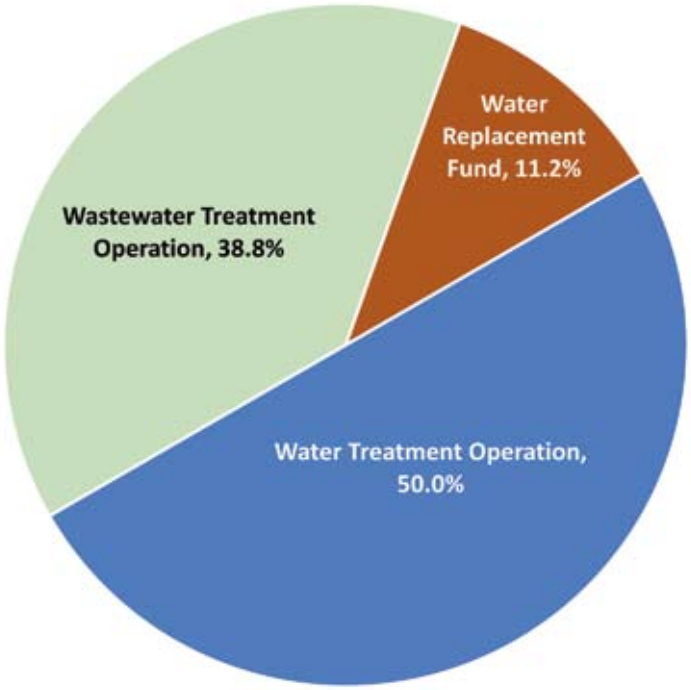


Figure 9: Summary of rate increase that would be necessitated by non-conserving scenario for Town of Gilbert, AZ

System Development Fees

System development fees, also known as connection fees, are the charges paid by each property owner to obtain a metered connection to the Gilbert water and wastewater system. System development fees in Gilbert are used to recover the cost of new water resources and infrastructure required to serve the new customer. Under the hypothetical non-conserving scenario an additional $340 million in infrastructure costs would need to be covered through system development fees. This amounts to an additional $7,733 per single-family equivalent system development in Gilbert today. System development fees in Gilbert are 45% lower today because of conservation. A summary is presented in Table 2 below.

Table 2: Town of Gilbert system development fees, 2017 and non-conserving scenario

Category	System Development Fee
Single-Family Water System Development Fee (2017)	$6,286
Single-Family Wastewater System Development Fee (2017)	$3,182
Single-Family System Development Fee Total (2017)	$9,468
Hypothetical Single-Family System Development Fee Total	$17,201
% Change in Single-Family System Development Fee	-45%

A summary comparison of the impact of water conservation on rates and system development fees is presented in Figure 10. This analysis envisions the amount paid by today's average single-family Gilbert customer using 144,000 gallons annually with today's water rates versus a single-family Gilbert customer with baseline (1997) water use patterns, hypothetically using 186,000 gallons annually, with the required higher rates.

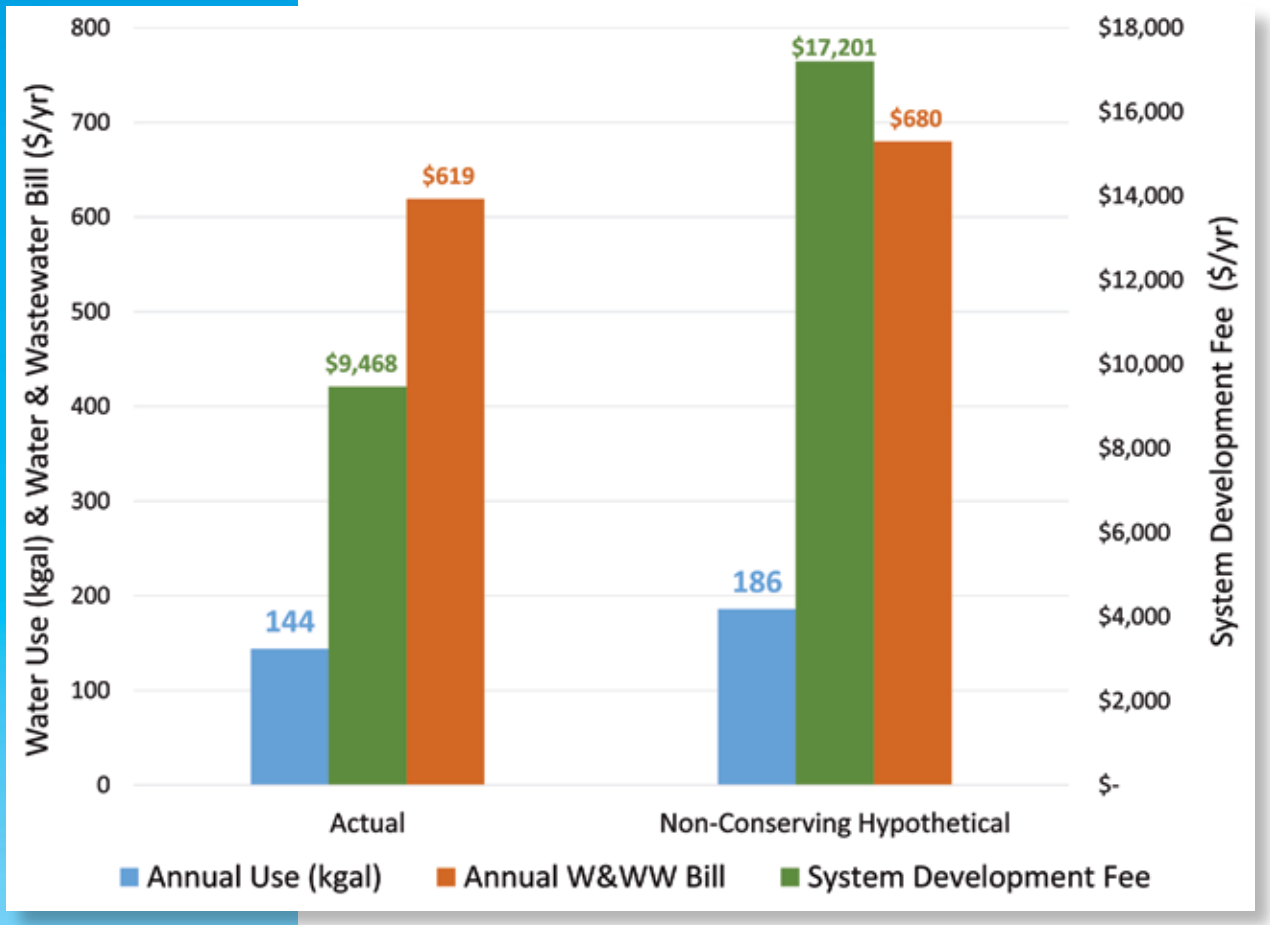


Figure 10: Impact of water conservation on rates and system development fees for Town of Gilbert, AZ

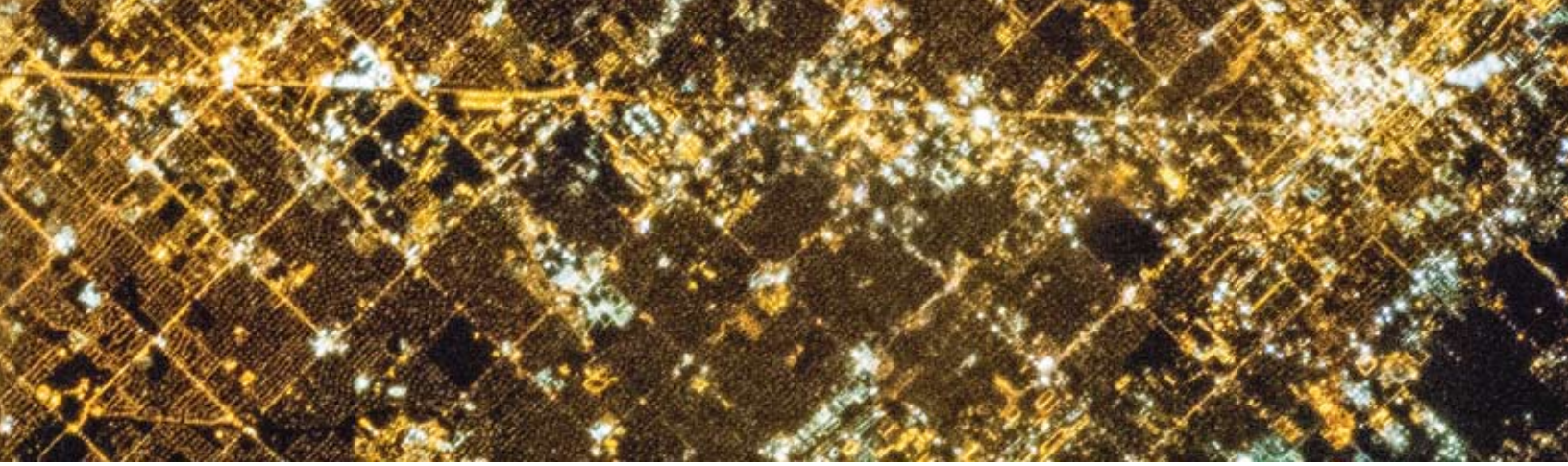


PHOTO: TOWN OF GILBERT, ARIZONA, AND SURROUNDING COMMUNITIES FROM THE INTERNATIONAL SPACE STATION AT NIGHT REVEALS PHENOMENAL GROWTH (NASA).

Summary of Findings

The findings of the avoided cost analysis for Gilbert are revealing: Per capita water use has declined substantially over the last two decades, resulting in significant savings in system development fees and in water and wastewater rates. If per capita water demand had not been reduced from 244 gpcd in 1997 to 173 gpcd in 2015, residents in Gilbert would be paying system development fees that are 82% higher and water and wastewater rates that are 6.1% higher than what they are today.

Per capita water use has declined substantially over the last two decades, resulting in significant savings in system development fees and in water and wastewater rates.

The key findings from Gilbert's avoided cost analysis are summarized below:

Gilbert's conservation efforts have helped reduce per capita water demand from 244 gpcd in 1997 to 173 gpcd today, a 29% decrease.

The Gilbert avoided cost analysis shows that system development fees and connection charges to new customers are 45% lower today than they would been in the absence of conservation.

The Gilbert avoided cost analysis shows that water and wastewater rates and charges to customers are 5.8% lower today than they would have been if per capita water demand had not declined.

- $2,067,909 - Avoided annual water treatment and operational costs.
- $1,603,437 - Avoided annual wastewater treatment and operational costs.
- $340,807,075 - Avoided water resources and wastewater treatment capital costs.

APPENDIX A: Avoided Cost Model Inputs and Outputs

Fundamental data inputs and outputs to and from the WaterDM avoided cost model are presented here.

Population and Water Demand

Baseline-1997

Baseline Year – 1997[9]
Population – 75,144
Water Produced (kgal) – 6,679,000
Water Produced (mgd) – 18.3
System wide GPCD – 244

Current-2015

Current Year – 2015
Population – 247,542
Water Produced (kgal) – 15,656,000
Water Produced (mgd) – 42.9
System wide GPCD – 173

Non-Conserving Forecast

Water Produced (kgal) – 22,002,196[10]
Water Produced (mgd) – 60.3
Water conserved (kgal) – 6,346,196
Water conserved (mgd) – 17.4

Water Treatment Impacts

Water treatment capacity is not a limiting factor for Gilbert.

9 From Town of Gilbert water and wastewater production and treatment records.
10 Calculated as: 244 gpcd x 365 days x current population.

Total Cost of ALL Required Non-Conserving Expansion	**$ 340,807,075**

Non-Conserving Forecast Avg Day (water system)	60	MGD
Non-Conserving Forecast Peak Day	96	MGD
Non-Conserving Peak Capacity Rqd. (includes growth capacity)	123	MGD
Peak Treatment Expansion Rqd. For Non-Conserving Peak	22	MGD
Estimated Unit Cost of Pumping & Transmission Expansion	$4,166,667	MGD
Estimated Cost of New Transmission Rqd.	**$91,546,581**	$

Water Resources

Current Water Rights and Permits	50	MGD
NC Water Requirement	60	MGD
Additional Water Rights Required	10	MGD
Cost of 100 year lease for tribal water (2017)	$3,800,000	$/MGD
Estimated Cost of New Water Rights	$39,063,959	$

Wastewater System

Wastewater Ratio of Avg. to Peak Day[11]	1.1	
Current Avg. Day Design[12]	19	MGD
Current Peak Day Design	20	MGD/YR
Current I & I Inflows (MG/year)	2	MGD
Non-Conserving Avg. Day Flow	20	MGD
Non-Conserving Peak Day Flow[13]	21	MGD
Non-Conserving Peak Capacity Rqd. (90% rule)	24	MGD
Estimated Rqd. Capacity	27	MGD
Expansion Rqd. For Non-Conserving Peak	7	MGD
Unit Cost of Wastewater Plane Expansion	$17,194,721	$/MGD
Estimated Cost of Wastewater Expansion	**$117,659,429**	$

11 Calculated from 2013 Gilbert treatment records.
12 2017 avg. day design.
13 Includes only Town of Gilbert.

Rate Impacts

Capitol Rate Impacts

1 Service Commitment Equivalent (SFE)[14]	144.0	MGD
Current/Actual # of SFEs[15]	108,722	MGD
Hypothetical # of Non-Conserving SFEs	152,793	MGD
Additional SFEs Under Non-Conserving Scenario	$44,071	$/MGD

Operational Rate Impacts

Loan Interest Rate	NA	%
Advance Payment Period	20	Years
% of Expansion Cost Financed	NA	%
Calculated Loan Interest	NA	$
Total Amount Recovered from System development fees	$340,807,075	$
Annual Payment over 20 Years	$17,040,353	$/Year
Additional per SFE System Development Fee Impact	**$7,733**	**$/Year**

% Increase in Demand – Non-Conserving vs. Current	40.5%	%
Operational Budget Increase	20.0%	%
Current Water Treatment Budget	$10,339,547	$
Non-Conserving Water Treatment Budget	$12,407,456	$
Avoided Water Treatment & Operation Cost	$2,067,909	$/Year
Annual Rate Impact per SFE	**$19**	$
Current Wastewater Treatment Budget	$8,017,185	$
Non-Conserving Wastewater Treatment Budget	$9,620,622	$
Avoided Wastewater Treatment & Operational Cost	$1,603,437	$/Year
Operational Budget Increase	20.0%	$
Annual Rate Impact per SFE	**$15**	$

14 1 SFE = average annual water use of 1 single-family home in Gilbert.
15 Calculated as: Total current demand divided by 1 SFE.

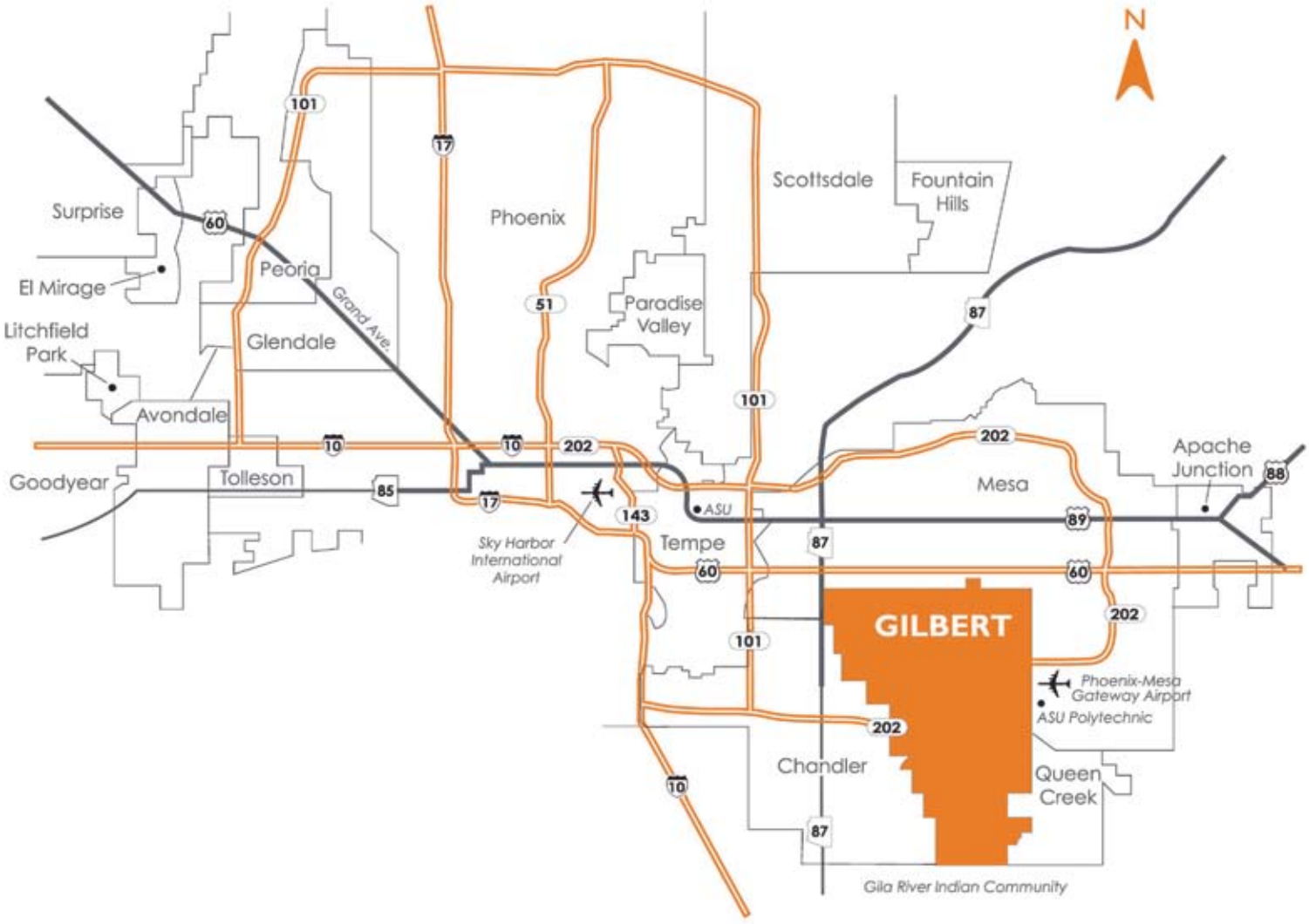
Current Water and Wastewater Replacement Fund	$8,064,000	$
Non-Conserving Water and Wastewater Replacement Fund	$10,386,432	$
Annual Rate Impact per SFE[16]	**$4**	$

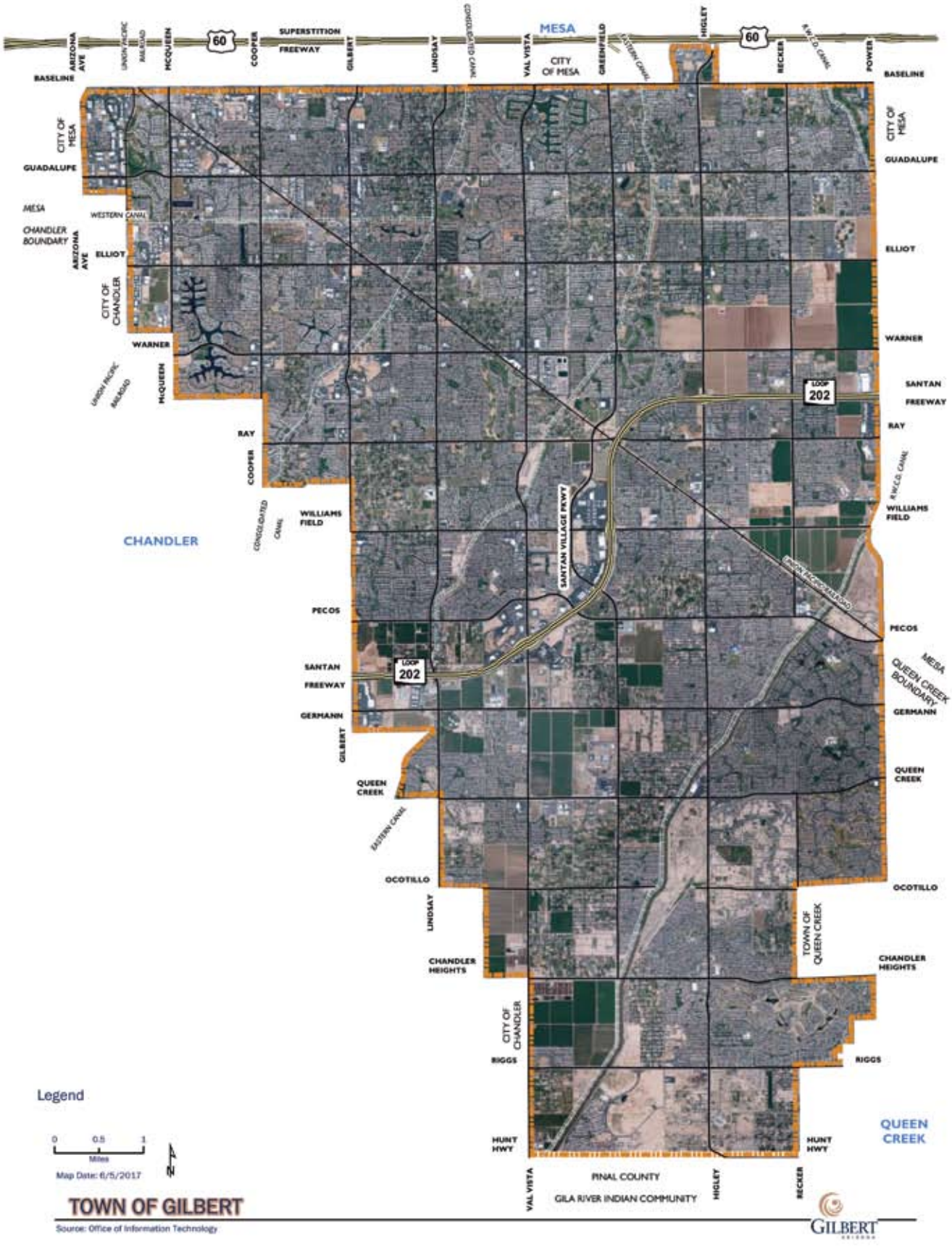
Total Rate Impact Per SFE	**$38**	$

Current Annual Water and Wastewater Payments Per SFE	$619	$
Non-Conserving Annual Water and Wastewater Payments Per SFE	$657	$
% Increase in Total Rates Per SFE	**6.1%**	**Higher than w/o conservation**
	5.8%	**Lower than w/o conservation**

16 Paid from rates. Assumes proportionally larger system and that the additional fund balance must be renewed every 5 years.

APPENDIX B: Service Area Maps

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CHANDLER HEIGHTS
RIGGS
HUNT HWY
ARIZONA AVE
MCQUEEN
COOPER
GILBERT
LINDSAY
VAL VISTA
GREENFIELD
HIGLEY
RECKER
POWER
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WILLIAMS FIELD
WESTERN CANAL
EASTERN CANAL
CONSOLIDATED CANAL
ROOSEVELT IRRIGATION DISTRICT CANAL
UNION PACIFIC RAILROAD
CHANDLER BOUNDARY
MESA QUEEN CREEK BOUNDARY
TOWN OF QUEEN CREEK
PINAL COUNTY
GILA RIVER INDIAN COMMUNITY
Legend
0 0.5 1
Miles
Map Date: 6/5/2017
TOWN OF GILBERT
Source: Office of Information Technology
GILBERT

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