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Technical Memorandum

To: *City of Franklin IWRP Team*

From: *CDM*

Date: *September 27, 2011*

Subject: *Integrated Water Resources Plan - Evaluation of Potential Irrigation Ordinance Water Savings*

Executive Summary

This analysis examines the potential outdoor irrigation water savings in Franklin, Tennessee achieved through the implementation of a water service area ordinance requiring "smart" controllers on all automatic irrigation systems for single-family residential and commercial customers. Water savings are estimated under three savings scenarios based on assumptions developed for the current automatic irrigation system penetration rate, customer compliance rate, and level of savings. Savings are presented for low, medium, and high scenarios.

The potential savings estimated based on the scenario assumptions indicate that implementing a smart controller ordinance in Franklin could reduce single-family residential and commercial peak season (i.e., May through November) outdoor water demands by as much as 15 percent and as little as 1.5 percent depending on the savings scenario evaluated. The estimate of the cost per unit of water saved ranges from $0.15 per 1,000 gallons saved under the high savings scenario to $1.45 per 1,000 gallons saved under the low savings scenario. Under each of the savings scenarios the cost of implementing the ordinance and achieving the estimated potential savings is less than the cost of acquiring water through either of Franklin's two water supply options; direct withdrawals from the Harpeth River or purchasing water from Harpeth Valley Utilities. Therefore, the results of this analysis show, based on the assumptions presented in this memorandum, that an irrigation control ordinance is a cost-effective method of conserving water in Franklin.

1.0 Introduction

This memorandum presents the results of an analysis estimating the potential water savings and program costs associated with implementing an irrigation ordinance for single-family residential and commercial water customers in the Franklin, Tennessee water service area. The process

represents a high-level planning approach designed to provide a range of potential future water demand savings associated with implementing and enforcing a system-wide irrigation control policy. The City of Franklin's *Draft Resolution Authorizing the Adoption of an Irrigation Ordinance for Potable and Reuse/Reclaimed Water* (*Draft Resolution*) serves as the basis for the types of activities evaluated. The draft ordinance includes requirements for irrigation system design and installation. For the purposes of this analysis, only the potential savings associated with requiring "smart" automatic irrigation controllers on all new and existing irrigation systems will be evaluated[1]. Other ordinance stipulations would likely contribute to potential outdoor water use savings, however, data limitations, including the absence of metered outdoor water use for many customers as well as a lack of an understanding of the current level of irrigation system penetration and customer attitudes toward different irrigation system types and methods, including graywater systems and drip irrigation systems, prevent an informed analysis of those requirements.

The approach to estimating potential water savings from irrigation ordinances first requires an estimate of the volume of water used for outdoor irrigation that would be targeted by the ordinance. Then a range of assumptions can be made regarding market penetration, enforcement, compliance, and other factors that influence the effectiveness of the ordinance. Finally, the costs and savings associated with the range of estimates can be developed.

2.0 Estimating Outdoor Water Use

Total annual billed residential water demands in the Franklin service area are about 3.2 million gallons per day (mgd) with the highest demands typically occurring in August and September. According to recent water billing data in Franklin, there are nearly 13,000 total residential water accounts inside the city and about 2,300 residential water accounts outside of the city limits. Franklin also has approximately 60 single-family residential metered irrigation accounts inside the city and about 70 residential metered irrigation accounts outside of the city. The annual billed residential irrigation demands in the Franklin service area are about 0.08 mgd, with the highest demands typically occurring in August and September.

There are nearly 1,000 total commercial water accounts inside the city and about 60 commercial water accounts outside the city limits. Total annual billed commercial water demands in Franklin are about 1.00 mgd with the highest demand typically occurring from August through October. Franklin also has approximately 90 commercial metered irrigation accounts inside the city and one commercial metered irrigation account outside the city limits. The annual billed commercial irrigation demands in the Franklin service area are about 0.12 mgd, with the highest demands typically occurring in July through September.

[1] "Smart" automatic irrigation system controllers have the purpose of eliminating wasteful irrigation water use by being equipped with sensors that measure humidity and/or soil moisture content and utilize local weather data to limit irrigation water use to optimal times and conditions.

The average (fiscal years 2000 to 2009) annual pattern of billed water demand in Franklin for both the single-family residential and commercial customer classes are shown in **Figure 1**. The non-irrigation accounts' average billed use is also depicted in Figure 1 and these data are referenced to the left vertical axis while the irrigation accounts' average billed use are depicted using the right vertical axis. The data in Figure 1 shows that average single-family residential and commercial non-irrigation billed demand peaks annually in September. The irrigation accounts' average billed water use peaks in August for both customer classes. Metered irrigation demands are relatively minor compared to demand associated with non-irrigation accounts. Average annual irrigation demands are about 3 percent of average annual non-irrigation demands for the single-family residential customer class and about 11 percent of total average non-irrigation demands for the commercial customer class.

The demand patterns shown in Figure 1 indicate that each sector's water use increases during summer months. June through November typically experiences the highest single-family residential and commercial water demands in the Franklin service area. Historical weather patterns in Franklin may help to explain the pattern in water demand pattern.

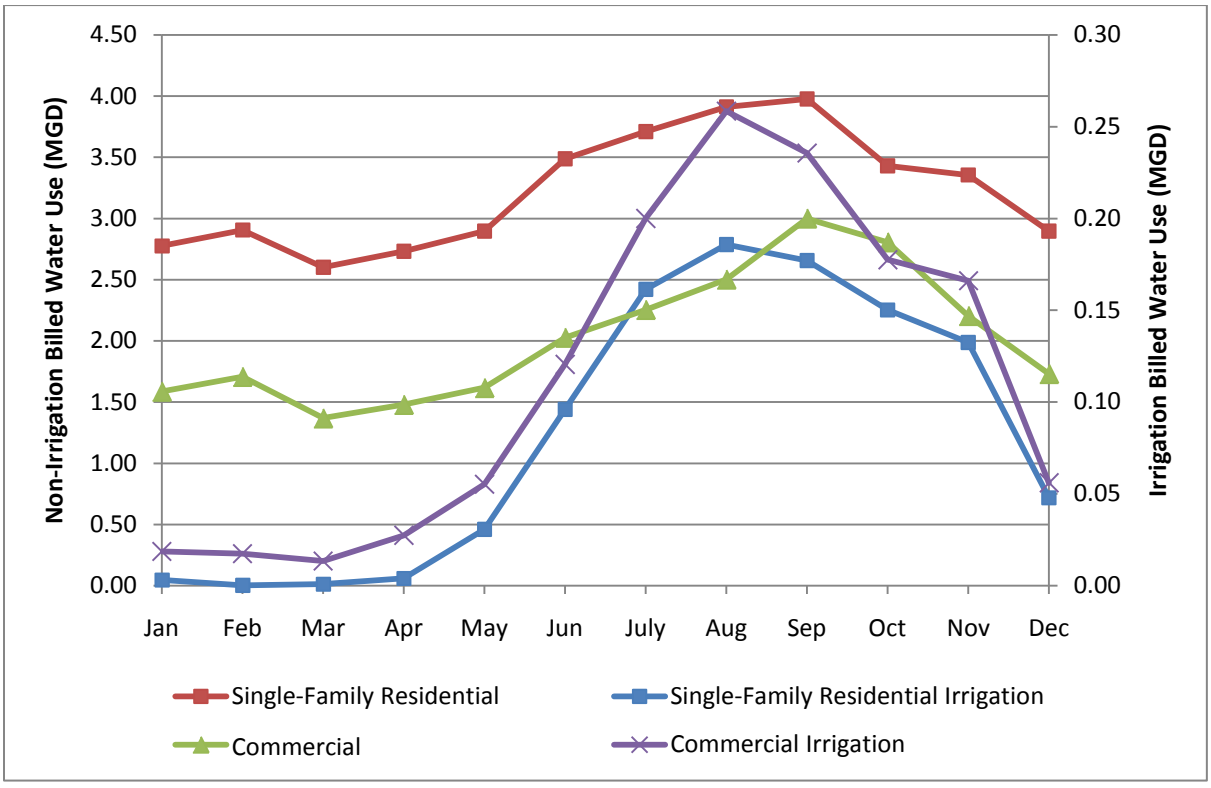


Figure 1 - Single-Family Residential and Commercial Demand Patterns: Fiscal Year 2000 through Fiscal Year 2009

Franklin receives an annual average of approximately 54 inches of precipitation, with March being the average wettest month and October being the average driest month. The average monthly precipitation and average daily high temperatures by month observed in Franklin are shown in **Figure 2,** which also shows June through October being the driest part of the year. This period also corresponds to the time of year when single-family residential water demand is highest. Therefore, the majority of the difference between the peak water demand season (i.e., May through November) and off-peak water demand season (i.e., December through April) is likely attributable to outdoor water use, when normal precipitation is at its lowest.

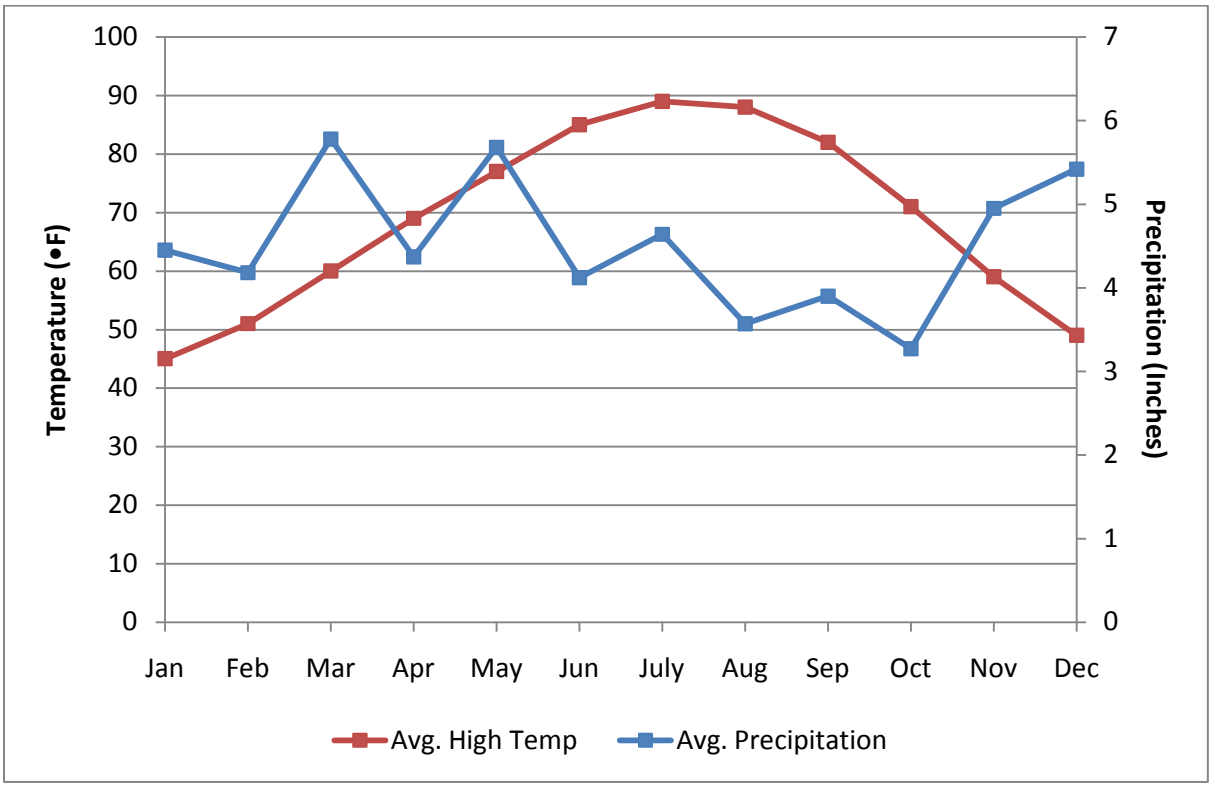


Figure 2 - Franklin, Tennessee Average Monthly Precipitation and High Temperature

The average historical peak season and off-peak season monthly residential demands in Franklin are provided in **Table 1**. The average seasonal monthly demands are the average of the historical monthly billed demand for all months in each particular season, with each month's demand weighted by the number of accounts active in each particular year. The average historical peak season and off-peak season monthly commercial demands in Franklin are provided in **Table 2**.

The irrigation accounts are expected to have little or no demand in the off-peak season and nearly all of the water use during the peak season. The standard (non-irrigation) accounts show a pattern

of normal water use, often associated with indoor water use, during the off-peak season. Thus, the difference between peak and off-peak water use may be associated with summer irrigation.

Table 1 - Average Single-Family Residential Historical Demand by Season

Metered Residential				Metered Residential Irrigation		
Month	**Avg. Residential Billed Demand, in mgd**	**Difference in Demand, in mgd**	**Avg. % Difference, Peak vs. Off-Peak**	**Avg. Residential Billed Demand, in mgd**	**Difference in Demand, in mgd**	**Avg. % Difference, Peak vs. Off-Peak**
Avg. Off-Peak Season Month (Dec-April)	2.78	0.76	27.4%	0.01	0.12	1200%
Avg. Peak Season Month (May -Nov)	3.54			0.13		

Table 2 - Average Commercial Historical Demand by Season

Metered Commercial				Metered Commercial Irrigation		
Month	**Avg. Commercial Billed Demand, in mgd**	**Difference in Demand, in mgd**	**Avg. % Difference , Peak vs. Off-Peak**	**Avg. Commercial Billed Demand, in mgd**	**Difference in Demand, in mgd**	**Avg. % Difference, Peak vs. Off-Peak**
Avg. Off-Peak Season Month (Dec-May)	0.86	0.23	26.7%	0.03	0.14	466.7%
Avg. Peak Season Month (Jun-Nov)	1.09			0.17		

The following section provides a discussion of the method used to determine the portion of peak season water demand attributed to outdoor water use, and thus, the water use from which potential savings can be achieved.

3.0 Minimum Month Methodology

The methodology to calculate minimum month outdoor water use is based on the premise that during wet months outdoor water use is minimal and during dry months outdoor water use is at its peak. For any given year or years, the average billed water use for each customer classification is determined for each month. Resultant values are plotted to determine the month with the lowest average consumption per customer, or the period when the majority of a customer's bill is for indoor water use. This lowest value is the minimum and represents the minimum consumption month. This method assumes that a percentage of the consumption may include outdoor water use regardless of whether or not the month is wet. **Table 3** provides the assumed percentage of outdoor water use during the minimum water consumption month, for the single-family residential and commercial customer classes. While it is likely that outdoor water use is zero in the minimum month, a value of 5 percent is assumed in this analysis to error on the conservative side. These percentages can readily be adjusted for each customer class.

Table 3 - Outdoor Water Use Assumptions for Minimum Month

Billing Classification	Percent of Outdoor Water Use
Single-Family Residential	5%
Commercial	5%

Using historical average water use, as described in Section 2.0 and the outdoor water use assumptions for the minimum month in Table 3, the minimum month analysis can be performed for the single-family residential and commercial customer classes in the Franklin, Tennessee service area. For this methodology, billing data beginning in July 2000 and ending in March 2010 for single-family residential and commercial customer classes were used in conjunction with outdoor water use assumptions for the minimum month. **Figure 3** shows results for the single-family sector, and **Figure 4** shows results for the commercial sector.

In Figure 3, data represent billed single-family residential consumption for non-irrigation accounts. During March, the minimum consumption month, 0.13 mgd or 5 percent of the average water consumed during that month is attributed to outdoor water use. For the remainder of the year, outdoor water use fluctuates month-to-month and is represented by any billed water use greater than 2.47 mgd (estimated minimum month indoor water use), as indicated by the green shaded area in Figure 3. Indoor water use is assumed to remain constant at 2.47 mgd, as indicated by the blue shaded area.

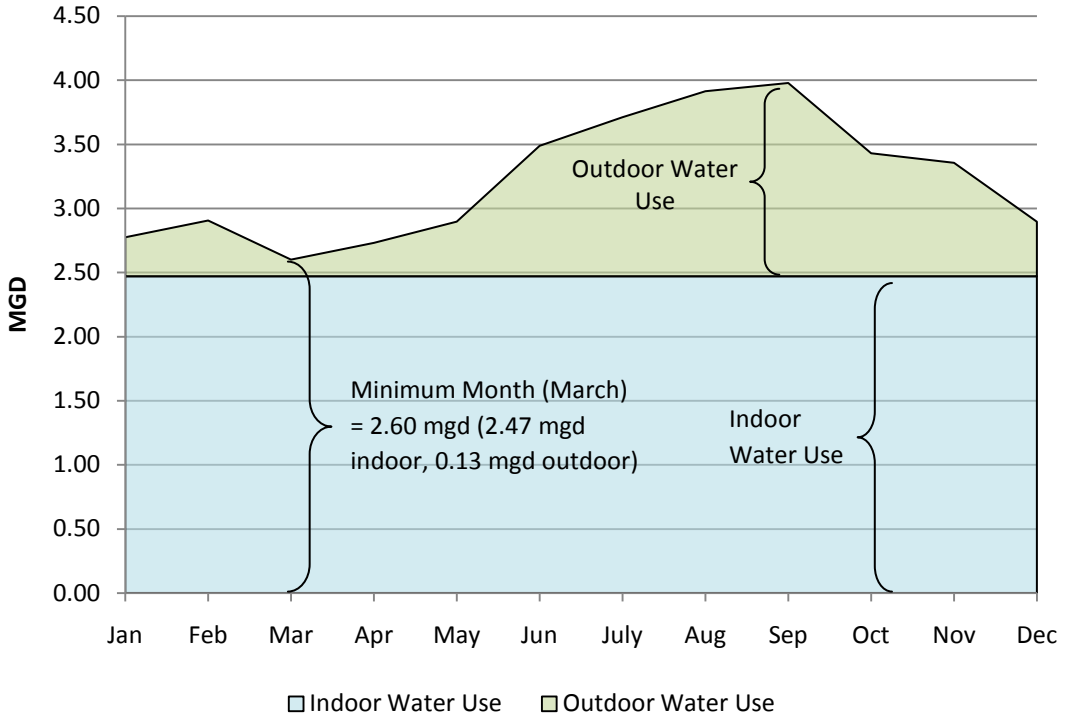


Figure 3 - Minimum Month Methodology for the Single-Family Residential Customer Class

Figure 4 shows results of the minimum month methodology for the commercial customer class for all non-irrigation accounts. Again, March is the month with the lowest overall billed water use for non-irrigation accounts. For the commercial sector, it is estimated that 0.04 mgd or 5 percent of the total water consumed during March is attributed to outdoor water use. For all other months of the year, any billed water use greater than 0.76 mgd, or 95 percent of the minimum month billed water use, is assumed to be outdoor water use, as indicated by the green shaded area in Figure 4.

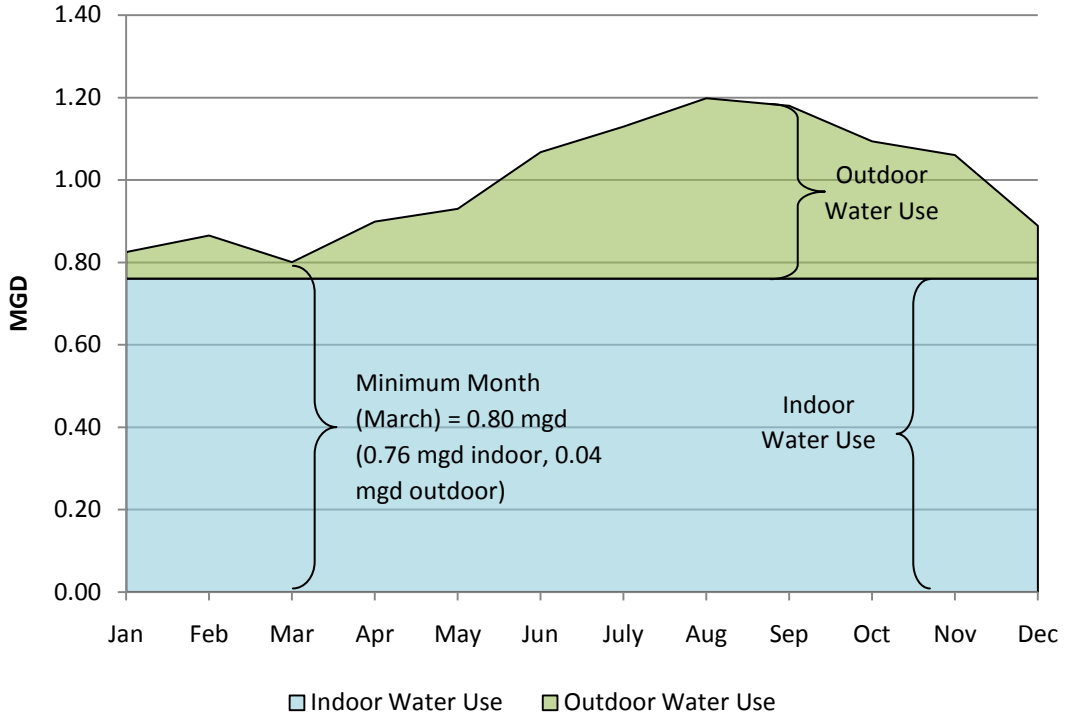


Figure 4 - Minimum Month Methodology for the Commercial Customer Class

The breakdown of outdoor water use for the single-family residential and commercial customer classes based on average annual billed water use for the period July 2000-March 2010 and the results of the minimum month methodology are presented in **Table 4**. Single-family residential outdoor water use is approximately 25 percent of average annual billed use and 33 percent of peak season use. Commercial outdoor water use is approximately 31 percent of average annual billed use and 40 percent of peak season use.

Table 4 - Single-Family and Commercial Average Annual Indoor and Outdoor Water Use Estimates

Customer Class	Total Average Billed, in MGD[1]	Indoor Estimate, in MGD	Outdoor Estimate, in MGD	Outdoor % of Total	Avg. Peak Season Outdoor Estimate, in MGD	Avg. Peak Season Outdoor % of Total
Single-Family	3.30	2.47	0.84	25%	1.20	33%
Commercial	1.11	0.76	0.35	31%	0.51	40%

[1] Total includes average billed use inside and outside of the City as well as metered irrigation use.
[2] Peak season is May through November

The minimum month methodology presented above demonstrates the typical breakdown of monthly indoor versus outdoor billed water use for single-family and commercial customer classes in Franklin. It is assumed that a portion of outdoor water use could be saved through the implementation of an irrigation ordinance. For this analysis, the rate of potential savings is inferred from case study findings of outdoor water use reductions, as a result of implementing an irrigation control ordinance, and is discussed in Section 4.0.

4.0 Key Assumptions

It is difficult to estimate the portion of peak season outdoor water demand used solely for irrigation, because it is expected that activities other than landscape irrigation contribute to peak season outdoor water use (e.g., car washing and swimming pools). Further, not all irrigation is provided through irrigation systems, as all houses and commercial facilities in the service area may not have such systems. However, it is reasonable to assume that the majority of that outdoor use is irrigation. For planning purposes, it is assumed that all of the peak season (i.e., May through November) outdoor water use, estimated following the minimum month methodology, is irrigation use eligible for potential irrigation ordinance program savings.

The assumption of 5 percent outdoor water use in the minimum month (Table 3) accounts for the portion of outdoor use that is not irrigation use. It is also assumed that estimated outdoor water use during the off-peak season is not eligible for potential irrigation ordinance program savings. It is important to note that assuming all of the estimated peak season outdoor water use is for landscape irrigation may result in overestimation of annual residential irrigation demands and consequently, of potential water savings achieved through an irrigation ordinance. It is likely that not all landscape irrigation in the service area is applied by means of a controlled irrigation system. Thus, not all water used for landscaping would be affected by an ordinance requiring smart controllers.

There is also some uncertainty associated with estimating potential water savings achieved with an irrigation ordinance. A major unknown, regarding adoption of an irrigation ordinance, is the level of compliance. Realized savings from the ordinance is dependent on water customers being aware, understanding requirements, and feeling incentivized to follow the ordinance, as well as the level of enforcement of the ordinance. Some important questions regarding compliance with an ordinance include:

1) What portion of residential water customers has automatic irrigation systems?
2) What percent of residential customers will comply with the ordinance?
3) What percent of residential customers will ignore the ordinance?
4) How will incentives or dis-incentives influence compliance?
5) How will enforcement of the ordinance occur?

4.1 Documented Savings

Documented savings from installation of irrigation control devices and implementation of irrigation ordinances throughout the U.S. can help to understand potential savings achievable for this analysis. It is important to note that various geographic and climatic variables can impact the level of savings observed from documented case studies. Therefore, generalizing these savings to other communities should be done with caution. Consequently, for this analysis, a range of potential savings are developed in order to understand the high and low boundaries of potential savings in Franklin, as illustrated in the literature.

It has been estimated that approximately half of outdoor residential water use is wasted due to poor irrigation practices such as overwatering, improper system design, evaporation, and wind (The Saving Water Partnership 2003). The U.S. Bureau of Reclamation (2008) found that installation of "smart" irrigation controls, mainly in the western U.S., resulted in 15 to 25 percent savings. The EPA has stated that for the average irrigation system in the U.S. sensor-based irrigation control technology has the potential to provide about 20 percent savings compared to conventional clock-driven controllers (EPA, 2011).

In Irvine Ranch, California, evapotranspiration (ET) controllers in test homes were able to convert almost 85 percent of the conservation potential into achieved savings. These savings represented an approximately 16 percent reduction in household outdoor water use (Hunt and Lessick, 2001). Additional analyses showed that outdoor water use savings of 24 percent could be achieved by single-family homes in the top third of high water users.

While much of the smart irrigation controller savings analysis and research has been conducted in drier climates where ET rates are higher, there is evidence of a significant potential for savings in climates that experience greater amounts of precipitation. For instance, Dukes (2008) found that smart irrigation controllers in Florida have the potential to significantly reduce irrigation water use. The results of the analysis indicate that by implementing smart irrigation controllers including

time clock adjustments, rain sensors, and ET controllers, systems in central Florida have the potential to reduce irrigation water use by 30 to 60 percent under normal to rainy weather conditions.

The level of potential irrigation water use savings are influenced by multiple factors including the length of the irrigation season, the type of grass and vegetation being irrigated, precipitation patterns, and customers' attitudes and perceptions. The savings identified in the literature in climates that range from dry to wet illustrate irrigation system smart controller potential savings from 15 to 60 percent. For the purposes of this analysis, based on the documented case study savings, the rate of potential savings is assumed to range from 15 to 25 percent and is estimated under three savings scenarios discussed below. These assumptions could be refined with further rigorous analysis.

4.2 Irrigation System Penetration Rates

Another factor in calculating potential irrigation ordinance water savings is the portion of single-family homes and commercial facilities that have irrigation systems (also referred to as market penetration rate of irrigation systems). According to the Draft Resolution, under the proposed irrigation control ordinance, automatic controllers shall be required for all irrigation systems and automatic systems shall have, at minimum, a device that measures humidity and/or soil moisture content or utilizes recent local weather data. All homes and facilities with irrigation systems would be subject to the ordinance requirements unless they have already installed smart irrigation controllers.

The irrigation system penetration rate is not known for Franklin. Therefore, assumptions regarding the penetration rate of irrigation systems for single-family homes and commercial facilities are required to estimate potential water savings. Thus, for the purposes of this analysis, three automatic irrigation system penetration rates are evaluated: 25 percent, 50 percent, and 75 percent.

4.3 Compliance Rates

After developing assumptions regarding irrigation system penetration rates in Franklin, it is necessary to create assumptions on the rate of compliance with an irrigation ordinance requiring retrofits to existing systems. There is little information available documenting irrigation ordinance participation rates. In Cary, North Carolina, a mid-sized city with approximately 35,000 water customers, compliance rates of 80 percent for residential customers and nearly 100 percent for commercial customers have been reported following a city-wide ordinance requiring rain sensors on all automatic irrigation systems (Platt, 2011). Cary boasts one of the more aggressive and well known water conservation programs in the country. Therefore, it is likely that the participation rates reported there would be at the high end of the spectrum. For the purposes of this analysis, three single-family residential and commercial compliance rates are evaluated: 40 percent, 60 percent, and 80 percent.

4.4 Savings Scenarios Assumptions

The irrigation ordinance assumptions, discussed above, form the basis for calculating potential irrigation water savings in Franklin. In total, three savings scenarios are evaluated, representing low, medium, and high potential savings. **Table 5** below summarizes these scenarios and assumptions. For this analysis, the irrigation system penetration rates, compliance rates, and savings rates, shown in Table 5, apply to both single-family residential and commercial customer classes.

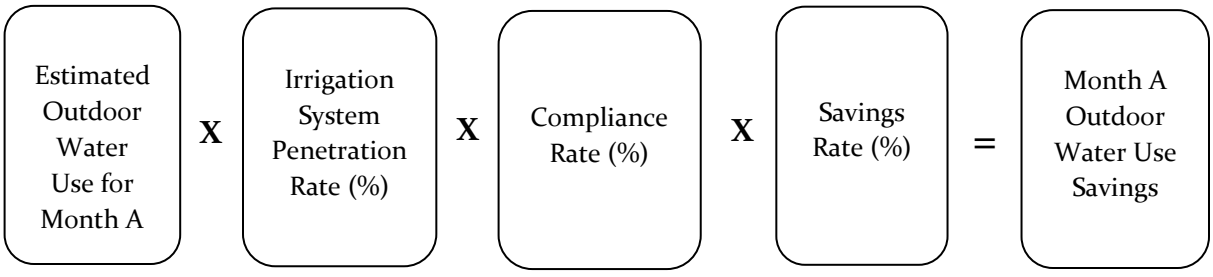
Table 5 - Irrigation Ordinance Savings Scenarios

Scenario	Irrigation System Penetration Rate	Compliance Rate	Outdoor Water Use Savings Rate
Low Savings	25%	40%	15%
Medium Savings	50%	60%	20%
High Savings	75%	80%	25%

5.0 Estimating Potential Water Savings

The potential water savings from implementation of an irrigation ordinance can be calculated using the monthly outdoor water use estimates and the scenario assumptions presented in Section 4.4. Potential irrigation ordinance savings are calculated as shown in **Figure 5**. Using the formula shown in Figure 5, the calculated outdoor water use savings are summed for each month in the peak season to derive the total annual irrigation control ordinance program savings potential.

Figure 5 - Estimate of Peak Season Month Irrigation Ordinance Water Use Savings



Potential future residential and commercial savings could be derived by applying the estimate of outdoor water use approach and the savings rate assumptions described above to a disaggregated water demand forecast for the City of Franklin water service area. That is, a forecast disaggregated by sector and month for future years. However, a disaggregated water demand forecast is not

available for this analysis. Thus, the estimated savings are based upon current service area characteristics (i.e., estimated seasonal irrigation use) with no growth in the number of accounts.

Using the method and assumptions described above, **Table 6** shows the estimated irrigation ordinance savings for the three savings scenarios. The savings vary significantly depending on the scenario. Under the low savings scenario, estimated savings from implementing an irrigation ordinance are only 1.5 percent of the average peak season outdoor water use. Conversely, under the high savings scenario, 15 percent of estimated outdoor water use during the peak season could be saved. **Figure 6** and **Figure 7** show results of the savings analysis for single-family residential and commercial customer classes, respectively.

Table 6. Estimated Irrigation Ordinance Water Savings

Scenario	Avg. Peak Season Month Outdoor Water Use, in mgd	Total Peak Season Outdoor Water Use, in mgd	Total Savings as % of Total Peak Season Outdoor Use	Estimated Total Peak Season Savings, in mgd
Single-Family Residential				
Low Savings	1.20	8.41	1.5%	0.13
Medium Savings	1.20	8.41	6.0%	0.50
High Savings	1.20	8.41	15.0%	1.26
Commercial				
Low Savings	0.51	3.55	1.5%	0.05
Medium Savings	0.51	3.55	6.0%	0.21
High Savings	0.51	3.55	15.0%	0.53

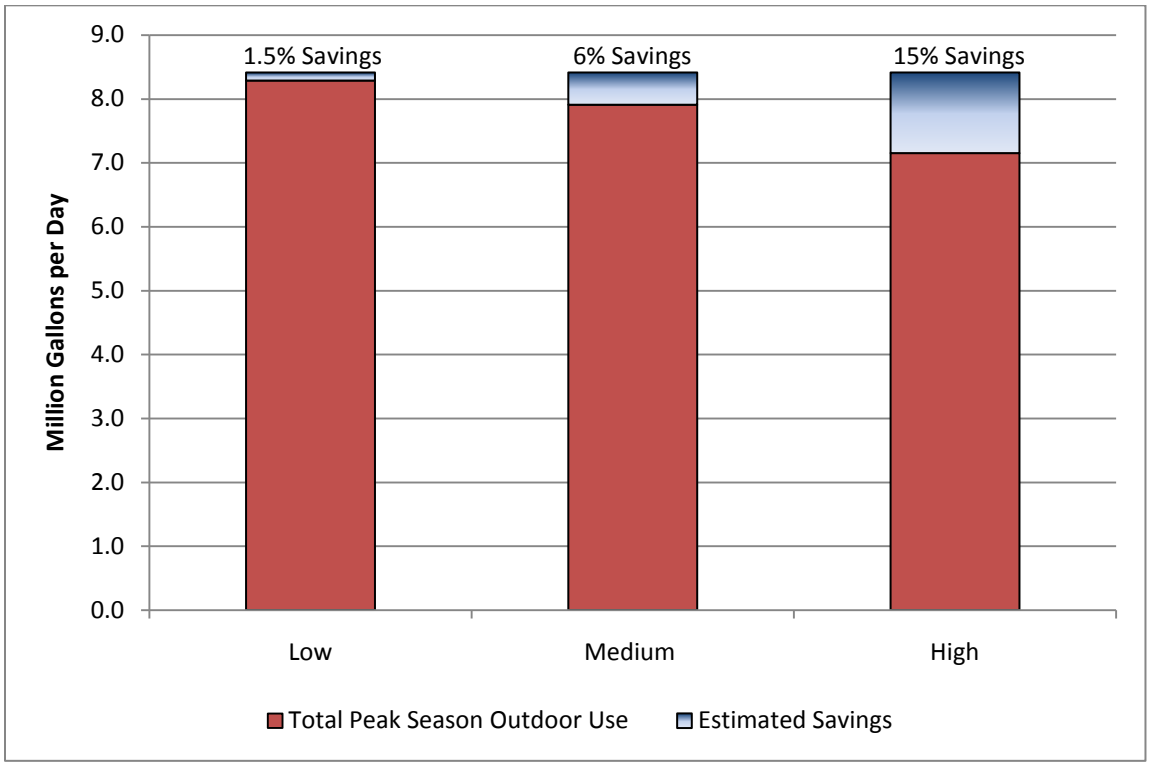


Figure 6 - Single-Family Residential Irrigation Ordinance Savings Estimates

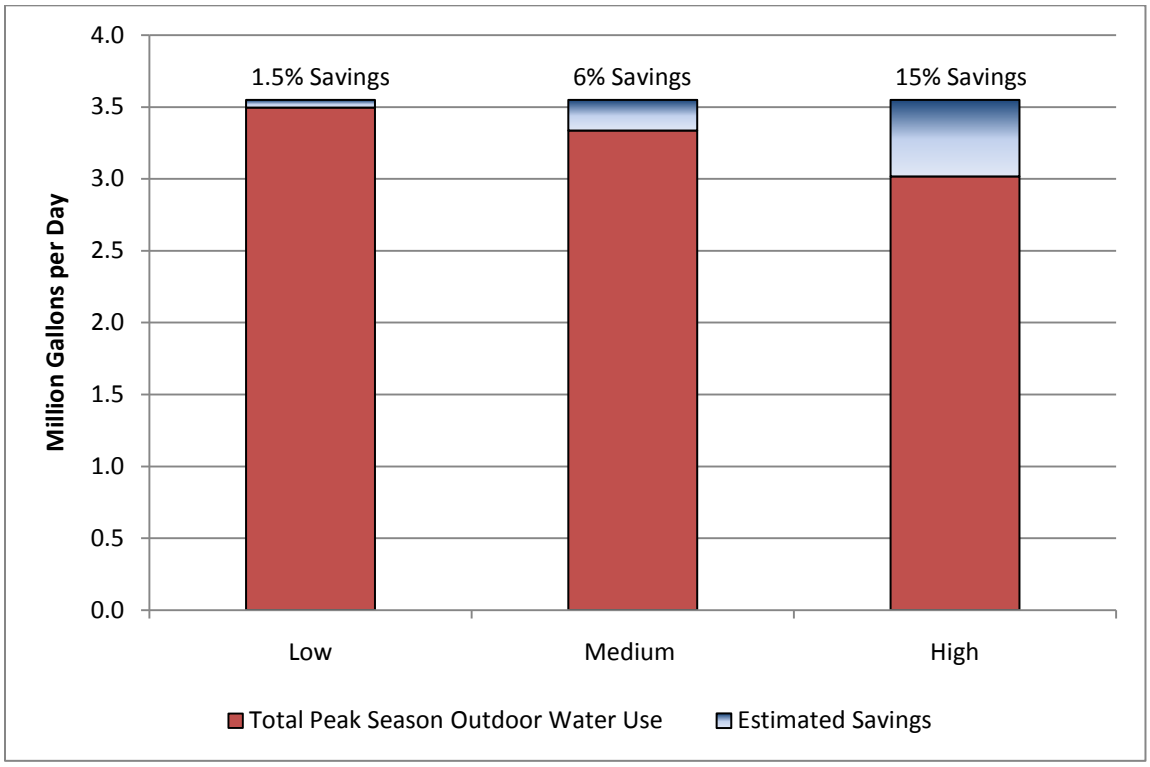


Figure 7 - Commercial Irrigation Ordinance Savings Estimates

6.0 Estimating Potential Program Costs

There are several cost considerations associated with implementing a system-wide irrigation ordinance. Program costs include staff time and materials to develop the ordinance, conducting outreach and education to water customers, enforcing the ordinance, and monitoring and tracking program performance. Costs may vary substantially from one utility to another. Furthermore, there is little information in the literature that identifies program costs for different system sizes, program objectives, and levels of enforcement.

Water conservation program budget information reported by the City of Cary, North Carolina provides a reference for costs required to implement and maintain a water conservation program in a mid-sized city. It should be noted that budget items listed for Cary reflect a conservation program that includes more activities than just an irrigation ordinance. However, the more aggressive a water conservation program is, the higher the costs associated with staff time to ensure compliance and consistency in the use of efficiency standards. **Table 7** presents some costs identified by Cary that may apply to an irrigation ordinance program in Franklin (Platt, 2011). For the purposes of this analysis, the Cary, North Carolina annual cost estimates shown in Table 7 are assumed to apply to Franklin; where there are a range of costs, the midpoint is used.

It should also be noted that the draft City of Franklin irrigation ordinance identifies a $150 penalty to be imposed for the first ordinance compliance violation. Therefore, it can be expected that money collected through the issuance of fines may be available to offset some program costs as presented in Table 7.

Table 7 - Selected Cary, North Carolina Conservation Annual Program Budget Items

Budget Item		Cary, NC Estimated Cost	Cost Assumptions Used for Franklin
Water Conservation Coordinator (Overall program manager)		1.0 FTE ($36,525 - $52,957)	$44,741
Water Conservation Assistant (Coordinate education and enforcement)		0.75 FTE ($30, 035 - $43,555)	$36,795
Field Technician (Conduct field enforcement of ordinance)		$8 - $10/hr during summer months ($4,160 - $5,200 per season)	$4,680
Supplies	Paper for Brochures	$3,000	$3,000
	Promotional Items	$5,000	$5,000
	Irrigation Supplies	$500	$500
Total Annual Budget		**$79,220 - $110,212**	**$94,716**

7.0 Estimate of Costs per Unit of Water Saved

Using the assumptions regarding the irrigation ordinance program costs shown in Table 7 and estimated program savings shown in Table 6, the annual program costs per unit of water saved can be calculated. The cost per unit of water saved provides decision makers with information necessary to understand the value of the program, in relation to other conservation programs or other sources of water supply.

The cost per unit of water saved is expressed on an annual peak season basis and is calculated by dividing the annual program costs by the estimate of annual water savings attributable to implementing and operating the program. The cost per unit of water saved is calculated as illustrated in **Figure 8**.

Figure 8 - Calculation of Cost per Unit of Water Saved

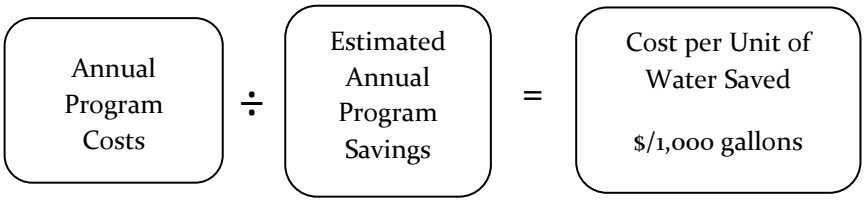


Table 8 shows results of the cost per unit of water saved analysis. The irrigation ordinance program becomes more cost effective as the savings scenario goes from low to high. Under the low savings scenario, it costs $1.45 to save 1,000 gallons, whereas under the high savings scenario, it costs only 14 cents to save 1,000 gallons.

Table 8 - Total Annual Irrigation Control Ordinance Program Cost per Unit of Water Saved

Savings Scenario	Annual Savings, in Thousands of Gallons	Cost/Thousand Gallons Saved
Low	65,484	$1.45
Medium	261,936	$0.36
High	654,841	$0.14

Note: Savings and cost per 1,000 gallons saved includes both single-family residential and commercial estimated savings.

8.0 Cost per Unit of Water Saved vs. Cost of Additional Supplies

In order to make an informed decision regarding various water supply options, the cost to obtain additional water supplies in Franklin can be compared to the costs and benefits of implementing an irrigation ordinance program. The City of Franklin has two options for procuring water supplies: purchase treated water from Harpeth Valley Utilities at a cost of $2.55 per 1,000 gallons or withdrawals from the Harpeth River at a cost of $1.72 per 1,000 gallons. A comparison of the irrigation ordinance savings scenario, costs per 1,000 gallons of water saved and the two water acquisition costs for Franklin, is shown in **Figure 9**. The figure shows that the irrigation ordinance program is a more cost-effective means for Franklin to obtain additional water supplies, compared to purchasing from Harpeth Valley Utilities or direct Harpeth River withdrawals.

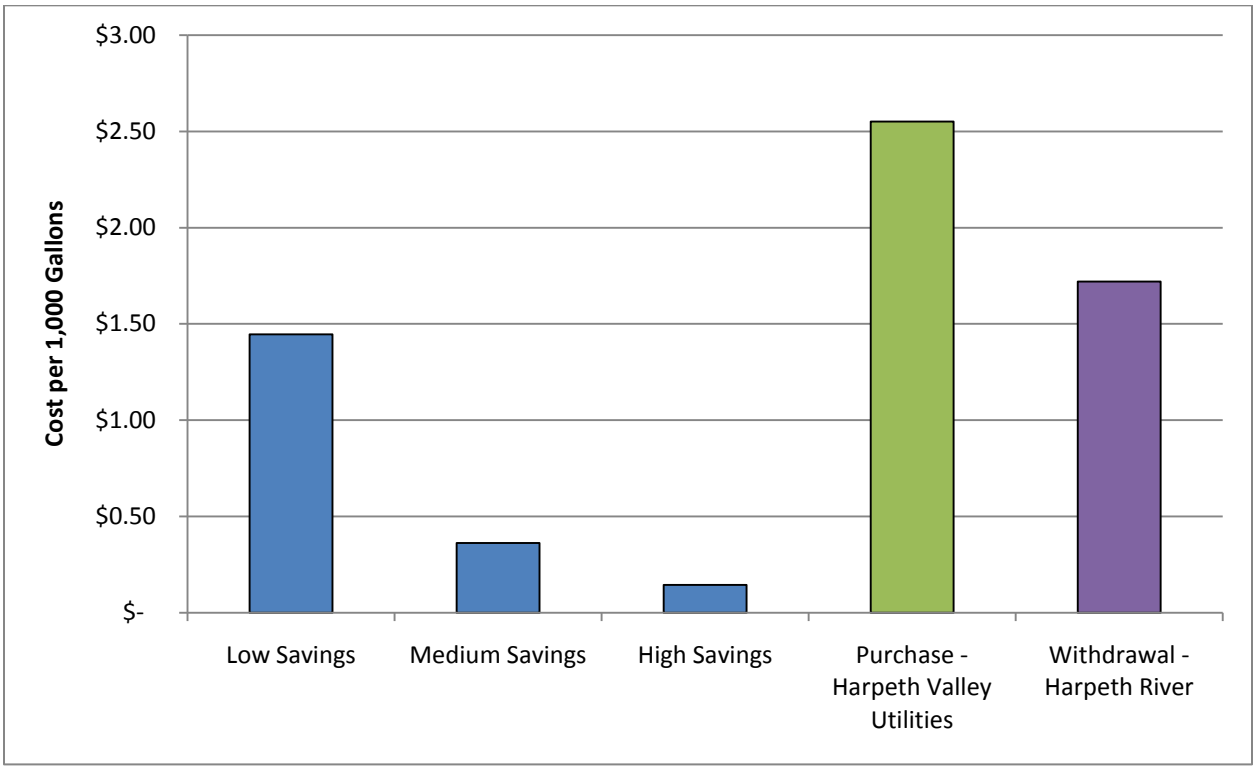


Figure 9 - Cost per 1,000 Gallons Saved/Acquired Comparison

9.0 Conclusion

This memorandum examines the potential single-family residential and commercial outdoor water use savings attributable to an irrigation control ordinance in the City of Franklin water service area. Potential savings are calculated using historical customer class billing data to develop an average year demand and assumptions regarding the current penetration rate of automatic irrigation systems, customer compliance, and efficiency gains by converting an automatic irrigation system to one with "smart" controllers that measure humidity and/or soil moisture and utilize recent local weather data in order to eliminate wasteful irrigation water use. The savings assumptions that form the basis for this analysis are informed by documented case studies throughout the U.S., where available. Potential irrigation water use savings are estimated for a low, medium, and high savings scenario.

Program cost assumptions are derived from documented cost estimates reported for the City of Cary, North Carolina. Because of its similar climate and service area characteristics, these program costs are assumed for Franklin. Furthermore, the estimated costs per unit of water saved from implementing an irrigation control ordinance are compared to known water purchase and treatment costs for Franklin.

Results of this analysis show, based on the assumptions presented in this memorandum, that an irrigation control ordinance is a cost-effective method of conserving water in Franklin. The combined single-family residential and commercial customer class peak seasonal savings range from 1.5 to 15 percent of total peak season outdoor water use depending on the savings scenario. These savings translate into program costs of $0.14 to $1.45 per 1,000 gallons saved, depending on the savings scenario. By comparison, it costs the City of Franklin between $1.72 and $2.55 per 1,000 gallons to obtain additional water supplies.

10.0 References

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