

# Toho Water Authority's Unique Approach to Pricing Irrigation Water

Andrew Burnham, David Hyder, and Patrick Luce

Over the past decade water providers across the United States have been dealing with a tremendous number of challenges, including unprecedented capital reinvestment needs, increasing regulatory requirements, and changing climate patterns. In response to these issues, water utilities have been forced to become more efficient and nimble in their operations, as well as more sophisticated in terms of how revenues are generated from water sales. The pricing of water service has been, and will continue to be, a key factor in the success of today's water utilities.

This article presents a case study example of a water utility in Florida that took a unique approach in pricing its irrigation water service. Specifically, the presentation of the case study provides an overview of how the Toho Water Authority (authority), located in central Florida, developed and implemented customized water budgets for its larger commercial irrigation customers.

The authority currently provides potable and reclaimed water to commercial accounts for irrigation purposes. In 2017, the authority engaged Stantec Consulting Services (Stantec) to assist in the development of water budgets

for its nonresidential irrigation accounts. Historically, the authority utilized an inclining block rate structure, with progressively more expensive units of water within each tier. Based on a review of water usage patterns, the authority realized that the rate structure was not appropriate in light of the significant variations in irrigation needs among various commercial accounts. In this scenario, accounts with two acres of irrigable area and accounts with a quarter-acre lot were placed in the same tiers, despite the fact that the irrigation needs differ significantly.

To provide a more equitable structure, Stantec worked with the authority to define specific water budgets for each individual irrigation account. The individual water budgets were developed based on irrigable area, crop type, soil type, beneficial rainfall, evapotranspiration data, and irrigation efficiency for each irrigation account. The budgets developed for the authority recognize the unique weather patterns experienced in the state of Florida, which demonstrates distinct seasonal variations in rainfall. The authority's approach, key considerations, and outcomes are discussed.

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## Background

At the beginning of Fiscal Year 2017 (Oct. 1, 2016), the authority adopted a new reclaimed water rate based on a cost of service and rate study completed in 2016. The adopted reclaimed water rate structure consists of inclining block usage rates, with the rate tier widths defined by the size of the customer meter. Table 1 presents the then-current reclaimed water rate structure for commercial reclaimed customers with meter sizes greater than 2 in.

As shown in the table, under the authority's current rate structure, the larger the reclaimed customer's meter, the more reclaimed water that is provided at each tier. This approach is consistent with industry practice and, in general, the size of the customer meter serves as a reasonable proxy for the amount of reclaimed water allocated to an individual customer; however, the authority has received feedback from its commercial reclaimed customers that the current structure may require modification due to impacts the structure is having on their monthly bills.

## Methodology

Stantec was tasked with developing a rate structure that provides individual reclaimed water allocations for each customer based on the specific attributes of the property receiving service. The goal of this type of structure is to encourage efficient reclaimed water usage on an individual customer basis recognizing the specific attributes of the property served. This approach essentially establishes a monthly irrigation budget for each customer based on the water required to sustain the vegetation on the property.

The development of allocation-based rates is outlined in the American Water Works Association Manual of Practice M1, "Principals of Water Rates, Fees, and Charges." The approach

Table 1. Current Reclaimed Water Volumetric Rates

Meter Size	Tier 1 (per 1,000 gal)	Tier 2 (per 1,000 gal)	Tier 3 (per 1,000 gal)
2 in.	0 – 80	80 - 160	160+
3 in.	0 – 160	160 - 320	320+
4 in.	0 – 250	250 – 500	500+
6 in.	0 – 500	500 - 1,000	1,000+
Tier Rates	\$1.87	\$2.97	\$4.47

### Irrigation Allocation Amount = Figure

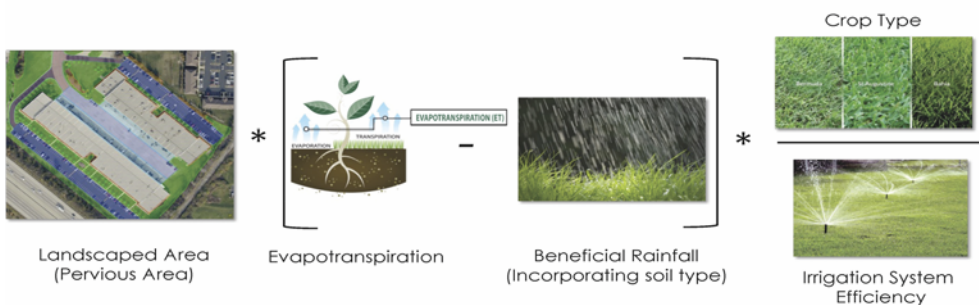


Figure 1. Irrigation Allocation Amount

outlined in the manual for the development of irrigation allocation amounts takes into consideration the landscaped (irrigable) area of the property, the water requirements (based on soil type, climate conditions, and crop type), and the efficiency of the irrigation system. The specific formula used for developing the allocations is outlined in Figure 1.

Irrigation Allocation Amount = Figure

The specific components of the irrigation allocation formula are as follows:

- ◆ **Landscaped Area** – The area identified on the property that requires watering (area with vegetation).
- ◆ **Evapotranspiration (ET)** – The amount of water that transpires through plant leaves combined with the amount that evaporates from the soil. The ET data define how much water is required to sustain the vegetation.
- ◆ **Beneficial Rainfall** – The amount of rainfall that is considered beneficial for watering vegetation. This is defined as rainfall that is stored in the root zone of the landscaped area, and excludes rainfall that contributes to runoff or drainage. The analysis includes the type of underlying soil for each property that impacts that amount of rainfall that is considered beneficial, given the ability of the soil to retain water.
- ◆ **Crop Type** – The specific water needs based on the type of crop irrigated and defined by the crop coefficient (Kc)<sup>1</sup>.
- ◆ **Irrigation System Efficiency** – Assumed efficiency/effectiveness of the irrigation system.

In typical water budget rate structures, the monthly irrigation allocations developed for each account reflects that account's water budget for each month; however, a key component of the analysis was to synthesize these allocations into a simpler rate structure with tiers. As such, once the irrigation allocations are developed, it's necessary to define the specific tiers of water usage within the rate structure for each customer. Rather than the tier widths being defined by the size of the meter (current approach), the widths can be set based on the irrigation allocations calculated for each customer, such that each customer has specifically defined tiers. The development of the tier widths in this manner allows for pricing of the reclaimed water to encourage efficient usage on a customer-by-customer basis. It should be noted that, based on discussions with authority staff, the actual pricing of the tiers (the specific rates per 1,000 gal) are currently appropriate, as they were developed based on a recent cost of service analysis. Therefore, the analysis does not

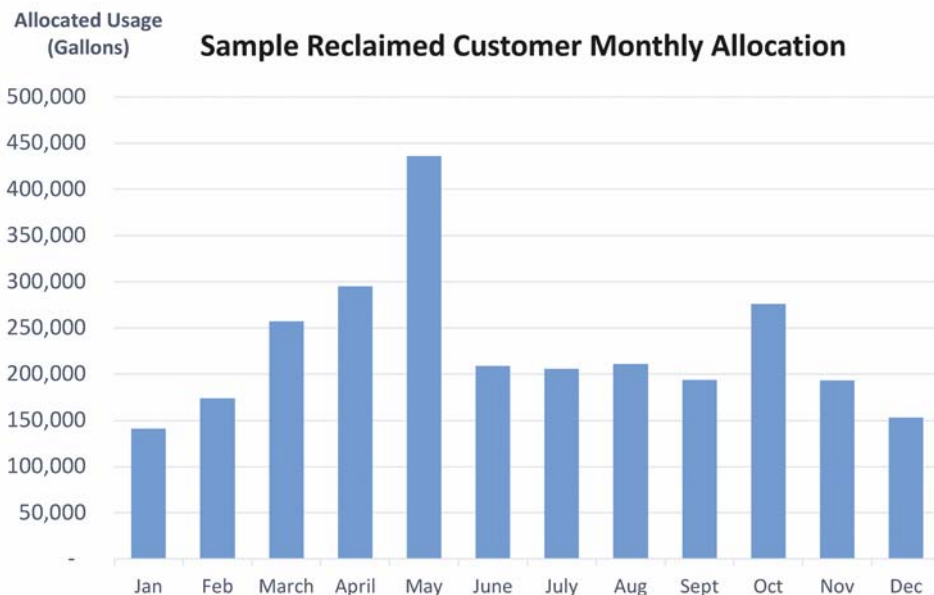


Figure 2. Calculated Monthly Allocations

assume any change in the actual rates; it simply examines the amount of reclaimed water that is provided to each customer at each of the tiered rates.

## Analysis

The approach previously outlined was used to develop reclaimed water allocation rates for all of the authority's commercial reclaimed customers with meters 2 in. or larger (which represents approximately 300 accounts). The specific analysis is outlined in this section.

### Data Analysis

To develop the irrigation allocations, a significant amount of data were collected and analyzed. The analysis included review of data and development of monthly irrigation allocations for a three-year period (calendar years 2013 to 2015). This period was selected to address any unusual weather patterns that may occur in any one year and was based on the availability of complete data for this period of time.

The specific data requirements for the analysis include those identified in the irrigation allocation formula described in the previous section. The authority provided Stantec with the landscaped area for each of its 2-in.-and-larger reclaimed water customers. The data were collected from the authority's geographical information system (GIS). Along with the landscaped area, the authority was able to provide the specific type of soil associated with each account.

The soil data were collected by the authority from the United States Geological Survey (USGS) and an analysis of each soil type was conducted using the United States Department of Agriculture (USDA) Web Soil Survey (WSS). The authority also provided daily rainfall amounts at each of its wastewater treatment plants for 2013 through 2015 and was able to collect daily ET data for this same time period from the USGS for Osceola County<sup>2</sup>. Finally, data were collected from the University Of Florida Institute of Food and Agricultural Sciences pertaining to the Kc for primary turf grass species utilized in Florida and the efficiency of typical commercial irrigation systems in the state.

### Assumptions

To complete the analysis several assumptions were made, including the following:

- ◆ The landscaped area identified by the authority is representative of the area that requires irrigation. The analysis did not reduce the area for vegetation, such as shrubs and trees, that may require lower watering requirements as compared to turf grass.
- ◆ The crop type for all properties is assumed to be Bermuda/St. Augustine and the associated monthly crop coefficient as defined by the University of Florida Institute of Food and Agricultural Sciences was utilized.
- ◆ A standard irrigation system efficiency of 75 percent was used in the analysis (comparable to the average efficiency of solid-set sprinkler systems).

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While these assumptions are based on industry standards and the knowledge of the typical attributes of the properties served by the authority, it will conduct on-going monitoring of the assumptions to ensure that they remain appropriate.

### Irrigation Allocations

Once the data were collected, the authority utilized the irrigation allocation formula and described assumptions to develop monthly irrigation allocation amounts for each of the reclaimed water customers over the period of 2013 to 2015. The monthly results over the three-year period were then averaged to develop a set of monthly allocations for each customer. While the allocations for each individual customer differ, given their specific property attributes, January was identified as the month with the lowest calculated allocation and May was consistently the month with the highest allocation. These results are in alignment with weather patterns in Florida and are consistent with irrigation needs during the year. The calculated monthly allocations for a sample reclaimed customer are shown in Figure 2, demonstrating the seasonal fluctuation in irrigation needs in Florida given the consistent seasonal weather patterns in the state.

### Tier Development

Once the monthly irrigation allocation analysis was completed for each customer, the next step was to determine how to implement

the allocations for each commercial customer within the tiered rate structure. Discussions with authority staff identified that the current three-tier structure is appropriate, provides administrative advantages, and allows for the normalization of weather trends.

During these discussions, it was determined that the first tier should be set at the month with the lowest allocation (January). This tier represents a base quantity of water required to meet watering needs for any given month.

The development of the second tier was guided by balancing the dual objectives of maintaining appropriate water conservation efforts of the “one water” resource and providing sufficient irrigation to sustain each property’s vegetation. The development of this second tier reflects a collaborative effort that partnered the analysis of this study with the authority’s conservation specialists. Discussions with authority staff and guidance from the South Florida Water Management District’s methodology on its commercial property annual irrigation allotments resulted in a second tier set at roughly double the first tier, which is equivalent to the water needs in March. This second tier reflects the approximate annual average allocation developed in the study of 50 cu in. of total annual irrigation.

Any usage above the allocation for March would fall into the third tier. It should be noted that this would be a portion of the likely water usage in April, May, and October. This structure was developed to encourage the efficient use of water, while providing sufficient water to meet

irrigation needs. Figure 3 provides a graphical representation of the tiers for a sample reclaimed customer.

While the figure represents the actual tiers for a sample customer, each respective customer tier would be set based on the allocations occurring in January and March.

While the tier allocations differ for each customer, the amount of water per sq ft of landscaped area by tier is the same for all customers. The Tier 1 allocation will provide each customer with 27.4 cu in. of water per sq ft of landscaped area per year and the Tier 2 allocation provides up to 50 cu in. per sq ft per year.

### Customer Impacts

The analysis included the determination of monthly reclaimed water bills for all of the larger commercial reclaimed customers under the current rates and the change in bills under the allocation-based rate structure. The results demonstrate that the vast majority of the customers will experience reductions in their bills as a result of the new structure, with a typical reduction being in the 10 to 15 percent range, reflecting in an overall reduction in revenue collection for the system. The magnitude of the reductions, however, varies based on the specific attributes of the property and the meter size associated with each customer. Since the current rate structure is tied to meter size, reclaimed customers with a small meter and a large landscaped area would experience a reduction in their monthly bills; conversely, a customer with a large meter and small landscaped area could potentially experience an increase. Figure 4 presents the monthly bill impacts for a sample customer using the current reclaimed rate and the allocation-based rate structures. The monthly bills are based on actual billed volumes since October 2016 and reflect the year-to-date comparisons as of the completion of the study.

### Fiscal Impact

As mentioned, the new rate structure will result in reductions in monthly reclaimed water bills. As a result, the revenue that the authority receives from these customers will also be reduced. Based on the analysis, it is estimated that the annual reduction in revenues would be approximately \$400,000 to \$450,000, which would be in the range of a 10 to 15 percent reduction in total revenues from this class of customers. It should be noted that the authority collects approximately \$97 million in annual revenues<sup>3</sup> and the resulting loss of rev-

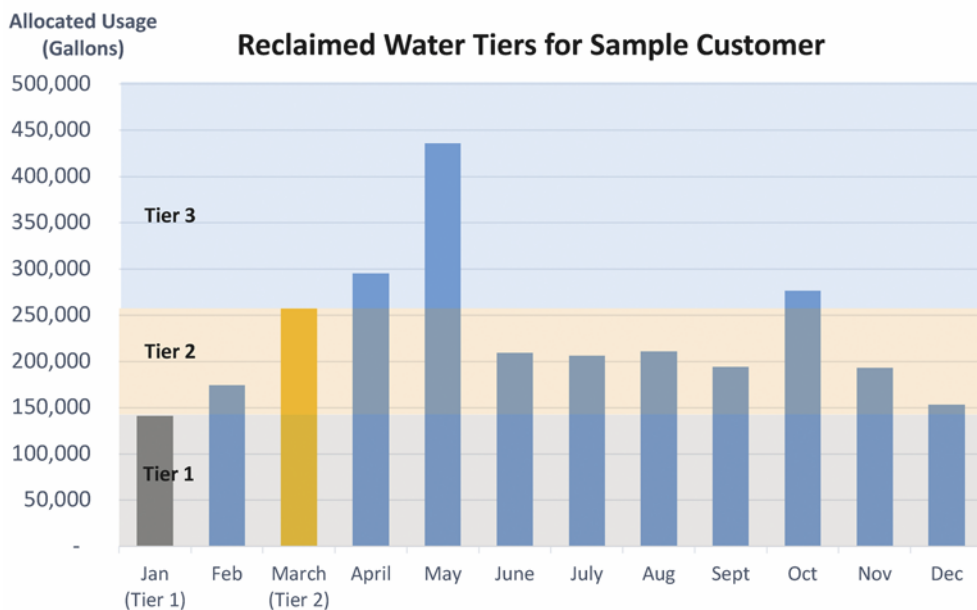


Figure 3. Tiers for a Sample Reclaimed Customer

enue would reflect a very small portion of total system revenue. Moreover, no assumed increases in use were made in response to the reductions in price, which may offset the impact.

## Conclusions and Recommendations

During the course of the study, the following conclusions and recommendations were developed regarding the allocation-based rate structure for the authority:

- ◆ The current rate structure for commercial reclaimed customers is not necessarily aligned with actual water requirements and efficient use. Based on the analysis, there are commercial reclaimed customers with relatively small meters serving large landscaped areas, and conversely, large meters serving relatively small landscaped areas.
- ◆ The adoption of an allocation-based rate structure for the authority's commercial reclaimed customers would provide a tailored structure for each individual customer. This structure would align irrigation needs with pricing for the reclaimed water.
- ◆ The allocation-based rate structure would additionally benefit commercial reclaimed customers who took steps to improve their efficiency by planting a turf grass, such as Bahia, which has a lower crop coefficient than the one assumed in the analysis, or improving their irrigation system efficiency above 75 percent. These improvements would reduce their water requirements and reduce their demands on the reclaimed system.
- ◆ Based on experience, the adoption of allocation-based rates needs to be accompanied with a significant amount of public outreach and engagement. While the calculated rates will result in reduced monthly bills for most customers, it's important for customers to understand the basis for their charges, and as a result, how they can potentially modify their usage patterns to conform to allocations identified based on their property characteristics.
- ◆ Should the authority adopt the allocation-based rates, the assumptions utilized in the analysis should be reviewed over time to ensure that they are appropriate and reflect typical property attributes.
- ◆ The allocations developed in the analysis are highly dependent on the landscaped area for each commercial reclaimed customer served by the authority. Should it adopt the structure, there is a potential that commercial customers may question their specific landscaped area and, as such, the authority

should consider developing a review process to address these specific inquiries.

## Implementation and Results

Based on the recommendations developed during the course of the study, the authority board adopted the allocation-based rates for commercial reclaimed customers effective the beginning of Fiscal Year 2018 (Oct. 1, 2017). To support the implementation of the rates, materials were developed to communicate the new rate structure with the authority's commercial reclaimed customers.

The authority has been collecting feedback resulting from the updated rate structure with the intent to make any necessary adjustments, but believes that the rollout of the new rate structure has been successful. Based on discussions with authority staff, the key challenges faced since implementation of the structure include the following:

- 1) Communication with key stakeholders.
  - ◆ There have been a number of ongoing dialogues with the governing board and staff: What are we doing? Why are we doing it? What are the benefits to the authority and its customers?
  - ◆ Reclaimed customers have reached out to the authority with questions: How is this structure better than the existing structure? What are the economic effects/benefits to me?
  - ◆ Overall, the authority believes that an emphasis on a good communication plan that is both transparent and understood by cus-

tomers, board, and staff helped to build some goodwill.

- 2) The new rate structure requires additional administrative effort, which has required the authority to re-engineer workflows. Some of the key workflow efforts include:
  - ◆ Gathering irrigation data for the formula for new customers to set up a billing account.
  - ◆ Creating a new role for GIS in determining previous area and crop types.
  - ◆ Developing a rotation to make periodic site visits once every two or three years to validate GIS data.
  - ◆ Developing an appeal process.
  - ◆ In the future, testing the use of drones as a means to capture, validate, and/or update GIS data.

## References

- <sup>1</sup> The value of the crop coefficient represents a multiplier that is applied to the general watering needs derived using the difference between the evapotranspiration and beneficial rainfall. This multiplier reflects the unique properties of plants and their resistance to being under-watered.
- <sup>2</sup> Aggregation of 1,070 reads per day throughout various geographic latitudes and longitudes in Osceola County.
- <sup>3</sup> The Statement of Revenues, Expenses, and Changes in Net Position on page 12 of the FY 2016 Comprehensive Annual Financial Report reflects total operating revenues of \$97,140,000. ◊

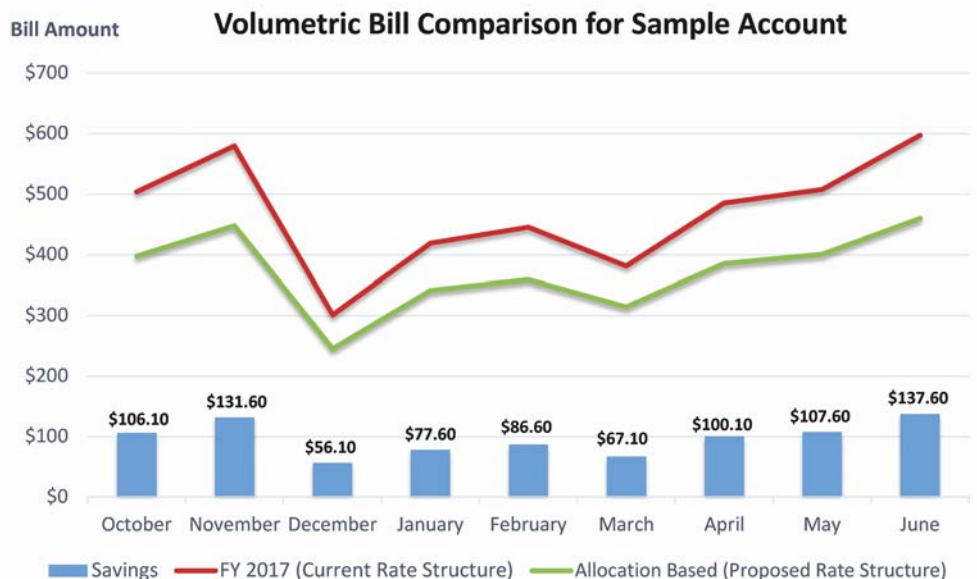


Figure 4. Monthly Bill Impacts for a Sample Customer