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Technical Memorandum

To: City of Franklin IWRP Steering Committee

From: CDM

Date: December 8, 2010

*Subject: City of Franklin IWRP, Phase II
Water Resources Demand Projections*

1.0 Introduction

The City of Franklin's unique setting—characterized by its commitment to preserve the City's history and heritage and its location in one of the fastest growing regions of the country—make Franklin a popular place to live and conduct business. From 1997 through 2010, the population of the City has nearly doubled and a continued trend of population growth is expected into the foreseeable future. This population growth has resulted from a combination of immigration, natural growth (births minus deaths), and annexation. Specifically over the past four decades, the City has annexed almost 24,000 acres. The rate at which Franklin continues to grow will depend on several factors—including how the nation and region rebounds from the current economic slowdown along with the availability and capacity to extend municipal services to undeveloped areas.

The City of Franklin Planning department has estimated that the population of Franklin would be at or near 78,000 within the City limits and the Urban Growth Boundary (UGB) by 2020. In its efforts to plan for future growth, the City has developed a land use plan to manage growth within the city and UGB. New construction continues in areas throughout the city and within Williamson County near the city borders. Commercial development continues in the northeastern portion of the city near the Cool Springs and McEwen Drive interchanges. The next major growth generator for Franklin is the land around the Goose Creek/I-65 Interchange at the southern boundary of the city. New residential development is planned and being constructed on the east, west and south sides of the city. With continued growth comes increasing pressure on City services and infrastructure. All areas of the City's infrastructure have experienced growth pressure, including roads and streets, water supply and treatment, wastewater treatment and disposal, and other City services. These ever-increasing demands

have led the City administration and staff to reevaluate their water resources from a long-term, holistic perspective that encompasses water supply and treatment, stormwater management, wastewater collection and treatment, and reclaimed water distribution. The process being used to accomplish this goal is the ongoing Integrated Water Resources Plan (IWRP).

The central points of the IWRP are reliably meeting the City's water needs and protecting the City's water resources, including the Harpeth River. The ecology and value of the river as a recreational resource is not only required component of this plan, but is desired as part of the quality of life in Franklin. At the same time, the City needs a reliable long-term source and infrastructure for drinking water and irrigation and sustainable solutions and infrastructure for reclaiming wastewater and discharging treated effluent when reclaimed water use is not feasible. In order to meet these challenges, the City looked to develop a long-range plan that establishes governing science and engineering principles, evaluates and debates alternatives, and builds broad consensus around a comprehensive set of sustainable, affordable actions that will provide for effective management of the City's water resources.

In order to develop the IWRP to address a 30-year planning period, estimates of future water resources demand are necessary to develop in-depth analyses of the costs and benefits of the project options identified in Phase I. Because the City of Franklin Planning Department has documented past growth and future population projections, the IWRP demand projections will be based upon existing population projection data and historical per capita demand data. If other previous demand information was available for given water resource systems, that information will be used in Phase II evaluations. This memorandum summarizes the population and water resource demand projections from previous studies; where previous demand projections have not been developed, this memorandum describes how demand projections have been developed for the purposes of Phase II of the IWRP.

2.0 Population Projections

The City of Franklin estimates population in their annual Development Report; the most recent version of that report was published in 2009. Future projections for the City of Franklin's population were based on a constant 2.9-percent growth rate from 2010 through 2030, in that report. For the purposes of developing 30-year projections for the IWRP, this growth rate has been extrapolated through 2040. Alternative population projections were gathered from several sources to compare to the City's Development Report projections. **Table 2-1** shows the City's population projections along with alternative high and low population projections for the City of Franklin at five year increments for the 30-year IWRP planning period of 2010 through 2040.

**Table 2-1
 Population Projections for City of Franklin**

| Year | Low Projection (Various Sources) | COF Projection (2009 Development Report) | High Projection (TACIR, 2010) |
|-------------|---|---|--|
| 2010 | 57,471 ^a | 62,675 ^d | 62,742 ^e |
| 2015 | 65,878 ^a | 72,305 ^d | 79,028 ^e |
| 2020 | 78,000 ^b | 83,416 ^d | 90,970 ^e |
| 2025 | 83,174 ^a | 96,233 ^d | 103,980 ^e |
| 2030 | 90,506 ^c | 111,020 ^d | 118,731 ^e |
| 2035 | 94,094 ^c | 128,079 ^d | 135,353 ^e |
| 2040 | 97,681 ^c | 147,759 ^d | 154,303 ^e |

^aPopulation Projections for the State of Tennessee, a joint publication of the Tennessee Advisory Commission on Intergovernmental Relations (TACIR) and The University of Tennessee Center for Business and Economic Research (CBER), 2003

^bCity of Franklin 2006 Annexation Study

^cExtension of the observed trend from 1990 population data through the 2025 projection based on historical population data from the City of Franklin (Fiscal Year 2005-2006 City of Franklin Operating and Capital Budget)

^dCity of Franklin 2009 Development Report

^ePopulation Projections for the State of Tennessee, TACIR and CBER, 2010

As shown in **Figure 2-1**, the projections diverge significantly after 2020 and result in very different population estimates for the end of the planning period in 2040. The primary cause of the divergence is the assumed growth rate: the City’s projection uses a consistent 2.9-percent increase in population for the next 30 years, whereas the low projection assumes that the growth rate will level off after 2020. The growth rate after 2020, in the low projection, decreases from around 3 - 4-percent per year to 2-percent per year in 2030 and to less than 1-percent per year in 2040. The high projection, from the recently released TACIR data, assumes an initial growth rate of 5-percent from 2010 to 2015, which decreases to approximately 3-percent from 2020 through 2040.

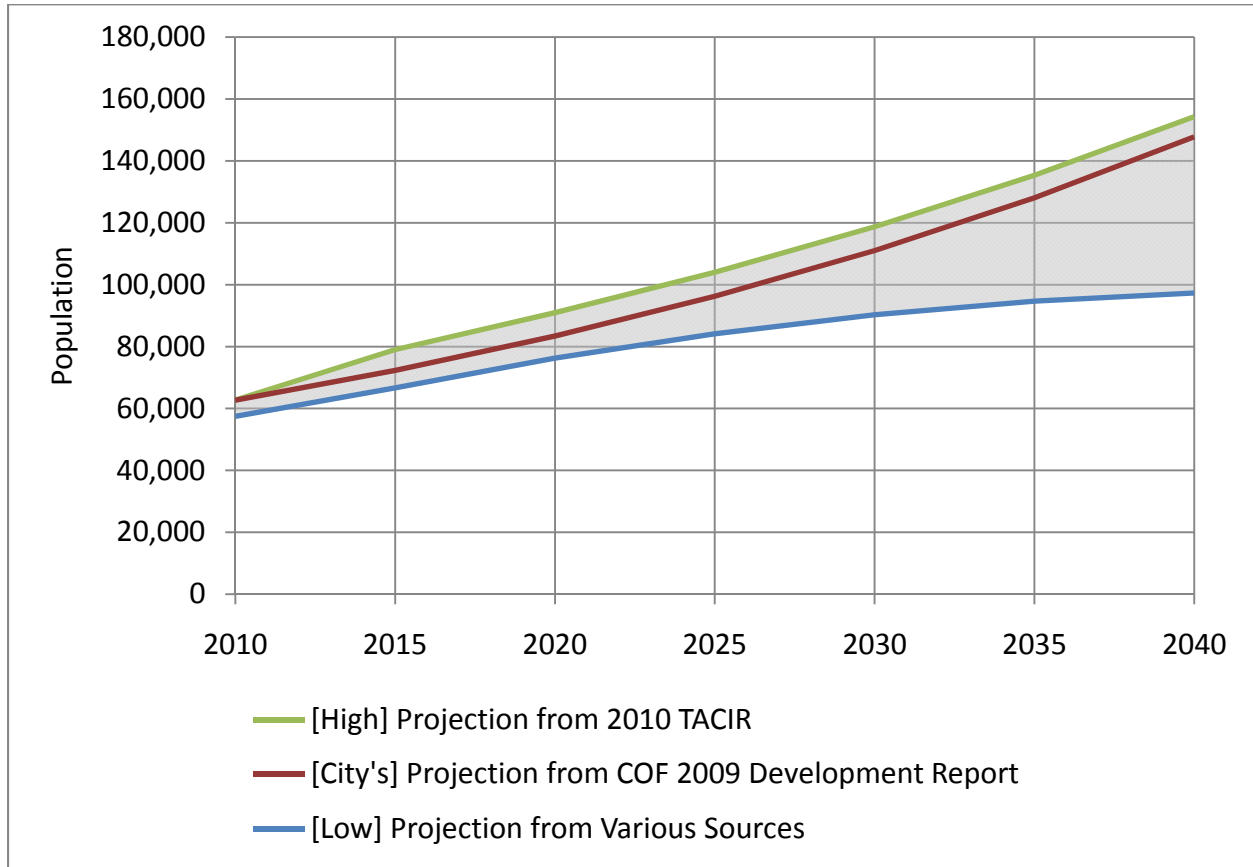


Figure 2-1
Population Projections for the City of Franklin

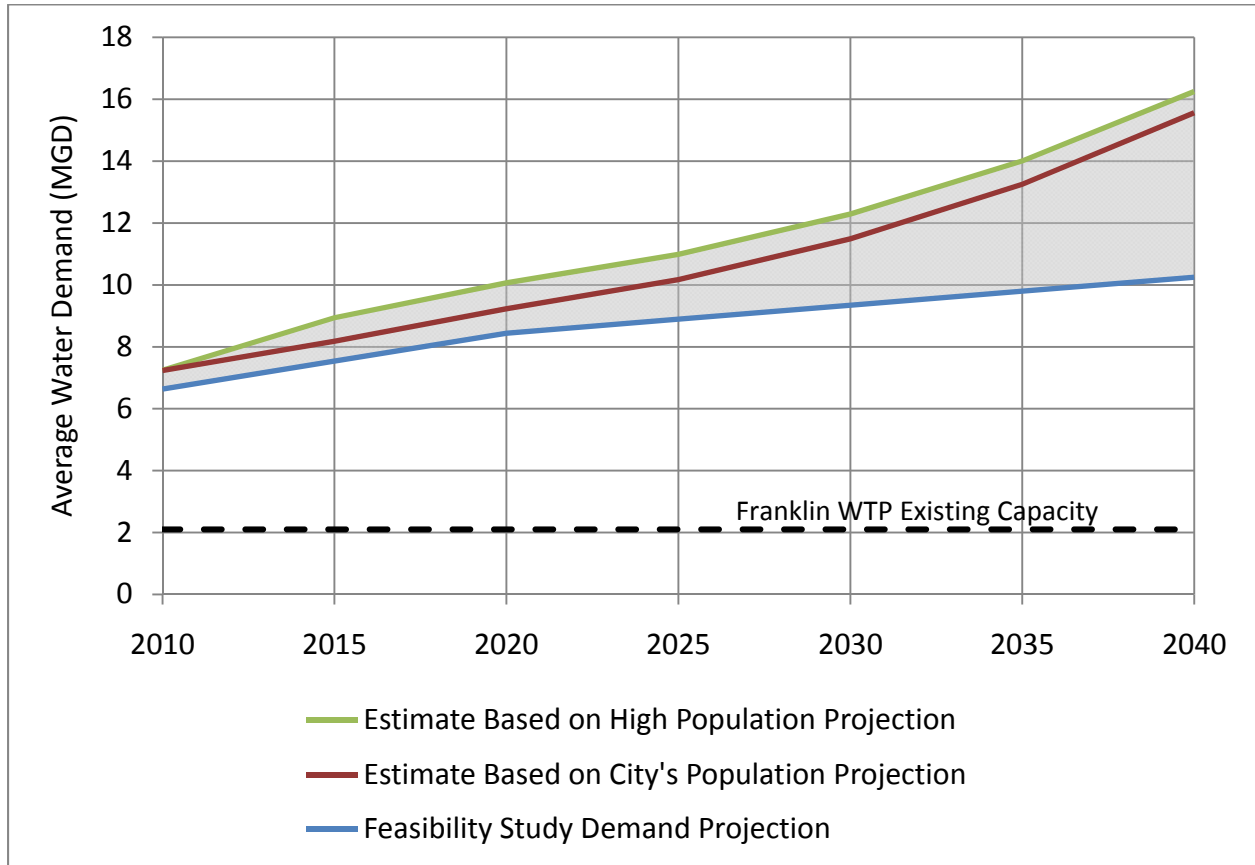
3.0 Water Demands

In June 2008, Jackson Thornton Utilities conducted an independent evaluation of a previous feasibility study on upgrading the Franklin Water Treatment Plant capacity. The original study included total annual water demand projections through 2038, which were reviewed in the evaluation report. The demand projections are based on the actual 2005 monthly water use values, and included a 0.18 million gallons per day (mgd) per year growth rate from 2005 to 2020, and a 0.09 mgd per year growth rate beyond 2020. This demand scenario generally follows the low population projection trend previously described in Section 2. A growth rate of 0.18 mgd is approximately 3-percent of the average daily demand in 2005; a growth rate of 0.09 mgd is approximately 1-percent of the average projected demand in 2020.

Alternative water demand projections were developed by adjusting the feasibility study projections proportionally to the City’s population projection and the TACIR population projection. **Table 3-1** and **Figure 3-1** show the high and low water demand projections for the planning period, 2010 to 2040.

**Table 3-1
 Water Demand Projections for City of Franklin**

| Year | Low Demand Projection in million gallons per day | COF Demand Projection in million gallons per day | High Demand Projection in million gallons per day |
|------|---|---|--|
| 2010 | 6.6 | 7.2 | 7.2 |
| 2015 | 7.5 | 8.2 | 8.9 |
| 2020 | 8.4 | 9.2 | 10.1 |
| 2025 | 8.9 | 10.2 | 11.0 |
| 2030 | 9.3 | 11.5 | 12.3 |
| 2035 | 9.8 | 13.3 | 14.0 |
| 2040 | 10.2 | 15.6 | 16.3 |



**Figure 3-1
 Water Demand Projections for the City of Franklin**

Seasonal variability in water use will cause daily demand to fluctuate, often resulting in greater demands in dry summer months when residents and businesses use significant volumes of water for landscape irrigation. Seasonal variations were developed during Phase I of the IWRP process and are explained in detail for the various water use sectors in Section 4 of the Phase I Report. **Figure 3-2** shows the projections for average water demand with shaded bands

representing the potential high and low seasonal demands. For comparative purposes, the values shown are normalized to daily demands (mgd) however the bands represent the average demand for the highest and lowest month in the year (not the greatest expected demand in a single day). The graph shows the estimated water demands based on the low population projection and based on the City's population projection.

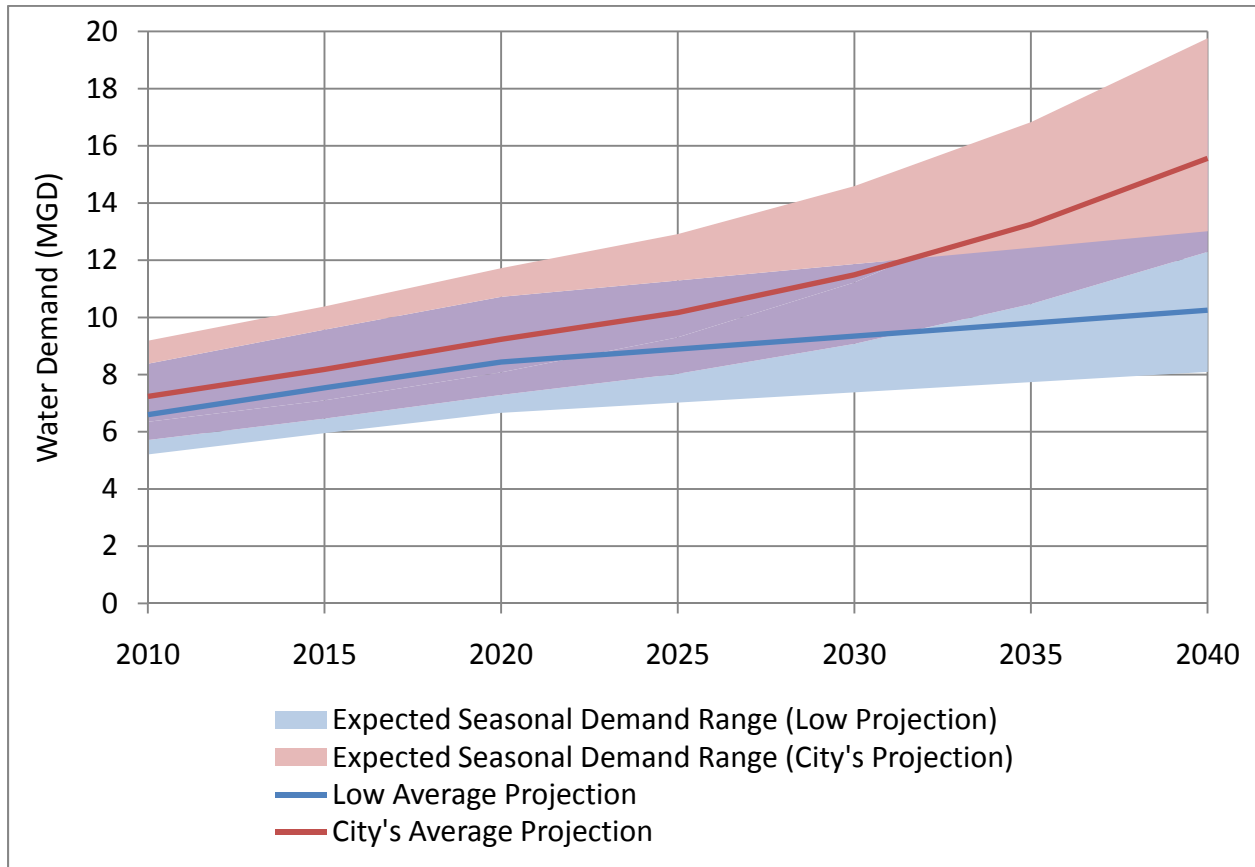


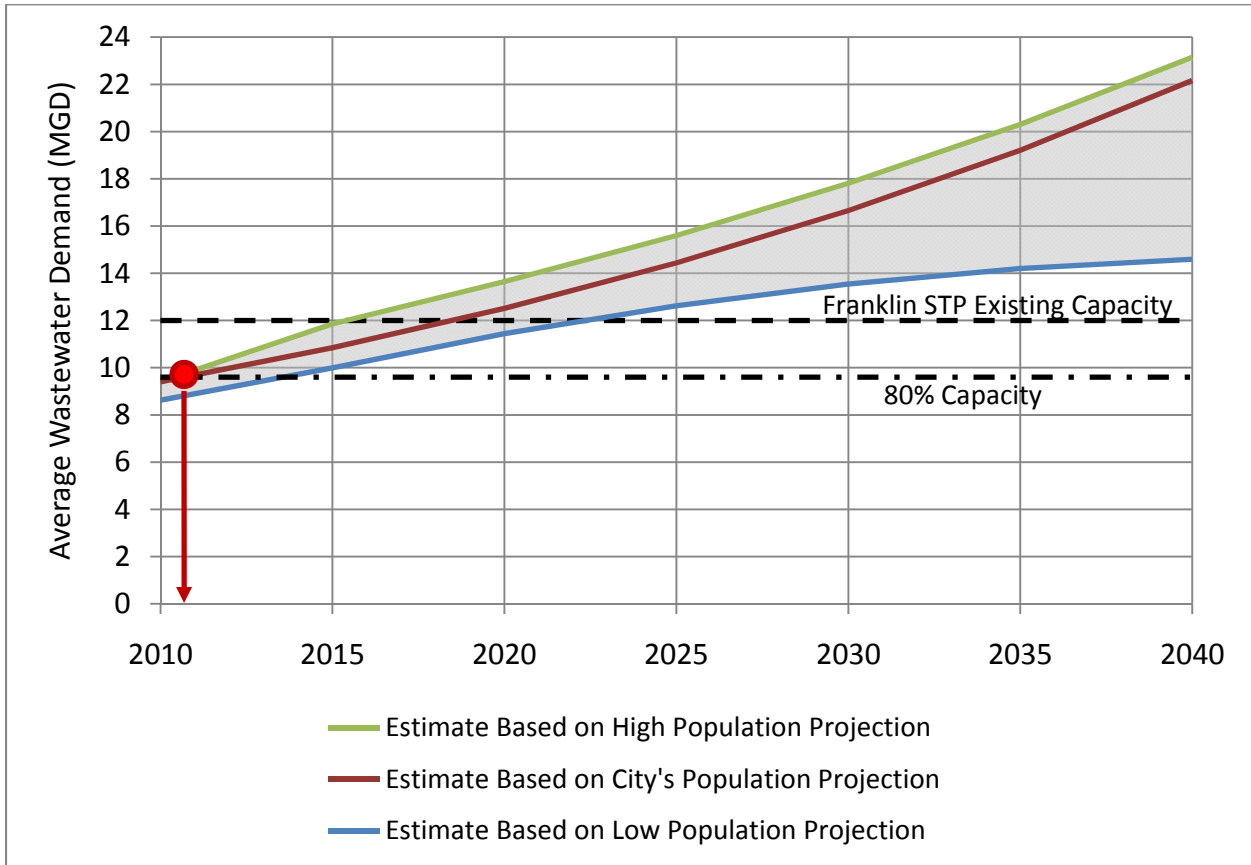
Figure 3-2
Water Demand Projections with Seasonal High and Low Estimates

4.0 Wastewater Demands

Wastewater demand projections were developed using the most recent ten years of wastewater influent data with population to estimate wastewater generated per person per day. While the sanitary sewer service area may not have covered all of the City of Franklin's population over the past 10 years, it was assumed for this estimate, that the growth rate of sewer customers is proportional to the growth rate of the City's population. An average of 150 gallons of wastewater generated per capita per day (gpcd) from 1999 through 2009 was calculated based on the reported average monthly wastewater influent. Calculations were performed using population as shown in Table 2-1 resulting in a minimum of 120 and maximum of 190 gpcd; 150 gpcd was applied to the high and low population projections, previously discussed in Section 2 to develop average daily wastewater demand projections shown in **Table 4-1** and **Figure 4-1**.

**Table 4-1
 Average Daily Wastewater Demand Projection**

| Year | Low Projection in million gallons per day | COF Projection in million gallons per day | High Projection in million gallons per day |
|------|--|--|---|
| 2010 | 8.6 | 9.4 | 9.4 |
| 2015 | 10.0 | 10.8 | 11.9 |
| 2020 | 11.4 | 12.5 | 13.6 |
| 2025 | 12.6 | 14.4 | 15.6 |
| 2030 | 13.5 | 16.7 | 17.8 |
| 2035 | 14.2 | 19.2 | 20.3 |
| 2040 | 14.6 | 22.2 | 23.1 |



**Figure 4-1
 Wastewater Demand Projections for the City of Franklin**

Wastewater demand projections are greater than water demand projections because each utility has different service areas and because of inflow and infiltration (I/I) to the wastewater collection system. This has been reported in historical data; the reported total water demand in 2005 was 2,282 million gallons while the total influent to the wastewater treatment plant was

reported to be 2,371 million gallons (based on records of average monthly flow). As part of the integrated modeling performed for Phase I of the IWRP, the I/I to Franklin’s wastewater collection system was estimated to be as high as 4.4 mgd (Section 4 of the Phase I Report). Additionally, Franklin’s calculated wastewater flow of 150 gpcd is greater than domestic wastewater flow specified for facility design in standard references such as the Ten States’ Standards (100 gpcd) or in the WEF MOP 8 (70 - 100 gpcd).

Seasonal variations in water use, rainfall, and groundwater table elevation will cause wastewater demand to fluctuate throughout the year. Seasonal variations were developed during Phase I of the IWRP and were based on available wastewater influent data, water use data, and seasonal rainfall totals (Section 4 of the Phase I Report). **Figure 4-2** shows projections for average wastewater demand, with shaded bands representing potential high and low seasonal demands. For planning purposes, values are normalized to daily demands (mgd); however, the bands represent the average demand for the highest and lowest month in the year and not the greatest demand in a single day. Wastewater demand estimates shown in Figure 4-2 are based on the low population projections and the City’s population projections.

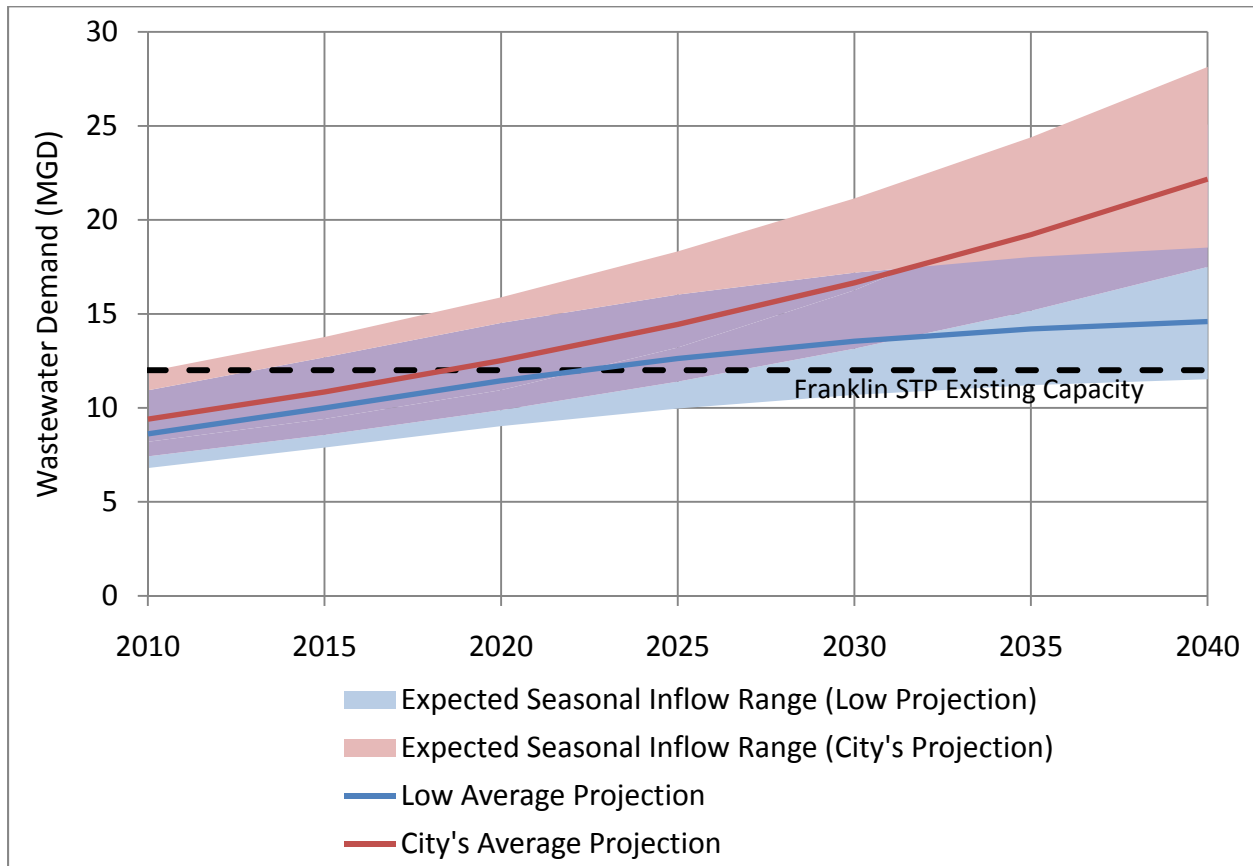


Figure 4-2
Wastewater Demand Projections with Seasonal High and Low Estimates

5.0 Reclaimed Water Demands

Demand projections for reclaimed water were calculated during Phase I of the IWRP based on values in the 2009 Reclaimed Water System Master Plan. This document lists various potential users and potential demands, which were aggregated into water use sectors (residential, commercial, and recreational); the demands were projected over the planning period. The growth of reclaimed water demand is specifically tied to the timeframe during which infrastructure improvements are implemented to supply those customers, and is not based on past reclaimed water or non-essential use patterns. The City predicts that there is an untapped demand for reclaimed water and extrapolating historical reclaimed or non-essential water use into the future would likely under predict the actual demand once the infrastructure and the resource itself are fully available. **Table 5-1** and **Figure 5-1** show the projected average reclaimed water demands by projection year and water use sector.

**Table 5-1
 Average Daily Reclaimed Water Demand Projection**

| Year | Reclaimed Water Demand in million gallons per day | | | |
|------|---|------------|--------------|-------|
| | Residential | Commercial | Recreational | Total |
| 2010 | 0.5 | 0.7 | 1.9 | 3.1 |
| 2015 | 0.5 | 0.7 | 1.9 | 3.1 |
| 2020 | 0.8 | 0.9 | 2.0 | 3.7 |
| 2025 | 1.2 | 1.2 | 2.1 | 4.4 |
| 2030 | 1.9 | 2.0 | 2.1 | 6.0 |
| 2035 | 2.7 | 2.7 | 2.1 | 7.5 |
| 2040 | 3.5 | 3.5 | 2.1 | 9.1 |

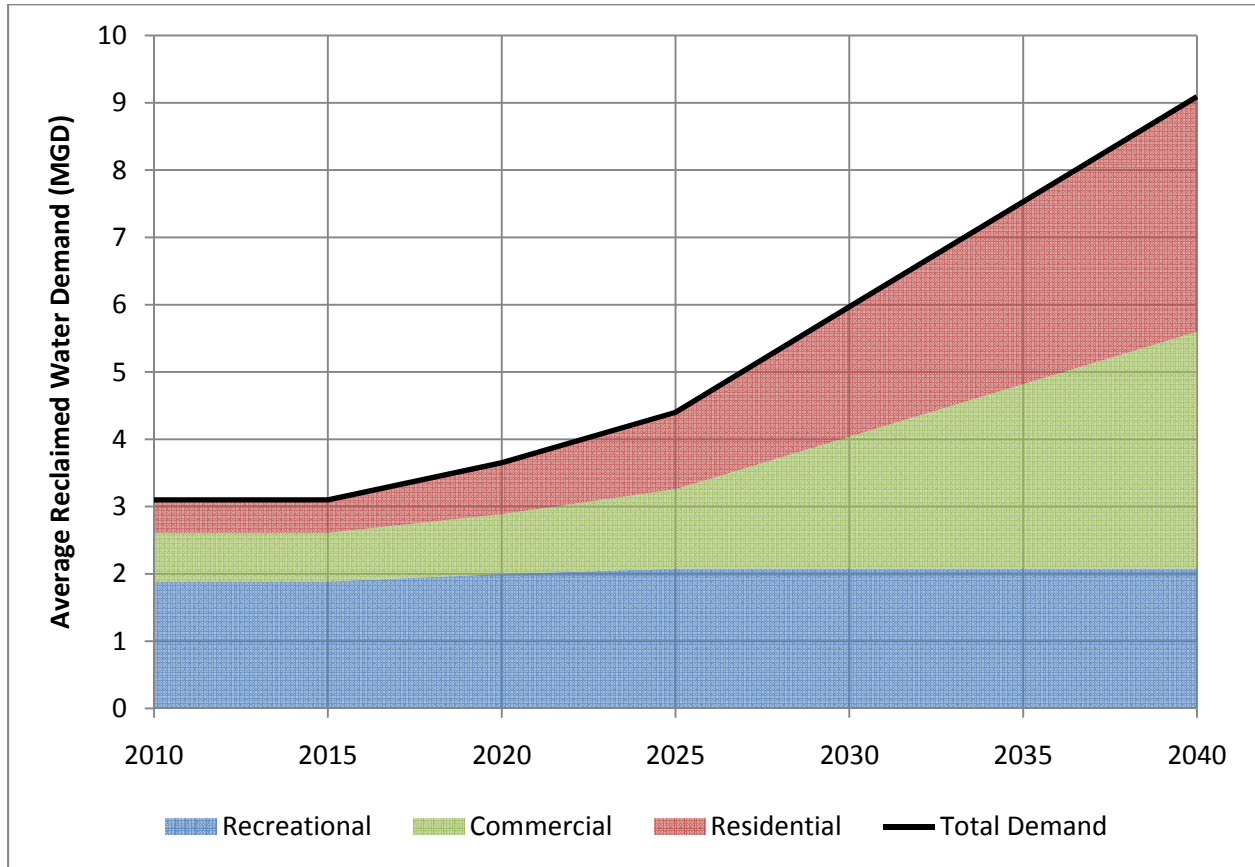


Figure 5-1
Reclaimed Water Demand Projections for the City of Franklin

There are large seasonal variations in reclaimed water demand, considering that most reclaimed water use is for irrigation in the dry summer months. The monthly variations were developed using records of wastewater effluent sent to reuse and discussions with IWRP Stakeholders and the City of Franklin staff. **Figure 5-2** shows the monthly variation in projected reclaim demands. Residential and commercial demands share the same seasonal pattern, while recreational demands for reclaimed water (including golf courses) tend to vary more drastically over the year. The graph shows the estimated monthly demands for reclaimed water compared to the projected annual average demand over the entire year. The projected monthly demand for any month in the planning period can be calculated by multiplying the percentage on the y-axis of Figure 5-2 with the annual average demand shown in Table 5-1 and Figure 5-2. Note that reclaimed water storage would be required to meet the peak seasonal demand.

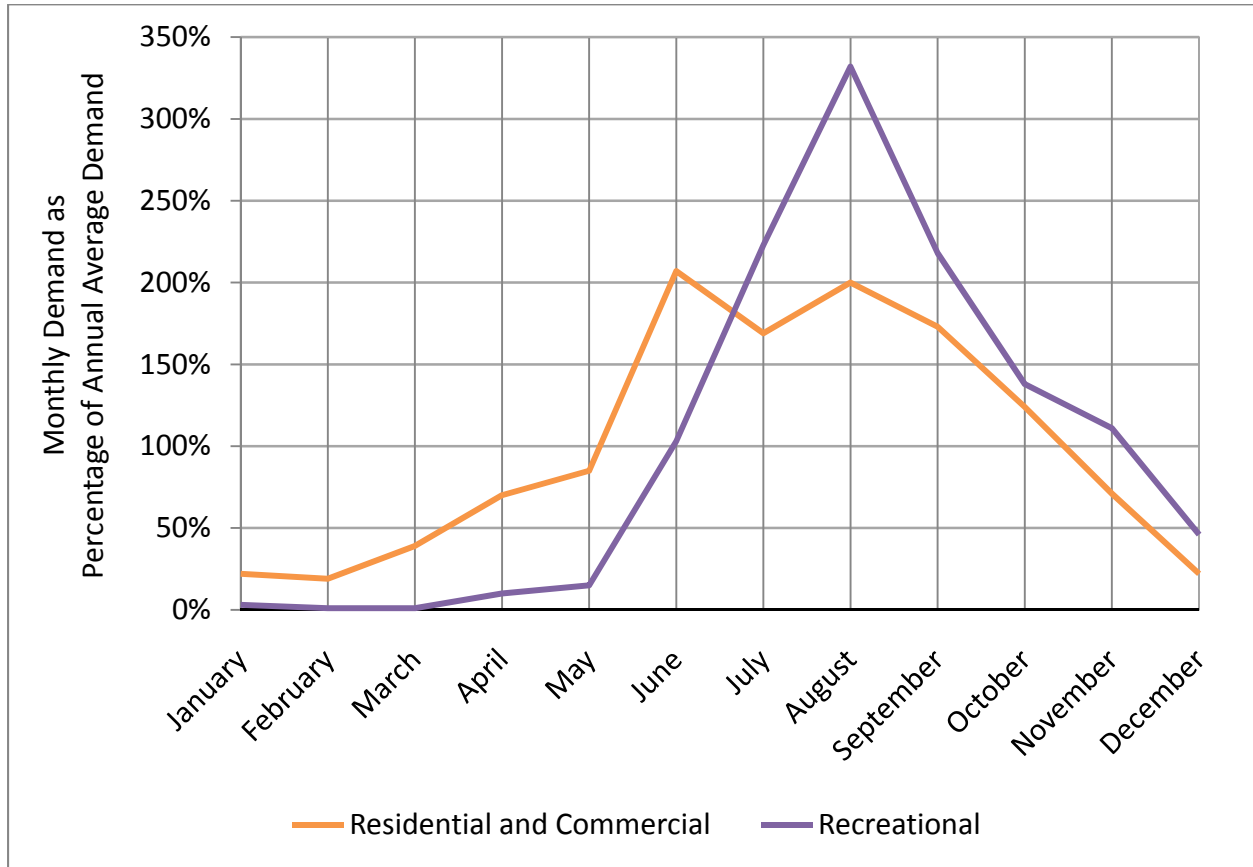


Figure 5-2
Reclaimed Water Demand Projections for the City of Franklin

6.0 Summary

The projected City of Franklin population, water demands, wastewater demands, and reclaimed water demands are summarized in **Table 6-1**. High, medium, and low demand projections for population, water demands, and wastewater demands are based on multiple data references for population growth projections. The low projection values were developed assuming a conservative growth rate in the City of approximately 3- to 4-percent population growth per year from 2010 to 2020, then approximately 2-percent per year from 2020 to 2030, and approximately 1-percent per year from 2030 to 2040. The City’s (medium) projection values assume a constant growth rate of approximately 3-percent per year during the planning period (2010 to 2040). The high projection values assume a 5-percent per year growth rate until 2020, which decreases to about 3-percent per year for 2020 to 2040. For each year, the top line shows the low projected value, the middle line shows the value based on the City’s 2009 population projections, and the bottom line shows the high projected value.

**Table 6-1
Summary of Average Daily Water Resource Demand Projections**

| Year | Source | Population | Average Water Resource Demand in million gallons per day | | |
|------|--------|------------|---|------------|-----------------|
| | | | Water | Wastewater | Reclaimed Water |
| 2010 | a | 57,471 | 6.6 | 8.6 | 3.1 |
| | b | 62,675 | 7.2 | 9.4 | |
| | c | 62,742 | 7.2 | 9.4 | |
| 2015 | a | 65,878 | 7.5 | 10.0 | 3.1 |
| | b | 72,305 | 8.2 | 10.8 | |
| | c | 79,028 | 8.9 | 11.9 | |
| 2020 | a | 78,000 | 8.4 | 11.4 | 3.7 |
| | b | 83,416 | 9.2 | 12.5 | |
| | c | 90,970 | 10.1 | 13.6 | |
| 2025 | a | 83,174 | 8.9 | 12.6 | 4.4 |
| | b | 96,233 | 10.2 | 14.4 | |
| | c | 103,980 | 11.0 | 15.6 | |
| 2030 | a | 90,506 | 9.3 | 13.5 | 6.0 |
| | b | 111,020 | 11.5 | 16.7 | |
| | c | 118,731 | 12.3 | 17.8 | |
| 2035 | a | 94,094 | 9.8 | 14.2 | 7.5 |
| | b | 128,079 | 13.3 | 19.2 | |
| | c | 135,353 | 14.0 | 20.3 | |
| 2040 | a | 97,681 | 10.2 | 14.6 | 9.1 |
| | b | 147,759 | 15.6 | 22.2 | |
| | c | 154,303 | 16.3 | 23.1 | |

^aLow projection (various sources, see Table 2-1)

^bCity's projection (2009 City of Franklin Development report)

^cHigh projection (2010 TACIR Report)

Data presented in Table 6-1 for population and water resources demands have been developed for a 30-year planning period; this information will be used during in-depth analyses of the costs and benefits of the project options identified in Phase I. The data have been identified or developed from previous studies as described above, such that efforts for developing cost/benefit information is based on and coordinated with the City of Franklin Planning documents, as well as other infrastructure studies conducted for the City.

7.0 References

- AECOM. July 2006. *Design Report for the Franklin Water Treatment Plant prepared for the City of Franklin, Tennessee.*
- Carlson, Steven W. and Adam Walburger, 2007. *Energy Index Development for Benchmarking Water and Wastewater Utilities.* AwwaRF
- CDM, November 2010. *Integrated Water Resources Plan Phase I Report.*
- City of Franklin Planning and Sustainability Department, November 2006. *Annexation Feasibility Study.* Franklin, TN.
- City of Franklin Planning and Sustainability Department, December 2007. *2007 Development Report.* Franklin, TN.
- City of Franklin Planning and Sustainability Department, December 2008. *2008 Development Report.* Franklin, TN.
- City of Franklin Planning and Sustainability Department, December 2009. *2009 Development Report.* Franklin, TN.
- Consoer, Townsend & Associates. June 1989. *Franklin Water Facilities and Supply Report prepared for the City of Franklin, Tennessee Mayor and Board of Alderman.*
- Jackson Thornton Utilities. June 2008. *Independent Evaluation of Feasibility Study Conducted by Metcalf & Eddy*
- Reinders, Erin. Personal Communication, December 2010.
- Population Projections for the State of Tennessee*, December 2003. Tennessee Advisory Commission on Intergovernmental Relations and the University of Tennessee Center for Business and Economic Research.
- Population Projections for the State of Tennessee*, December 2010. Tennessee Advisory Commission on Intergovernmental Relations and the University of Tennessee Center for Business and Economic Research.
- Smith Seckman Reid. February 2009. *Reclaimed Water System Master Plan prepared for the City of Franklin Water Management Department.*
- Wastewater Committee of the Great Lakes--Upper Mississippi River Board of State and Provincial Public Health and Environmental Managers (Ten States), 2004. *Recommended Standards for Wastewater Facilities.* Albany, NY.
- Water Environment Federation, 1998. *Design of Municipal Wastewater Treatment Plants; WEF Manual of Practice No. 8 (MOP 8).* Alexandria, VA.