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Memorandum

To: City of Flagstaff
From: WestWater Research
Date: April 7, 2021
Re: Reclaimed Water Pricing Policy and Economic Value of Water

Background and Purpose

The City of Flagstaff ("Flagstaff" or "City") is completing a comprehensive review of its reclaimed water services to support the development of a Reclaimed Water Master Plan. A portion of the assessment of reclaimed water services is a review of the costs associated with providing reclaimed water, revenue requirements, the current rate structure, and relevant policy considerations in the context of a broader analysis of price setting and provision of service. In addition, an analysis of the economic value of reclaimed water may provide useful context to guide decision making related to resource allocation. This memorandum is organized to contain the following:

- Overview of Flagstaff's reclaimed water supply and infrastructure
- Background on the City's historical and current reclaimed water service
- Review of historical costs of providing reclaimed water and reclaimed water revenues
- Description of the current reclaimed water rate structure
- Comparative analysis of reclaimed water rate structures in other communities throughout Arizona
- Synthesis of rate structure and water policy considerations
- Analysis of the economic value of reclaimed water
- Summary of key considerations related to rate setting and resource allocation

Flagstaff's Reclaimed Water Supply

The City of Flagstaff operates two water reclamation facilities (WRF), Rio de Flag and Wildcat Hill, to treat wastewater and produce Class A+ reclaimed water.[1] The Rio de Flag WRF is located just south of downtown Flagstaff and has a treatment capacity of 12.3 acre-feet (AF) per day. The Wildcat Hill WRF is located northeast of downtown and has a treatment capacity of 18.4 AF per day. Together, the two plants have a maximum treatment capacity of 11,200 AF of reclaimed water per year. Table 1 shows the volume of reclaimed water produced, delivered and discharged at both WRFs for the last five years.

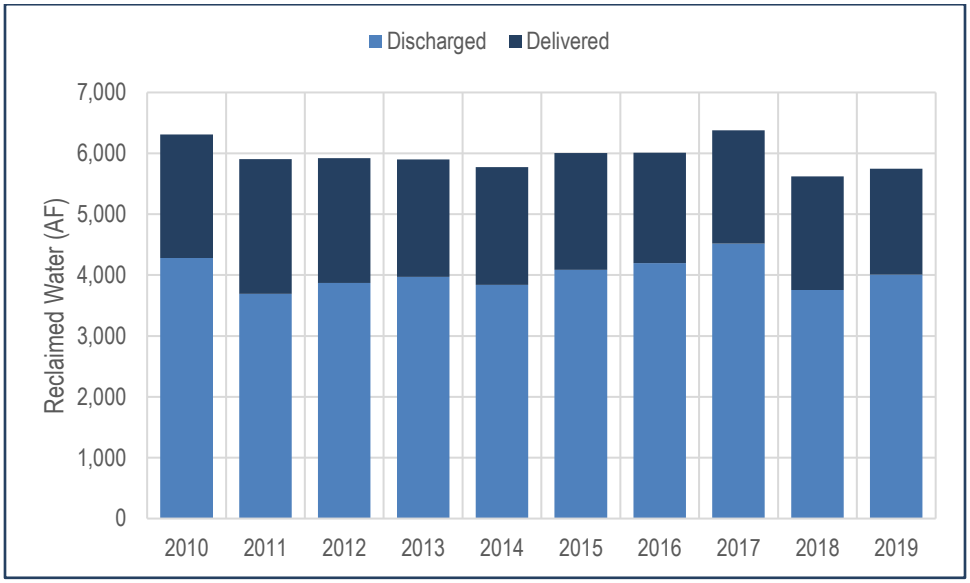
[1] The Arizona Department of Environmental Quality (ADEQ) regulates the production of reclaimed water including assigning quality ratings (Class A+, A, B+, B, and C) based on the treatment process, with A+ being the highest rating.

Table 1: Reclaimed Water Production and Delivery (2015 - 2019)

Year	Produced (AF)			Delivered to Reuse (AF)	Discharged to Rio de Flag (AF)
	Wildcat Hill	Rio de Flag	Total		
2015	3,853	2,183	6,036	1,952	4,084
2016	3,795	2,182	5,976	1,782	4,194
2017	4,205	2,088	6,293	1,776	4,517
2018	3,735	1,827	5,563	1,810	3,753
2019	4,098	1,714	5,812	1,805	4,007

Since 2010, the total reclaimed water produced at both WRFs has averaged 5,960 AF per year, with a maximum production of 6,377 AF in 2017 and a minimum production of 5,623 AF in 2018. During the same period, the annual volume of reclaimed water delivered to reuse customers ranged from 1,740 AF to 2,212 AF (29% - 37% of total annual production). About 4,000 AF per year of produced reclaimed water is uncommitted, meaning it is not reserved for delivery to customers. A portion of reclaimed water that is not delivered to customers is used to meet environmental commitments, including maintaining water levels in Frances Short Pond during the dry months and maintaining minimum flows in the Rio de Flag. As a result of minimal capacity for reclaimed water storage, the remainder of produced reclaimed water is discharged into Rio de Flag. Some of that discharge percolates into the underlying aquifer and is later recovered by the City's water supply wells. The total volume of reclaimed water delivered to customers and discharged to the Rio de Flag for each year from 2010 to 2019 is shown in Figure 1. By 2054, it is expected that uncommitted reclaimed water availability will increase to about 5,000 AF per year.[2]

Figure 1: Reclaimed Water Delivery to Reuse and Discharge to Rio de Flag (2010 - 2019)



Flagstaff's Reclaimed Water Service

The City of Flagstaff has been providing reclaimed water to customers since the 1960s. The Continental Country Club was the first customer to receive reclaimed water from the City. Since then, the City has expanded the reclaimed customer base to now serve about 70 customers using reclaimed water for non-potable residential, landscape irrigation,

[2] Analysis by Brown & Caldwell for City of Flagstaff Reclaimed Water Master Plan.

commercial, and manufacturing purposes. A map of the City's current reclaimed water distribution system is available in Appendix A.

Reclaimed Water Purchase Agreements

Each reclaimed water customer in the City of Flagstaff must execute a reclaimed water purchase agreement to receive reclaimed water service. Generally, these agreements include:

- A limited term between 5 – 20 years
- A specified total maximum peak monthly delivery rate
- A specified total annual maximum delivery volume
- A description of the place and purpose of the reclaimed water use

Some reclaimed water purchase agreements have additional provisions to clarify details of each party's responsibilities in the agreement. For example, the Arizona Snowbowl is required to pay an Annual Minimum Payment equivalent to the cost to the City associated with providing 138 AF of reclaimed water. The Annual Minimum Payment is required regardless of the volume of reclaimed water delivered to the Arizona Snowbowl, and this payment is applied to the first 138 AF of delivered reclaimed water each year. Based on the reclaimed agreements reviewed by WestWater, all reclaimed customers are charged the reclaimed water rates approved by City Council, and there are no provisions for special rates within the purchase agreements. The City's current reclaimed water rates are provided in Appendix B.

Historical Pricing and Allocation

Historically, reclaimed water was provided by Flagstaff on a first come first served basis and was priced based on policy rather than cost of service. The first customers of reclaimed water were golf courses, and a declining block rate structure was assigned to these users to encourage off-peak use. The establishment of a pricing structure to incentivize consumption was motivated in part by a lack of storage for reclaimed water in the system. In 1993, reclaimed water rates were set to 75% of potable water rates, and in 2002 a City Council ordinance adjusted reclaimed water rates to be set at 35% of potable water for most uses. In 2010, rates were adjusted again to reflect revenue requirements determined through a cost of service study. The primary goal of reclaimed water rate setting has been cost recovery, with revenue targets set to recover operational and capital improvement costs. Investment in the reclaimed water system distribution infrastructure (purple pipe delivery) has been somewhat limited in the past, due to the City lacking a firm understanding of how reclaimed water demand might grow in the future. Due to the high installation expense, most purple pipe to date has been constructed to serve specific customers.

Current Pricing and Allocation

Demand for reclaimed water in Flagstaff has increased, and for the past several years the City has not been able to execute new reclaimed water purchase agreements due to distribution limitations. During peak demand the reclaimed water system is fully committed, meaning existing water delivery commitments use the full system capacity. However, reclaimed water demand varies seasonally, with the lowest demand in March and November, and the highest demand in June and July for turf irrigation purposes. Current rates for reclaimed water are approved by City Council and are set to collect revenues sufficient to cover operational costs and anticipated capital improvement expenses (see current potable and reclaimed water rates in Appendix B). In 2014, the City adopted a policy to guide reclaimed water allocations which states that distribution of reclaimed water will prioritize renewing existing agreements, then will allocate to new agreements in which reclaimed water will offset potable demand, and finally, will allocate to uses that provide community benefits.

Historical Cost of Providing Reclaimed Water

The City has a goal of ensuring that the reclaimed water fund is self-sustaining, and not subsidized by the potable, wastewater, or stormwater funds.[3] Beginning in fiscal year 2016, the reclaimed water fund expenses and revenues have been accounted for independently of other water funds. The expenses and revenues of the reclaimed water fund for FY 2016 – 2020 are presented in Table 2.

Table 2: Reclaimed Water Fund Summary

Fiscal Year	Revenues	Expenditures	Annual Net Revenue
FY 2016	$1,031,188	$342,601	$688,586
FY 2017	$712,179	$446,344	$265,835
FY 2018	$1,413,774	$528,110	$885,664
FY 2019	$818,176	$520,521	$297,655
FY 2020	$1,122,464	$464,381	$658,083

Reclaimed water fund revenues and expenditures fluctuate from year to year, however the fund has maintained a positive annual net revenue for the last five fiscal years. Annual net revenues contribute to the reclaimed water enterprise fund and are used to support operations and maintenance, capital improvements, and maintenance of working capital. Variability in expenditures is largely attributable to changing costs of maintenance and staffing along with investments in capital improvement between years. Reclaimed water fund revenues are comprised of fixed charge revenues and variable charges based on consumption volume. Annual weather patterns affect the demand for reclaimed water and changes in revenue are associated with changes in demand. In addition, changes in the reclaimed water customer base affect the revenue earned from fixed charges. In recent years, only about 30-35% of reclaimed water produced has been delivered to reclaimed water customers contributing to revenue generation. The volume of reclaimed water delivered to customers is limited by system capacity constraints in the summer months and Flagstaff's commitment to environmental and other non-revenue uses of reclaimed water.

Infrastructure and Capital Improvement

The reclaimed water system includes existing infrastructure as well as plans for continued capital improvement projects. The City plans to invest in two infrastructure projects in the next two years that will increase reclaimed system capacity. The first will be to address a bottleneck in the distribution line, which is expected to add 0.4 million gallons per day (mgd) (448 AF/year) of reclaimed water delivery capacity. The second project, scheduled for FY 21, will be to upgrade a booster station at the Wildcat Hill WRF adding an additional 1.2 mgd (1,344 AF/year) to the reclaimed system distribution capacity. Together, these capital improvement projects will yield an added 1.6 mgd (1,792 AF/year) to the reclaimed water system distribution capacity.

Reclaimed Water Rate Structure

The City of Flagstaff follows the 2014 Principles of Sound Water Management Policy C1.1 outlined in the Utilities Integrated Master Plan which states:

> *"the City shall have a goal of a minimum of full cost recovery for reclaimed water that is delivered within and outside of the City's incorporated limits. To the extent the City Council determines whether these charges discourage the use of reclaimed water, the charges for reclaimed water shall be adjusted to encourage its use. The adjusted charge will be subsidized by the water rate customers."*[4]

[3] Communication with City of Flagstaff Water Resource Manager Erin Young. September 28, 2020.
[4] City of Flagstaff – Utilities Division. 2014. Utilities Integrated Master Plan.
https://www.flagstaff.az.gov/DocumentCenter/View/44363/Master_Policies_April_1_2014_Final_proof-version?bidId=

The current rate structure for reclaimed water service in the City of Flagstaff was last updated effective August 1, 2020. Rate structure design for the City is supported by a rate study completed by Willdan Financial Services in 2016 and structured to be applicable through 2020. Current rates include a monthly fixed charge for users based on the size of the meter, and a volumetric charge based on monthly water use.

The Principles of Sound Water Management Policy A3.1 stipulates that 25% of reclaimed water revenues should be generated from fixed charges and the remainder of required revenues generated from commodity rates. Flagstaff City Code outlines the justification for the monthly service charge for reclaimed water, designed to cover the fixed costs of operation and maintenance of the reclaimed water system. The monthly service charge is applied to customers with a reclaimed water connection, regardless of whether reclaimed water is used.[5]

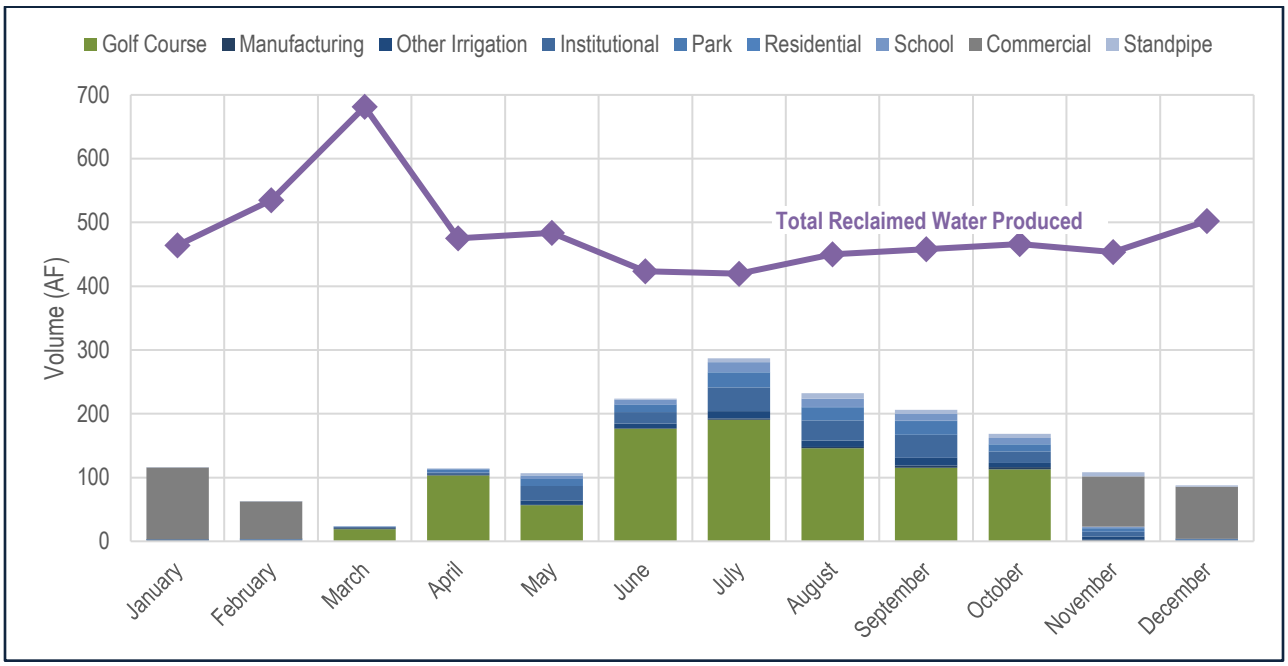
The volumetric charges include a tiered structure for single family residential connections and golf courses, as well as a rate differential for connections inside the City and connections outside of the City to account for greater costs associated with delivery for connections outside of the City. In addition, the Flagstaff City Code includes provision that reclaimed water rates shall be set to 35% of potable water rates for customers that do not require a main extension, and 75% of potable rates for customers that do require a main extension, beginning in 2021.[6] A full description of the current potable and reclaimed water rates is available in Appendix B.

Current Reclaimed Water Demand and Revenues

Reclaimed water revenues fluctuate with changing demand throughout the year. Peak demand occurs in the summer, largely driven by irrigation demand of the golf courses that are reclaimed water customers. In 2019, reclaimed water deliveries for the month of July totaled 287 AF. Reclaimed water demand in the winter months is dominated by use at the Arizona Snowbowl, which uses reclaimed water for snowmaking. Between the months of December – February 2019, more than 90% of delivered reclaimed water was delivered to the Snowbowl. Winter delivery of reclaimed water to the Snowbowl is an important source of revenue generation in months that would otherwise have very low reclaimed water demand. Figure 2 shows the volume of reclaimed water produced in each month of 2019, along with the volume of water delivered by customer type.

[5] City of Flagstaff. City Code. Title 7, Chapter 3, Section 18 – Reclaimed Water Rate Schedule.
[6] City of Flagstaff. City Code. Title 7, Chapter 3, Section 18 – Reclaimed Water Rate Schedule.

Figure 2: 2019 Reclaimed Water Production and Deliveries by Customer Type



Reclaimed Water Rates in Arizona Communities

The production and distribution of reclaimed water by wastewater utilities is a relatively new service. Reclaimed water pricing policies are still being developed for many reclaimed water providers.[7] It is useful to examine pricing data from comparable reclaimed water providers to understand the pricing strategies that are currently being applied in Arizona. This section compares Flagstaff's reclaimed water rates to rates charged by 30 other utilities throughout Arizona with service populations ranging from a few hundred to nearly 700,000.

The 2017 City of Flagstaff Financial Plan and Rate Analysis Report indicates that the City charges reclaimed water rates that are lower as a percent of potable water rates than many other communities in Arizona. Reclaimed water rates at the time of the report were set at 32% of the potable water rates in the City, whereas other communities such as Tucson, Oro Valley, and Flowing Wells charged reclaimed water rates that were above 50% of the potable water rates.[8]

On a per unit charge basis, Flagstaff's reclaimed water rates fall just below the average of Arizona water utilities providing reclaimed water service that were included in the analysis. Among 30 Arizona reclaimed water providers analyzed, the average rate for users within city limits in 2019 was $465/AF. Considering only public utilities, the average rate for reclaimed water in 2019 $583/AF. The highest per unit rates for reclaimed water, all above $815/AF, are charged by City of Buckeye, Seven Canyons Water and Water Treatment Company, EPCOR Water Company – Sun City West, Oro Valley, and the City of Tucson. The lowest reclaimed water rate among analyzed providers is $65/AF charged by Coronado Utilities.[9] Reclaimed water rates for the 30 providers included in this analysis are available in Appendix C.

Among water providers with service populations contained in the EPA Safe Drinking Water Information System (SDWIS) Query Tool, reclaimed water rates are not well correlated with service area population. The lack of correlation between service area population and reclaimed water rates suggests that policy considerations (rather than scale

[7] Zieburtz, W., Coopersmith, M., & Burnham, A. 2019. American Water Works Association: Water Reuse Cost Allocations and Pricing Survey. https://www.awwa.org/Portals/0/AWWA/ETS/Resources/AWWAReuseSurveyReportMay2019_WEBRES.pdf?ver=2019-10-07-151457-847
[8] City of Flagstaff, Management Services Division. October 6, 2017. City of Flagstaff Financial Plan and Rate Analysis Report.
[9] UNC School of Government, Environmental Finance Center. 2019. Utility Rate Sheets for Arizona. https://efc.sog.unc.edu/resource/utility-rate-sheets-az

economies) are the primary determinants of reclaimed water rates (Figure 3). Most providers analyzed (16 out of 20) serve populations less than 100,000 and reclaimed water rates among those providers range from $81/AF to $1,075/AF. Rates for reclaimed water among providers serving more than 100,000 range between $130/AF to $870/AF. The number of reclaimed water customer connections within each service area, which may not be well represented by the total service area population, is not captured in this comparison. However, the size of the service area population does provide an indication of the scale of the utility operations.

Figure 3: Arizona Reclaimed Water Rates by Service Population (n=20)

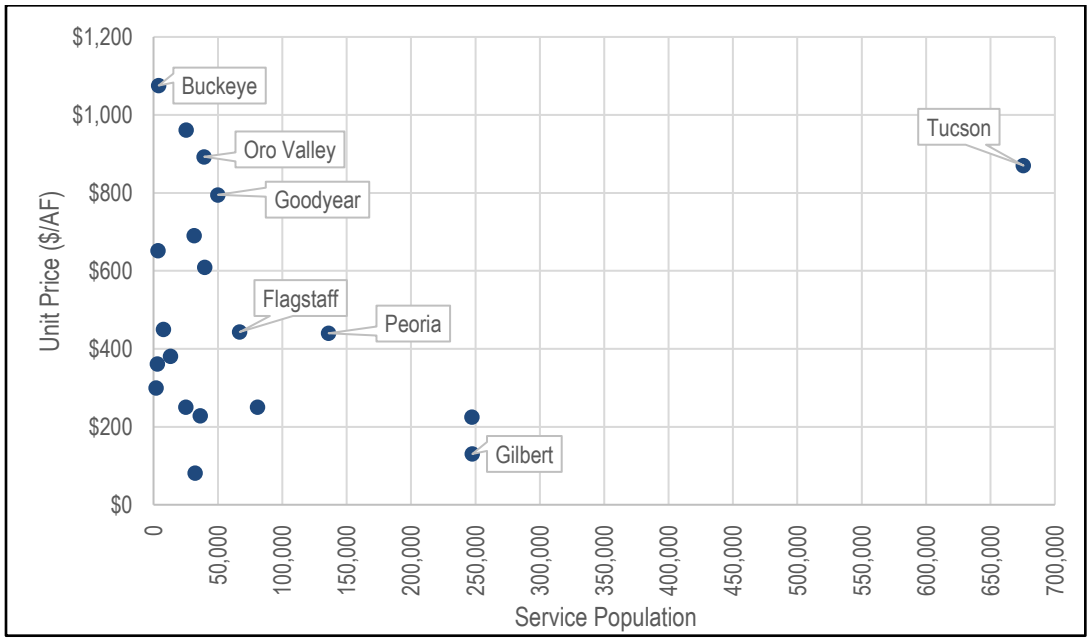


Table 3 includes a matrix comparing reclaimed water providers in Arizona across several factors. As the matrix shows, most municipal providers set rates according to their cost of service, with some reclaimed water systems receiving financial subsidy from other utility funds. Most reclaimed water rates are set as a uniform volumetric rate[10], and very few providers have included any a conservation incentive through rate setting for reclaimed water. Among most providers, the primary uses of reclaimed water are irrigation for parks, schools, golf courses, and HOAs as well as some reclaimed water used for dust control and environmental purposes.

[10] A uniform volumetric rate is a constant per unit price for water, independent of the volume of consumption. An increasing block rate sets volumetric consumption tiers, with the unit price increasing for each tier. A decreasing block rate also employs volumetric consumption tiers, but sets a lower unit price for consumption in higher volume tiers.

Table 3: Reclaimed Water Provider Comparison Matrix

Provider	2019 Rate ($/1,000 gallons)[11]	2019 Rate ($/AF) [12]	Rate Setting and Approval	Rate Basis	Rate structure	Permitted Volume (AFY)	Reclaim for Direct Reuse (AFY)	Primary Customers	Service Population[13]
Buckeye	$3.30	$1,075.31	City Council	Cost of service	Uniform	11,425	770	Parks, Schools, Golf Courses	4,035
Oro Valley	$2.74	$892.83	City Council / Water Utilities Commission	Fixed cost recovery	Uniform	IGA agreement with Tucson Water	1,760	Parks, Golf Courses	39,366
Tucson (Agua Nueva WRF)	$2.67	$870.02	Mayor, City Council	Cost of service, subsidized	Uniform	39,430	12,880[14]	Parks, Golf Courses, Schools, Environmental use	675,686
Goodyear	$2.44	$795.08	Mayor, City Council	Cost of service	Uniform	6,217	1,050	Golf Courses, Construction	50,001
Surprise	$2.12	$690.80	City Council	Cost of service	Uniform	30,043	1,285	Irrigation (landscape and agriculture)	31,649
Clarkdale	$2.00	$651.70	Town Council	N/A	Uniform	392	392	Construction, Environmental use	3,714
Page	$1.38	$449.67	City Council	Cost of service	Uniform	2,240	840	Golf Course	7,777
Flagstaff	$1.36 - 4.58	$443.16 - $1,492.40	City Council	Cost of service	Increasing block + Uniform	11,200	1,740	Ski Resort, Golf Courses, Landscape Irrigation	67,000
Peoria	$1.35	$439.90	City Council	Cost of service	Uniform	18,202	2,320	Parks, Golf Courses, HOAs	135,975
Fountain Hills Sanitary District	$1.17	$381.25	District Board of Directors	ARS Title 48	Uniform	3,699	1,925	Parks, Golf Courses	13,300
Rio Verde Utilities, Inc.	$1.11	$361.69	ACC	Revenue requirement	Uniform	785	170	Not available	3,184
EPCOR Water Company – Anthem	$0.77	$250.91	ACC	Revenue requirement	Uniform	3,363	620	Not available	25,300
Chandler	$0.69	$224.84	City Council	Cost of service	Uniform	28,025	31,955	Parks, Golf Courses, HOAs	247,328
Gilbert	$0.40	$130.34	City Council	Cost of service	Uniform	20,279	8,295	Parks, Golf Courses, HOAs	247,600

[11] Accessed from UNC School of Government Environmental Finance Center, Utility Rate Sheets for Arizona https://efc.sog.unc.edu/resource/utility-rate-sheets-az. Accessed September 21, 2020. For rate structures with more than one user category, residential reclaimed water rate is reported. For rates that differ based on location, inside city rates are reported.
[12] Accessed from UNC School of Government Environmental Finance Center, Utility Rate Sheets for Arizona https://efc.sog.unc.edu/resource/utility-rate-sheets-az. Accessed September 21, 2020. For rate structures with more than one user category, residential reclaimed water rate is reported. For rates that differ based on location, inside city rates are reported.
[13] Accessed from EPA SDWIS Federal Reports Query Tool. https://ofmpub.epa.gov/apex/sfdw/f?p=108:200::::::
[14] Volume delivered to Tucson Water from Agua Nueva WTF

Rate Setting Considerations

There are numerous important issues to consider in the context of reclaimed water planning and pricing. Setting water rates, including rates for reclaimed water, requires many levels of consideration related to the financial goals of the utility, economic incentive structures among customers, and overall water planning priorities. The following provides a discussion of the topics of consideration related to setting rates and appropriate pricing approaches for reclaimed water services.

- **General Rate Setting Practices:** The water industry has not yet converged on a single standardized approach to pricing and rate setting for reclaimed water resources. Utility rates are often designed so that fixed charges are set to cover fixed costs of operation, while variable charges are used to generate sufficient revenue to cover the variable costs of treatment and distribution.[15] Some utilities charge based purely on cost of service, with rates set to generate revenues that will cover all costs of treatment and delivery. However, due to the high costs of treating water for reclaimed water use, this approach often results in rates that are higher than potable water rates, presenting a disincentive to use reclaimed water.[16] Other providers incorporate consideration of the economic incentive to use reclaimed water and set rates that are substantially lower than potable water rates to encourage demand. Utilities may set rates to reflect only the marginal cost of service, to cover treatment and distribution costs of providing reclaimed water, and fund large infrastructure improvements through funds from other sources.[17] Often, rates that are not based on cost of service are set at a percentage of potable water rates deemed sufficient to incentivize reclaimed water use where appropriate.
- **Affordability:** While the American Water Works Association generally advises water rate structure design based on cost of service, reclaimed water involves both water and wastewater systems, which presents complexities in the allocation of costs and revenues. Setting charges for reclaimed water purely based on cost of service is likely in most systems to result in calculated per unit reclaimed water rates that are higher than potable water rates. Reclaimed water is still perceived as an inferior resource in many communities, and in many systems is not available for direct potable use, so rates for reclaimed water should be set below potable water rates in order to encourage reclaimed water use to offset potable demand where possible.
- **Consumption Incentives:** There are multiple strategies a utility can employ to incentivize the use of reclaimed water. The most common is to set reclaimed water rates lower than current potable water rates. Other options to increase participation in reclaimed water use, particularly in anticipation of system expansion, include connection fee waivers, rebates, reduced sewer rates, or municipal ordinances requiring reclaimed water use in certain applications. The EPA Guidelines for Water Reuse provides more detailed discussion on the range of options for incentivizing the use of reclaimed water.[18]
- **Conservation Incentives:** Pricing and rate structure design can have a substantial impact on conservation incentive among customers. Certain types of rate structure design are well suited to incentivizing conservation, while others are unlikely to send appropriate price signals to customers and cause changes in water use patterns. Price structures that are most effective in incentivizing conservation are increasing block rates, time of day pricing, seasonal rates, and water surcharges.[19]

[15] Clumpner, G. Recycled Water Pricing Alternatives. 2016. https://www.nbsgov.com/blog/2016/09/29/recycled-water-pricing-alternatives/
[16] O'Reilly, D., & Pierce, C. 2008. Survey Examines Reclaimed Water Rates, Charges. https://www.waterworld.com/home/article/16189791/survey-examines-reclaimed-water-rates-charges
[17] Zieburtz, W., Coopersmith, M., & Burnham, A. 2019. American Water Works Association: Water Reuse Cost Allocations and Pricing Survey. https://www.awwa.org/Portals/0/AWWA/ETS/Resources/AWWAReuseSurveyReportMay2019_WEBRES.pdf?ver=2019-10-07-151457-847
[18] US Environmental Protection Agency. 2012. Guidelines for Water Reuse. https://www.epa.gov/sites/production/files/2019-08/documents/2012-guidelines-water-reuse.pdf
[19] US Environmental Protection Agency. Pricing and Affordability of Water Services. https://www.epa.gov/sustainable-water-infrastructure/pricing-and-affordability-water-services

Policy Considerations

In addition to setting reclaimed water rates that achieve an appropriate balance of economic use incentive and conservation signaling, changing policy related to reclaimed water, both on the local and state level, can impact the future of reclaimed water use in the City of Flagstaff. As the City continues to consider new uses for reclaimed water, there are several policy considerations that are likely to become relevant to the use and allocation of reclaimed water resources. Relevant policy considerations related to reclaimed water service are described below.

- **Allocations:** The City has established a priority system for allocating available reclaimed water resources among users. Priority will be given to renewing existing reclaimed water purchase agreements, followed by reclaimed water uses that result in conservation of potable water supplies, and lastly the City will consider reclaimed water uses that provide public benefit.[20] Within each of these prioritization categories, there may be additional consideration needed to determine which new uses are best to achieve the overall goal. For example, among new uses that offset potable demand, which new uses would be preferred? Similarly, among new uses that generate community benefit, how is community benefit defined? Answering these questions by incorporating additional details into the current allocation policy may help to streamline decisions around new uses of reclaimed water in the future.
- **Development Requirements:** As the City of Flagstaff's reclaimed water use system expands, there are many ways to ensure that reclaimed water use is prioritized within new developments. Currently, the City Zoning Code requires that any sites "adjacent to reclaimed water lines… shall be required to connect to the lines and utilize reclaimed water for the primary water source for irrigation," however, there may be potential to expand the required uses of reclaimed water within the Zoning Code. The current distribution system for reclaimed water in the City does not reach all areas that may be suited for reclaimed water use (see map of Flagstaff's reclaimed water distribution system in Appendix A). For example, new developments outside of the current reclaimed distribution system may be required as a condition of permitting to commit to a cost share to expand reclaimed delivery infrastructure to meet irrigation needs and other allowable uses at the development site. The City previously implemented a rebate program for new reclaimed water connections, by including a provision in reclaimed water purchase agreements that a percent of the cost incurred to the buyer for extending reclaimed water service lines is paid back by the City every year until conversion costs are recovered. System expansion funded through reclaimed water purchase agreements is an effective option for the City to finance infrastructure to meet increasing reclaimed water demand without incurring interest or issuance costs related to bond funding.
- **Direct Potable Reuse:** The Arizona Administrative Code (AAC) was updated in 2018 to include new provisions allowing direct potable reuse (DPR) of water under specific conditions. Water providers may apply for a permit through Arizona Department of Environmental Quality (ADEQ) for an Advanced Reclaimed Water Treatment Facility, designed to perform secondary treatment to reclaimed water to meet potable water quality standards and be used for direct human consumption. Water that is treated in an Advanced Reclaimed Water Treatment Facility is purified water suitable for human consumption and is no longer legally considered reclaimed water. The legal definition of water treated at an Advanced Reclaimed Water Treatment Facility allows for the resource to be added to the potable water supply and does not require a separate distribution system for delivery to customers. The City is considering DPR as one of several options for reclaimed water reuse in the future, and may benefit from additional feasibility and cost studies to help understand the implications of this option relative to other water supply augmentation options.

Economic Value of Water Use

Particularly in semi-arid regions like Flagstaff, reclaimed water is a valuable resource and represents an important part of the City's water resource portfolio. Reclaimed water can provide a reliable and sustainable source of water to meet

[20] City of Flagstaff – Utilities Division. 2014. Utilities Integrated Master Plan. https://www.flagstaff.az.gov/DocumentCenter/View/44363/Master_Policies_April_1_2014_Final_proof-version?bidId=

various demands. When assessing how to structure charges for this resource, it may be prudent to consider not only the cost of providing reclaimed water to customers, but also the economic value of the resource. While the market for reclaimed water in Northern Arizona is still relatively nascent, climate variability and increasing population size are likely to increase total demand for water resources in the future. Two strategies for understanding the economic value of reclaimed water are presented in the following sections.

Economic Value of Water Use by Land Use Type

One approach that can provide information that may be useful to include in City decision making around water resource allocation is to determine the economic value generated by water use in various applications. An estimate of the economic value generated by various land uses can be calculated by determining the City's average net revenue[21] per unit of land area in different land uses, and the average net water demand of each land use on a per unit of land area basis. The estimated economic value generated through water use in different land uses is equal to the net revenue per unit of land area divided by the net water demand per unit of land area for each land use type. This results in a relative ranking of land use types that generate higher or lower average economic value for the City through water use. The results of this analysis for the City of Flagstaff are presented in Table 4.

Table 4: Economic Value of Water Use by Land Use Type[22]

Zone Type	Net Revenues ($/acre)	Net Water Demand (AF/acre)	Economic Value ($/AF)
Residential	$ $	💧	Medium
Commercial	$ $ $ $ $	💧 💧	High
Industrial	$	💧 💧 💧	Low
Public Facility	$	💧 💜	Low
Golf Course	$ $	💜 💜 💜	Low
Snowbowl	$ $ $	💜 💜	Medium

Market Based Valuation

Another strategy for determining the economic value of reclaimed water is to examine comparable market transactions for the resource. This allows for an estimation of the intrinsic value of the resource at the point of production based on what other entities have paid. There are several recent examples of reclaimed water transactions in Arizona that provide an indication of the current market value of the resource. These transactions suggest that the market value of reclaimed water in Arizona between $60 - $350/AF per year, though price depends on the reclaimed water application. For example, reclaimed water transactions to serve environmental purposes are in some cases priced lower than reclaimed water transactions that serve municipal or industrial purposes. Table 5 provides a summary of several recent reclaimed water transactions that have been negotiated in Arizona.

[21] This includes revenues generated by the City through property taxes, sales tax, charges for services, and other government functions minus the costs expended for provision of City services.
[22] Net Water Demand: blue droplet = potable water, purple droplet = reclaimed water.

Table 5: Sample of Recent Reclaimed Water Transactions in Arizona

Buyer	Seller	Initial Year	Term	Volume (AF)	Annual Payment ($/AF, 2021)	One Time Upfront Payment ($/AF)
Cochise County	City of Bisbee	2019	25-year lease	200	$60	-
Freeport McMoRan	City of Globe	2018	50-year lease	500	$180	-
US Bureau of Reclamation	City of Bullhead City	2017	4-year lease	2,200	$118	-
Central Arizona Water Conservation District	Litchfield Park Service Co.	2014	One time sale of 100-year water rights	2,400	-	$2,547
Freeport McMoRan	City of Bisbee	2010	11-year lease	403	$81	-
Palo Verde Nuclear Generating Station	SROG Cities (Phoenix, Mesa, Tempe, Scottsdale, Glendale)	2010	41-year lease	67,692	$176	-
Arizona Department of Game and Fish	City of Flagstaff	2008	20-year lease	161	$346	-
Water Property Investors, LLC	Town of Prescott Valley	2007	One time sale of 100-year water rights	1,103	-	$24,650

Current reclaimed water rates charged by the City, between $466/AF and $1,564/AF depending on customer class and level of consumption, are above the market prices presented in Table 5. However, the price of reclaimed water charged by the City of Flagstaff is set to recover distribution and capital improvement costs. No value is assigned to the water resource itself. In contrast, the reclaimed water purchase agreements summarized above represent the intrinsic value of the resource at the point of production, prior to any additional infrastructure or delivery costs. In the near term, there may be revenue generating opportunities for the City to market reclaimed water not delivered to current reclaimed customers that would otherwise be put to non-revenue uses or discharged. In the future, an assessment of the current market value of reclaimed water can be included in rate setting considerations in addition to addressing cost recovery.

Summary and Conclusions

Currently, demand for reclaimed water service is greater than the City's available supply given system distribution constraints. In the future, as the City's reclaimed water system expands with an increase in treatment and distribution capacity, several considerations related to reclaimed pricing, planning and prioritization may be appropriate to include in decision making.

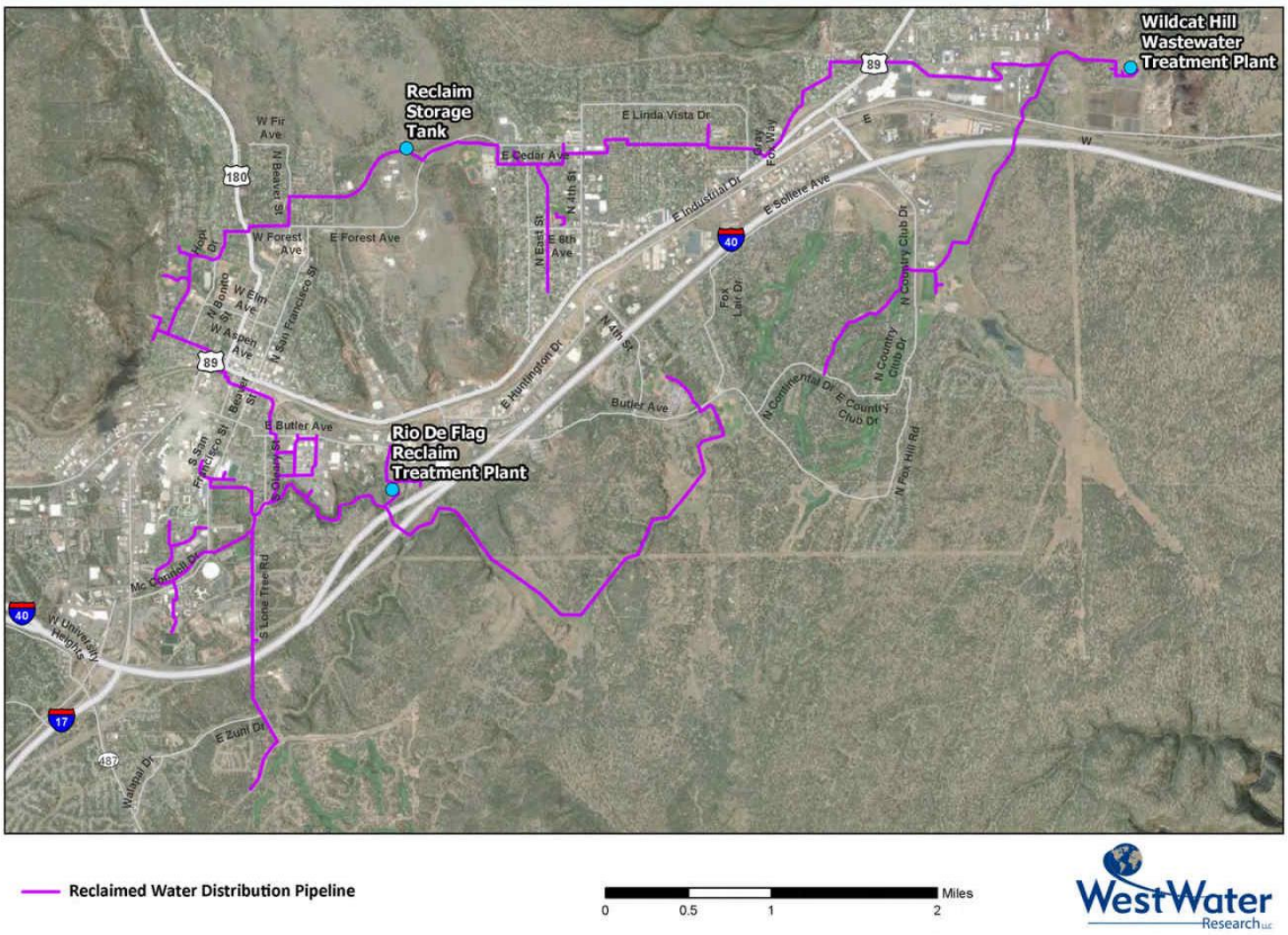
- Within the City's existing allocation policy for reclaimed water, there remains ambiguity around how to allocate limited supplies among competing uses. It may be appropriate to refine the allocation policy to define which use types that offset potable demand are preferred and how community benefit is defined for the purpose of allocation decisions.
- The City of Flagstaff reclaimed water rates are near the average of reclaimed rates throughout Arizona. Communities across Arizona charge between 30% - 100% of potable rates for reclaimed water. There may

be an opportunity to increase the rates charged for reclaimed water delivery while maintaining pricing that generates demand incentives. Increasing rates would serve to increase reclaimed water fund revenues which could be used to fund capital improvement investments and system upgrades to increase the efficiency of reclaimed water use in the City.

- In 2018, direct potable reuse of water became an option in Arizona following changes to the Arizona Department of Environmental Quality rules on reclaimed water. More analysis is needed to understand the costs and suitability of direct potable reuse as a water supply augmentation option for the City. A DPR feasibility analysis should incorporate not only the present costs associated with developing the necessary infrastructure and treatment costs associated with DPR, but also the costs that would be offset by delaying the need to develop new potable water supplies for the City.
- The economic value of water use varies by use type, however, examining the economic value of water use generated by different land use types is one of many tools that can help to inform future planning and allocation decisions.
- A market valuation approach can be used to determine the intrinsic value of reclaimed water as a resource, in addition to delivery and capital improvement costs. This may be a useful metric of comparison to guide future revisions to the City's reclaimed pricing policy.
- In addition to considering the economic value of reclaimed water resources in rate setting, reclaimed water agreements can be prioritized based on uses that generate the most overall value for the City. As system expansion allows for new reclaimed water purchase agreements, there may be an opportunity to set criteria for new customer selection that includes consideration of the economic, community, and environmental benefits generated from different uses of reclaimed water in the City.

Appendix A

Map of Flagstaff's Reclaimed Water Distribution System



Appendix B

City of Flagstaff Potable Water Rates

Potable Water		
Monthly Fixed Charge		
Meter Size	Inside City Rate	Outside City Rate
3/4"	$16.64	$18.30
1"	$19.60	$21.56
1 1/2"	$26.98	$29.68
2"	$35.84	$39.42
3"	$56.52	$62.17
4"	$86.05	$94.66
6"	$159.88	$175.87
8"	$248.47	$273.32
10"	$351.83	$387.01

Volumetric Rate						
Customer Class	Tier	Water Rate	Water Energy Rate	WRIP Fee	Total Inside City Rate	Total Outside City Rate
Single Family	Tier 1 (0 - 3,500 gallons)	$3.44	$0.83	$0.52	$4.79	$5.27
	Tier 2 (3,501 - 6,200 gallons)	$4.45	$0.83	$0.52	$5.80	$6.38
	Tier 3 (6,201 - 11,500 gallons)	$6.86	$0.83	$0.52	$8.21	$9.03
	Tier 4 (11,501+ gallons)	$13.72	$0.83	$0.52	$15.07	$16.58
Multi-Family Units		$4.42	$0.83	$0.52	$5.77	$6.35
Commercial/Schools		$4.69	$0.83	$0.52	$6.04	$6.64
Northern Arizona University		$4.30	$0.83	$0.52	$5.65	N/A
Manufacturing		$4.63	$0.83	$0.52	$5.98	$6.58
Landscaping/Lawn Meters		$4.69	$0.83	$0.52	$6.04	$6.64
Hydrant Meter		$7.17	$0.83	$0.52	$8.52	N/A
Standpipe*		$7.17	$0.83	$0.52	$9.56	N/A

City of Flagstaff Reclaimed Water Rates

Reclaimed Water			
Monthly Fixed Charge			
Meter Size	Meter Fee	Service Fee	Total Fees
3/4"	$340.00	$24.00	$364.00
1"	$520.00	$24.00	$544.00
1 1/2"	$920.00	$24.00	$944.00
2"	$1,070.00	$24.00	$1,094.00
3"	$3,130.00	$24.00	$3,154.00
4"	$4,130.00	$24.00	$4,154.00
6"	$6,130.00	$24.00	$6,154.00
8"	$13,737.00	$24.00	$13,761.00
10"	Call	$24.00	Call

Volumetric Rate			
Customer Class	Tier	Inside City Rate	Outside City Rate
Private Residential	Tier 1 (0 - 3,500 gallons)	$1.43	$1.57
	Tier 2 (3,501 - 6,200 gallons)	$1.77	$1.95
	Tier 3 (6,201 - 11,500 gallons)	$2.56	$2.82
	Tier 4 (11,501+ gallons)	$4.80	$5.28
Commercial (no main Ext):		$1.95	$2.15
Commercial (w/ main Ext):		$4.14	$4.55
Manufacturing (no main Ext):		$1.93	$2.12
Manufacturing (w/ main Ext):		$4.10	$4.51
NAU (No main extension):		$1.82	N/A
NAU (with main extension):		$3.85	N/A
City Departmental		$1.95	N/A
Hydrant Meter		$4.00	N/A
Standpipe**		$4.53	N/A
Off Peak/Golf Course:	Tier 1 (0 - 150,000,000 gallons)	$1.65	$1.82
	Tier 2 (150,000,001+ gallons)	$1.65	$1.82

Appendix C

Arizona Provider Reclaimed Water Rates

Provider	2019 Rate ($/1,000 gallons)	2019 Rate ($/AF)
Buckeye	$3.30	$1,075.31
Seven Canyons Water and Water Treatment Company	$3.00	$977.55
EPCOR Water Company-Sun City West	$2.95 - $3.56	$961.26 - $1,160.03
Oro Valley	$2.74	$892.83
Tucson	$2.67	$870.02
The Links at Coyote Wash Utilities, LLC	$2.59	$843.95
Goodyear	$2.44	$795.08
Surprise	$2.12	$690.80
Clarkdale	$2.00	$651.70
El Mirage	$1.87	$609.34
Liberty Utilities-Carefree, Cave Creek, Scottsdale, Black Mountain Sewer	$1.67	$544.17
Northern Gila County Sanitary District	$1.50	$488.78
Page	$1.38	$449.67
Flagstaff	$1.36 - $4.58	$443.16 - $1,492.40
Peoria	$1.35	$439.90
Fountain Hills Sanitary District	$1.17	$381.25
Rio Verde Utilities, Inc.	$1.11	$361.69
Red Rock Utilities, LLC	$0.92	$299.78
Mountain Pass Utility Company	$0.87	$283.49
EPCOR - Agua Fria	$0.77	$250.91
EPCOR Water Company - Anthem	$0.77	$250.91
EPCOR Water Company - Mohave	$0.70	$228.10
Chandler	$0.69	$224.84
Sunrise Vistas Utilities Company	$0.62	$202.03
Liberty Utilities-Gold Canyon	$0.59	$192.25
Saddlebrooke Utility Company	$0.58	$188.99
Gilbert	$0.40	$130.34
Far West Water and Sewer, Inc.	$0.25	$81.46
Verde Santa Fe Wastewater Company, Inc.	$0.23	$74.95
Coronado Utilities	$0.20	$65.17