

## AGENDA

### FLOWER MOUND TOWN COUNCIL

#### WORK SESSION (6:00 P.M.) AND REGULAR MEETING (7:00 P.M.)

SEPTEMBER 20, 2018

FLOWER MOUND TOWN HALL, 2121 CROSS TIMBERS ROAD, FLOWER MOUND, TEXAS

*Please silence or turn off all electronic devices in the Council Chambers.*

- A. **CALL WORK SESSION TO ORDER**
- B. **INVOCATION**
- C. **PLEDGE OF ALLEGIANCE TO THE AMERICAN FLAG AND TO THE TEXAS FLAG** *"Honor the Texas flag; I pledge allegiance to thee, Texas, one state under God, one and indivisible."*
- D. **WORK SESSION ITEM**
  - 1. Discuss Lakeside Reuse Master Plan
- E. **ADJOURN WORK SESSION**
- F. **CALL REGULAR MEETING TO ORDER**
  - 1. Meet & Greet applicants and current board members
- G. **BOARDS/COMMISSIONS** *(Bold text represents boards with vacancies)*

Conduct interviews and make appointments or reappointments\*, and discuss and consider resignations, evaluations, reassignments, discipline, or dismissals for the following boards or commissions\*\*: **Animal Services Board, Board of Adjustment/Oil & Gas Board of Appeals, Community Development Corporation, Cultural Arts Commission (CAC), DCTA Board of Directors (Town appointed representative), Environmental Conservation Commission (ECC), LISD Liaison, Parks Board, Planning & Zoning Commission, SMARTGrowth Commission, Tax Increment Reinvestment Zone Number One (TIRZ #1), Transportation Commission, and Veterans Liaison.**

\*Council Chambers  
\*\*Executive Conference Room
- H. **ADJOURN REGULAR MEETING**

I do hereby certify that the Notice of Meeting was posted on the bulletin board at the Town Hall for the Town of Flower Mound, Texas, in a place convenient and readily accessible to the general public at all times and said Notice was posted on the following date and time: September 17, 2018, 3:30 p.m. at least 72 hours prior to the scheduled time of said meeting.

---

**Theresa Scott, Town Secretary**

The Flower Mound Town Hall and Council Chambers are wheelchair accessible. Requests for accommodations or interpretive services must be made 48 hours prior to this meeting by contacting Theresa Scott, Town Secretary, at (972) 874-6076.



## **TOWN COUNCIL AGENDA ITEM NO. 1**

### **WORK SESSION ITEM**

---

**DATE:** September 20, 2018

**FROM:** Brian Waltenburg, P.E., CIP Engineering Manager

**ITEM:** **Staff is requesting direction regarding the draft Lakeside Reuse Water Master Plan. A presentation will be given at the Town Council meeting regarding the Lakeside Reuse Water Master Plan with a question and answer period to follow.**

---

**BACKGROUND INFORMATION:** In response to current and projected population increases and the associated increased demands on existing water infrastructure, the Town of Flower Mound (Town), located in Denton County, Texas, is proposing a project to provide reclaimed water from the Town's Wastewater Treatment Plant (WWTP) to the Lakeside Business District area.

Reclaimed water can be used for many beneficial purposes, including irrigation of landscaped areas and evaporation makeup water for ponds. This project would reduce the demands on the Town's potable water system by replacing potable water currently used for irrigation with reclaimed water.

The draft Lakeside Reuse Water Master Plan report presents the findings and recommendations for providing reclaimed water to irrigation customers in the Lakeside Business District area of the Town of Flower Mound (Town) from the nearby wastewater treatment plant (WWTP).

#### **ATTACHMENTS:**

1. Draft Lakeside Reuse Water Master Plan

**DRAFT MOTION:** As this is a work session item, no formal action is requested. Staff is seeking direction and input from the Town Council regarding the draft Lakeside Reuse System Master Plan.



Town of Flower Mound

# LAKE SIDE REUSE WATER MASTER PLAN

May 2018



*Ellen T. McDonald*  
Submitted by:  
5-17-18



*Sarah C. M. Kerr*  
5-17-18



ALAN PLUMMER  
ASSOCIATES, INC.

ENVIRONMENTAL  
ENGINEERS AND SCIENTISTS



## Table of Contents

---

|       |                                                           |    |
|-------|-----------------------------------------------------------|----|
| 1     | Executive Summary .....                                   | 1  |
| 2     | Introduction .....                                        | 5  |
| 2.1   | Projected Population and Water Demands .....              | 7  |
| 3     | Reclaimed Water Demand Analysis .....                     | 9  |
| 3.1   | Existing Reclaimed Water Demand .....                     | 11 |
| 3.2   | Estimated Future Demand .....                             | 18 |
| 3.3   | Irrigation Customer Communication.....                    | 21 |
| 4     | Reclaimed Water Supply and Required Storage .....         | 22 |
| 4.1   | Required Reclaimed Water Storage .....                    | 23 |
| 5     | Hydraulic Evaluation .....                                | 26 |
| 5.1   | Model Development .....                                   | 26 |
| 5.2   | Performance Criteria .....                                | 29 |
| 5.3   | Model Pressure Results .....                              | 29 |
| 5.4   | Model Water Age Results .....                             | 31 |
| 5.4.1 | Flushing Device Considerations .....                      | 34 |
| 6     | Wastewater Treatment Plant Effluent Quality.....          | 35 |
| 6.1   | Wastewater Treatment Plant Information.....               | 35 |
| 6.2   | Reclaimed Water Quality Requirements .....                | 35 |
| 6.3   | Evaluation of Historical WWTP Effluent Quality .....      | 36 |
| 6.4   | Recommended Wastewater Treatment Plant Improvements ..... | 39 |
| 6.4.1 | Treatment Improvements .....                              | 41 |
| 6.4.2 | Infrastructure Additions.....                             | 42 |
| 7     | Implementation Plan and Costs .....                       | 45 |
| 7.1   | Prior to Phase 1 .....                                    | 45 |
| 7.2   | Phase 1 .....                                             | 48 |
| 7.3   | Phase 2.....                                              | 48 |
| 7.4   | Phase 3.....                                              | 48 |
| 7.5   | Phase 4.....                                              | 49 |
| 7.6   | Phase 5.....                                              | 49 |



## Lakeside Reuse Water Master Plan

|     |                                                              |    |
|-----|--------------------------------------------------------------|----|
| 7.7 | Phase Costs.....                                             | 50 |
| 8   | Financial Evaluation .....                                   | 53 |
| 8.1 | Financing Strategies and Funding Opportunities .....         | 53 |
| 8.2 | Federal and State Funding Programs .....                     | 53 |
| 8.3 | Debt Repayment and Operations and Maintenance Financing..... | 55 |
| 8.4 | Projected Payback Period for Lakeside Reuse System .....     | 55 |
| 8.5 | Potential Impact of Financial Assumptions .....              | 58 |
| 9   | Summary and Recommendations .....                            | 60 |



## List of Figures

---

|                                                                                         |    |
|-----------------------------------------------------------------------------------------|----|
| Figure 1: Lakeside Business District Location.....                                      | 6  |
| Figure 2: Irrigation Meter Locations.....                                               | 10 |
| Figure 3: Available Monthly Consumption Data by Year .....                              | 13 |
| Figure 4: Historical Peak Months by Irrigation Meter.....                               | 14 |
| Figure 5: Average Irrigation by Hour on a Peak Day .....                                | 17 |
| Figure 6: Existing and Future Irrigation Service Zones.....                             | 20 |
| Figure 7: Daily Effluent Flow from Town WWTP .....                                      | 22 |
| Figure 8: Hourly Effluent Flow from Town WWTP .....                                     | 23 |
| Figure 9: Required Volume of Reclaimed Water Storage.....                               | 24 |
| Figure 10: Modeled Reclaimed Water Distribution System .....                            | 28 |
| Figure 11: Model Results for Existing Meters.....                                       | 30 |
| Figure 12: Model Results for Water Age Including Future Demand .....                    | 32 |
| Figure 13: Model Results for Water Age Not Including Future Demand.....                 | 33 |
| Figure 14: Monthly Average Effluent Quality– CBOD <sub>5</sub> and <i>E. coli</i> ..... | 37 |
| Figure 15: Daily Maximum Effluent Quality – <i>E. coli</i> .....                        | 38 |
| Figure 16: Daily Effluent Quality – Turbidity .....                                     | 39 |
| Figure 17: Wastewater Treatment Plant Site Plan .....                                   | 40 |
| Figure 18: Recommended WWTP Improvements.....                                           | 41 |
| Figure 19: Lakeside Reuse System Implementation Plan .....                              | 47 |
| Figure 20: Projected Annual Reuse Water Demand .....                                    | 57 |
| Figure 21: Reclaimed Water System Financial Analysis .....                              | 58 |
| Figure 22: Cumulative Difference for Several Scenarios.....                             | 59 |



## List of Tables

---

|                                                                             |    |
|-----------------------------------------------------------------------------|----|
| Table 1: Projected Population, Demand, and Supply from Regional Plan.....   | 7  |
| Table 2: Simplified Zoning Divisions.....                                   | 9  |
| Table 3: Existing Reclaimed Water System Demands .....                      | 12 |
| Table 4: Summary of Historical Hourly Data .....                            | 15 |
| Table 5: Hourly Irrigation Data during High Flow Days.....                  | 16 |
| Table 6: Summary of Existing Lakeside Reclaimed Water System Demands.....   | 18 |
| Table 7: Summary of Lakeside Reuse System Existing and Future Demands ..... | 19 |
| Table 8: Estimated Future Demand for the Lakeside Business District.....    | 21 |
| Table 9: Selected Survey Responses .....                                    | 21 |
| Table 10: Town WWTP Daily Effluent Flow Summary .....                       | 23 |
| Table 11: Required Storage using Historical Effluent Flow .....             | 25 |
| Table 12: Summary of Modeled Demands .....                                  | 27 |
| Table 13: Performance Criteria .....                                        | 29 |
| Table 14: Reclaimed Water System Pipeline Diameters.....                    | 29 |
| Table 15: WWTP TPDES Discharge Requirements.....                            | 35 |
| Table 16: Type I Reclaimed Water Quality Limits .....                       | 36 |
| Table 17: Implementation Plan Summary .....                                 | 51 |
| Table 18: Lakeside Reuse System Demand Summary by Phase .....               | 51 |
| Table 19: Preliminary Implementation Plan Schedule .....                    | 52 |
| Table 20: Financing Assumptions .....                                       | 56 |



## List of Acronyms and Abbreviations

---

|                   |                                                 |
|-------------------|-------------------------------------------------|
| ac-ft/yr          | acre-feet per year                              |
| AMI               | Automated Meter Infrastructure                  |
| APAI              | Alan Plummer Associates, Inc.                   |
| CBOD <sub>5</sub> | five-day carbonaceous biochemical oxygen demand |
| DMR               | Discharge Monitoring Report                     |
| EPS               | extended period simulation                      |
| ft                | feet                                            |
| gal               | gallons                                         |
| gpcd              | gallons per capita per day                      |
| gpd               | gallons per day                                 |
| gph               | gallons per hour                                |
| gpm               | gallons per minute                              |
| lbs               | pounds                                          |
| LF                | linear feet                                     |
| MG                | million gallons                                 |
| MGD               | million gallons per day                         |
| NCTCOG            | North Central Council of Governments            |
| O&M               | operating and maintenance                       |
| OPCC              | opinion of probable construction cost           |
| psi               | pounds per square inch                          |
| SBR               | sequencing batch reactor                        |
| SRF               | State Revolving Fund                            |
| SWD               | side water depth                                |
| SWIFT             | State Water Implementation Fund for Texas       |
| TCEQ              | Texas Commission on Environmental Quality       |
| Town              | Town of Flower Mound                            |
| TPDES             | Texas Pollutant Discharge Elimination System    |
| TWDB              | Texas Water Development Board                   |
| UV                | ultraviolet                                     |
| VFD               | variable frequency drive                        |
| WSE               | water surface elevation                         |
| WWTP              | wastewater treatment plant                      |



## List of Appendices

---

Appendix A – Lakeside Business District Zoning Map

Appendix B – Top Irrigation Users Contact Information and Surveys

Appendix C – Current Irrigation Meters and Demands in the Study Area

Appendix D – Future Demand Included in Hydraulic Model

Appendix E – Water Age Phase Model Results

Appendix F – Flower Mound Reclaimed Water Authorization

Appendix G – Financial Evaluation



## 1 Executive Summary

---

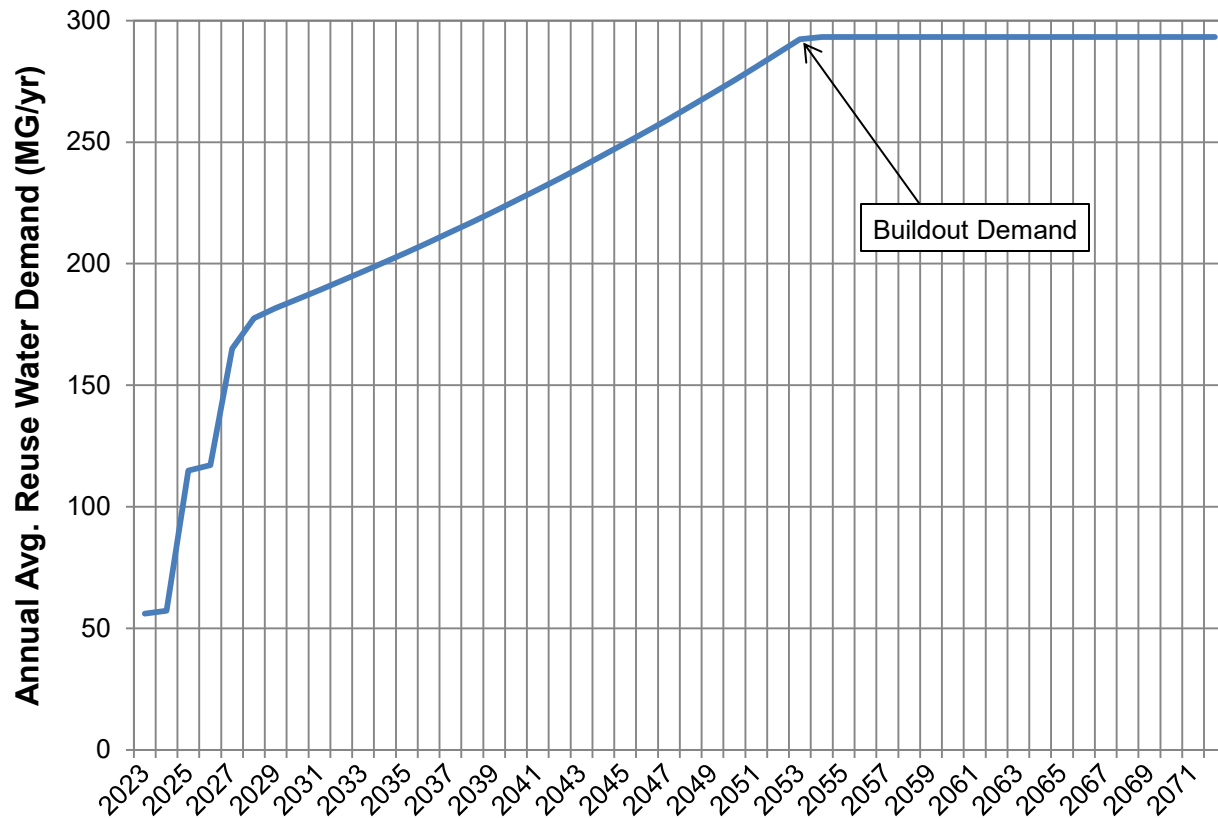
The Lakeside Reuse Water Master Plan report presents the findings and recommendations for providing reclaimed water to irrigation customers in the Lakeside Business District area of the Town of Flower Mound (Town) from the nearby wastewater treatment plant (WWTP).

The Town provided Alan Plummer Associates, Inc. with a list of 106 potable water irrigation meters throughout the Lakeside Business District for connection to a future reclaimed water distribution system. A map of the proposed distribution system is shown in Figure 10. Historical monthly meter consumption data were collected and analyzed to develop average and peak demands for the area. A hydraulic model was used to perform an evaluation of the proposed distribution system based on the peak demands calculated from the historical data and future build-out demands estimated from current zoning for the area. A summary of the estimated existing and future system demands is shown in Table E-1 and Figure E-1.

**Table E-1: Summary of Existing and Future Reclaimed Water Demand in the Lakeside Business District**

| Demand Type             | Units | Existing | Future | Total Build-Out Demand |
|-------------------------|-------|----------|--------|------------------------|
| <b>Peak Day Demand</b>  | MGD   | 3.79     | 2.76   | 6.56                   |
| <b>Peak Hour Demand</b> | MGD   | 12.1     | 8.84   | 21.0                   |
| <b>Average Demand</b>   | MGD   | 0.46     | 0.34   | 0.80                   |

The hydraulic evaluation of the proposed reclaimed water distribution system was performed using the Innovyze InfoWater® hydraulic model to appropriately size pipelines in the proposed reclaimed water system while maintaining water pressure between 40 psi and 100 psi. The reclaimed water system is shown in Figure 11. It includes approximately 15 miles of pipeline ranging in diameter from 2 inches to 30 inches.



**Figure E-1 – Lakeside Business District Average Reclaimed Water Demand**

In addition to pipeline infrastructure, several improvements are recommended at the WWTP. These improvements include a new ultraviolet disinfection system, a transfer pump station, two 1 million gallon (MG) storage tanks, a sodium hypochlorite feed system, and a reuse pump station.

A phased implementation plan is proposed for the reuse system to manage capital costs and maximize revenue from the reuse system. The phases were established based on proximity to the WWTP and amount of reclaimed water demand. Meters located close to the WWTP with high demand will be connected to the reuse system in the early phases, and meters located far from the WWTP in undeveloped areas will be connected during later phases.

Irrigation meters near the WWTP along Spinks Road will be the first meters connected to the reclaimed water system in Phase 1. These meters are primarily used for irrigation



of open spaces at Gerault Park, Heritage Park, and Bakersfield Park. The system would be expanded in Phase 2 to include Irrigation meters on commercial properties generally located along Lakeside Parkway, east of Gerault Road. The third phase would expand the reclaimed water system to additional properties along Lakeside Parkway and Spinks Road between Gerault Road and Long Prairie Road. Phase 4 of the implementation plan would extend reclaimed water service along Long Prairie Road between Silveron Boulevard and Gerault Road, and will also connect to three dead ends created in Phases 2 and 3 to form a looped system. The fifth and final phase of the implementation plan would provide service To the residential properties located along Lakeside Parkway, west of Long Prairie Road. A summary of the proposed implementation plan is provided in Table E-2.

**Table E-2: Reclaimed Water Implementation Plan**

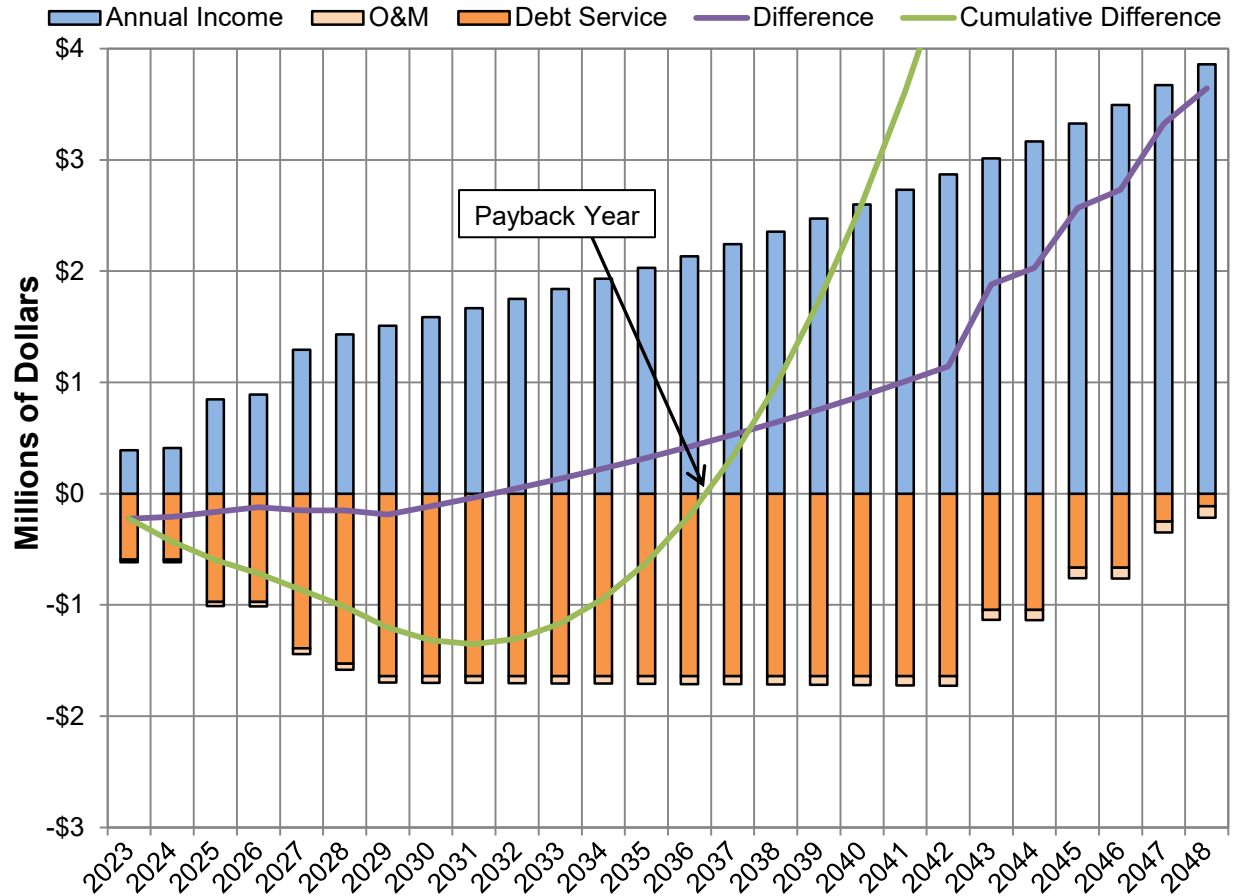
| Phase               | Improvements at WWTP                                                                                      | LF of Pipe Installed | OPCC (million) <sup>1</sup> |
|---------------------|-----------------------------------------------------------------------------------------------------------|----------------------|-----------------------------|
| 1                   | Transfer pump station<br>Temporary storage tanks<br>Reuse pump station<br>Sodium hypochlorite feed system | 14,900               | \$9.03                      |
| 2                   | 1 MG storage tank                                                                                         | 20,800               | \$5.45                      |
| 3                   | 1 MG storage tank                                                                                         | 18,900               | \$5.63                      |
| 4                   | -                                                                                                         | 9,900                | \$1.44                      |
| 5                   | -                                                                                                         | 12,900               | \$1.80                      |
| <b>Total System</b> |                                                                                                           | <b>77,400</b>        | <b>\$23.35</b>              |

A preliminary financial evaluation was conducted for the proposed reclaimed water system to estimate the financial impact that the reclaimed water system would have on the Town. A payback period of approximately 14 years was estimated (Figure E-2).

The financial evaluation is significantly impacted by a number of factors such as loan term, loan interest rate, and the Town's reclaimed water rate. It is also important to note that these calculations do not include loss in revenue by replacing potable water for irrigation with reclaimed water. They also do not include benefits associated with



reduction of peak demands on the potable water system. Therefore, it is recommended that the Town conduct a formal financial evaluation and rate study prior to moving forward with development of the reclaimed water system.



Financing Assumptions shown in Table 20

**Figure E-2: Reclaimed Water System Financial Analysis**



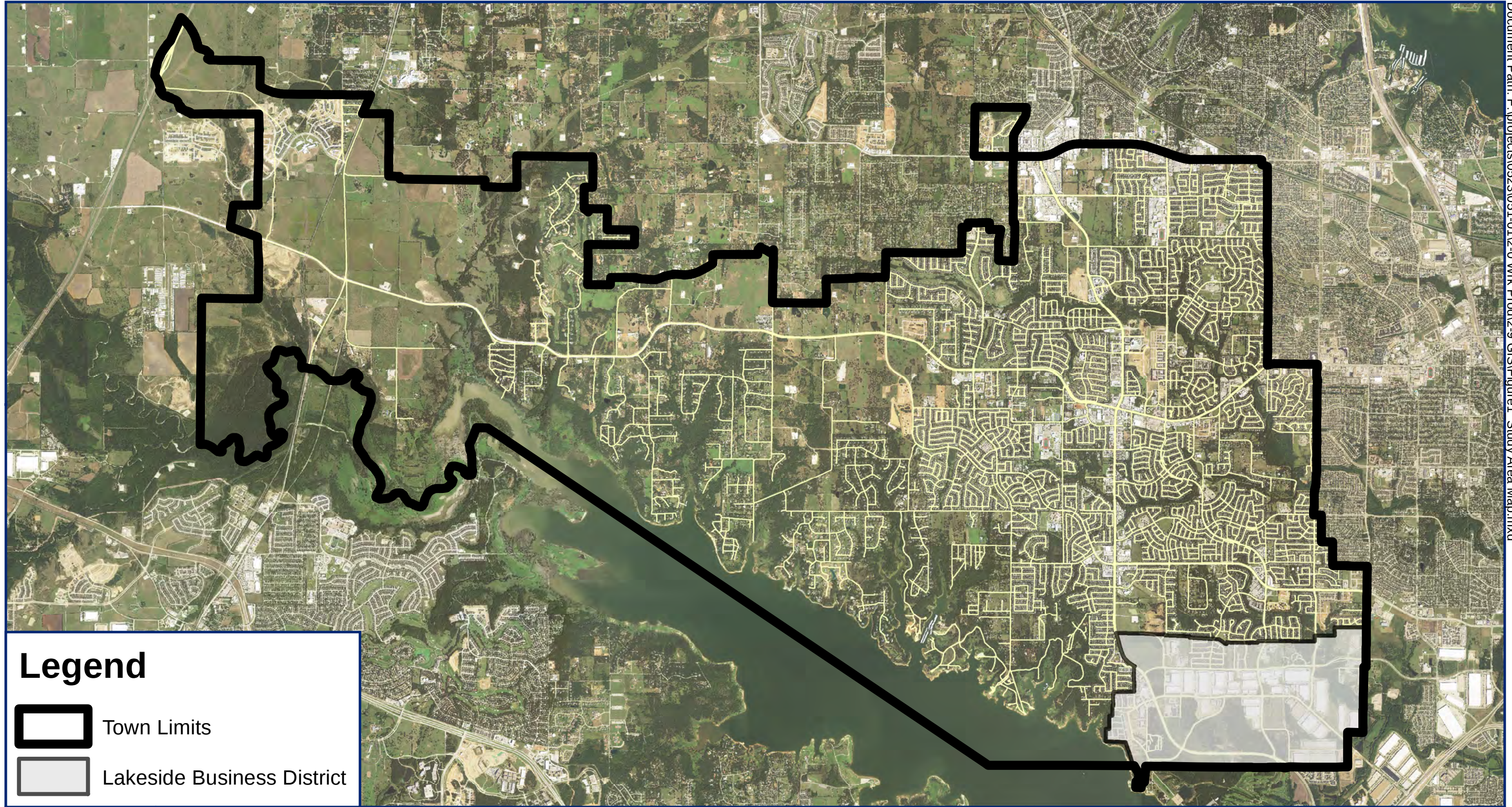
## 2 Introduction

---

In response to current and projected population increases and the associated increased demands on existing water infrastructure, the Town of Flower Mound (Town), located in Denton County, Texas, is proposing a project to provide reclaimed water from the Town's Wastewater Treatment Plant (WWTP) to the Lakeside Business District area, identified in Figure 1. Reclaimed water can be used for many beneficial purposes, including irrigation of landscaped areas and evaporation makeup water for ponds. This project would reduce the demands on the Town's potable water system by replacing potable water currently used for irrigation with reclaimed water. Potential irrigation areas in the Lakeside Business District include recreational sports facilities, parks, road medians, boulevards, parkways, commercial buildings with landscaped areas, multi-use areas, and others. Grapevine Golf Course is also near the Lakeside Business District, but was not included as a potential irrigation area in this report, as directed by the Town.

The Town retained the services of Alan Plummer Associates, Inc. (APAI) to develop the Lakeside Reuse Water Master Plan. The purpose of this reuse master plan is to evaluate the feasibility of providing reclaimed water to irrigation customers in the Lakeside Business District area. The contents of the master plan include:

- Identification of irrigation customers in the Lakeside Business District and estimated demands.
- Evaluation of reclaimed water supply available from the Town's WWTP.
- Proposed reclaimed water distribution system route and hydraulic evaluation.
- Reclaimed water quality requirements and recommended WWTP improvements.
- Proposed implementation plan and opinions of probable construction costs.



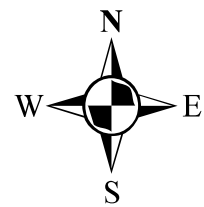
## Legend



Town Limits



Lakeside Business District



0 0.3 0.6 1.2 1.8 2.4 3 Miles

DATE: 5/15/2018

Town of Flower Mound Lakeside Reuse Water Master Plan

Figure 1: Lakeside Business District Location



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



## 2.1 PROJECTED POPULATION AND WATER DEMANDS

The Town of Flower Mound serves potable water to an estimated retail customer population of approximately 72,000, a population that increased by 27.5% between 2000 and 2010. The Town is located in the Texas Water Development Board (TWDB) water planning Region C, which contains 16 counties in North Central Texas and most of the upper half of the Trinity River Basin. According to the 2016 Region C Water Plan, the Town's population is expected to reach a buildout population of 93,000 by 2030. The Town's estimated 2017 population<sup>1</sup> (71,850) is on track to meet the 2020 population listed in the 2016 Region C Plan (75,555). The corresponding estimated total water demand is projected to grow to approximately 23,000 acre-feet per year by 2030 and then remain relatively stable after that time (Table 1).

**Table 1: Projected Population, Demand, and Supply from Regional Plan**

| (Values in Ac-Ft/Yr)                                                 | Projected Population and Demand |               |               |               |               |               |
|----------------------------------------------------------------------|---------------------------------|---------------|---------------|---------------|---------------|---------------|
|                                                                      | 2020                            | 2030          | 2040          | 2050          | 2060          | 2070          |
| <b>Projected Population</b>                                          | <b>75,555</b>                   | <b>93,000</b> | <b>93,000</b> | <b>93,000</b> | <b>93,000</b> | <b>93,000</b> |
| <b>Projected Water Demand</b>                                        |                                 |               |               |               |               |               |
| Municipal Demand                                                     | 19,049                          | 23,148        | 23,022        | 22,948        | 22,924        | 22,922        |
| <b>Total Projected Demand</b>                                        | <b>19,049</b>                   | <b>23,148</b> | <b>23,022</b> | <b>22,948</b> | <b>22,924</b> | <b>22,922</b> |
| <b>Currently Available Water Supplies</b>                            |                                 |               |               |               |               |               |
| UTRWD                                                                | 10,477                          | 11,297        | 8,763         | 6,929         | 6,162         | 5,401         |
| Dallas Water Utilities                                               | 6,166                           | 6,166         | 6,166         | 6,166         | 5,817         | 5,540         |
| <b>Total Current Supplies</b>                                        | <b>16,643</b>                   | <b>17,462</b> | <b>14,929</b> | <b>13,094</b> | <b>11,979</b> | <b>10,941</b> |
|                                                                      |                                 |               |               |               |               |               |
| <b>Need (Demand - Current Supply)</b>                                | <b>2,407</b>                    | <b>5,686</b>  | <b>8,093</b>  | <b>9,854</b>  | <b>10,945</b> | <b>11,981</b> |
| <b>Water Management Strategies</b>                                   |                                 |               |               |               |               |               |
| Water Conservation                                                   | 349                             | 597           | 691           | 765           | 841           | 917           |
| Additional Water from Upper Trinity Regional Water District          | 0                               | 2,685         | 5,082         | 6,825         | 7,529         | 8,243         |
| Additional Water from Dallas Water Utilities and additional pipeline | 2,249                           | 2,404         | 2,320         | 2,264         | 2,574         | 2,822         |
| <b>Total Water Management Strategies</b>                             | <b>2,589</b>                    | <b>5,686</b>  | <b>8,093</b>  | <b>9,854</b>  | <b>10,945</b> | <b>11,981</b> |
| <b>Reserve (Shortage)</b>                                            | <b>192</b>                      | <b>0</b>      | <b>0</b>      | <b>0</b>      | <b>0</b>      | <b>0</b>      |

\*From TWDB 2016 Region C Water Plan: Table 5D.101

<sup>1</sup> Population estimate provided by the North Central Council of Governments (NCTCOG)

*Lakeside Reuse Water Master Plan*

Flower Mound is committed to supporting sustainable water conservation and efficiency practices. The Town's water conservation ordinance has identified wastewater recycling and reuse as a promising strategy to reduce potable water demands. Implementation of this water reuse project would allow the Town to replace potable water used for irrigation with reclaimed water to preserve current water supplies.



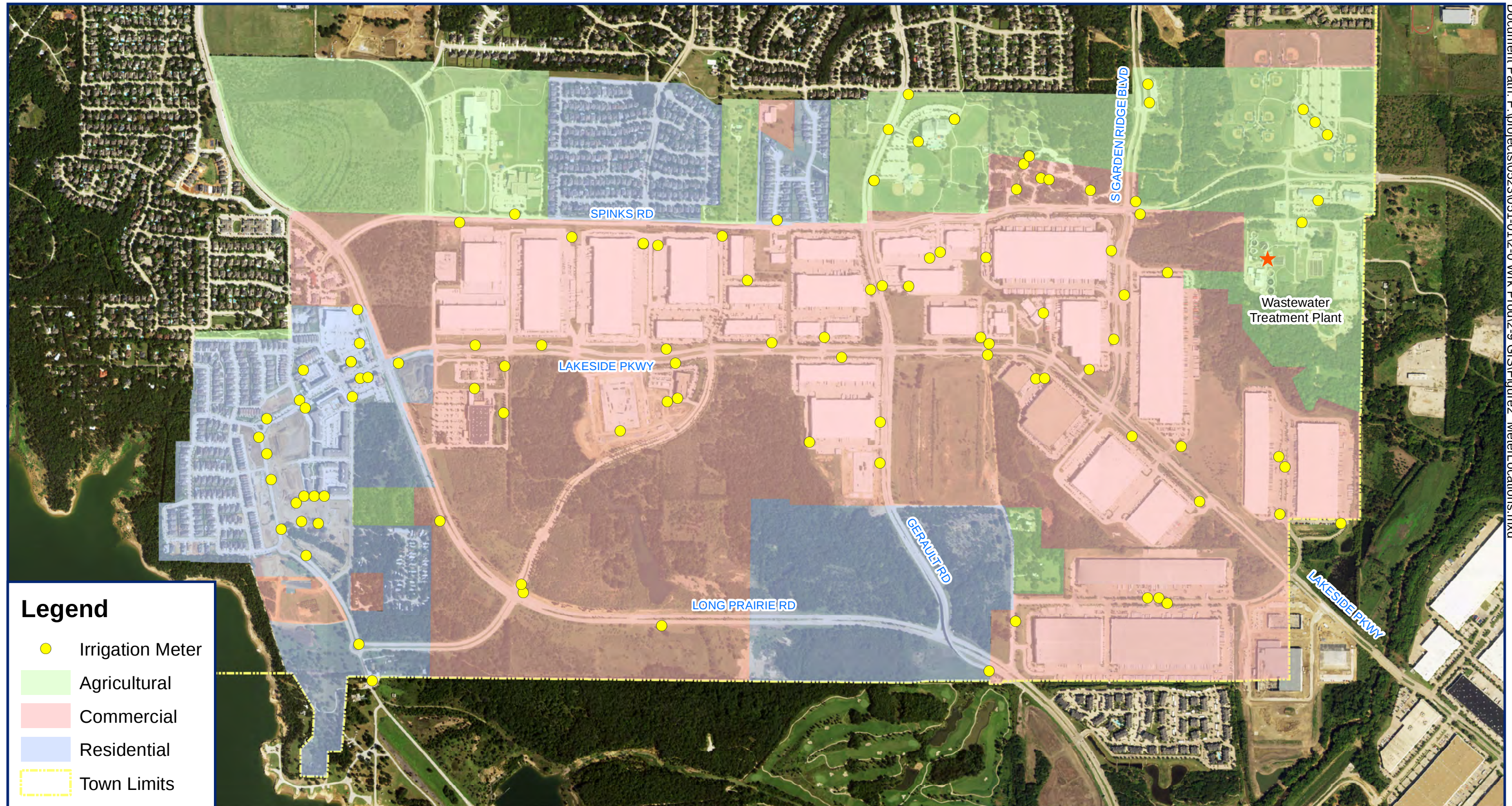
### 3 Reclaimed Water Demand Analysis

The Town provided APAI with a list of 106 potable water irrigation meters throughout the Lakeside Business District for connection to a future reclaimed water distribution system. While the majority of land within the Lakeside Business District is zoned as either commercial or industrial, significant areas in or near the District are zoned for recreational facilities or residential areas. A detailed zoning map for the Lakeside Business District is provided in Appendix A. For simplicity, the zones have been combined into three categories: Agricultural, Commercial, and Residential, as shown in Table 2. The land area and number of irrigation meters in each zone are also presented in the table. Locations of the irrigation meters and the simplified zones are presented in Figure 2.

**Table 2: Simplified Zoning Divisions**

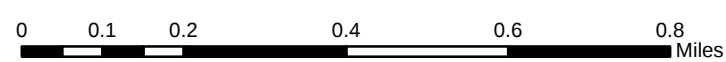
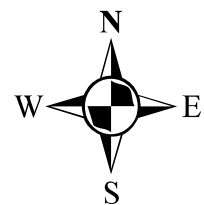
| <b>Simplified Zones</b> | <b>Number of Irrigation Meters</b> | <b>Land Area (acres)</b> | <b>Flower Mound Zoning Map</b> |
|-------------------------|------------------------------------|--------------------------|--------------------------------|
| Agricultural            | 24                                 | 425                      | Agricultural                   |
| Commercial              | 56                                 | 1,110                    | Commercial                     |
|                         |                                    |                          | Industrial                     |
|                         |                                    |                          | Combined Use                   |
|                         |                                    |                          | Multi-Family                   |
|                         |                                    |                          | Mobile Homes                   |
|                         |                                    |                          | Mixed Use                      |
|                         |                                    |                          | Retail                         |
|                         |                                    |                          | Single Family                  |
| Residential             | 26                                 | 418                      |                                |
| Combined                | <b>106</b>                         | <b>1,953</b>             | -                              |

The Lakeside Business District is not yet fully developed and future development could significantly increase the reclaimed water demand. The following sections estimate the reclaimed water demand for existing areas currently serviced by a dedicated irrigation meter and future areas not yet serviced.



**Legend**

- Irrigation Meter
- Agricultural
- Commercial
- Residential
- Town Limits



DATE: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan

### Figure 2: Irrigation Meter Locations



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



### 3.1 EXISTING RECLAIMED WATER DEMAND

Historical monthly meter consumption data were collected for the 106 irrigation meters and analyzed to estimate the future reclaimed water demand. Monthly consumption data can be used to estimate the average monthly demand for the reclaimed water system, but do not provide information regarding changes in demand throughout the month or within a given day. The reclaimed water conveyance equipment and infrastructure will be designed to meet the Peak Hour and Peak Day Demand. Further data analysis and assumptions are required to estimate the peak hour demand from monthly consumption data. The following definitions are used to quantify demands:

Peak Month: The historical month with the greatest total water demand.

Peak Month Demand: Total water demand during the Peak Month. This value is available from monthly consumption data provided by the Town.

Peak Day: The day in the Peak Month with the greatest water demand.

Peak Day Demand: Total water demand during the Peak Day.

Peak Day Factor: Peak Day Demand divided by the Peak Month Demand.

Peak Hour: The hour in the Peak Day with the greatest water demand.

Peak Hour Demand: Total water demand for the Peak Hour. The conveyance infrastructure will be designed to operate at the peak hour demand.

Peak Hour Factor: Peak Hour Demand divided by Peak Day Demand.

Peak Month Demand for the future reclaimed water system was estimated using the monthly consumption data provided by the Town. Available monthly consumption data since 2007 was evaluated for each meter. The Peak Month Demand per meter was assumed to be equal to the highest month of consumption from historical data. The Peak Month Demand for each meter was added together to estimate the Peak Month Demand for the entire reclaimed water system (Table 3). Available monthly data for each meter were averaged together to calculate an average demand per meter. The

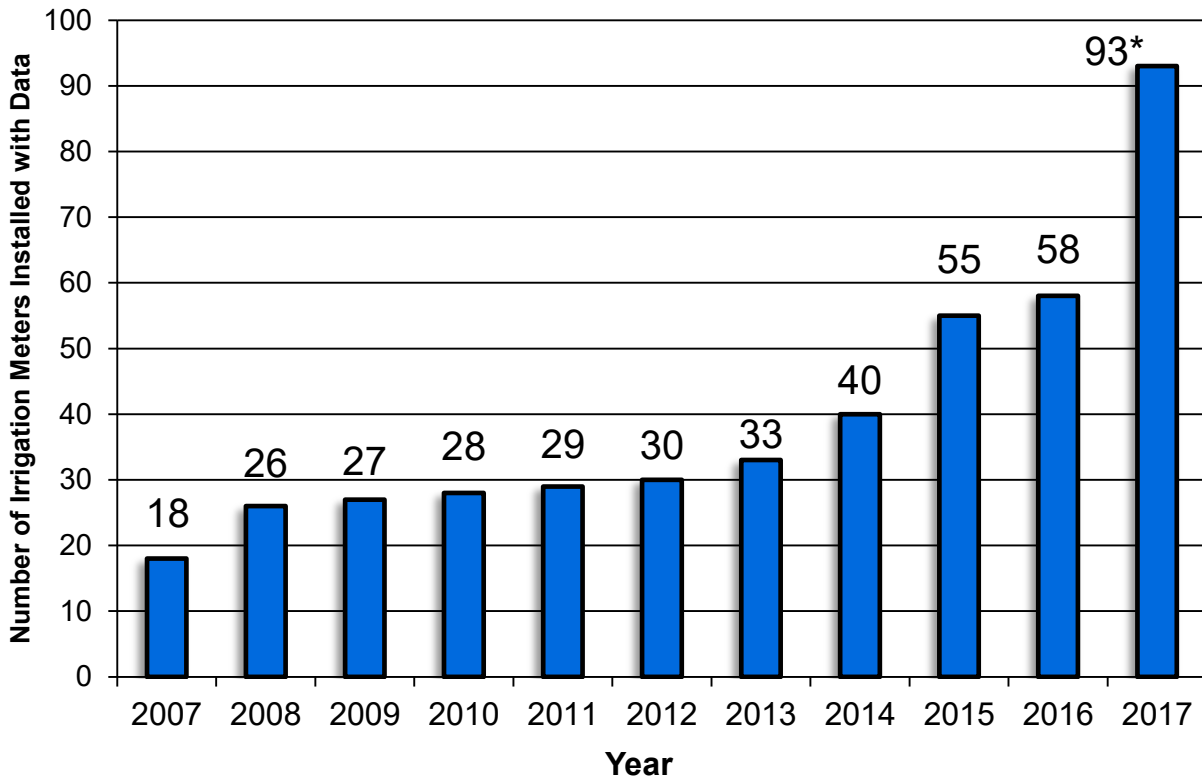


average demands for each meter were added together to determine the estimated average demand for the entire reclaimed water system (Table 3). The conveyance infrastructure will be designed to meet peak demands, but the average demands can be used to estimate system revenues and operational costs.

**Table 3: Existing Reclaimed Water System Demands**

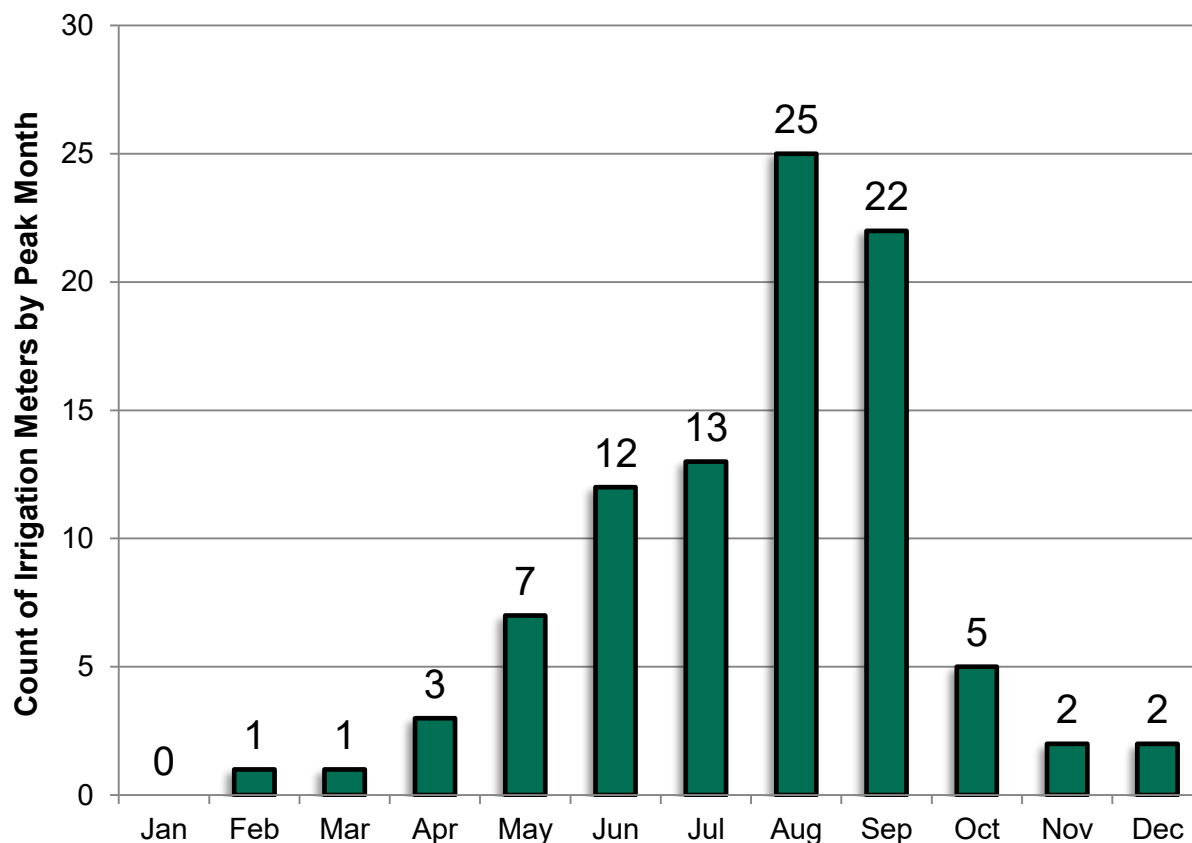
| Value                  | MGD  |
|------------------------|------|
| <b>Peak Day Demand</b> | 3.79 |
| <b>Average Demand</b>  | 0.46 |

Figure 3 displays the number of irrigation meters in the Lakeside Business District with available monthly consumption data by year. The highest month of consumption (peak month) for each irrigation meter was found regardless of which year it occurred, and Figure 4 displays the summary of peak months by irrigation meter. This summary demonstrates that the highest irrigation demand in the Lakeside Business District area occurs in August and September. Thirteen of the 106 irrigation meters did not have any recorded monthly consumption data at the time of this master plan.



\*Thirteen of the 106 meters are newly installed and do not have any available consumption data at the time of this master plan.

**Figure 3: Available Monthly Consumption Data by Year**



\*Thirteen of the 106 meters are newly installed and do not have any available consumption data at the time of this master plan.

**Figure 4: Historical Peak Months by Irrigation Meter**

In addition to monthly consumption data, daily and hourly consumption data were also available since the Town has replaced their existing manual meters with Automated Meter Infrastructure (AMI). Hourly consumption data between July 15, 2017 and October 19, 2017 were evaluated for three of the largest irrigation users in the Lakeside Business District. The Peak Day and Peak Hour Demands and associated Peak Day and Peak Hour Factors were obtained from this data set and are presented in Table 4.

**Table 4: Summary of Historical Hourly Data**

| <b>Meter Number</b>                        | <b>55-0165-99</b> | <b>86-2995-99</b> | <b>86-9210-99</b> | <b>Combined</b> |
|--------------------------------------------|-------------------|-------------------|-------------------|-----------------|
| <b>Peak Month<sup>1</sup></b>              | 8/2017            | 9/2017            | 8/2017            | 9/2017          |
| <b>Peak Month Demand<sup>1</sup> (gpd)</b> | 20,939            | 23,550            | 5,829             | 46,477          |
| <b>Peak Day</b>                            | 8/9/2017          | 9/1/2017          | 8/21/2017         | 9/1/2017        |
| <b>Peak Day Demand<sup>2</sup> (gpd)</b>   | 46,042            | 51,685            | 31,329            | 79,749          |
| <b>Calculated Peak Day Factor</b>          | 2.20              | 2.19              | 5.37              | <b>1.72</b>     |
| <b>Peak Day Demand<sup>2</sup> (gph)</b>   | 1,918             | 2,154             | 1,305             | 3,323           |
| <b>Peak Hour</b>                           | 10 am             | 7 pm              | 8 pm              | 11 pm           |
| <b>Peak Hour Demand<sup>2</sup> (gph)</b>  | 4,837             | 4,493             | 3,910             | 11,199          |
| <b>Calculated Peak Hour Factor</b>         | 2.52              | 2.09              | 3.00              | <b>3.37</b>     |

1. Only monthly consumption data collected between 7/15/2017 and 10/19/2017 was evaluated.

2. Based on hourly consumption data collected between 7/15/2017 and 10/19/2017.

The purpose of the Peak Day Factor is to calculate the Peak Day Demand from the Peak Month Demand by accounting for the fact that irrigation likely does not occur every day in a month. A simplified assumption would be that an individual user might irrigate their property every other day during a low precipitation, high temperature period of time. Irrigating every other day would represent a Peak Day Factor of 2.0. This assumption is confirmed by the hourly data displayed in Table 4, where the combined Peak Day Factor for the three meters was 1.72. Peaking factors can vary by the type of irrigation (such as golf course, parks and rec, commercial, residential, etc.) but typically range between 1.0 and 3.0<sup>2</sup>. A Peak Day Factor of 2.0 was selected for this evaluation. Using this factor, the assumed Peak Day Demand for the entire system is 3.79 million gallons per day (MGD)<sup>3</sup>.

In a similar manner, the purpose of the Peak Hour Factor is to calculate the Peak Hour Demand from the Peak Day Demand, knowing that an irrigation user does not typically irrigate their property for all 24 hours in a day. Rather, irrigation may be accomplished in an 8 hour window, which would represent a Peak Hour Factor of 3.0. Hourly data from

<sup>2</sup> Direct, Non-Potable Reuse Guidance Document, Prepared for Region C Water Planning Group, Alan Plummer Associates, Inc. and Freese and Nichols, Inc., April 2009. Table 5-1.

<sup>3</sup> Equal to the Peak Month Demand of 1.89 MGD times the Peak Day Factor of 2.0.

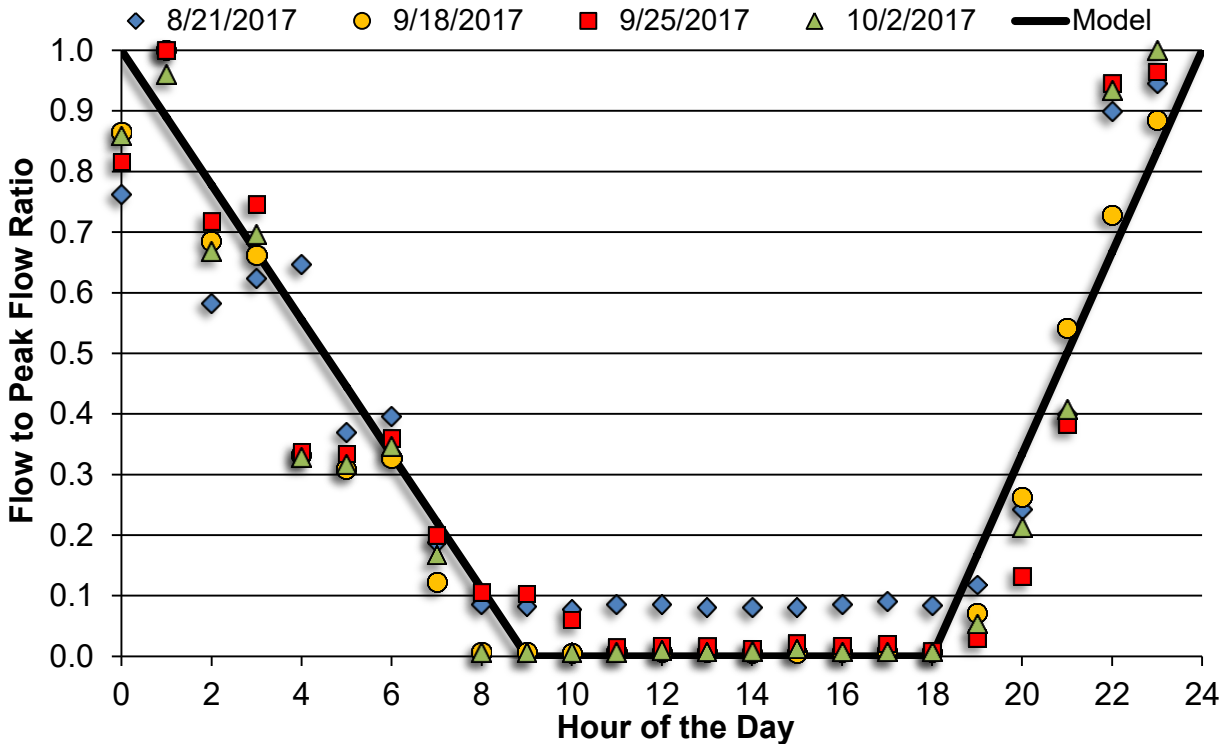


the three meters show Peak Hour Factors that range between 2.09 and 3.37 (Table 4). Hourly data for a full 24 hours from a number of peak flow days is shown in Table 5. An irrigation pattern can be estimated from this data.

**Table 5: Hourly Irrigation Data during High Flow Days**

| Hour | Sum of 3 Irrigation Meters (gal) |         |         |         | Hourly Flow to Daily Peak Flow Ratio |         |         |         |
|------|----------------------------------|---------|---------|---------|--------------------------------------|---------|---------|---------|
|      | 8/21/17                          | 9/18/17 | 9/25/17 | 10/2/17 | 8/21/17                              | 9/18/17 | 9/25/17 | 10/2/17 |
| 0    | 8,704                            | 9,651   | 8,158   | 9,409   | 0.76                                 | 0.87    | 0.82    | 0.86    |
| 1    | 11,419                           | 11,150  | 9,996   | 10,518  | 1.00                                 | 1.00    | 1.00    | 0.96    |
| 2    | 6,659                            | 7,631   | 7,180   | 7,319   | 0.58                                 | 0.68    | 0.72    | 0.67    |
| 3    | 7,118                            | 7,371   | 7,453   | 7,627   | 0.62                                 | 0.66    | 0.75    | 0.70    |
| 4    | 7,380                            | 3,692   | 3,382   | 3,593   | 0.65                                 | 0.33    | 0.34    | 0.33    |
| 5    | 4,218                            | 3,443   | 3,342   | 3,476   | 0.37                                 | 0.31    | 0.33    | 0.32    |
| 6    | 4,516                            | 3,643   | 3,594   | 3,803   | 0.40                                 | 0.33    | 0.36    | 0.35    |
| 7    | 2,149                            | 1,369   | 1,997   | 1,839   | 0.19                                 | 0.12    | 0.20    | 0.17    |
| 8    | 980                              | 74      | 1,058   | 78      | 0.09                                 | 0.01    | 0.11    | 0.01    |
| 9    | 951                              | 71      | 1,033   | 68      | 0.08                                 | 0.01    | 0.10    | 0.01    |
| 10   | 891                              | 58      | 606     | 65      | 0.08                                 | 0.01    | 0.06    | 0.01    |
| 11   | 984                              | 70      | 152     | 74      | 0.09                                 | 0.01    | 0.02    | 0.01    |
| 12   | 973                              | 81      | 175     | 104     | 0.09                                 | 0.01    | 0.02    | 0.01    |
| 13   | 932                              | 71      | 167     | 82      | 0.08                                 | 0.01    | 0.02    | 0.01    |
| 14   | 929                              | 65      | 129     | 90      | 0.08                                 | 0.01    | 0.01    | 0.01    |
| 15   | 922                              | 62      | 221     | 134     | 0.08                                 | 0.01    | 0.02    | 0.01    |
| 16   | 983                              | 71      | 175     | 84      | 0.09                                 | 0.01    | 0.02    | 0.01    |
| 17   | 1,038                            | 89      | 210     | 85      | 0.09                                 | 0.01    | 0.02    | 0.01    |
| 18   | 957                              | 72      | 82      | 85      | 0.08                                 | 0.01    | 0.01    | 0.01    |
| 19   | 1,349                            | 796     | 300     | 586     | 0.12                                 | 0.07    | 0.03    | 0.05    |
| 20   | 2,771                            | 2,922   | 1,326   | 2,328   | 0.24                                 | 0.26    | 0.13    | 0.21    |
| 21   | 4,568                            | 6,033   | 3,835   | 4,469   | 0.40                                 | 0.54    | 0.38    | 0.41    |
| 22   | 10,275                           | 8,114   | 9,455   | 10,234  | 0.90                                 | 0.73    | 0.95    | 0.93    |
| 23   | 10,796                           | 9,872   | 9,647   | 10,958  | 0.95                                 | 0.89    | 0.97    | 1.00    |

Demand throughout these days (normalized by the peak hour demand) is displayed in Figure 5. It can be seen from this figure that the data from all four days demonstrate a similar trend. The single hour with the highest demand (Peak Hour) occurred between 11 pm and 2 am on all four days. Additionally, demand decreased to almost zero during the daytime hours of 9 am to 6 pm. This trend is consistent with typical irrigation practices of irrigating during the evening when pedestrian activity and evaporation is at a minimum. An approximated irrigation pattern (shown in Figure 5) to be used for the reclaimed water system analysis was developed based on the historical trends from these four days.



**Figure 5: Average Irrigation by Hour on a Peak Day**

The Peak Hour Demand and Peak Hour Factor can be calculated from the geometry of the modeled irrigation pattern by determining the percentage of the day that irrigation actually occurs:

$$\text{Peak Hour Factor} = \frac{\text{Peak Hour Demand}}{\text{Peak Day Demand}} = \frac{24 \text{ hours}}{\frac{(1.0 * 9 \text{ hours})}{2} + \frac{(1.0 * 6 \text{ hours})}{2}} = 3.2$$

The Peak Hour Factor of 3.2 calculated from the shape of the approximated irrigation pattern is within the range of historical peaking factors presented in Table 4, where an average of 3.37 was calculated. Peak Hour Factors generally range between 1.0 and 6.0 depending on the entity accomplishing irrigation<sup>4</sup>. A Peak Hour Factor of 3.2 was selected for this evaluation based on the historical data presented in Figure 5. Using the

<sup>4</sup> Direct, Non-Potable Reuse Guidance Document, Prepared for Region C Water Planning Group, Alan Plummer Associates, Inc. and Freese and Nichols, Inc., April 2009. Table 5-1.



peaking factors defined above, the estimated Peak Hour Demand for the entire existing system is 12.1 MGD<sup>5</sup>. The average demand was calculated to be 0.46 MGD. A summary of the assumed existing reclaimed water demands used in this evaluation is presented in Table 6.

**Table 6: Summary of Existing Lakeside Reclaimed Water System Demands**

| <b>Demand Type</b>         | <b>Value</b> |
|----------------------------|--------------|
| <b>Peak Monthly Demand</b> | 1.89 MGD     |
| <b>Month to Day Factor</b> | 2.0          |
| <b>Peak Daily Demand</b>   | 3.79 MGD     |
| <b>Day to Hour Factor</b>  | 3.2          |
| <b>Peak Hourly Demand</b>  | 12.1 MGD     |
| <b>Average Demand</b>      | 0.46 MGD     |

### 3.2 ESTIMATED FUTURE DEMAND

The Lakeside Business District has rapidly developed in recent years, and is anticipated to continue growing. The reclaimed water demand could significantly increase in the coming years as more businesses and developments are constructed. Future demands in the Lakeside area were estimated by calculating current peak hour unit demands (gpm/acre) and applying them to areas not yet serviced with dedicated irrigation meters.

Current peak hour unit demands were calculated for each of the simplified zones (agricultural, commercial, residential), acknowledging that land zoned differently may have different irrigation demands. These peak hour unit demands were multiplied by the total area available for future development, by zone, to estimate future irrigation demand.

A few areas in the Lakeside Business District were not included in the future demand calculation because development in these areas is not anticipated. The land south and west of the WWTP was deemed not available for development since it lies within the

---

<sup>5</sup> Peak Hour Demand = Peak Day Demand (3.79 MGD) times Peak Hour Factor of 3.2.

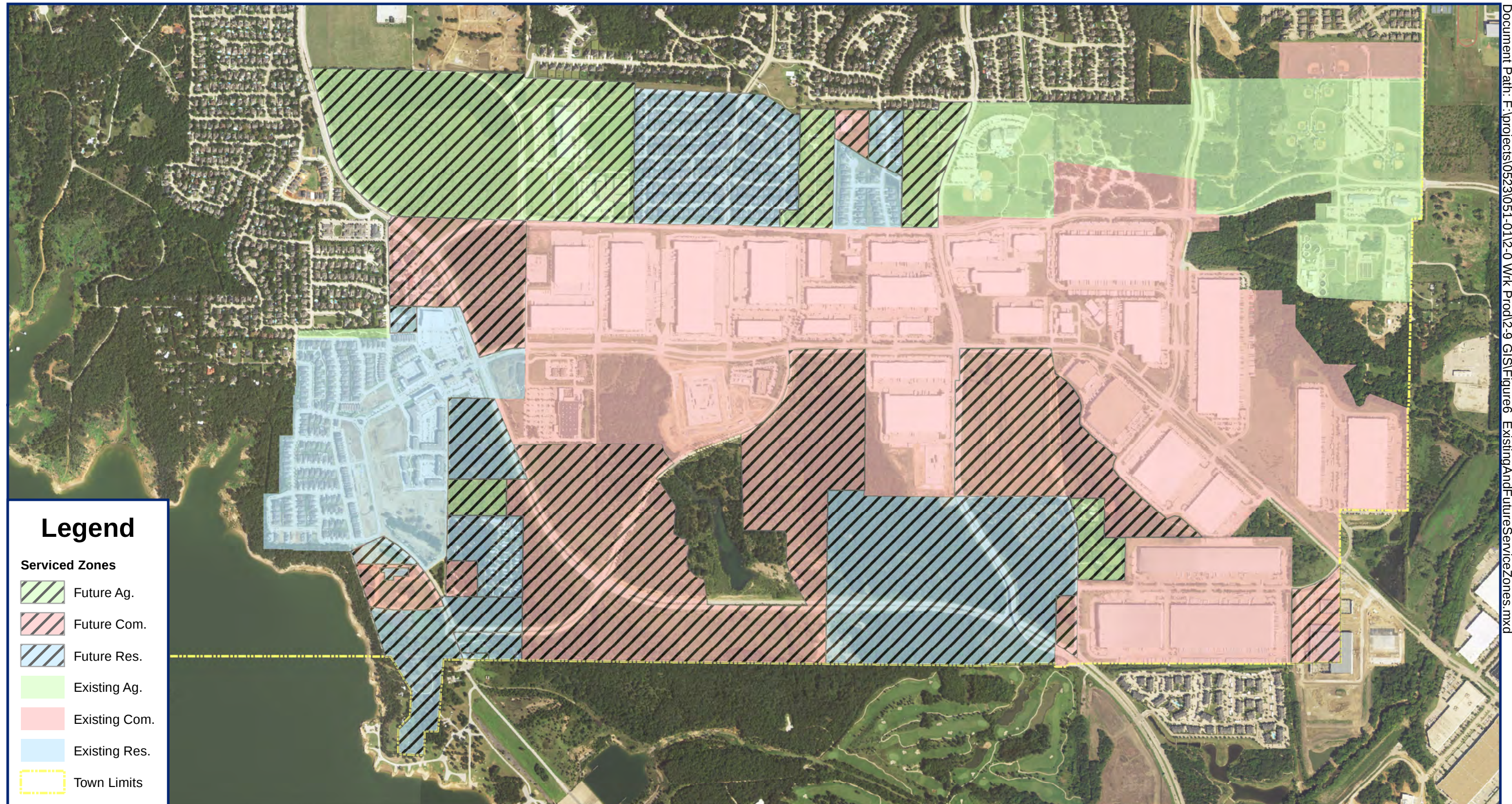


100-year floodplain. Additionally, an on-channel pond exists south of Silveron Boulevard and north of Long Prairie Rd. This pond may be considered “waters of the United States” which would require environmental permitting and mitigation to disturb the area.

Figure 6 displays area already serviced by irrigation meters in the Lakeside Business District along with area available for future service, by zone, and area not available for future service. The Peak Day Demand in the Lakeside Business District is anticipated to increase from 3.79 MGD to 6.56 MGD after the area becomes fully serviced (Table 7). Table 8 provides a detailed summary of existing and future demands.

**Table 7: Summary of Lakeside Reuse System Existing and Future Demands**

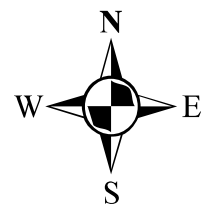
| <b>Demand Type</b> | <b>Units</b> | <b>Existing</b> | <b>Future</b> | <b>Total</b> |
|--------------------|--------------|-----------------|---------------|--------------|
| Peak Day Demand    | MGD          | 3.79            | 2.76          | 6.56         |
| Peak Hour Demand   | MGD          | 12.1            | 8.84          | 21.0         |
| Average Demand     | MGD          | 0.46            | 0.34          | 0.80         |



## Legend

### Serviced Zones

-  Future Ag.
-  Future Com.
-  Future Res.
-  Existing Ag.
-  Existing Com.
-  Existing Res.
-  Town Limits



0 0.1 0.2 0.4 0.6 0.8 Miles

DATE: 5/15/2018

Town of Flower Mound Lakeside Reuse Water Master Plan

**Figure 6: Existing and Future Irrigation Service Zones**



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536

**Table 8: Estimated Future Demand for the Lakeside Business District**

| Item No.      | Parcel/Zone Type                   | Units    | Ag.  | Com. | Res. | Total |
|---------------|------------------------------------|----------|------|------|------|-------|
| [1]           | Existing Peak Hour Demand          | MGD      | 0.77 | 9.7  | 1.65 | 12.1  |
| [2]           | Area Currently Serviced            | acres    | 194  | 686  | 145  | 1,024 |
| [3]=[1] / [2] | Estimated Peak Hour Unit Demand    | gpm/acre | 2.76 | 9.82 | 7.90 | -     |
| [4]           | Future Area Available for Service  | acres    | 187  | 352  | 278  | 817   |
| [5]           | Area Not Available for Service     | acres    | 37   | 72   | 2    | 111   |
| [6]=[3]x[4]   | Additional Future Peak Hour Demand | MGD      | 0.74 | 4.98 | 3.16 | 8.88  |
| [7]=[1]+[6]   | Total Future Peak Hour Demand      | MGD      | 1.51 | 14.7 | 4.81 | 21.0  |

### 3.3 IRRIGATION CUSTOMER COMMUNICATION

The five largest existing irrigation users in the Lakeside Business District were contacted to obtain information about their irrigation system and to inform them of the goals of this study. A standard survey was distributed to each of the five customers with specific questions regarding the user's irrigation system. Two of the five users returned the survey.

The survey responses confirm the assumption that irrigators in the Lakeside Business District typically irrigate every other day between 6 pm and 9 am. Selected responses from the two surveys received are summarized in Table 9. The two completed surveys and contact information for the top five irrigation users are provided in Appendix B.

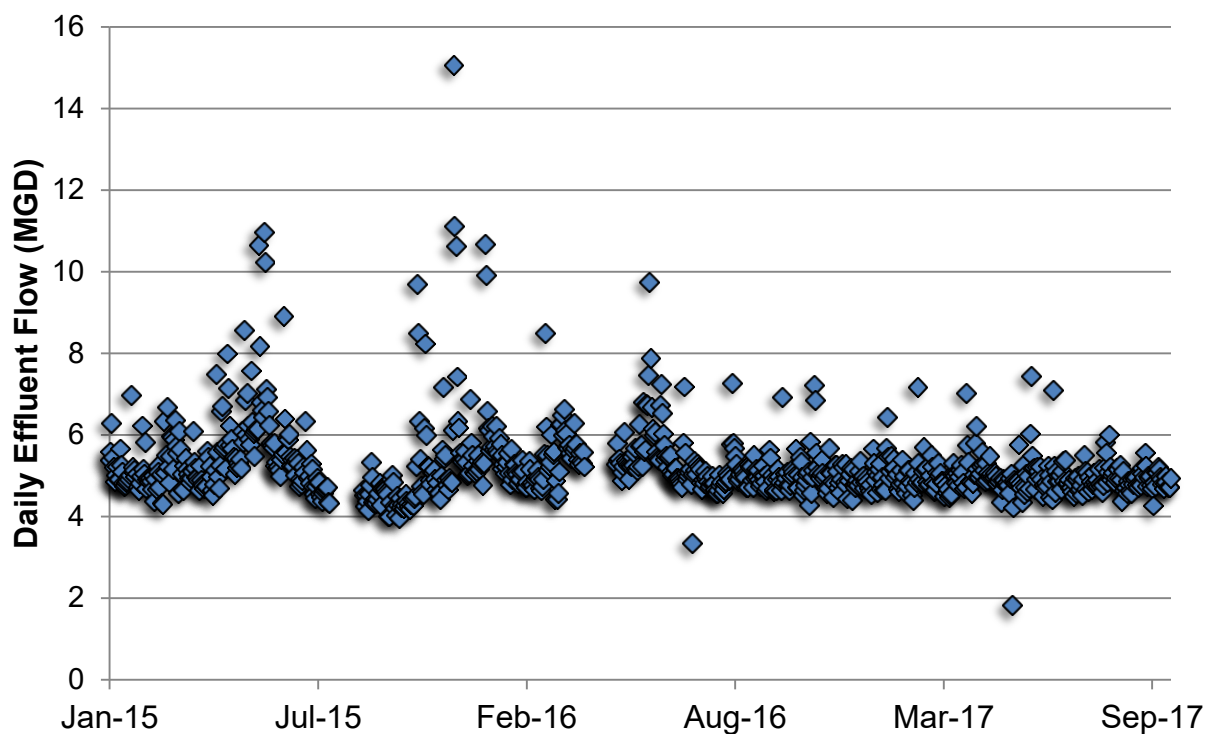
**Table 9: Selected Survey Responses**

| Survey Number | Minimum System Pressure (psi) | Maximum System Pressure (psi) | Irrigation Schedule | Irrigation Window |
|---------------|-------------------------------|-------------------------------|---------------------|-------------------|
| 1             | 40                            | 100                           | Every Other Day     | 10 pm – 5 am      |
| 2             | -                             | 80                            | Every Other Day     | 8 pm – 5 am       |



## 4 Reclaimed Water Supply and Required Storage

The Town owns and operates a WWTP, serving the eastern part of the Town, which will supply reclaimed water for the future Lakeside Business District reuse system. The plant has a permitted annual average capacity of 10 MGD and a two-hour peak capacity of 33.3 MGD. Historical effluent flow data collected between 2015 and 2017 were analyzed to determine the amount of reclaimed water currently available. Figure 7 and Table 10 demonstrate that the WWTP produces 5.22 MG of reclaimed water per day on average, and at least 4.43 MG each day 95% of the time. However, the plant uses a non-continuous treatment process (sequencing batch reactor (SBR)) which causes the effluent flow to vary significantly throughout the day depending on the status of the SBR, as seen in Figure 8. The minimum effluent flow during the day represents the limitation for supplying reclaimed water to the distribution system if no storage is constructed. A simplified approximation of diurnal changes in effluent flow throughout the day, discounting the effects of the SBR, is also shown in Figure 8.

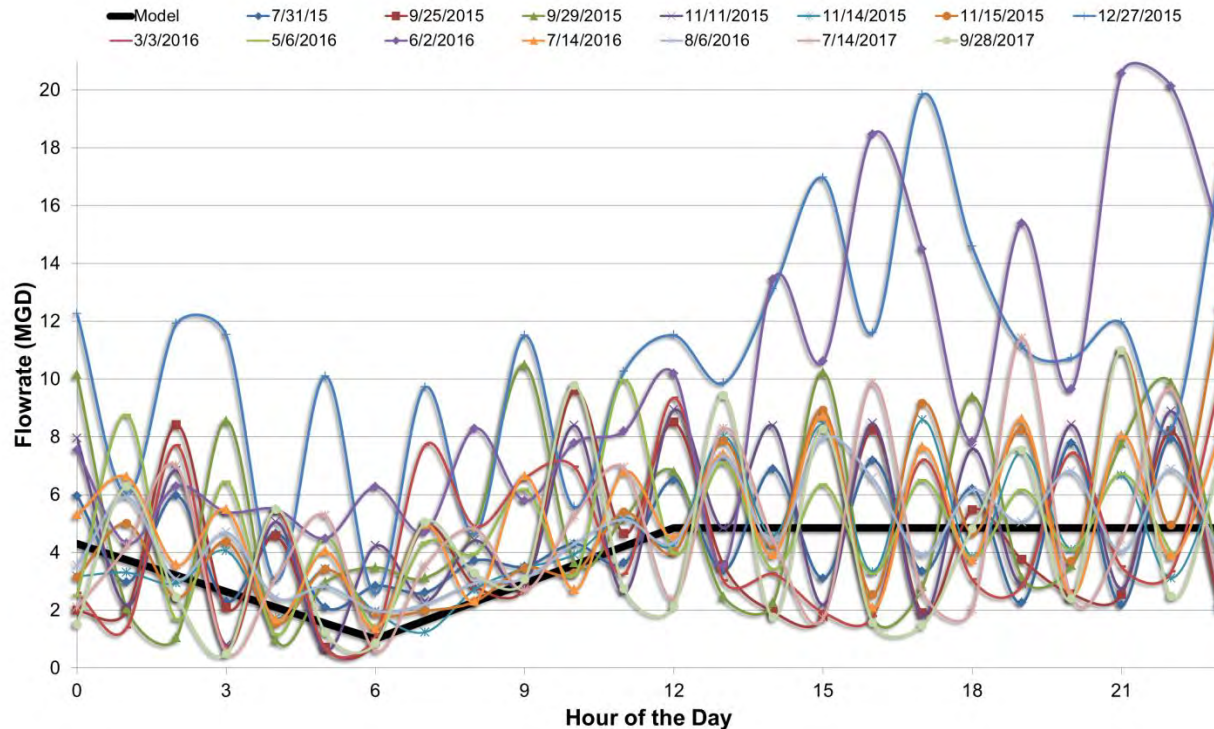


**Figure 7: Daily Effluent Flow from Town WWTP**

**Table 10: Town WWTP Daily Effluent Flow Summary**

| Description                | Value <sup>1</sup> (MGD) |
|----------------------------|--------------------------|
| Minimum                    | 1.81                     |
| 5 <sup>th</sup> Percentile | 4.43                     |
| Average                    | 5.22                     |
| Maximum                    | 15.1                     |

1. Daily effluent flow data from 1/1/15 to 10/15/17

**Figure 8: Hourly Effluent Flow from Town WWTP**

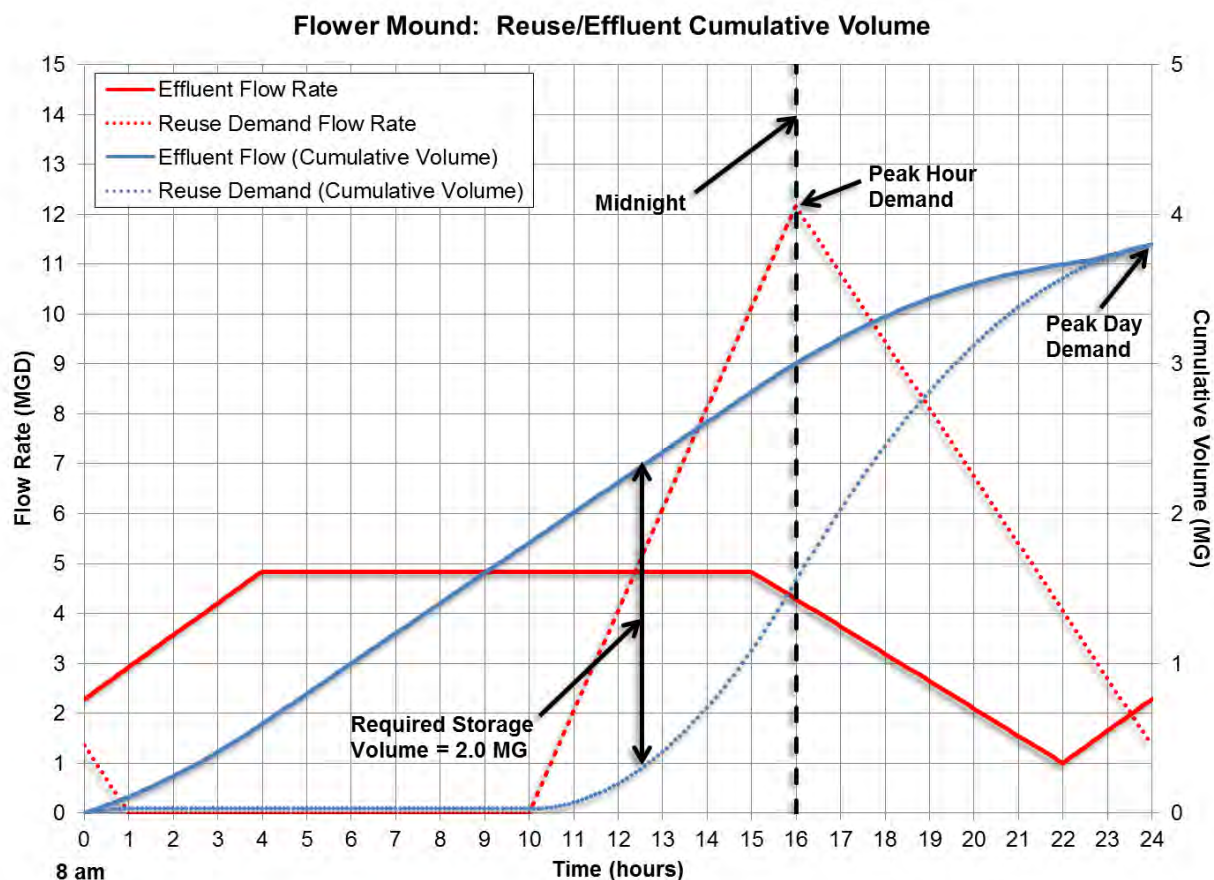
#### 4.1 REQUIRED RECLAIMED WATER STORAGE

The estimated Peak Day Demand of 3.79 MGD for the existing 106 irrigation meters is well below the amount of water produced by the WWTP on a typical day. In fact, of the 958 days of effluent flow data available, there were only two days where the WWTP produced less than 3.79 MGD of reclaimed water. However, as discussed in Section 3.1, irrigation demand is not consistent throughout the day, but increases to a maximum around midnight and reduces to no demand during the daytime. The historical hourly effluent data displayed in Figure 8 demonstrates that there were few days where hourly



effluent flow was greater than the reclaimed water Peak Hour Demand of 12.1 MGD. Therefore, storage will be required at the WWTP to meet the reclaimed water demand.

The hourly reclaimed water demand pattern approximation was compared against the hourly reclaimed water supply approximation to initially calculate the minimum volume of storage required (Figure 9). It is estimated from this calculation that approximately 2 MG of storage would be required to meet the existing reclaimed water demand on a day where the WWTP produces a Peak Day Demand of at least 3.79 MG in a day, which was achieved on 99.8% of days from historical data. For confirmation, the calculation was repeated using historical hourly flow instead of the approximated effluent diurnal flow. The calculated required storage ranged from 0.25 MG to 2.00 MG (Table 11), confirming the calculation initially performed.



**Figure 9: Required Volume of Reclaimed Water Storage**

**Table 11: Required Storage using Historical Effluent Flow**

| <b>Date</b> | <b>Daily Effluent Flow (MG)</b> | <b>Peak Hour Effluent Flow Rate (MGD)</b> | <b>Minimum Required Storage Volume (MG)</b> |
|-------------|---------------------------------|-------------------------------------------|---------------------------------------------|
| 7/31/2015   | 4.32                            | 7.94                                      | 1.71                                        |
| 9/25/2015   | 4.00                            | 9.62                                      | 2.00                                        |
| 9/29/2015   | 5.00                            | 10.48                                     | 1.39                                        |
| 11/11/2015  | 4.83                            | 8.93                                      | 1.62                                        |
| 11/14/2015  | 4.43                            | 8.58                                      | 1.89                                        |
| 11/15/2015  | 5.00                            | 12.47                                     | 1.50                                        |
| 12/27/2015  | 10.68                           | 19.85                                     | 0.25                                        |
| 3/3/2016    | 4.41                            | 9.98                                      | 1.79                                        |
| 5/6/2016    | 4.88                            | 9.97                                      | 1.51                                        |
| 6/2/2016    | 9.74                            | 20.57                                     | 0.74                                        |
| 7/14/2016   | 5.04                            | 8.71                                      | 1.42                                        |
| 8/6/2016    | 4.57                            | 7.95                                      | 1.72                                        |
| 7/14/2017   | 4.49                            | 11.41                                     | 1.78                                        |
| 9/28/2017   | 4.26                            | 10.99                                     | 1.89                                        |

It is recommended that the Town construct 2 MG of storage at the WWTP to meet the existing Peak Day Demand of 3.79 MGD and the existing Peak Hour Demand of 12.1 MGD.

The required storage volume is calculated from existing demands only and does not account for future growth in the Lakeside Business District area. As additional users beyond the 106 meters initially identified are connected to the distribution system, it is recommended that the required storage volume be reevaluated. Additional storage may be necessary to accommodate future demand. However, as the Lakeside Business District area grows, wastewater flows to the WWTP will also rise, increasing the supply of reclaimed water and dampening the effect that additional growth will have on storage requirements. Additionally, reclaimed water users could be placed on an irrigation schedule in the future to manage peak demands and reduce storage requirements.



## 5 Hydraulic Evaluation

---

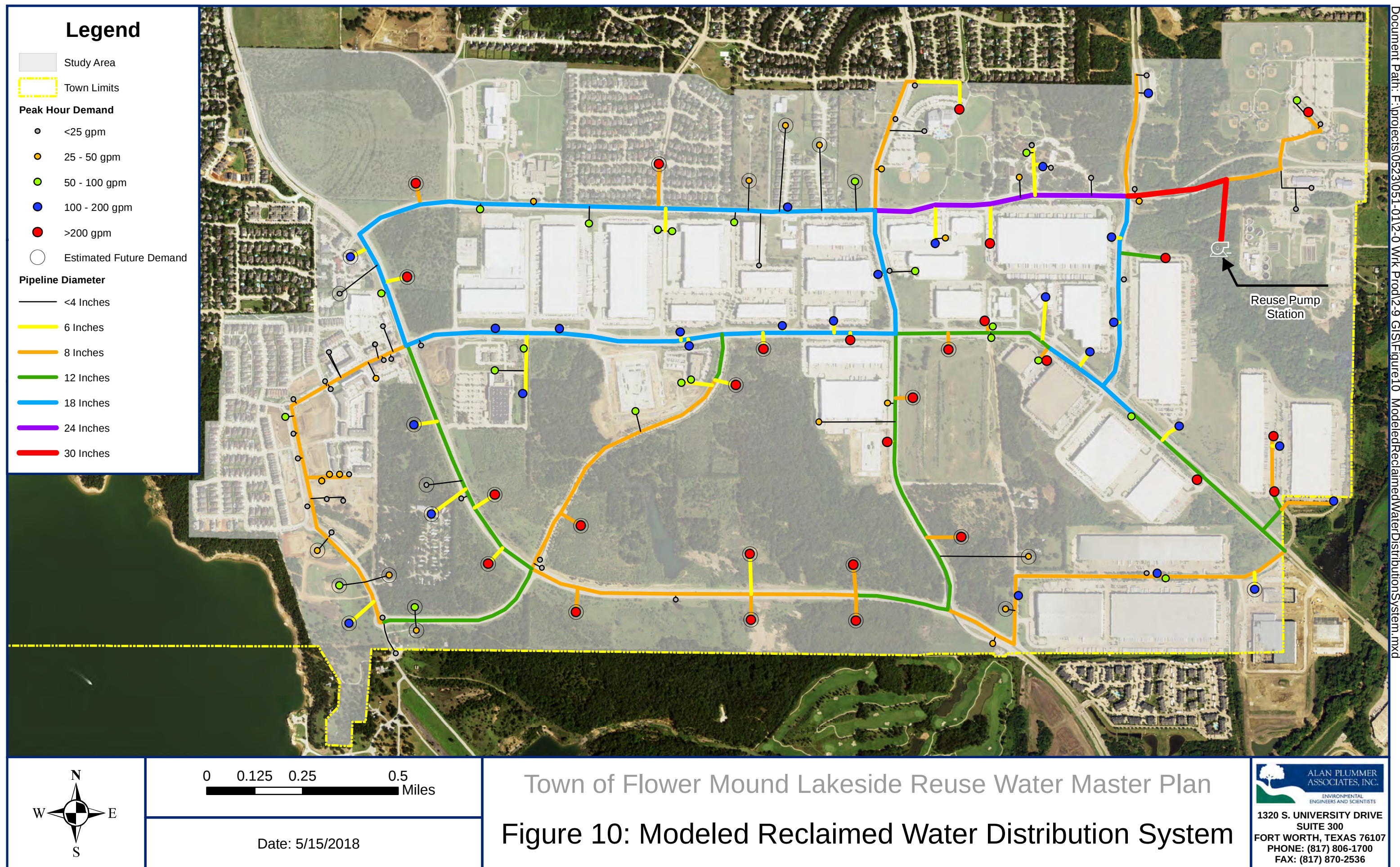
A hydraulic evaluation of the proposed reclaimed water distribution system was performed using the Innovyze InfoWater® hydraulic model. A Peak Day Demand scenario was created as an extended period simulation (EPS) with a duration of 24 hours. This simulation contains the Peak Hour Demand condition occurring at midnight, as indicated by historical data presented in Figure 5. The hydraulic modeling was conducted to appropriately size pipelines in the reclaimed water distribution system and to determine the resulting water pressure throughout the system. A second hydraulic model, using an average demand scenario, was created to evaluate the water age within the system. This second model was created as an EPS with a duration of 168 hours (1 week). Water age can be used as an indicator to evaluate the water quality deterioration within a distribution system. This simulation assumes the same irrigation pattern as the Peak Day Demand scenario but uses the average demand within the system instead of Peak Day Demand, to be conservative. The following sections describe the model development, performance criteria, and model results.

### 5.1 MODEL DEVELOPMENT

The hydraulic model contains both existing and estimated future demands. The Peak Hour Demand for each of the existing meters was placed in the model and assigned the approximated irrigation pattern displayed in Figure 5. Appendix C contains information for all 106 existing irrigation meters, including their Peak Hour Demand and average consumption. Estimated future demand was also included in the model. Appendix D contains a map showing the location of future demand added to the model and a table specifying the amount of demand per location. A summary of the existing and future Peak Hour and average demands included in the hydraulic model are displayed in Table 12. Standard hydraulic roughness coefficients based on PVC pipe were used in the model. The Peak Hour Demands included in the hydraulic model and the modeled pipeline sizes are presented in Figure 10.

**Table 12: Summary of Modeled Demands**

| Description                             | Value |
|-----------------------------------------|-------|
| Existing Peak Hour Demand, MGD          | 12.1  |
| Additional Future Peak Hour Demand, MGD | 8.84  |
| Total Future Peak Hour Demand, MGD      | 21.0  |
| Existing Average Demand, MGD            | 0.46  |
| Additional Future Average Demand, MGD   | 0.34  |
| Total Future Average Demand, MGD        | 0.80  |





## 5.2 PERFORMANCE CRITERIA

A number of model performance criteria were developed in conjunction with the Town (Table 13). These criteria specify the minimum/maximum allowable water pressure at irrigation meters and maximum allowable unit headloss through pipelines in the system.

**Table 13: Performance Criteria**

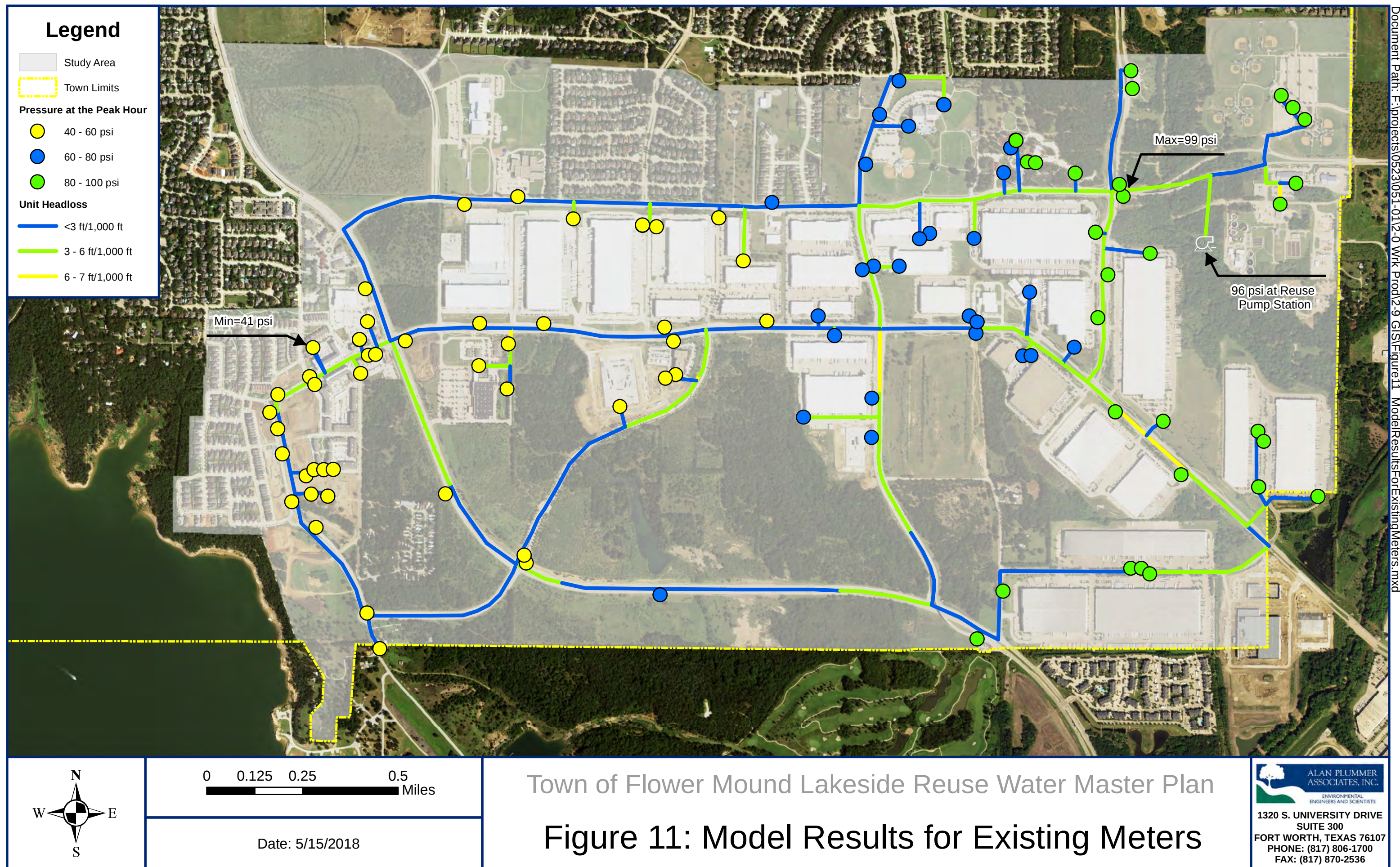
| Performance Criteria                 | Value                         |
|--------------------------------------|-------------------------------|
| Minimum Pressure at Irrigation Meter | 40 psi                        |
| Maximum Pressure at Irrigation Meter | 100 psi                       |
| Maximum Unit Headloss                | 7 feet per 1,000 feet of pipe |

## 5.3 MODEL PRESSURE RESULTS

The hydraulic model was used to evaluate the performance of the system based on the criteria defined in Table 13. Meters near the WWTP are only slightly under 100 psi while the meters at the western edge of the Lakeside area are only slightly above 40 psi (Figure 11). These differences are partly due to the variation in elevation throughout the Lakeside Business District. The elevation at the western edge of the Lakeside area is approximately 100 ft higher than the eastern edge, resulting in a pressure reduction of 43 psi due to static headloss alone. The remaining difference in pressure can be attributed to frictional losses in the pipelines. A summary of pipeline length by diameter is shown in Table 14. The combined length of all pipelines is approximately 15 miles.

**Table 14: Reclaimed Water System Pipeline Diameters**

| Diameter (inches) | Total Length (ft) |
|-------------------|-------------------|
| 30                | 1,861             |
| 24                | 2,949             |
| 18                | 16,888            |
| 14                | 1,250             |
| 12                | 13,184            |
| 10                | 2,181             |
| 8                 | 23,108            |
| 6                 | 5,872             |
| 4                 | 2,806             |
| 3                 | 3,663             |
| 2                 | 3,661             |
| <b>Total</b>      | <b>77,423</b>     |

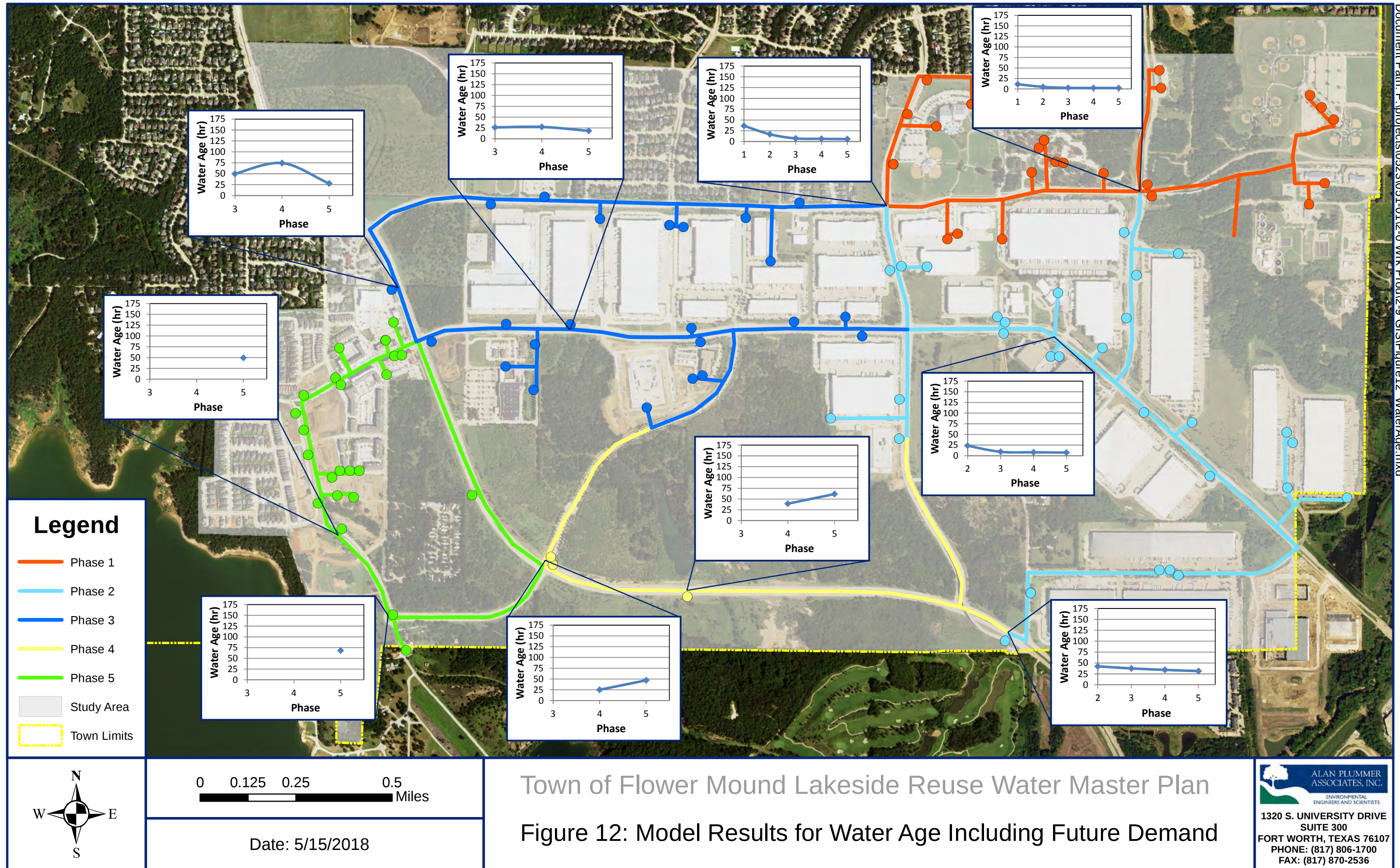


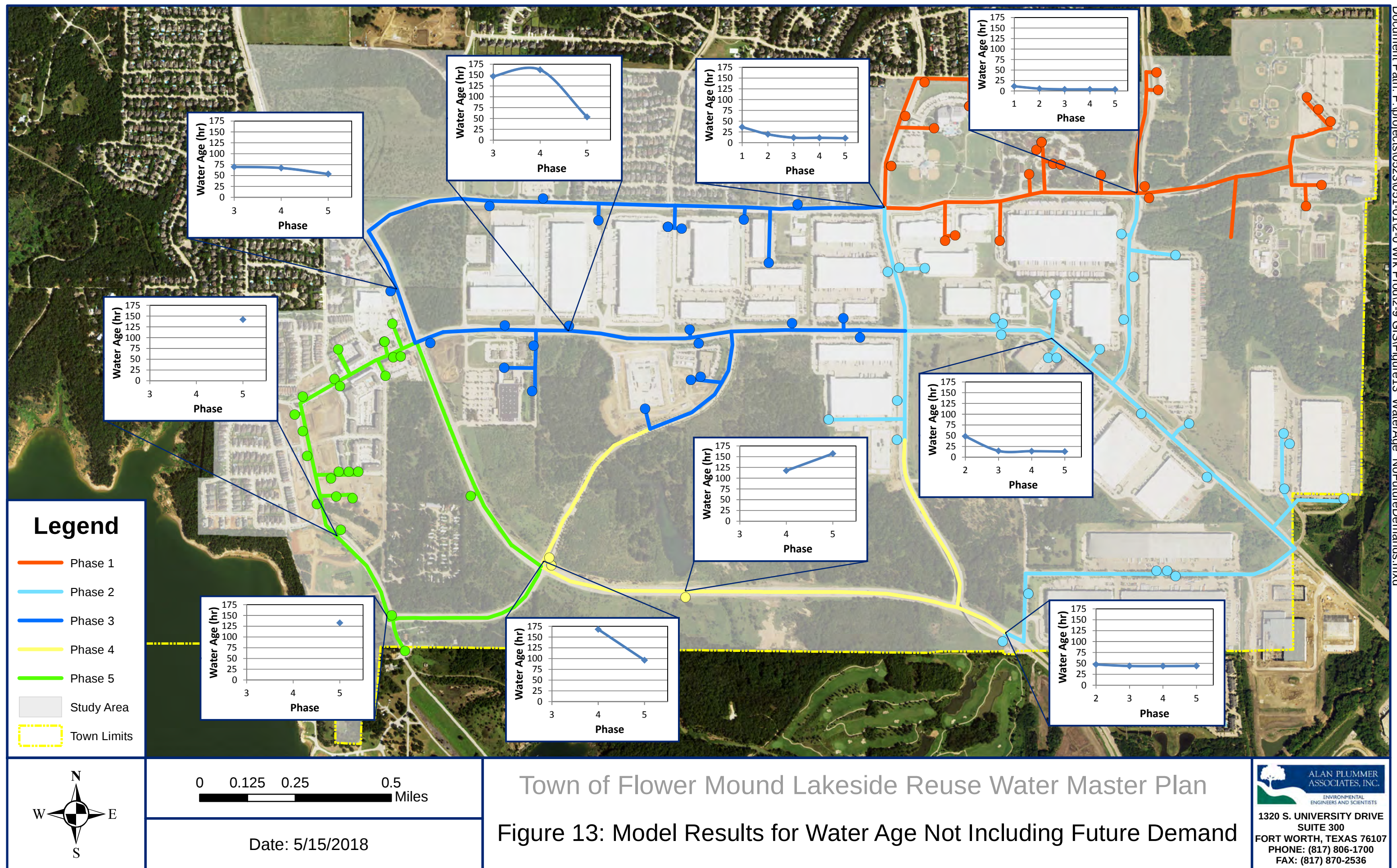


## 5.4 MODEL WATER AGE RESULTS

In addition to water pressure on a peak day, the hydraulic model was also used to simulate the anticipated water age in the system on an average day. Water age can be used as an indicator of water quality conditions. Higher water age (older water) may be more susceptible to chlorine residual decay and potential water quality issues. Water age is a helpful metric in reclaimed water systems to identify regions of the network that may be prone to biological growth in the pipeline and residual decay.

The results of the water age model for areas of interest across the distribution system are shown in Figure 12 and Figure 13. Two different simulations were conducted using the water age model, one including estimated future demands (Figure 12) and one that does not include estimated future demands (Figure 13). The model, in both scenarios, indicates that as more phases are brought online the overall water age within the system decreases. As expected, the northeast area of the system has much lower water age than the southwest area due to the distance from the source and because there is less demand in the southwest area. When this area begins to fully develop and customers are added on to the system, the water age significantly decreases. Model results for water age throughout the system during each phase, and in each scenario, are presented in Appendix E. The southwest area is shown to have very high water age if future demand is not included, which again reinforces the recommendation of building Phases 4 and 5 once the area is more developed.







#### **5.4.1 Flushing Device Considerations**

It is recommended that the Town install a flushing device to periodically flush out stagnant water within the system during seasons of low demand. Periods of low irrigation, such as winter months or periods with significant rainfall, can cause water age within the system to increase since little to no irrigation will occur during these times. The flushing device would evacuate water from the reclaimed water system and deposit it into a manhole connected to the Town's sewer collection system.

Possible locations for the flushing device, located in conjunction with sewer lines and manholes, are shown in Appendix E. The locations shown in Appendix E represent the possible location for each respective phase. The flushing device would be relocated after the completion of each phase. The possible locations presented in Appendix E were selected based on the following criteria:

1. Located near a major sewer line (> 12 inches);
2. Located on a major reclaimed water line (> 12 inches); and
3. Located on the fringes of the reclaimed system.

The locations presented in Appendix E are preliminary. The Town should confirm the capacity of the sewer lines prior to selecting a location during each phase to ensure that the collection system would be able to handle the additional volume of water added during a flushing event.



## 6 Wastewater Treatment Plant Effluent Quality

The Texas Commission on Environmental Quality (TCEQ) has water quality requirements for reclaimed water used for non-potable purposes. In the following sections, effluent quality from the Town's WWTP is compared with regulated reclaimed water quality requirements and improvements to the plant are recommended.

### 6.1 WASTEWATER TREATMENT PLANT INFORMATION

The Town's WWTP has been in operation since 1972. The WWTP is authorized to discharge treated wastewater into Baker's Branch under the Texas Pollutant Discharge Elimination System (TPDES) Permit No. WQ0011321001. The original plant was expanded in 1985 to 2 MGD, and in 1993, was expanded from 2 to 5 MGD. The plant consists of a conventional activated sludge treatment process including primary clarifiers (currently decommissioned), aeration basins, and final clarifiers. In 2001, the WWTP was expanded to its current treatment capacity of 10 MGD by the addition of a parallel 5 MGD activated sludge treatment train that uses sequencing batch reactors (SBRs). Secondary effluent from each of the parallel treatment processes is combined and filtered through cloth media filters. Finally, filtered effluent is disinfected using ultraviolet (UV) irradiation prior to discharge at the plant outfall. The Town's TPDES permit limits are presented in Table 15.

**Table 15: WWTP TPDES Discharge Requirements**

| Effluent Characteristic | Units          | Daily Average | 7-day Average | Daily Max | Single Grab |
|-------------------------|----------------|---------------|---------------|-----------|-------------|
| CBOD <sub>5</sub>       | mg/L (lbs/day) | 10 (834)      | 15            | 25        | 35          |
| TSS                     | mg/L (lbs/day) | 15 (1251)     | 25            | 40        | 60          |
| NH <sub>3</sub> -N      | mg/L (lbs/day) | 2 (167)       | 5             | 10        | 15          |
| <i>E. coli</i>          | MPN/100 mL     | 126           | N/A           | 399       | N/A         |

### 6.2 RECLAIMED WATER QUALITY REQUIREMENTS

The TCEQ's water quality requirements for reclaimed water are stricter than the Town's TPDES discharge limits. The TCEQ has two categories for reclaimed water depending



on the use of reclaimed water (Type I and Type II), and they each have different limits. Type I reclaimed water can be used for irrigation in areas with the potential for public contact with the water, such as public parks or athletic fields. Type II reclaimed water, on the other hand, can only be used in areas where public contact is unlikely, such as land with restricted access. Therefore, Type I reclaimed water has stricter water quality limits than Type II. Due to the public nature of land to be irrigated in the Lakeside Business District, reclaimed water produced from the Town's WWTP would need to meet the Type I quality limits, which are presented in Table 16. While the Town does not currently provide reclaimed water to any customer, they have already obtained the necessary authorization from the TCEQ to produce and distribute Type I reclaimed water. The Town's reclaimed water authorization is included in Appendix F.

**Table 16: Type I Reclaimed Water Quality Limits**

| Parameter                           | Unit       | Quality Limit <sup>1</sup> |
|-------------------------------------|------------|----------------------------|
| CBOD <sub>5</sub>                   | mg/L       | 5                          |
| Turbidity                           | NTU        | 3                          |
| <i>E. coli</i> or<br>Fecal Coliform | CFU/100 mL | 20 <sup>2</sup>            |
|                                     |            | 75 <sup>3</sup>            |

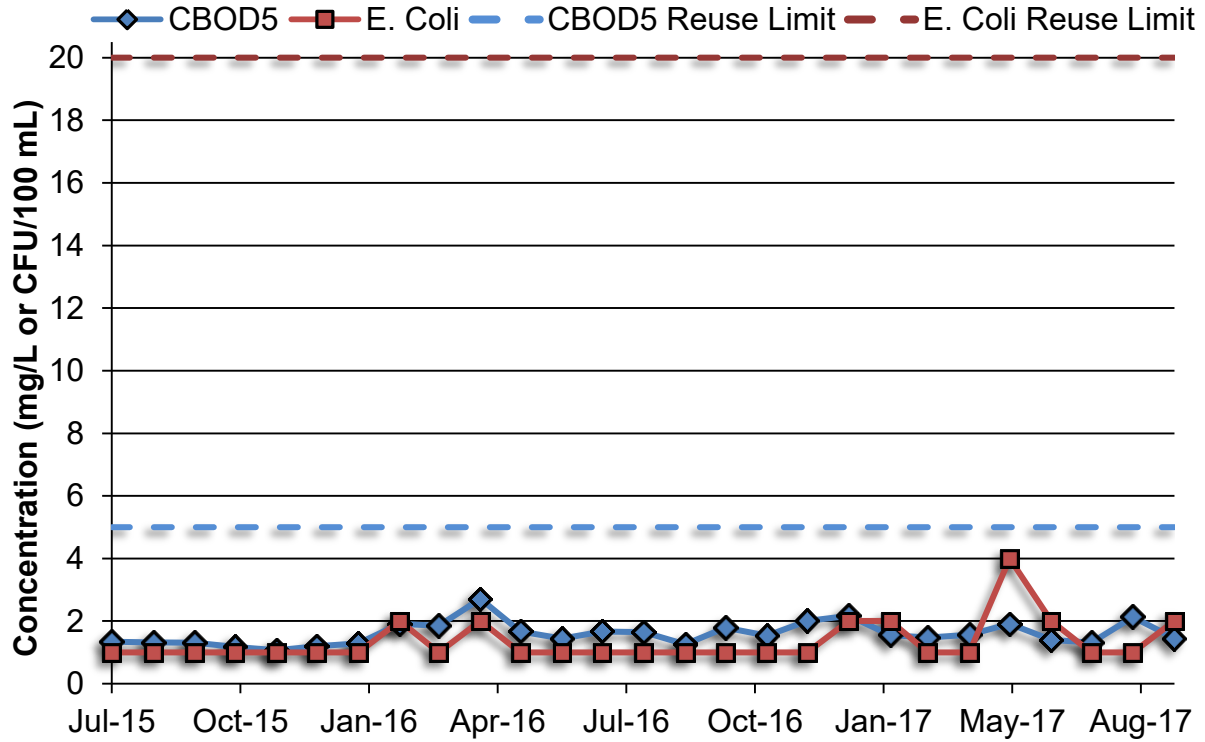
1. Measured as 30-day average, unless otherwise noted

2. 30-day geometric mean

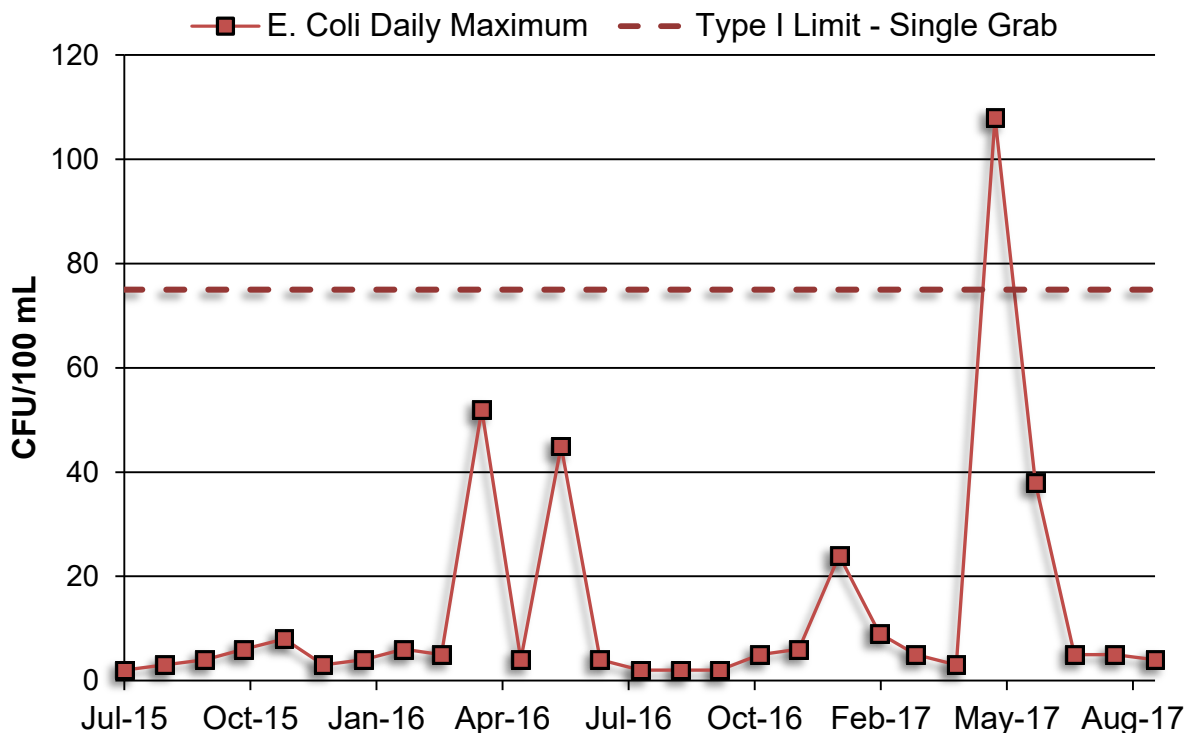
3. Single grab sample

### 6.3 EVALUATION OF HISTORICAL WWTP EFFLUENT QUALITY

Effluent water quality data from the Town's WWTP were collected and analyzed to determine if treatment improvements would be required to meet Type I reclaimed water quality limits. Monthly Discharge Monitoring Reports (DMRs) indicate that the average effluent concentrations of five-day carbonaceous biochemical oxygen demand (CBOD<sub>5</sub>) and *E. coli* have not exceeded their respective Type I average limits over the past three years (Figure 14). However, the May 2017 DMR had a reported daily maximum *E. coli* concentration of 108 CFU/100 mL. While this single value did not exceed the WWTP's TPDES limit, it would have exceeded the Type I reclaimed water single grab limit for *E. coli*. May 2017 was the only month in the past three years where this single grab sample limit was exceeded (Figure 15).

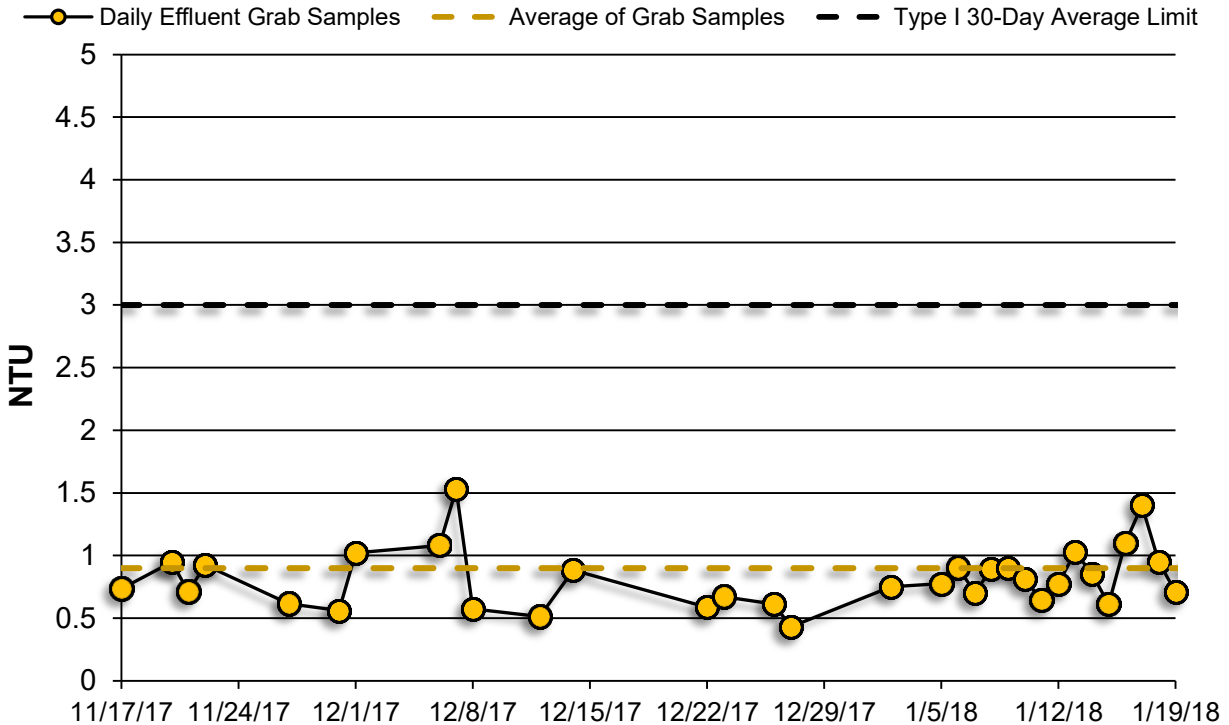


**Figure 14: Monthly Average Effluent Quality– CBOD<sub>5</sub> and *E. coli***



**Figure 15: Daily Maximum Effluent Quality – *E. coli***

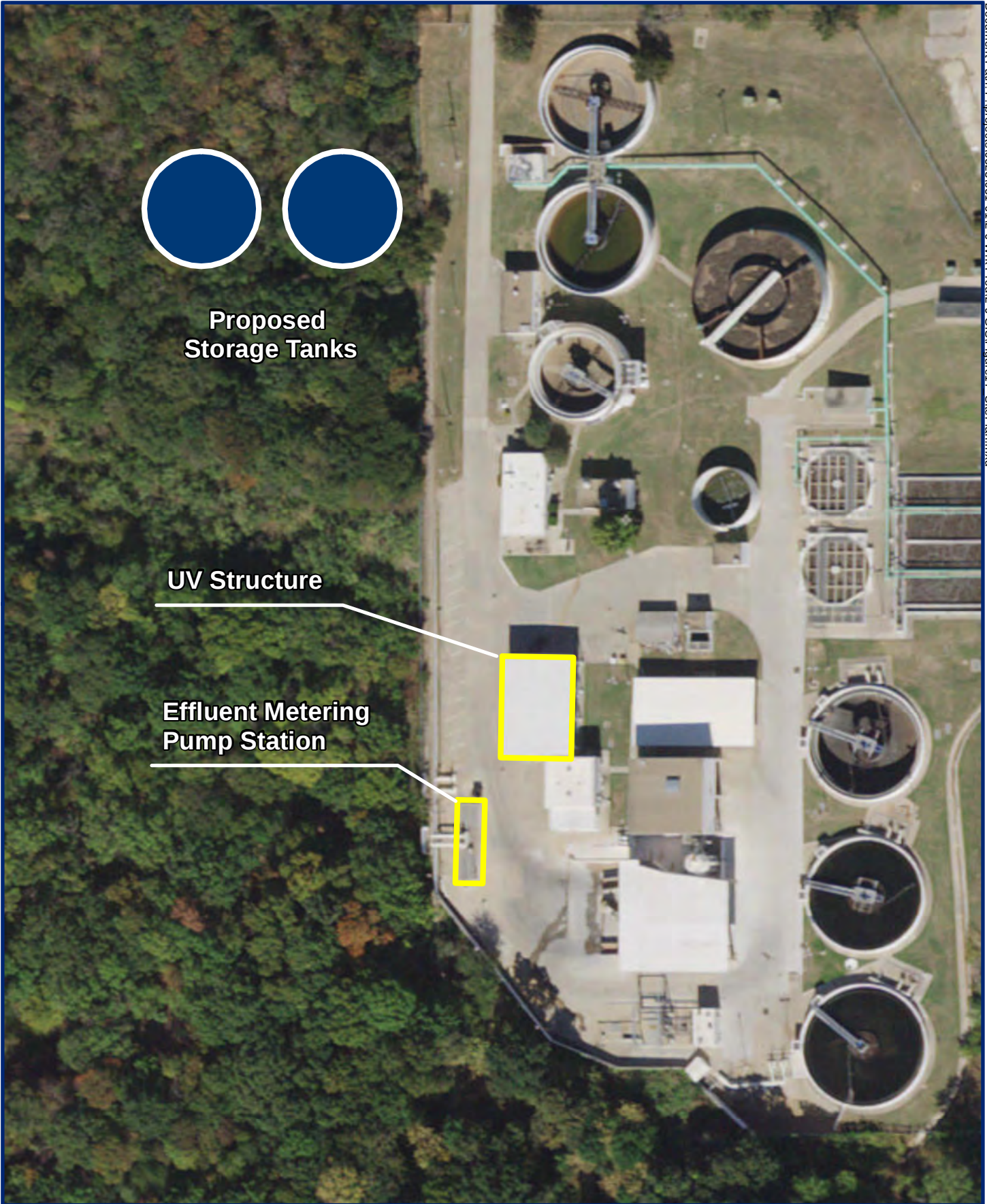
The TCEQ requires turbidity of Type I reclaimed water to be less than 3 NTU on a 30-day average. However, turbidity data is not routinely collected at the WWTP since it is not included as a requirement in the TPDES permit. The Town began collecting turbidity data in November 2017 to determine if treatment improvements would be required to meet Type I quality requirements. The limited effluent turbidity data collected indicates that the existing WWTP treatment processes are adequate to meet the Type I turbidity limit, and no improvements are anticipated to be necessary (Figure 16).



**Figure 16: Daily Effluent Quality – Turbidity**

#### 6.4 RECOMMENDED WASTEWATER TREATMENT PLANT IMPROVEMENTS

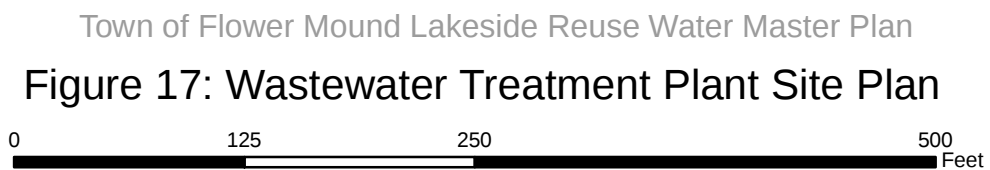
This section summarizes the WWTP improvements recommended to implement water reuse in the Lakeside Business District. The recommended improvements are grouped into two categories: treatment improvements and infrastructure additions. The treatment improvements include a new UV system, and sodium hypochlorite feed system. The infrastructure additions include a Transfer Pump Station, two storage tanks, and a Reuse Pump Station. A site plan and process flow diagram depicting the recommended improvement and infrastructure additions at the WWTP are displayed in Figure 17 and Figure 18, respectively. The Transfer and Reuse Pump Stations are not shown on the site plan. The locations of these pump stations will be determined at a later date.

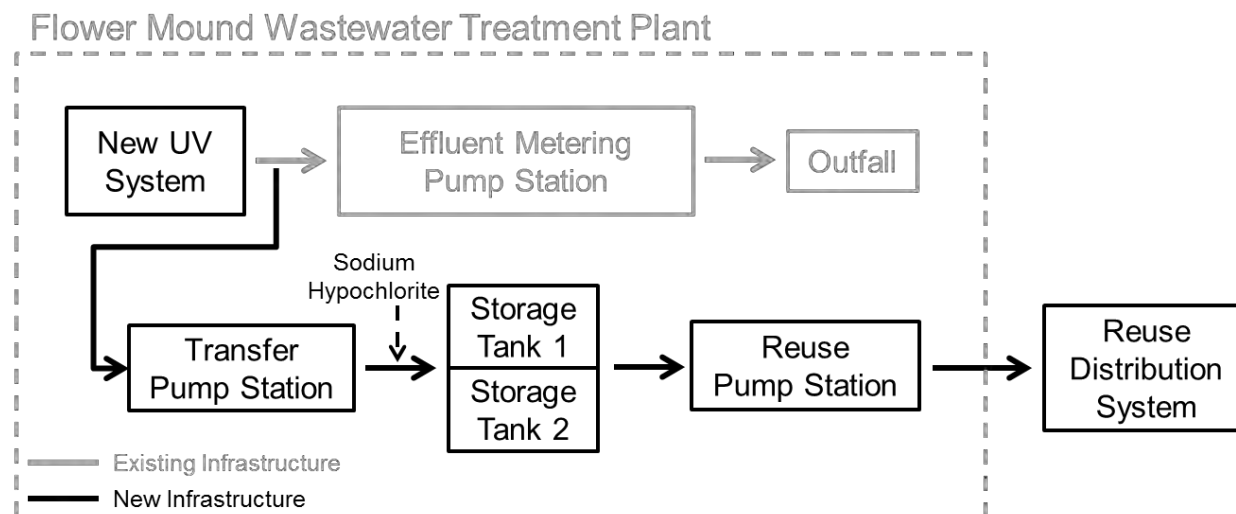


Proposed  
Storage Tanks

UV Structure

Effluent Metering  
Pump Station





**Figure 18: Recommended WWTP Improvements**

#### **6.4.1 Treatment Improvements**

The effluent quality data summarized in Section 5.3 indicate that the existing treatment processes at the WWTP are adequate to meet the Type I requirements for CBOD<sub>5</sub> and turbidity. However, the *E. coli* data suggest a potential need for improvements to the disinfection process. Replacing the plant's UV disinfection system is recommended for the following reasons:

1. The existing UV disinfection equipment is a Trojan 3000 system, which the manufacturer no longer sells or services. It is recommended that the existing UV system be replaced with a newer system that will be supported by the manufacturer.
2. The single grab sample for *E. coli* collected in May 2017 would have exceeded the Type I maximum limit of 75 CFU/100mL. In general, UV systems used in reuse applications are designed to deliver a higher dose than UV systems used at WWTPs that discharge to a stream or lake due to the stricter quality restrictions placed on reuse water. The existing system is designed to deliver 40 mJ/cm<sup>2</sup> using the *Bacillus Subtilis* indicator organism. New UV systems are designed using the male-specific-2 (MS2) bacteriophage as the indicator organism, instead, which is more resistant to UV than *Bacillus Subtilis*. In this



application, it is recommended that the replacement UV system be designed to deliver a dose of  $40 \text{ mJ/cm}^2$  (using the MS2 bacteriophage) to reclaimed water used for irrigation. However, final effluent discharged to Baker's Branch would not need to be disinfected at this high dosage. A UV dosage of only  $30 \text{ mJ/cm}^2$  (MS2 bacteriophage) would be necessary to meet the plant's TPDES discharge requirements. To save capital and operating expenses, the plant's future UV system could be designed to deliver  $30 \text{ mJ/cm}^2$  in peak flow conditions, but  $40 \text{ mJ/cm}^2$  during normal conditions. Reclaimed water used for irrigation would always be given a dose of  $40 \text{ mJ/cm}^2$ .

In addition to a replacement UV system, a chemical feed system is also recommended. While the UV system alone will provide adequate disinfection to meet the Type I bacterial requirements, it will not provide a disinfection residual for the distribution system. Although a disinfection residual is not directly required by TCEQ regulations, it is recommended in order to control biological growth within the distribution system. A sodium hypochlorite disinfection system is recommended and would be added to the reclaimed water prior to entering the storage tanks. The sodium hypochlorite disinfection system would be sized for the reuse flow rate from the plant.

#### **6.4.2 Infrastructure Additions**

Beyond treatment improvements, there are a number of infrastructure additions required at the WWTP. These include two storage tanks and two pump stations.

##### **6.4.2.1 Storage Tanks**

As explained in Section 4.1, storage will be required at the WWTP to provide water to the reclaimed water system when demands exceed the supply produced by the WWTP. The analysis suggests that a total storage of 2 MG will be required to supply the Peak Day Demand to the existing irrigation meters on a low flow day at the WWTP.

Reclaimed water storage can be provided using either ponds or constructed storage tanks. The Town's reclaimed water authorization (Section II of Appendix F) provides



guidance for the construction of holding ponds designed to store Type I reclaimed water. While open ponds are typically less costly than storage tanks, water stored in ponds is more susceptible to negative changes in water quality. Specifically, the turbidity and *E. coli* limits may be difficult to meet after storage in an open pond. Therefore, covered ground storage tanks are recommended at the WWTP.

It is recommended that two 1 MG covered ground storage tanks be constructed instead of a single 2 MG tank. This will allow the Town to reduce the capital cost burden by delaying construction of the second tank until a later date, since the reclaimed water system will be constructed in phases. Additionally, two parallel tanks will provide more operational flexibility than a single tank since one tank could be taken offline for maintenance without discontinuing service to the reclaimed water system. The tanks will be conceptually located west of the decommissioned primary clarifiers, across the road and will be approximately 92 feet in diameter with a side water depth (SWD) of 20 feet. The existing primary clarifiers at the Town's WWTP have been decommissioned and it may be possible to locate the storage tanks in the same footprint of the clarifiers. However, the Town directed APAI to conceptually locate the tanks west of the primary clarifiers.

The Town may want to consider installing a potable water line to the storage tanks to fill them with potable water in the event that the supply of reclaimed water is disrupted.

#### **6.4.2.2 Pump Station**

Two pump stations will be required to deliver reclaimed water to the Lakeside Business District area from the existing WWTP. The first will be a Transfer Pump Station to convey final effluent downstream of the new UV system to the proposed reclaimed water storage tanks. Water will need to be lifted approximately 50 feet from the water surface elevation (WSE) at the UV structure to the WSE at the proposed tanks.

The Reuse Pump Station will be constructed downstream of the storage tanks and will supply reclaimed water to the distribution system. Vertical turbine pumps with variable frequency drives (VFD) are recommended in this application to allow the adjustment of

*Lakeside Reuse Water Master Plan*

flows to more closely match the variable demand. These pumps will need to provide approximately 250 feet of head. A hydropneumatic tank will also be required downstream of the pump station to maintain pressure in the distribution system when the pumps are not operational.



## 7 Implementation Plan and Costs

---

A phased implementation plan is proposed for the reuse system to manage capital costs and maximize revenue from the reuse system. The phases were established based on proximity to the WWTP and amount of reclaimed water demand. Meters located close to the WWTP with high demand will be connected to the reuse system in the early phases, and meters located far from the WWTP in undeveloped areas will be connected during later phases. While the Lakeside area is rapidly developing, there remain some areas that may not be developed for a number of years. It would be advantageous to the Town to wait until a significant demand is present in those areas before extending the reuse system to them.

The proposed Lakeside Reuse System Implementation Plan consists of five phases, with each phase expanding the reuse system to a new area of the Lakeside Business District. The proposed implementation plan is shown in Figure 19, and the following sections describe the scope of each phase.

### 7.1 PRIOR TO PHASE 1

The UV disinfection system at the WWTP requires replacement prior to the first phase of the implementation plan. As noted earlier, the plant's existing UV system is no longer supported by the manufacturer. Additionally, the bacterial requirements are stricter for Type I reclaimed water than the plant's existing TPDES discharge permit, which will require a UV system with a higher disinfection dose.

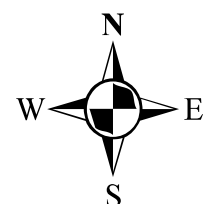
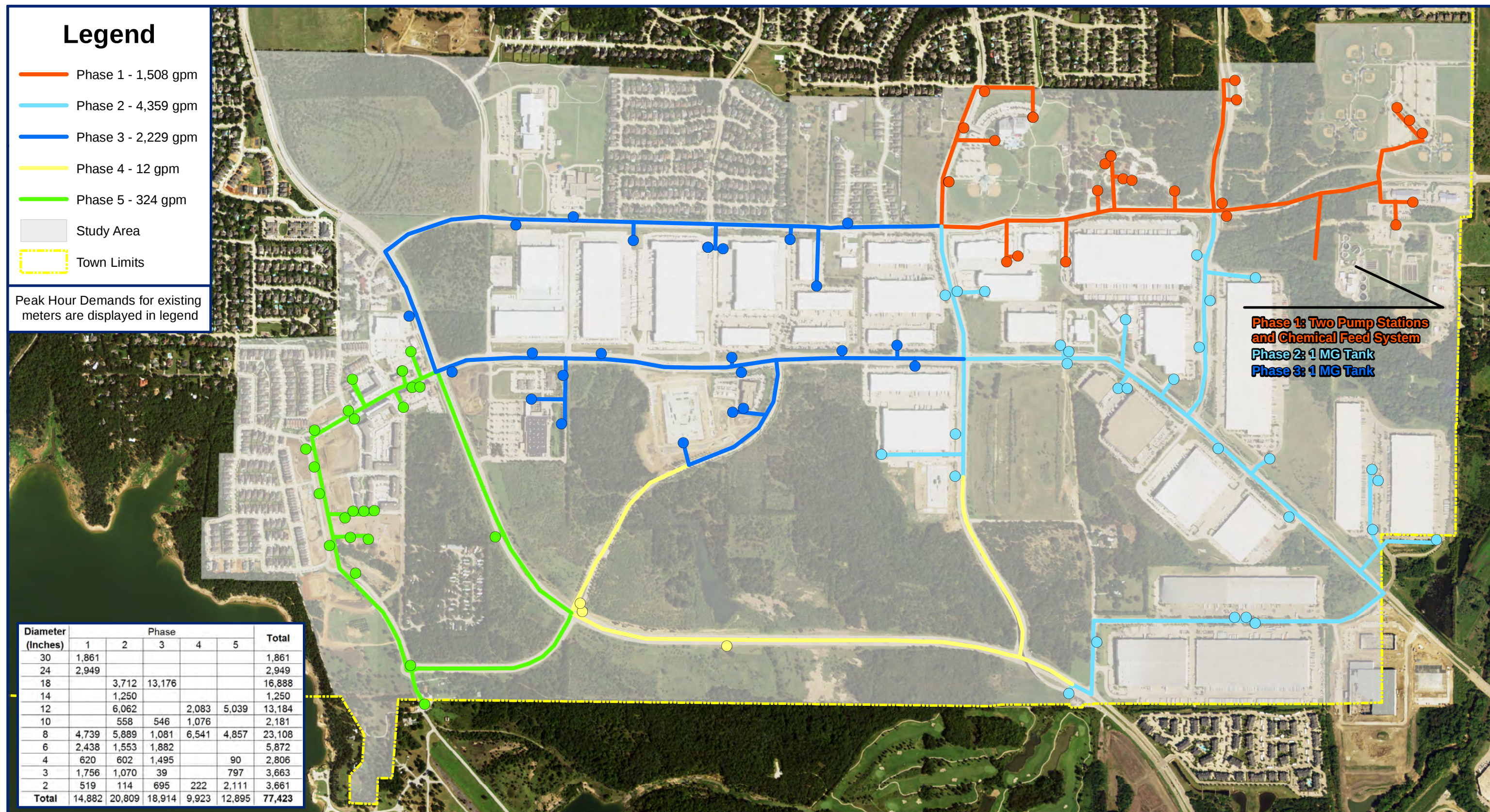
It is also recommended that the Town develop a number of administrative documents and financial evaluations prior to Phase 1 that will be required to provide reclaimed water. These administrative documents and financial evaluations include:

1. Rate Study: A financial evaluation to determine the rate structure for reclaimed water.
2. Standard Contract for Customer: A contract between the Town and each customer will be required. A standard contract can be developed before Phase 1



that will be used for all customers who will connect to the reclaimed water system. The contract may include items such as: prohibited uses of reclaimed water, price of reclaimed water, compliance with TCEQ rules and regulations, delivery of reclaimed water, quality of water to be provided, obligation of the parties, etc.

3. Reclaimed Water Policies and Procedures: Policies and procedures typically addressed by a reclaimed water program include technical design specifications, cross-connection control requirements, funding sources and rules, rate structure, site inspection authority, enforcement policies, reclaimed water user manual, and an emergency response plan.
4. Reclaimed Water Operating and Maintenance Plan: A reclaimed water O&M plan is required by the TCEQ in the Town's reclaimed water authorization (Appendix F). The O&M plan must present a labeling and separation plan for the prevention of cross connections, procedures for monitoring reclaimed water, schedules for routine maintenance, and other times.
5. Development of Town Reclaimed Water Ordinance: Several aspects of the reclaimed water program may require modification of existing ordinances or creation of new ordinances. Some possible considerations relative to Town ordinances include: establishment of pricing structure, potential restrictions on the use of potable water for irrigation within the Lakeside Business District area, or requirements for developers to install dual distribution systems for new developments in the Lakeside Business District.
6. Public Outreach Program/Materials: It is recommended that the Town identify a public relations coordinator to develop a public awareness campaign for the reclaimed water system. Possible marketing efforts may include: stakeholder workshops, news media articles, informational website, public television announcements, or public presentations at community events.



0 0.125 0.25 0.5 Miles

Date: 5/15/2018

# Town of Flower Mound Lakeside Reuse Water Master Plan

## Figure 19: Lakeside Reuse System Implementation Plan

**ALAN PLUMMER ASSOCIATES, INC.**  
ENVIRONMENTAL ENGINEERS AND SCIENTISTS  
1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



## 7.2 PHASE 1

Phase 1 will include further upgrades to the WWTP along with approximately 15,000 linear feet (LF) of reclaimed water piping to connect to 26 existing irrigation meters near the WWTP. The 26 meters connected in Phase 1 are primarily Town meters irrigating parks along Spinks Road including Gerault Park, Heritage Park, and Bakersfield Park.

The Peak Hour Demand for the meters connected in Phase 1 is estimated to be low enough to not necessitate the construction of a large storage tank. However, three temporary 10,000 gallon storage tanks are recommended to maintain operational consistency for the pumps between the different phases.

The WWTP improvements constructed in Phase 1 will include the transfer pump station, sodium hypochlorite feed system, temporary polyethylene storage tanks, and the reuse pump station. The pump stations will be constructed with space to accommodate additional pumps required in subsequent phases.

## 7.3 PHASE 2

The reclaimed water system will be expanded in Phase 2 to include irrigation meters on commercial properties generally located along Lakeside Parkway, east of Gerault Road. Twenty nine existing irrigation meters will be connected in Phase 2 and the Peak Hour Demand will significantly increase from 2.2 MGD in Phase 1 to a cumulative demand of 8.5 MGD. This increase in demand will necessitate additional storage at the WWTP. The temporary storage tanks installed during Phase 1 will be replaced in Phase 2 with the first 1 MG covered storage tank. Additional pumps will be installed at the Transfer and Reuse Pump Stations in Phase 2, and approximately 20,800 LF of pipeline will be added in the distribution system.

## 7.4 PHASE 3

The third phase will expand the reclaimed water system to additional properties along Lakeside Parkway and Spinks Road between Gerault Road and Long Prairie Road.



Approximately 18,900 LF of pipe will be added to the system to include 24 additional irrigation meters. The expansion of the system will necessitate construction of the second 1 MG covered storage tank at the WWTP and will provide additional pumping capacity at the Reuse Pump Station. It is recommended that the required storage be reevaluated in Phase 3 to account for any changes in reclaimed water demand or supply. The cumulative Peak Hour Demand will increase from 8.5 MGD in Phase 2 to 11.6 MGD.

## **7.5 PHASE 4**

The fourth phase of the implementation plan will extend reclaimed water service along Long Prairie Road between Silveron Boulevard and Gerault Road, and will also connect to three dead ends created in Phases 2 and 3 to form water loops. This area is predominantly undeveloped. There are three existing irrigation meters in this area; together they only increase the Peak Hour Demand by 0.02 MGD. However, significant growth is anticipated in this area. It is recommended that the Town delay implementation of Phase 4 until significant demand is present in the service area to generate revenue following construction of the expansion.

## **7.6 PHASE 5**

Reclaimed water service to the residential properties located along Lakeside Parkway, west of Long Prairie Road will be included in the fifth and final phase. Approximately 12,900 LF of pipeline will be added in this phase to include 24 additional irrigation meters, but the Peak Hour Demand will only increase by approximately 0.5 MGD. This area of the Lakeside Business District has room for development and it is anticipated that future growth will increase the reclaimed water demand in this area. However, it is recommended that the Town delay construction of Phase 5 until the area is further developed and demand has increased.



## 7.7 PHASE COSTS

Opinions of probable construction cost (OPCC) and annual operating and maintenance costs (O&M) were created for each phase of the implementation plan. The scope and cost of each phase is summarized in Table 17 with demands summarized in Table 18. A preliminary implementation plan schedule has been developed, assuming that the Town will construct one phase each year (Table 19). However, it is recommended that construction of Phases 4 and 5 be delayed until additional reclaimed water demand is present in those areas.

**Table 17: Implementation Plan Summary**

| Phase               | Improvements at WWTP                                                                                      | LF of Pipe Installed | Existing Irrigation Meters Connected | OPCC (million) <sup>1</sup> | Cumulative Annual O&M <sup>1</sup> |
|---------------------|-----------------------------------------------------------------------------------------------------------|----------------------|--------------------------------------|-----------------------------|------------------------------------|
| 1                   | Transfer pump station<br>Temporary storage tanks<br>Reuse pump station<br>Sodium hypochlorite feed system | 14,900               | 26                                   | \$9.03                      | \$42,000                           |
| 2                   | 1 MG storage tank <sup>2</sup>                                                                            | 20,800               | 29                                   | \$5.45                      | \$53,000                           |
| 3                   | 1 MG storage tank <sup>2</sup>                                                                            | 18,900               | 24                                   | \$5.63                      | \$62,000                           |
| 4                   | -                                                                                                         | 9,900                | 3                                    | \$1.44                      | \$64,000                           |
| 5                   | -                                                                                                         | 12,900               | 24                                   | \$1.80                      | \$63,000                           |
| <b>Total System</b> |                                                                                                           | <b>77,400</b>        | <b>106</b>                           | <b>\$23.4</b>               | <b>-</b>                           |

1. Costs are presented in December 2017 dollars

2. Storage requirements based on estimated demand for existing 106 irrigation meters.

**Table 18: Lakeside Reuse System Demand Summary by Phase**

| Phase        | Average Demand (MGD) |             |             |            | Peak Day Demand (MGD) |             |             |            |
|--------------|----------------------|-------------|-------------|------------|-----------------------|-------------|-------------|------------|
|              | Existing             | Future      | Total       | Cumulative | Existing              | Future      | Total       | Cumulative |
| 1            | 0.15                 | 0.00        | 0.15        | 0.15       | 0.68                  | 0.00        | 0.68        | 0.68       |
| 2            | 0.16                 | 0.04        | 0.19        | 0.34       | 1.96                  | 0.38        | 2.34        | 3.02       |
| 3            | 0.13                 | 0.18        | 0.31        | 0.65       | 1.00                  | 0.98        | 1.98        | 5.00       |
| 4            | 0.03                 | 0.09        | 0.11        | 0.76       | 0.15                  | 0.98        | 1.13        | 6.13       |
| 5            | 0.002                | 0.04        | 0.04        | 0.80       | 0.01                  | 0.42        | 0.43        | 6.56       |
| <b>Total</b> | <b>0.46</b>          | <b>0.34</b> | <b>0.80</b> | <b>-</b>   | <b>3.79</b>           | <b>2.76</b> | <b>6.56</b> | <b>-</b>   |

**Table 19: Preliminary Implementation Plan Schedule**

| Phase | Year of Completion |
|-------|--------------------|
| 1     | 2023               |
| 2     | 2025               |
| 3     | 2027               |
| 4     | TBD <sup>1</sup>   |
| 5     | TBD <sup>1</sup>   |

1. It is recommended that construction of Phases 4 and 5 be delayed until the reclaimed water demand increases in the areas serviced in those phases.



## 8 Financial Evaluation

---

The Town requested that a preliminary financial evaluation be conducted for the proposed reclaimed water system. The financial evaluation includes an assessment of the cost to the Town for the overall system based on the construction and operations and maintenance costs shown in Table 17. This financial evaluation is only preliminary and it is recommended that the Town conduct a formal rate study prior to implementing the reclaimed water program. This section begins with a discussion of available financial strategies and funding opportunities and then concludes by presenting the financial evaluation.

### 8.1 FINANCING STRATEGIES AND FUNDING OPPORTUNITIES

As a consequence of the increased appreciation of the benefits of reclaimed water, there are several funding opportunities that may be available to cities and utilities who seek to implement reuse programs. There are generally three methods of financing these sorts of projects, which are often employed in combination: federal or state grants, federal or state loans, and rate/fee restructuring. In most cases, a combination of federal and state grants and loans fund the up-front capital expenditures. With these sorts of sources, eligibility requirements have to be met, and most of these programs explicitly state that funds cannot be employed for any O&M needs. Water and wastewater revenue bonds can also serve to spread the capital costs over a considerable amount of time. The following sections examine some of the more common federal and state programs used to finance capital costs of reuse projects.

### 8.2 FEDERAL AND STATE FUNDING PROGRAMS

The Bureau of Reclamation may provide funding through Title XVI water reuse grants, which finance project construction in the 17 western states. The award to construct reclaimed water facilities is often preceded by funding for appropriate studies and research regarding the best reuse program for the area. These monies are given to economically and environmentally sound projects that are not eligible for other types of federal funding.



Texas has developed several programs to facilitate the implementation of reuse projects, many of which are sponsored by the Texas Water Development Board (TWDB). One program available through the TWDB is the State Participation Program, which enables the TWDB to assume a temporary ownership interest in regional projects when the local sponsors are unable to assume debt for the optimally sized facility. While this program has typically been used for water system construction, the TWDB has indicated that it can also be applied to reuse projects if excess capacity is provided in the reuse facilities to meet anticipated future demands. The goal of this program is to allow for the “right sizing” of projects in consideration of future growth. For new water supply projects, the TWDB will fund up to 80% of the costs and for other projects up to 50% of the costs. Only excess capacity can be funded through this program.

Another program available through the TWDB is the State Water Implementation Fund for Texas (SWIFT). Funding through SWIFT is used specifically for recommended water management strategy projects within the most recently adopted state water plan, and only components included in the plan are eligible. Types of eligible projects include conservation and reuse, desalinating groundwater and seawater, building new pipelines, developing reservoirs and well fields, and purchasing water rights. The TWDB offers a variety of financing options through SWIFT including low-interest loans, deferred loans, and board participation to accommodate the diversity of projects included in the state water plan. Funds can be used for planning, design, acquisition, and construction costs, and SWIFT also has the ability to provide multi-year commitments for entities that have project funding needs spanning several years.

Aside from TWDB’s initiatives, the EPA guides the management of another state-managed source of financing, the State Revolving Fund (SRF). Under this program, low-interest loans, 80% of which are federally funded, are offered to entities for use in upgrading existing facilities, installing water-efficient devices, and supporting tax incentives for water conservation programs. Under the broader umbrella of the SRF are the Clean Water SRF and the Drinking Water SRF; the former focuses more on improvements for wastewater projects, while the latter funds are intended for water improvements that address health and compliance issues for existing water utilities.



SRF funds can also be used for development of water conservation plans or the development of water conservation regulations. Water reuse projects can be funded under either the Clean Water SRF or Drinking Water SRF.

### **8.3 DEBT REPAYMENT AND OPERATIONS AND MAINTENANCE FINANCING**

Debt recovery and operations and maintenance costs can be recovered through monthly water or sewer rates and/or through direct charges for the reclaimed water. Many utilities have struggled with how to set volume rates for reclaimed water. Often, in order to insure that the water is marketable, the reclaimed water rate is set as a percentage of the potable water rate. In other instances, elimination of effluent discharges to receiving streams was the goal of the program and reclaimed water was provided to customers at a very minimal cost. However, as experience with reclaimed water rate systems develops, it is becoming recognized that the best method of allocating costs is through a cost-of-service evaluation that is consistent and defensible. Often sharing costs among the wastewater, water and reclaimed water users is justified and can minimize the burden on any one group of users.

### **8.4 PROJECTED PAYBACK PERIOD FOR LAKESIDE REUSE SYSTEM**

The projected payback period for the Lakeside Reuse System project was evaluated based on the project phasing in Table 19. The payback period is defined as the time elapsed between the initial capital investment in the project and the break-even year, i.e. when the total cumulative revenue from the project is equal to the total cumulative expenditures (including debt service and operation and maintenance costs). It should be noted that the estimated payback period is very sensitive to financing assumptions, such as principal forgiveness of the construction cost, interest rate of the loan, and inflation. The assumptions used in this evaluation are shown in Table 20. The TWDB offers loans at 130 basis points (1.3%) less than the market interest rate<sup>6</sup>, and based on

---

<sup>6</sup> "Clean Water State Revolving Fund (CWSRF) Loan Program." *Clean Water State Revolving Fund* | Texas Water Development Board, [www.twdb.texas.gov/financial/programs/CWSRF/](http://www.twdb.texas.gov/financial/programs/CWSRF/).



the Town's current bond rating, a conservative annual finance interest rate of 2.0% was selected.

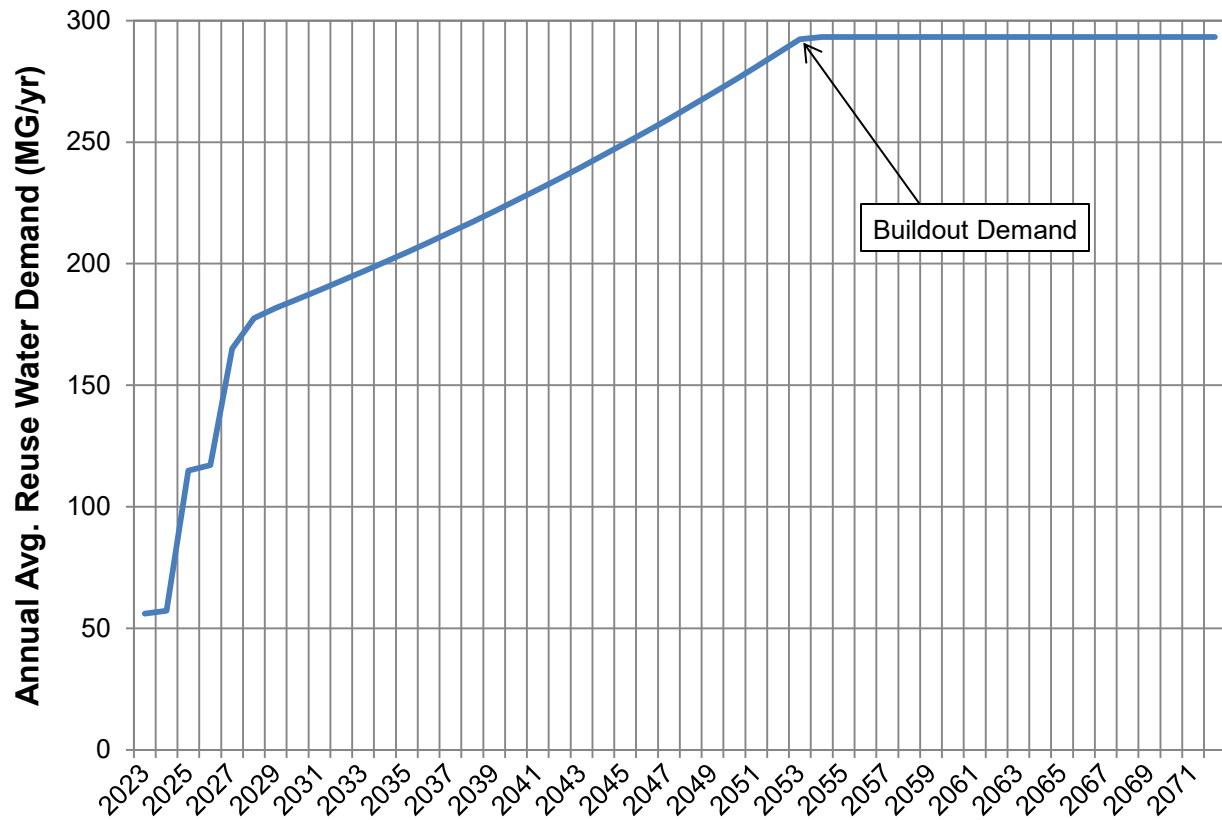
**Table 20: Financing Assumptions**

| Financial Variable                                            | Value    |
|---------------------------------------------------------------|----------|
| Capital Recovery Period                                       | 20 Years |
| Project Life                                                  | 50 Years |
| Annual Interest Rate                                          | 2.0%     |
| Annual Inflation Rate                                         | 3.0%     |
| Percent of Total Capital Cost Funded by Grant Funding Program | 10%      |
| Reclaimed Water Rate (Percentage of Potable Water Rate)       | 85%      |

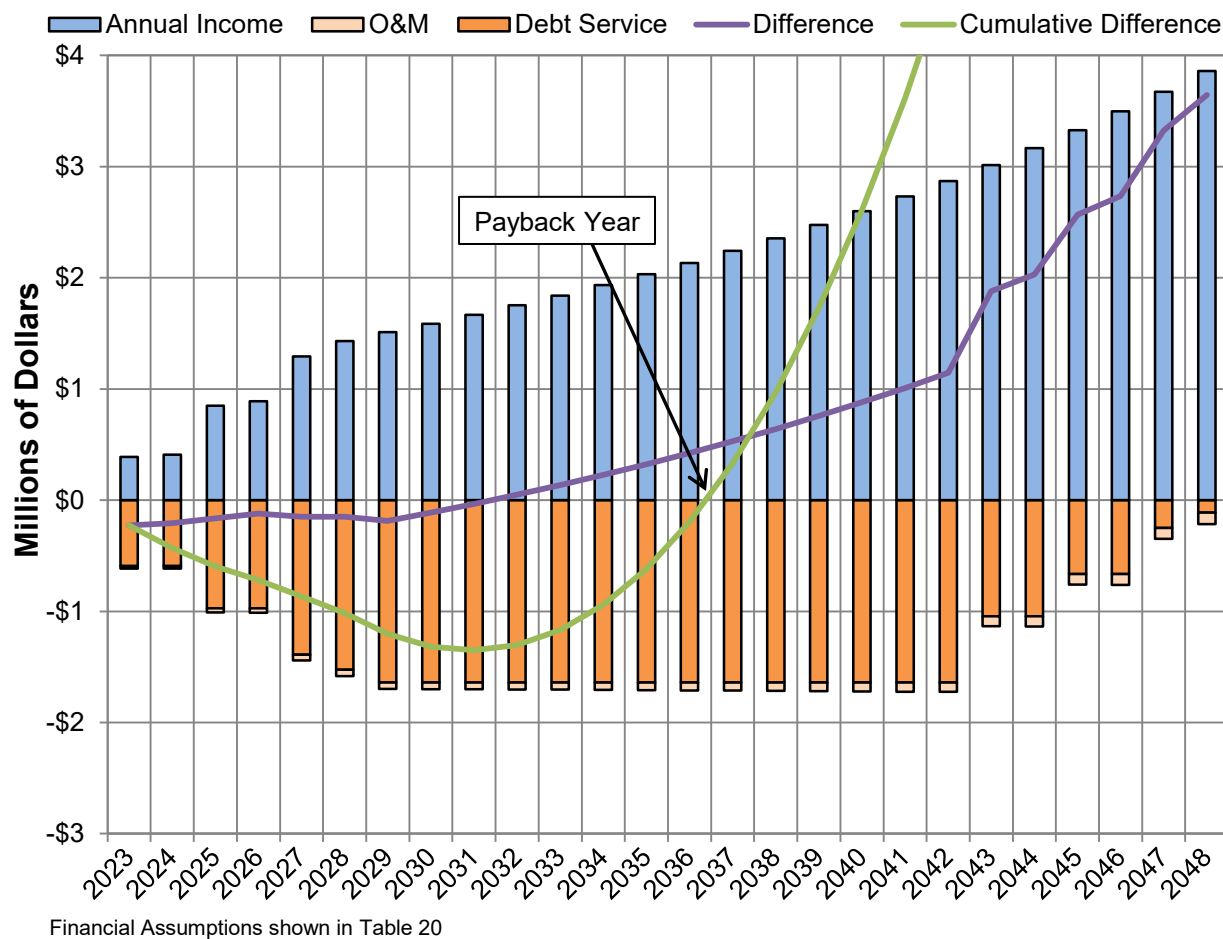
The annual average reuse water demand assumed for this evaluation is shown in Figure 20. A summary of the analysis is shown in Figure 21, and the calculated payback year would occur in 2037. If the Town were to charge 85% of the current 2018 potable rate for reuse water, the top 10 average monthly consumers would have an average bill reduction of 14%.<sup>7</sup> The overall current customer base would see an average bill reduction of 11%. A more detailed customer analysis is shown in Appendix G. This evaluation does not take into account the loss of revenue caused by replacing potable water sales with reclaimed sales, since reclaimed water will be sold at a lower rate than potable water.

---

<sup>7</sup> This calculation assumes that the base charge for a reclaimed water meter remains the same as the base charge for a potable water meter. Only the consumptive use rates for reclaimed water would be reduced.



**Figure 20: Projected Annual Reuse Water Demand**



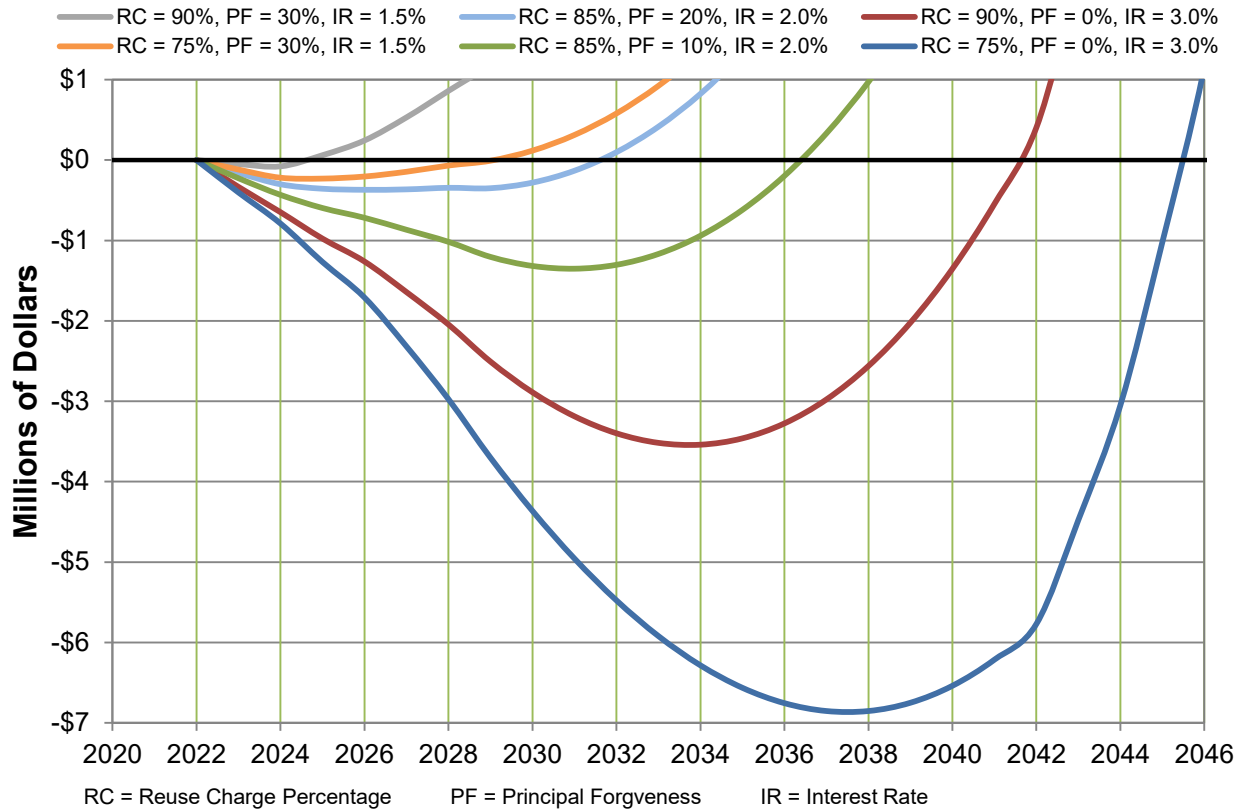
**Figure 21: Reclaimed Water System Financial Analysis**

## 8.5 POTENTIAL IMPACT OF FINANCIAL ASSUMPTIONS

A sensitivity analysis was performed to evaluate the impacts that principal forgiveness (from grants, or other entities), annual finance interest rate, and the rate charged for reuse water could have on the payback period for the Town. The payback year of the reuse water system as a whole was computed across a range for all three variables, principal forgiveness, interest rate, and reuse water charge. The principal forgiveness ranged from 0 to 30% of the total capital cost of all phases; the interest rate varied between 1.5%, 2.0%, and 3.0%, and reuse water rate ranged from 75% to 90% of the projected potable water rates charged. The cumulative difference between estimated net costs and net profits were evaluated and the respective payback year was



calculated in each scenario. Best and worst case scenarios along with a few other scenarios are summarized in Figure 22. The payback year ranges from 2025 in the best case scenario to 2046 in the worst case scenario. The rest of the evaluated scenarios used to calculate payback periods are included in Appendix G.



**Figure 22: Cumulative Difference for Several Scenarios**



## 9 Summary and Recommendations

---

As the Town expands and potable water demands increase, irrigating with reclaimed water instead of potable water is an effective conservation strategy available to the Town. The proximity of the Lakeside Business District to the Town's WWTP and its current irrigation demand make reclaimed water irrigation an attractive option for the area. Furthermore, future development in this area is anticipated to increase the amount of potable water used for irrigation.

However, significant infrastructure will be required to deliver reclaimed water to irrigation meters throughout the Lakeside Business District including: two pump stations, two storage tanks, a chemical feed system, and an updated UV system at the WWTP, along with approximately 15 miles of pipeline.

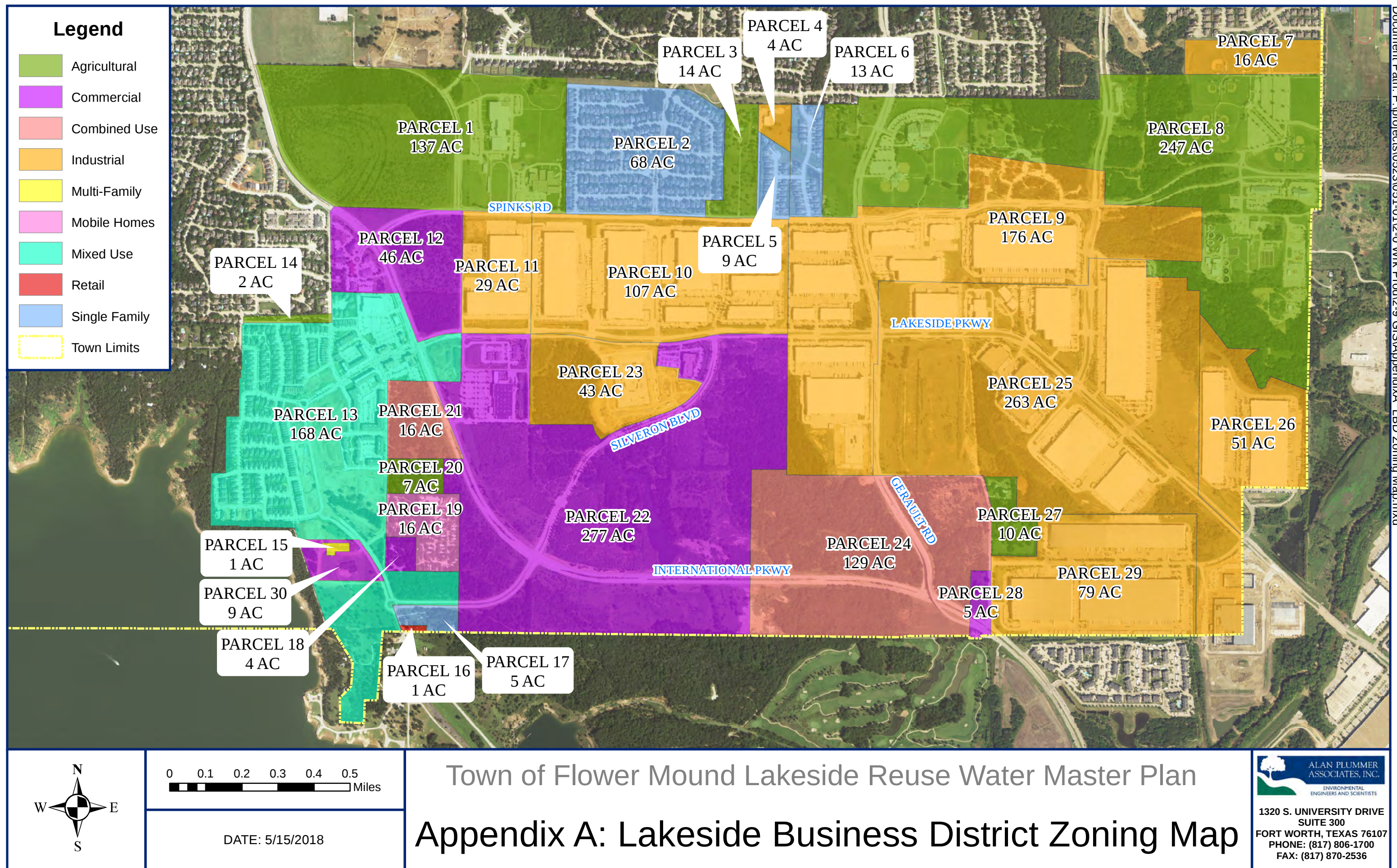
A detailed economic evaluation was not included in the scope of this master plan. If the Town desires to continue pursuing development of a reclaimed water system in the Lakeside Business District, it is recommended that a rate study be completed to determine a rate structure for reclaimed water. Additional economic factors should be considered when determining the economic feasibility of constructing this Lakeside Reuse System. For example, state and federal agencies have developed low interest loan programs that are specifically reserved for projects that promote water conservation by using reclaimed water. In some instances, grant funds are also available through these same programs.

The following initial actions are recommended:

- Launch a public outreach program;
- Develop a reclaimed water ordinance;
- Develop a standard contract for reclaimed water customers;
- Perform a rate study for the Lakeside Reuse System;
- Pursue State and Federal funding opportunities; and
- Replace the UV System.

## Appendix A – Lakeside Business District Zoning Map

---

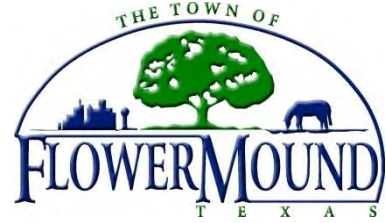


## Appendix B – Top Irrigation Users Contact Information and Surveys

| Meter Number | Average Monthly Consumption (gallons) | Contact Name    | Phone Number | Email Address                   |
|--------------|---------------------------------------|-----------------|--------------|---------------------------------|
| 86-2995-99   | 342,244                               | Ryley Hastings  | 469-763-2403 | Ryley.Hastings@stryker.com      |
| 86-9210-99   | 314,926                               | Daniel Davila   | 512-826-2727 | ddavila@exeterpg.com            |
| 86-3445-99   | 287,230                               | Christy Walters | 972-361-6725 | Christy.walters@dukerealty.com  |
| 86-3260-99   | 282,990                               | Greg Simnacher  | 214-267-0457 | greg.simnacher@streamrealty.com |
| 86-5971-99   | 281,499                               | Michael Johnson | 214-232-8579 | -                               |

## Reclaimed Water Use Survey

Property Name: Stryker Communications  
 Contact Person: Ryley Hastings  
 Title: Facilities Lead  
 Phone Number: 469-470-4134  
 Email Address: Ryley.Hastings@Stryker.com  
 Mailing Address: 571 Silveron Blvd Flower Mound, TX 75028  
 Meter Number: 86-2995-99



### System Information

|                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                      |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|----------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Does the system have a separate irrigation meter?                                                                                                                                                                                                | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                                                                                                                                                                                                                  |
| Are there any other connections to the irrigation system for uses other than irrigation?                                                                                                                                                         | <input type="checkbox"/> Complex Pools <input type="checkbox"/> Drinking Fountains<br><input type="checkbox"/> Decorative Fountains <input type="checkbox"/> Hose Bibs<br><input type="checkbox"/> Dumpster Wash Down <input type="checkbox"/> Car Washing <input type="checkbox"/> Ponds<br><input type="checkbox"/> Water Features <input type="checkbox"/> Cooling Towers<br><input type="checkbox"/> Other _____ |
| Do you have any onsite storage or booster pumping for your irrigation system?                                                                                                                                                                    | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                                                                                                                                                                                                                                  |
| How many acres are irrigated?                                                                                                                                                                                                                    | Approximately 12 Acres                                                                                                                                                                                                                                                                                                                                                                                               |
| How many zones does this irrigation system have?                                                                                                                                                                                                 | 77                                                                                                                                                                                                                                                                                                                                                                                                                   |
| If known, what is the flow rate (in gpm) needed to serve each zone or alternatively, what is the estimated maximum flow rate required during any irrigation period?                                                                              | Approximately 68gpm per zone average, 204 max for 3 simultaneous zones.                                                                                                                                                                                                                                                                                                                                              |
| How many irrigation zones are typically irrigated simultaneously?                                                                                                                                                                                | 3                                                                                                                                                                                                                                                                                                                                                                                                                    |
| How many irrigation heads are in each zone?                                                                                                                                                                                                      | 14 Avg.                                                                                                                                                                                                                                                                                                                                                                                                              |
| What is the approximate flowrate per irrigation head?                                                                                                                                                                                            | 4.8 gpm (1.6gpm sprays, 8gpm rotors)                                                                                                                                                                                                                                                                                                                                                                                 |
| What is the maximum/minimum operating pressure on the system?                                                                                                                                                                                    | 40/100                                                                                                                                                                                                                                                                                                                                                                                                               |
| What is the irrigation system water window (E.G. Number of hours to water the property)?                                                                                                                                                         | 5 During growing season                                                                                                                                                                                                                                                                                                                                                                                              |
| Is there a preference for the time of day the irrigation system should be operated?                                                                                                                                                              | 22:00-05:00                                                                                                                                                                                                                                                                                                                                                                                                          |
| How many days per week do you irrigate during peak summer period (in the absence of drought restrictions)?                                                                                                                                       | <input checked="" type="checkbox"/> Monday <input type="checkbox"/> Tuesday <input checked="" type="checkbox"/> Wednesday <input type="checkbox"/> Thursday<br><input checked="" type="checkbox"/> Friday <input type="checkbox"/> Saturday <input checked="" type="checkbox"/> Sunday                                                                                                                               |
| Would you be willing to change the watering schedule if needed?                                                                                                                                                                                  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                                                                                                                                                                                                                  |
| To convert to reclaimed water, all valve boxes and other exposed piping or controls will need to be designated with purple covers, tape, etc. Identify the number of such exposed elements (E.G. Ten 6" Round, Fifteen 14x19 Rectangular, ETC.). | 17x30" Jumbo Valve Box - 19<br>10" Round Valve Box - 67<br>6" Round Valve Box - 22                                                                                                                                                                                                                                                                                                                                   |
| Do you foresee any connection or retrofit issues with your system if you were to convert to reclaimed water? What would they be?                                                                                                                 | None foreseen                                                                                                                                                                                                                                                                                                                                                                                                        |

## Reclaimed Water Use Survey

**Property Name:** SCG Lakeside  
Commerce Center  
1410 Lakeside Pkwy  
Flower Mound, Tx



**Contact Person:** Michael Johnson, Lawnscape of Dallas, LTD.

**Title:**

**Phone Number:** 214-232-8579

**Email Address:**

**Mailing Address:**

### System Information

|                                                                                                                                                                                                                                                  |                                                                                                                                                                                                                                                                                                                                                                                                                          |
|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|--------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------------|
| Does the system have a separate irrigation meter?                                                                                                                                                                                                | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                                                                                                                                                                                                                      |
| Are there any other connections to the irrigation system for uses other than irrigation?                                                                                                                                                         | <input type="checkbox"/> Complex Pools <input type="checkbox"/> Drinking Fountains<br><input type="checkbox"/> Decorative Fountains <input type="checkbox"/> Hose Bibs<br><input type="checkbox"/> Dumpster Wash Down <input type="checkbox"/> Car Washing <input type="checkbox"/> Ponds<br><input type="checkbox"/> Water Features <input type="checkbox"/> Cooling Towers<br><input type="checkbox"/> Other <u>No</u> |
| Do you have any onsite storage or booster pumping for your irrigation system?                                                                                                                                                                    | <input type="checkbox"/> Yes <input checked="" type="checkbox"/> No                                                                                                                                                                                                                                                                                                                                                      |
| How many acres are irrigated?                                                                                                                                                                                                                    | <u>0.1-2</u>                                                                                                                                                                                                                                                                                                                                                                                                             |
| How many zones does this irrigation system have?                                                                                                                                                                                                 | <u>37</u>                                                                                                                                                                                                                                                                                                                                                                                                                |
| If known, what is the flow rate (in gpm) needed to serve each zone or alternatively, what is the estimated maximum flow rate required during any irrigation period?                                                                              | <u>356 GPM - 55 GPM</u>                                                                                                                                                                                                                                                                                                                                                                                                  |
| How many irrigation zones are typically irrigated simultaneously?                                                                                                                                                                                | <u>1</u>                                                                                                                                                                                                                                                                                                                                                                                                                 |
| How many irrigation heads are in each zone?                                                                                                                                                                                                      | <u>18-20</u>                                                                                                                                                                                                                                                                                                                                                                                                             |
| What is the approximate flowrate per irrigation head?                                                                                                                                                                                            | <u>Spray 1.5 GPM Rotor 4 GPM</u>                                                                                                                                                                                                                                                                                                                                                                                         |
| What is the maximum/minimum operating pressure on the system?                                                                                                                                                                                    | <u>80 PSI</u>                                                                                                                                                                                                                                                                                                                                                                                                            |
| What is the irrigation system water window (E.G. Number of hours to water the property)?                                                                                                                                                         | <u>16 hr 6:00 PM - 10:00 AM</u>                                                                                                                                                                                                                                                                                                                                                                                          |
| Is there a preference for the time of day the irrigation system should be operated?                                                                                                                                                              | <u>8:00 PM - 5:00 AM</u>                                                                                                                                                                                                                                                                                                                                                                                                 |
| How many days per week do you irrigate during peak summer period (in the absence of drought restrictions)?                                                                                                                                       | <input checked="" type="checkbox"/> Monday <input type="checkbox"/> Tuesday <input checked="" type="checkbox"/> Wednesday <input type="checkbox"/> Thursday<br><input checked="" type="checkbox"/> Friday <input type="checkbox"/> Saturday <input checked="" type="checkbox"/> Sunday                                                                                                                                   |
| Would you be willing to change the watering schedule if needed?                                                                                                                                                                                  | <input checked="" type="checkbox"/> Yes <input type="checkbox"/> No                                                                                                                                                                                                                                                                                                                                                      |
| To convert to reclaimed water, all valve boxes and other exposed piping or controls will need to be designated with purple covers, tape, etc. Identify the number of such exposed elements (E.G. Ten 6" Round, Fifteen 14x19 Rectangular, ETC.). | <u>40 10" round</u><br><u>7 12x15 rectangular</u>                                                                                                                                                                                                                                                                                                                                                                        |
| Do you foresee any connection or retrofit issues with your system if you were to convert to reclaimed water? What                                                                                                                                |                                                                                                                                                                                                                                                                                                                                                                                                                          |

- ① Will the spray heads and rotors need to be retrofitted
- ② Will a master valve be required
- ③ Will a whole system filter be needed
- ④ Are there dissolved solids or chemicals that would stain or affect stucco walls or stone facades
- ⑤ Backflow requirements; DCVA or RPZ



## Appendix C – Current Irrigation Meters and Demands in the Study Area

| Customer                                  | Meter Number | Phase | Use Type <sup>1</sup> | Months of Data | Peak Month | Max Month (gal) | Max Month (gpm) | Peak Hour (gpm) | Average Consumption (gal per month) |
|-------------------------------------------|--------------|-------|-----------------------|----------------|------------|-----------------|-----------------|-----------------|-------------------------------------|
| TOWN METER                                | 55-0265-99   | 1     | A                     | 5              | Aug-17     | 1,679,000       | 38.33           | 245.33          | 959,900                             |
| TOWN METER                                | 55-0055-99   | 1     | A                     | 5              | Aug-17     | 2,039,500       | 46.56           | 298.01          | 886,700                             |
| TOWN METER                                | 55-0165-99   | 1     | A                     | 5              | Jun-17     | 687,700         | 15.70           | 100.49          | 527,080                             |
| TOWN METER                                | 86-0380-99   | 1     | C                     | 5              | Jun-17     | 685,000         | 15.64           | 100.09          | 450,400                             |
| CHI / SILVERON LP <sup>2</sup>            | 86-2995-99   | 3     | C                     | 7              | Sep-17     | 706,500         | 16.13           | 103.23          | 385,025                             |
| BIG BOX PROPERTY OWNER <sup>2</sup>       | 86-9210-99   | 2     | C                     | 40             | Sep-16     | 2,844,000       | 64.93           | 415.56          | 314,926                             |
| DUKE REALTY LMTD PARTNERSHIP <sup>2</sup> | 86-3445-99   | 2     | C                     | 111            | Nov-13     | 2,353,500       | 53.73           | 343.89          | 287,230                             |
| LIT INDUSTRIAL LIMITED <sup>2</sup>       | 86-3260-99   | 2     | C                     | 80             | Jul-08     | 1,596,000       | 36.44           | 233.21          | 282,990                             |
| SCG LAKESIDE COMMERCE CENTER <sup>2</sup> | 86-5971-99   | 3     | C                     | 120            | Sep-07     | 945,500         | 21.59           | 138.16          | 281,499                             |
| THE HOME DEPOT                            | 86-5962-99   | 3     | C                     | 123            | Sep-12     | 1,071,300       | 24.46           | 156.54          | 280,593                             |
| LIT HW1 LP                                | 86-6024-99   | 2     | C                     | 103            | Sep-07     | 1,107,500       | 25.29           | 161.83          | 267,978                             |
| TOWN METER                                | 86-0326-99   | 2     | C                     | 2              | Sep-17     | 1,078,000       | 24.61           | 157.52          | 267,500                             |
| TAF DALLAS INDUSTRIAL PORTIFOLIO LP       | 86-4026-99   | 3     | C                     | 37             | Jul-15     | 1,533,900       | 35.02           | 224.13          | 258,997                             |
| NATIONAL INDUSTRIAL HOLDINGS              | 86-5215-99   | 2     | C                     | 83             | Jul-09     | 1,177,500       | 26.88           | 172.05          | 246,925                             |
| TOWN METER                                | 55-0185-99   | 1     | A                     | 5              | Aug-17     | 729,100         | 16.65           | 106.54          | 246,440                             |
| TOWN METER                                | 86-0320-99   | 2     | C                     | 4              | May-17     | 597,500         | 13.64           | 87.31           | 242,500                             |
| STACY FAMILIES ENTERPRISES                | 86-6040-99   | 2     | C                     | 67             | Aug-09     | 1,346,500       | 30.74           | 196.75          | 231,533                             |
| CHI / SILVERON LP                         | 86-2990-99   | 3     | C                     | 9              | May-17     | 429,800         | 9.81            | 62.80           | 231,211                             |
| LMEG WIRELESS LLC                         | 86-2890-99   | 2     | C                     | 10             | Apr-17     | 1,391,000       | 31.76           | 203.25          | 230,960                             |
| MI WINDOWS AND DOORS                      | 86-9870-99   | 3     | C                     | 29             | Jun-16     | 596,100         | 13.61           | 87.10           | 229,340                             |
| KOHLER CO                                 | 86-3470-99   | 1     | C                     | 101            | Aug-07     | 1,739,000       | 39.70           | 254.10          | 222,077                             |
| WAYFAIR LLC                               | 86-9880-99   | 3     | C                     | 18             | Jul-16     | 1,052,500       | 24.03           | 153.79          | 221,124                             |
| TOWN METER                                | 55-0085-99   | 1     | A                     | 5              | Jun-17     | 443,000         | 10.11           | 64.73           | 208,920                             |
| SCG LAKESIDE COMMERCE CENTER              | 86-4260-99   | 3     | C                     | 102            | May-09     | 757,500         | 17.29           | 110.68          | 200,576                             |
| EASTGROUP PROPERTIES                      | 86-9920-99   | 3     | R                     | 25             | Oct-15     | 774,200         | 17.68           | 113.13          | 195,496                             |
| TOWN METER                                | 55-0195-99   | 1     | A                     | 4              | Jul-17     | 355,300         | 8.11            | 51.92           | 194,740                             |
| IPT LAKESIDE CORPORATE CENTER             | 86-9220-99   | 2     | C                     | 112            | Aug-15     | 806,500         | 18.41           | 117.84          | 192,540                             |
| IPT LAKESIDE CORPORATE CENTER             | 86-9240-99   | 3     | C                     | 110            | Jul-13     | 815,500         | 18.62           | 119.16          | 189,992                             |
| BEST BUY STORES LP                        | 86-6033-99   | 2     | C                     | 108            | Sep-14     | 684,000         | 15.62           | 99.95           | 184,385                             |
| SPEARS MANUFACTURING                      | 86-3855-99   | 2     | C                     | 102            | Feb-11     | 2,519,500       | 57.52           | 368.15          | 184,188                             |
| BIG BOX PROPERTY OWNER                    | 86-4116-99   | 2     | C                     | 34             | Aug-15     | 617,900         | 14.11           | 90.29           | 180,805                             |
| TOWN METER                                | 55-0285-99   | 1     | A                     | 5              | Sep-17     | 264,000         | 6.03            | 38.58           | 179,300                             |
| KOHLER CO                                 | 86-3505-99   | 2     | C                     | 90             | Aug-15     | 976,000         | 22.28           | 142.61          | 178,883                             |
| AZURE LAKESIDE                            | 86-0945-99   | 4     | R                     | 24             | Jun-16     | 563,610         | 12.87           | 82.35           | 169,383                             |
| WIFPIR PROPERTIES LLC                     | 86-8860-99   | 3     | C                     | 98             | Sep-14     | 887,500         | 20.26           | 129.68          | 164,847                             |
| HEAT AND CONTROL INC                      | 86-3830-99   | 2     | C                     | 116            | Jul-13     | 871,800         | 19.90           | 127.39          | 160,305                             |
| MI WINDOWS AND DOORS                      | 86-9865-99   | 3     | C                     | 28             | Jul-15     | 687,500         | 15.70           | 100.46          | 154,287                             |
| DUKE REALTY LMTD PARTNERSHIP              | 86-3455-99   | 2     | C                     | 103            | Nov-13     | 990,500         | 22.61           | 144.73          | 153,472                             |
| EASTGROUP PROPERTIES                      | 86-9900-99   | 2     | C                     | 25             | Sep-16     | 495,500         | 11.31           | 72.40           | 151,472                             |

| Customer                            | Meter Number | Phase | Use Type <sup>1</sup> | Months of Data | Peak Month | Max Month (gal) | Max Month (gpm) | Peak Hour (gpm) | Average Consumption (gal per month) |
|-------------------------------------|--------------|-------|-----------------------|----------------|------------|-----------------|-----------------|-----------------|-------------------------------------|
| IPT LAKESIDE CORPORATE CENTER       | 86-5265-99   | 3     | C                     | 42             | Oct-15     | 545,300         | 12.45           | 79.68           | 143,542                             |
| LISANTI FOODS                       | 86-9890-99   | 3     | C                     | 19             | Mar-16     | 424,500         | 9.69            | 62.03           | 132,476                             |
| COMMUNICATIONS TEST DESIGN INC      | 86-9205-99   | 2     | C                     | 80             | Sep-13     | 2,870,500       | 65.54           | 419.43          | 132,229                             |
| LIT INDUSTRIAL LIMITED              | 86-3285-99   | 2     | C                     | 96             | Jun-08     | 825,000         | 18.84           | 120.55          | 131,404                             |
| MORTGAGE FINANCIAL SERVICES         | 86-8825-99   | 3     | C                     | 92             | May-11     | 476,500         | 10.88           | 69.63           | 130,964                             |
| TOWN METER                          | 55-0365-99   | 1     | A                     | 4              | Aug-17     | 214,000         | 4.89            | 31.27           | 130,760                             |
| TOWN METER                          | 86-0390-99   | 2     | C                     | 5              | Jul-17     | 187,000         | 4.27            | 27.32           | 128,400                             |
| IPT LAKESIDE CORPORATE CENTER       | 86-5230-99   | 3     | C                     | 47             | Aug-13     | 633,100         | 14.45           | 92.51           | 128,125                             |
| WIFPIR PROPERTIES LLC               | 86-8855-99   | 3     | C                     | 95             | Aug-09     | 429,000         | 9.79            | 62.68           | 120,187                             |
| TOWN METER                          | 55-0245-99   | 1     | A                     | 5              | Jun-17     | 190,500         | 4.35            | 27.84           | 120,000                             |
| MORTGAGE FINANCIAL SERVICES         | 86-4705-99   | 3     | C                     | 78             | Aug-11     | 570,500         | 13.03           | 83.36           | 113,193                             |
| IPT LAKESIDE CORPORATE CENTER       | 86-5270-99   | 3     | C                     | 39             | Oct-15     | 551,300         | 12.59           | 80.56           | 113,113                             |
| LIT INDUSTRIAL LIMITED              | 86-3290-99   | 2     | C                     | 94             | Jun-08     | 811,900         | 18.54           | 118.63          | 110,442                             |
| LIT INDUSTRIAL LIMITED              | 86-3270-99   | 2     | C                     | 98             | Jun-08     | 2,175,900       | 49.68           | 317.94          | 105,934                             |
| AZURE LAKESIDE                      | 86-3515-99   | 4     | R                     | 34             | Aug-15     | 238,370         | 5.44            | 34.83           | 102,419                             |
| EASTGROUP PROPERTIES                | 86-9910-99   | 1     | C                     | 25             | Oct-15     | 261,600         | 5.97            | 38.22           | 102,184                             |
| TOWN METER                          | 55-0215-99   | 1     | A                     | 5              | Jul-17     | 151,100         | 3.45            | 22.08           | 95,700                              |
| GREYSTAR DEV                        | 86-3391-99   | 4     | R                     | 1              | Sep-17     | 182,930         | 4.18            | 26.73           | 91,465                              |
| CCA                                 | 86-5145-99   | 2     | C                     | 49             | Sep-13     | 536,600         | 12.25           | 78.41           | 90,411                              |
| MOVIE HOUSE & EATERY                | 86-3590-99   | 3     | R                     | 25             | Sep-15     | 670,200         | 15.30           | 97.93           | 82,624                              |
| TOWN METER                          | 55-0105-99   | 1     | A                     | 5              | Jun-17     | 107,000         | 2.44            | 15.63           | 77,700                              |
| TOWN METER                          | 55-0135-99   | 1     | A                     | 5              | Jun-17     | 135,000         | 3.08            | 19.73           | 75,900                              |
| TOWN METER                          | 55-0315-99   | 1     | A                     | 5              | Aug-17     | 118,300         | 2.70            | 17.29           | 74,520                              |
| TITAN CORRUGATED INC                | 86-9195-99   | 2     | C                     | 94             | Oct-07     | 417,000         | 9.52            | 60.93           | 72,027                              |
| TAF DALLAS INDUSTRIAL PORTIFOLIO LP | 86-4042-99   | 2     | C                     | 35             | Aug-15     | 223,600         | 5.11            | 32.67           | 69,022                              |
| AZURE LAKESIDE                      | 86-3566-99   | 4     | R                     | 27             | Sep-15     | 260,840         | 5.96            | 38.11           | 68,085                              |
| TOWN METER                          | 55-0225-99   | 1     | A                     | 4              | Aug-17     | 125,900         | 2.87            | 18.40           | 67,160                              |
| TAF DALLAS INDUSTRIAL PORTIFOLIO LP | 86-4041-99   | 2     | C                     | 35             | Dec-14     | 265,700         | 6.07            | 38.82           | 66,189                              |
| TOWN METER                          | 86-0430-99   | 5     | C                     | 5              | Jul-17     | 83,500          | 1.91            | 12.20           | 63,200                              |
| SCG LAKESIDE COMMERCE CENTER        | 86-4270-99   | 3     | C                     | 104            | May-12     | 396,500         | 9.05            | 57.94           | 56,408                              |
| AZURE LAKESIDE                      | 86-3520-99   | 4     | R                     | 34             | Aug-17     | 128,040         | 2.92            | 18.71           | 47,556                              |
| AZURE LAKESIDE                      | 86-0940-99   | 4     | R                     | 23             | Apr-16     | 187,190         | 4.27            | 27.35           | 45,386                              |
| TOWN METER                          | 86-0385-99   | 2     | C                     | 5              | Jul-17     | 65,030          | 1.48            | 9.50            | 42,508                              |
| GREYSTAR DEV                        | 86-0970-99   | 4     | R                     | 22             | Apr-16     | 138,580         | 3.16            | 20.25           | 39,614                              |
| TOWN METER                          | 55-0345-99   | 1     | A                     | 2              | Sep-17     | 158,300         | 3.61            | 23.13           | 37,580                              |
| TOWN METER                          | 86-0631-99   | 4     | R                     | 5              | Aug-17     | 67,640          | 1.54            | 9.88            | 28,546                              |
| ONCOR ELECTRIC DELIVERY             | 86-3915-99   | 3     | A                     | 66             | Sep-08     | 204,000         | 4.66            | 29.81           | 26,967                              |
| LAKESIDE DFW RETAIL                 | 86-3186-99   | 4     | R                     | 16             | Jul-16     | 37,670          | 0.86            | 5.50            | 24,747                              |
| AZURE LAKESIDE                      | 86-3573-99   | 4     | R                     | 28             | Aug-15     | 130,740         | 2.98            | 19.10           | 23,948                              |

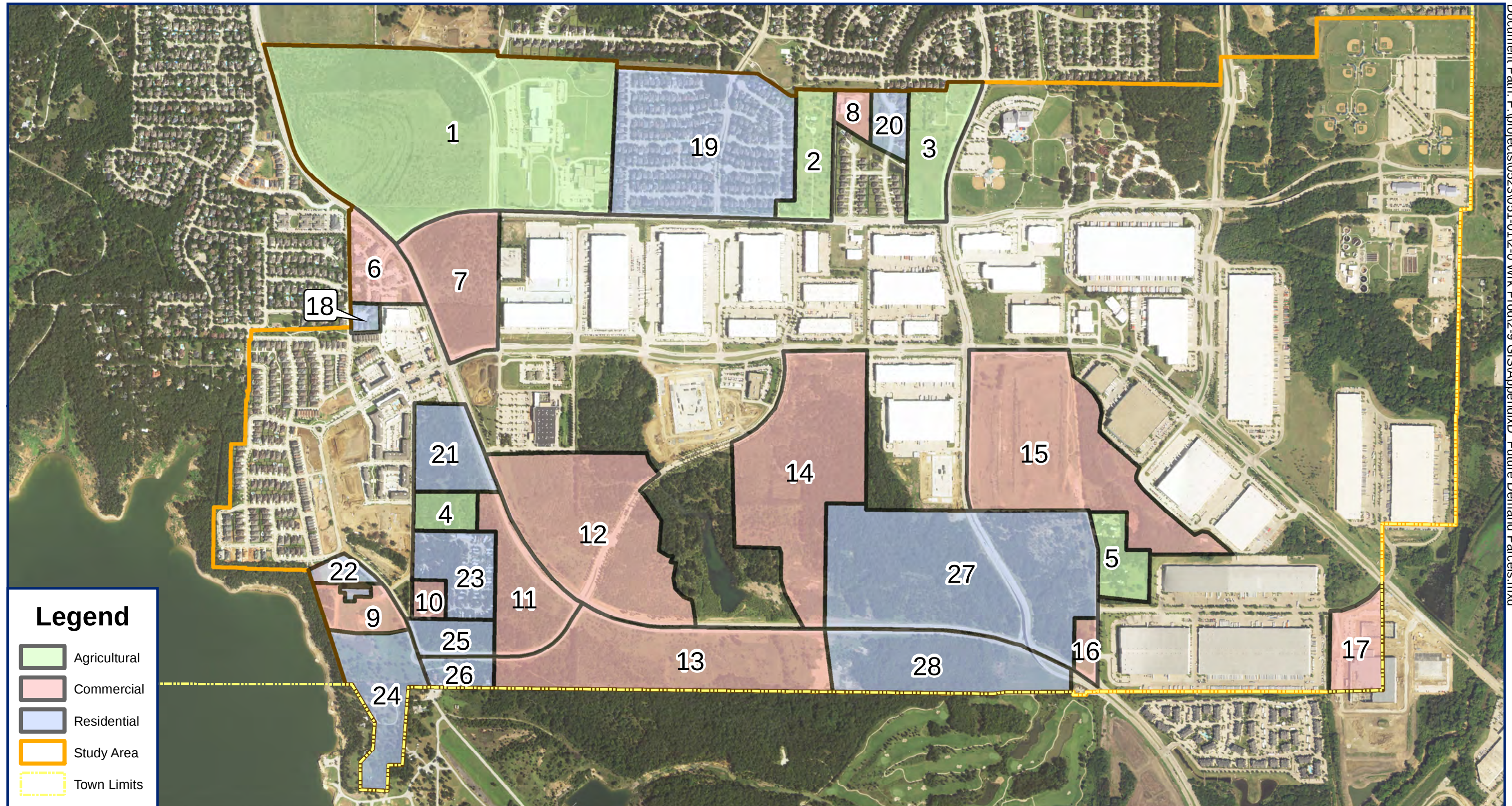
| Customer                      | Meter Number | Phase | Use Type <sup>1</sup> | Months of Data | Peak Month | Max Month (gal) | Max Month (gpm) | Peak Hour (gpm) | Average Consumption (gal per month) |
|-------------------------------|--------------|-------|-----------------------|----------------|------------|-----------------|-----------------|-----------------|-------------------------------------|
| TOWN METER                    | 86-0570-99   | 4     | R                     | 5              | May-17     | 28,500          | 0.65            | 4.16            | 23,000                              |
| TOWN METER                    | 86-0655-99   | 4     | R                     | 5              | Aug-17     | 32,710          | 0.75            | 4.78            | 18,526                              |
| AZURE LAKESIDE                | 86-3574-99   | 4     | R                     | 24             | Aug-15     | 78,580          | 1.79            | 11.48           | 17,689                              |
| TOWN METER                    | 86-0410-99   | 4     | C                     | 5              | Sep-17     | 17,500          | 0.40            | 2.56            | 15,900                              |
| GREYSTAR DEV                  | 86-5480-99   | 4     | R                     | 2              | Sep-17     | 28,290          | 0.65            | 4.13            | 15,030                              |
| AZURE LAKESIDE                | 86-3246-99   | 4     | R                     | 30             | Sep-17     | 53,710          | 1.23            | 7.85            | 13,986                              |
| KOHLER CO                     | 86-3510-99   | 1     | A                     | 79             | Dec-10     | 229,500         | 5.24            | 33.53           | 13,793                              |
| GREYSTAR DEV                  | 86-5470-99   | 4     | R                     | 2              | Aug-17     | 22,270          | 0.51            | 3.25            | 12,603                              |
| IPT LAKESIDE CORPORATE CENTER | 86-5973-99   | 3     | C                     | 44             | Sep-11     | 98,000          | 2.24            | 14.32           | 6,757                               |
| AZURE LAKESIDE                | 86-3370-99   | 4     | R                     | 31             | May-16     | 22,460          | 0.51            | 3.28            | 4,820                               |
| TOWN METER                    | 55-0035-99   | 1     | A                     | 3              | Jun-17     | 4,500           | 0.10            | 0.66            | 2,300                               |
| TOWN METER                    | 55-0255-99   | 1     | A                     | 5              | Aug-17     | 2,000           | 0.05            | 0.29            | 1,300                               |
| TOWN METER (NEW)              | 55-0735-99   | 1     | A                     | 1              | Sep-17     | 200             | 0.00            | 0.03            | 200                                 |
| TOWN METER                    | 55-0325-99   | 1     | A                     | 1              | Aug-17     | 180             | 0.00            | 0.03            | 36                                  |
| LIT HW1 LP                    | 86-6017-99   | 2     | C                     | 2              | Aug-15     | 400             | 0.01            | 0.06            | 4                                   |
| GREYSTAR DEV                  | 86-3523-99   | 4     | R                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| TOWN METER (NEW)              | 55-0725-99   | 1     | A                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| TOWN METER                    | 86-0585-99   | 4     | R                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| TOWN METER                    | 55-0145-99   | 1     | A                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| TOWN METER                    | 86-0420-99   | 3     | R                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| TOWN METER                    | 55-0175-99   | 1     | A                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| TOWN METER                    | 86-0405-99   | 5     | C                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| TOWN METER                    | 86-0395-99   | 5     | C                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| TOWN METER                    | 86-0580-99   | 4     | R                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| GREYSTAR DEV                  | 86-3521-99   | 4     | R                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| TOWN METER                    | 86-0322-99   | 2     | C                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| GREYSTAR DEV                  | 86-3393-99   | 4     | R                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |
| GREYSTAR DEV                  | 86-3394-99   | 4     | R                     | 0              | -          | 0               | 0.00            | 0.00            | 0                                   |

<sup>1</sup>A=Agricultural; C=Commercial; R=Residential<sup>2</sup>Contacted customer to inform of reclaimed water master plan

**Total**      **8,433**      **14,055,096**

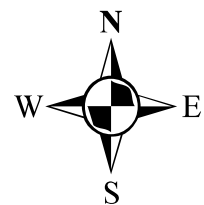
## Appendix D – Future Demand Included in Hydraulic Model

---



## Legend

- Agricultural
- Commercial
- Residential
- Study Area
- Town Limits



0 0.075 0.15 0.3 0.45 0.6 0.75 Miles

DATE: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan

### Appendix D: Future Demand Included in Hydraulic Model

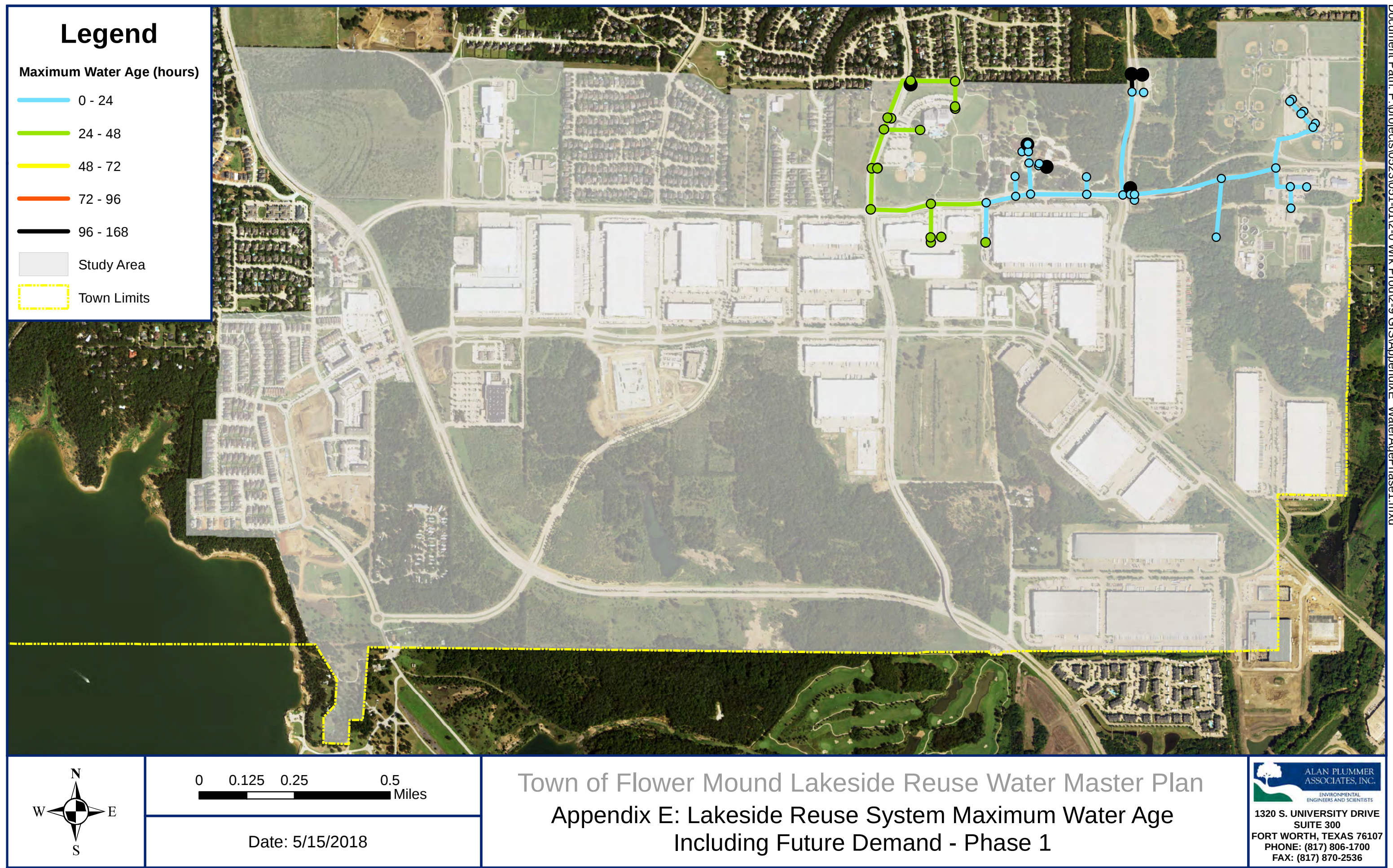


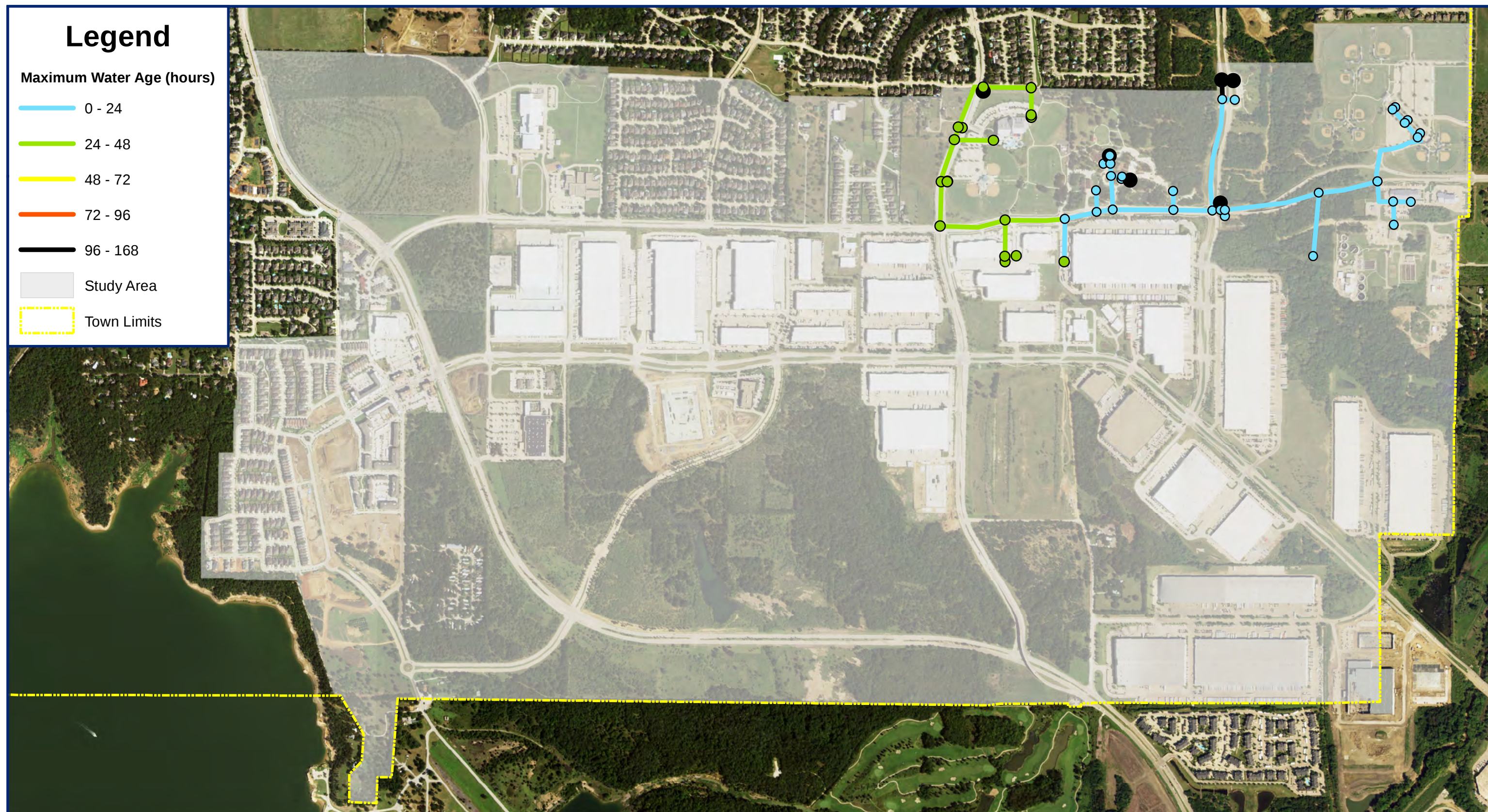
1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536

| Parcel Type  | Parcel ID # | Acres      | Unit Peak Hour Demand (gpm/Acre) | Peak Hour Demand (gpm) |
|--------------|-------------|------------|----------------------------------|------------------------|
| Agricultural | 1           | 141.17     | 2.76                             | 389.62                 |
| Agricultural | 2           | 14.17      | 2.76                             | 39.11                  |
| Agricultural | 3           | 18.52      | 2.76                             | 51.11                  |
| Agricultural | 4           | 6.75       | 2.76                             | 18.63                  |
| Agricultural | 5           | 10.23      | 2.76                             | 28.23                  |
| <b>Total</b> |             | <b>191</b> | <b>-</b>                         | <b>527</b>             |
| Commercial   | 6           | 12.77      | 9.82                             | 125.39                 |
| Commercial   | 7           | 28.97      | 9.82                             | 284.45                 |
| Commercial   | 8           | 4.19       | 9.82                             | 41.16                  |
| Commercial   | 9           | 9.17       | 9.82                             | 90.08                  |
| Commercial   | 10          | 3.54       | 9.82                             | 34.75                  |
| Commercial   | 11          | 22.56      | 9.82                             | 221.51                 |
| Commercial   | 12          | 61.56      | 9.82                             | 604.57                 |
| Commercial   | 13          | 53.87      | 9.82                             | 529.04                 |
| Commercial   | 14          | 64.22      | 9.82                             | 630.68                 |
| Commercial   | 15          | 69.80      | 9.82                             | 685.39                 |
| Commercial   | 16          | 3.80       | 9.82                             | 37.36                  |
| Commercial   | 17          | 12.60      | 9.82                             | 123.76                 |
| <b>Total</b> |             | <b>347</b> | <b>-</b>                         | <b>3,408</b>           |
| Residential  | 18          | 2.26       | 7.90                             | 17.86                  |
| Residential  | 19          | 69.33      | 7.90                             | 547.74                 |
| Residential  | 20          | 6.28       | 7.90                             | 49.64                  |
| Residential  | 21          | 16.22      | 7.90                             | 128.12                 |
| Residential  | 22          | 4.62       | 7.90                             | 36.48                  |
| Residential  | 23          | 16.08      | 7.90                             | 127.06                 |
| Residential  | 24          | 21.86      | 7.90                             | 172.71                 |
| Residential  | 25          | 8.23       | 7.90                             | 65.00                  |
| Residential  | 26          | 5.80       | 7.90                             | 45.82                  |
| Residential  | 27          | 92.35      | 7.90                             | 729.54                 |
| Residential  | 28          | 36.07      | 7.90                             | 284.93                 |
| <b>Total</b> |             | <b>279</b> | <b>-</b>                         | <b>2,205</b>           |

## Appendix E – Water Age Phase Model Results

---



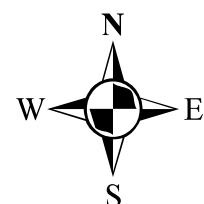


# Legend

Maximum Water Age (hours)

- 0 - 24
- 24 - 48
- 48 - 72
- 72 - 96
- 96 - 168

- Study Area
- Town Limits

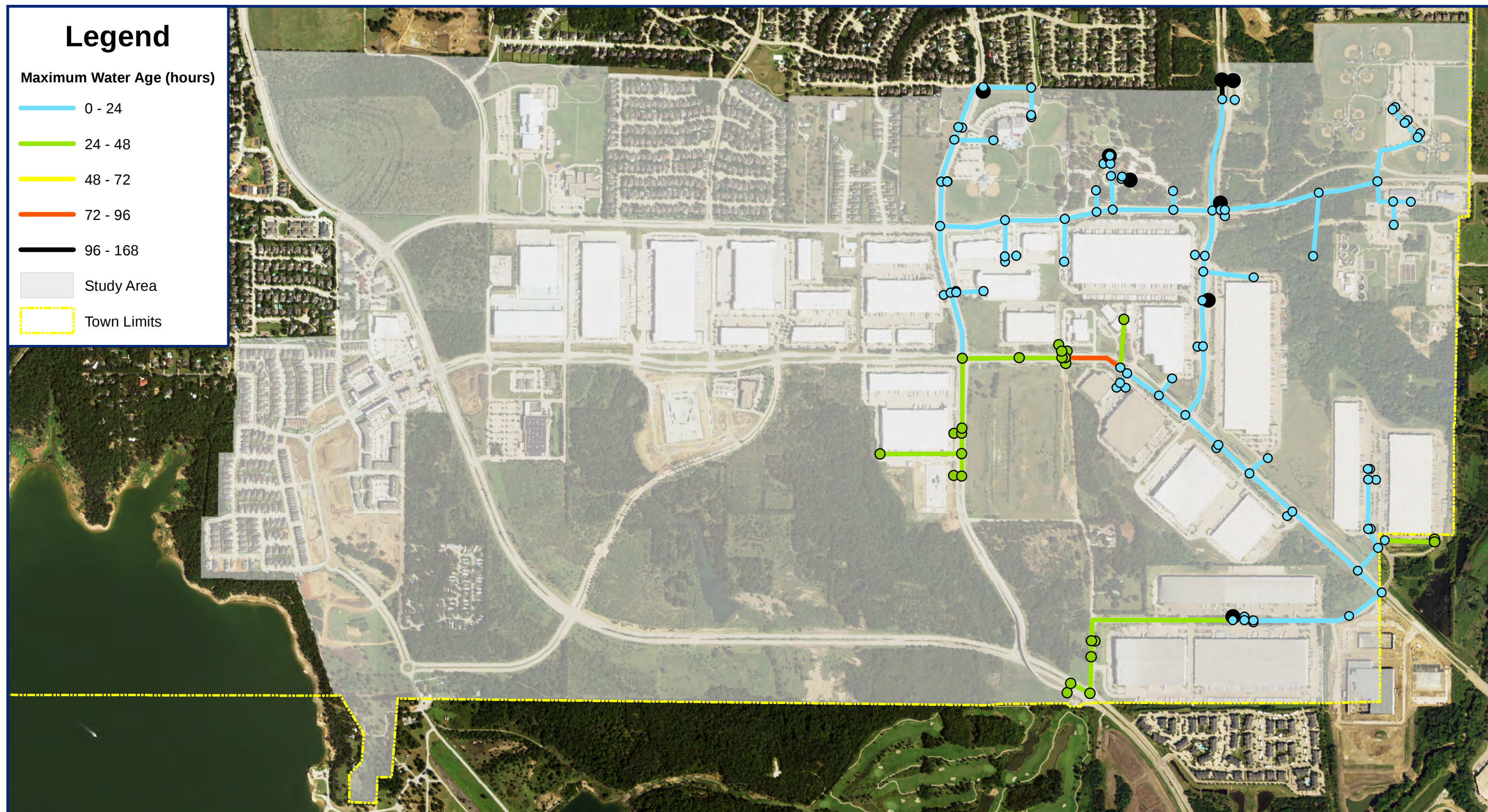


0 0.125 0.25 0.5 Miles

Date: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan Appendix E: Lakeside Reuse System Maximum Water Age Not Including Future Demand - Phase 1

 **ALAN PLUMMER ASSOCIATES, INC.**  
ENVIRONMENTAL ENGINEERS AND SCIENTISTS  
1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



# Legend

Maximum Water Age (hours)

0 - 24

24 - 48

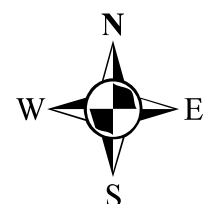
48 - 72

72 - 96

96 - 168

Study Area

Town Limits



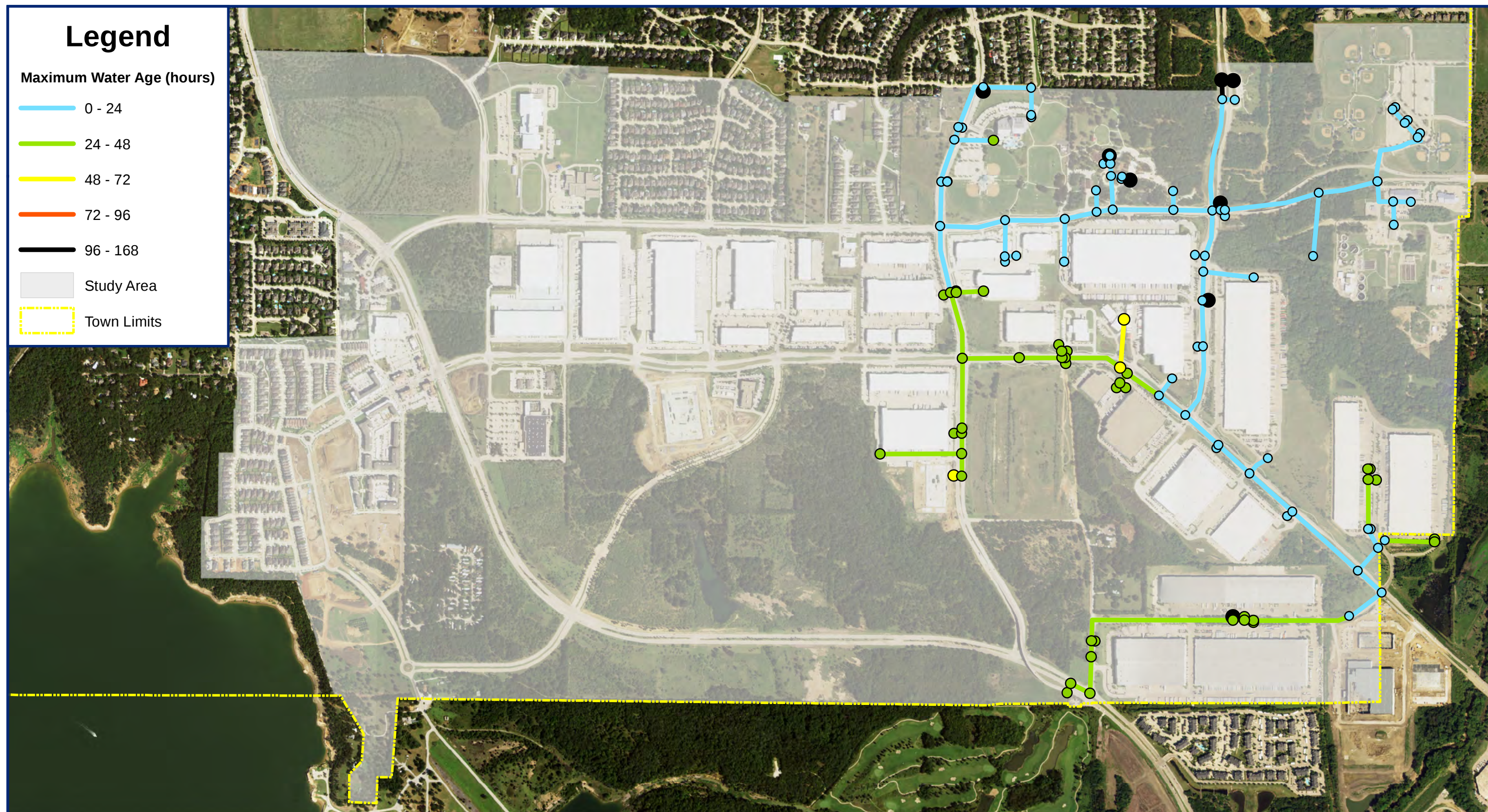
0 0.125 0.25 0.5 Miles

Date: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan Appendix E: Lakeside Reuse System Maximum Water Age Including Future Demand - Phase 2



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



# Legend

Maximum Water Age (hours)

0 - 24

24 - 48

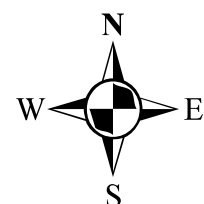
48 - 72

72 - 96

96 - 168

Study Area

Town Limits



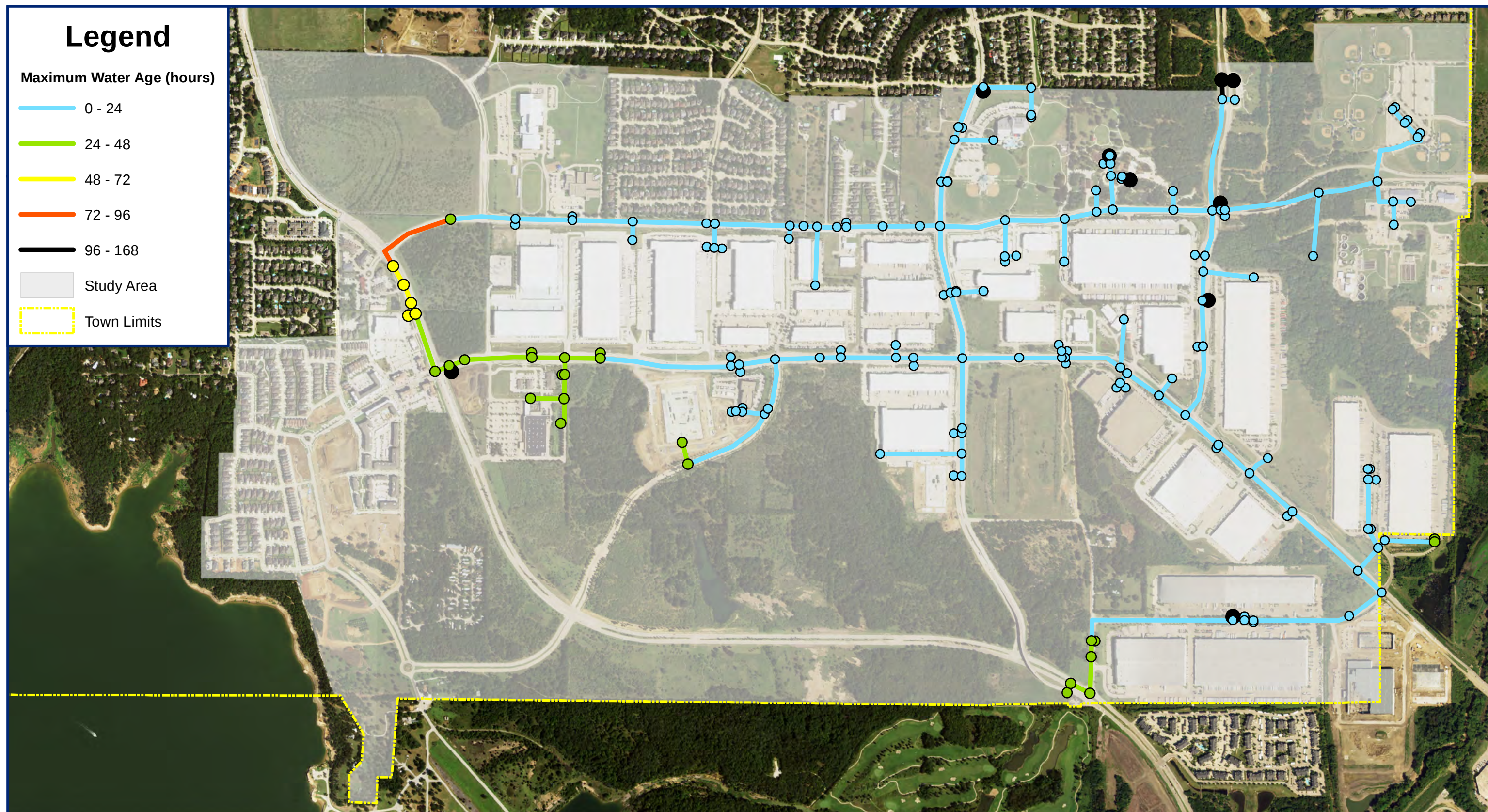
0 0.125 0.25 0.5 Miles

Date: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan Appendix E: Lakeside Reuse System Maximum Water Age Not Including Future Demand - Phase 2



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



# Legend

Maximum Water Age (hours)

0 - 24

24 - 48

48 - 72

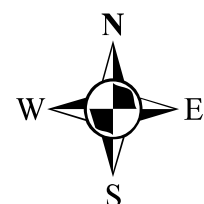
72 - 96

96 - 168

Study Area

Town Limits

## Town of Flower Mound Lakeside Reuse Water Master Plan Appendix E: Lakeside Reuse System Maximum Water Age Including Future Demand - Phase 3



0 0.125 0.25 0.5  
Miles

Date: 5/15/2018



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



# Legend

Maximum Water Age (hours)

0 - 24

24 - 48

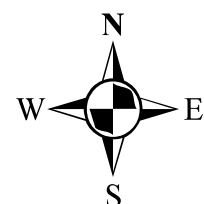
48 - 72

72 - 96

96 - 168

Study Area

Town Limits



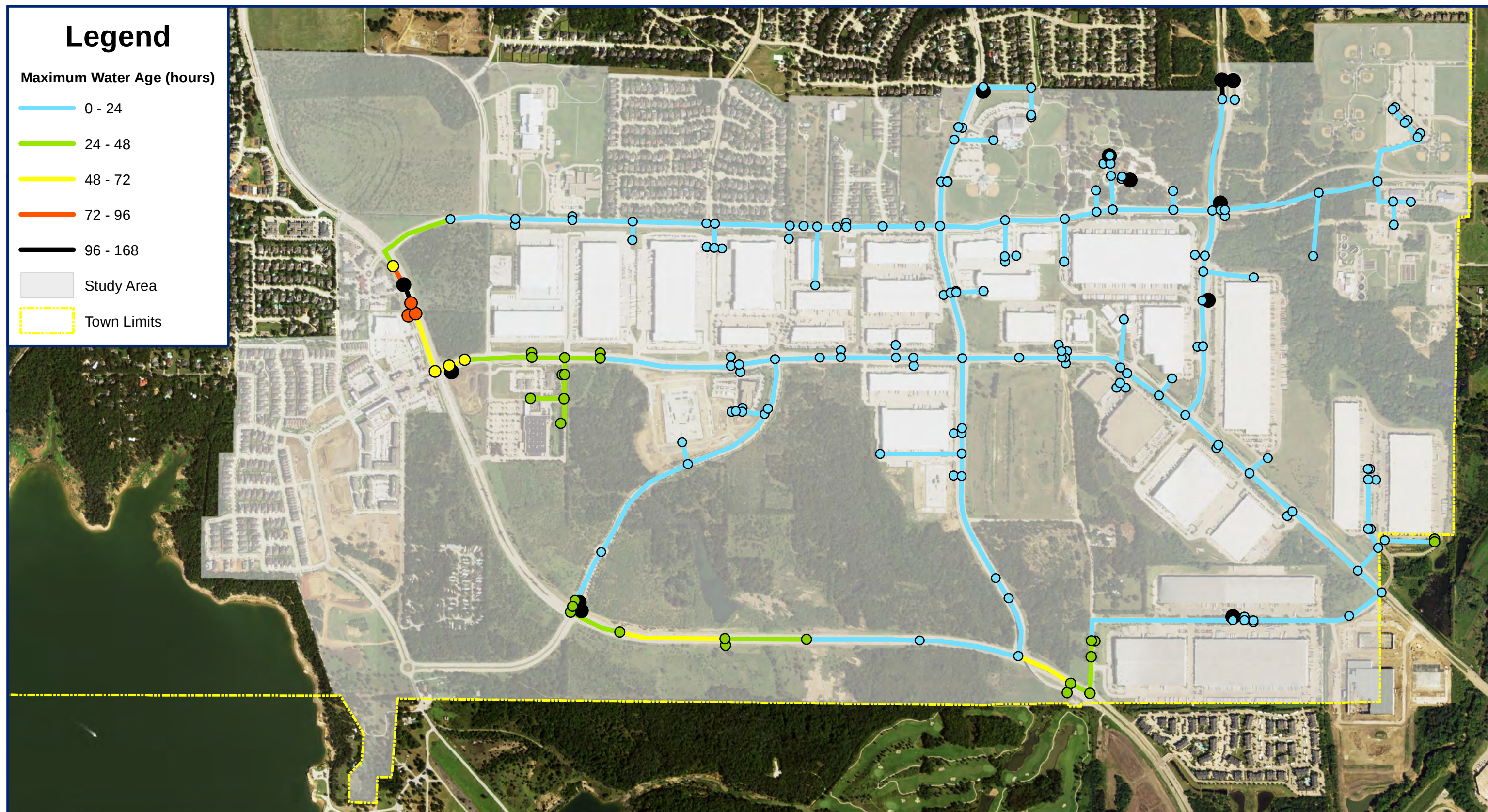
0 0.125 0.25 0.5 Miles

Date: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan Appendix E: Lakeside Reuse System Maximum Water Age Not Including Future Demand - Phase 3



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



# Legend

## Maximum Water Age (hours)

0 - 24

24 - 48

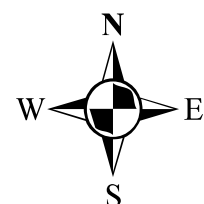
48 - 72

72 - 96

96 - 168

Study Area

Town Limits



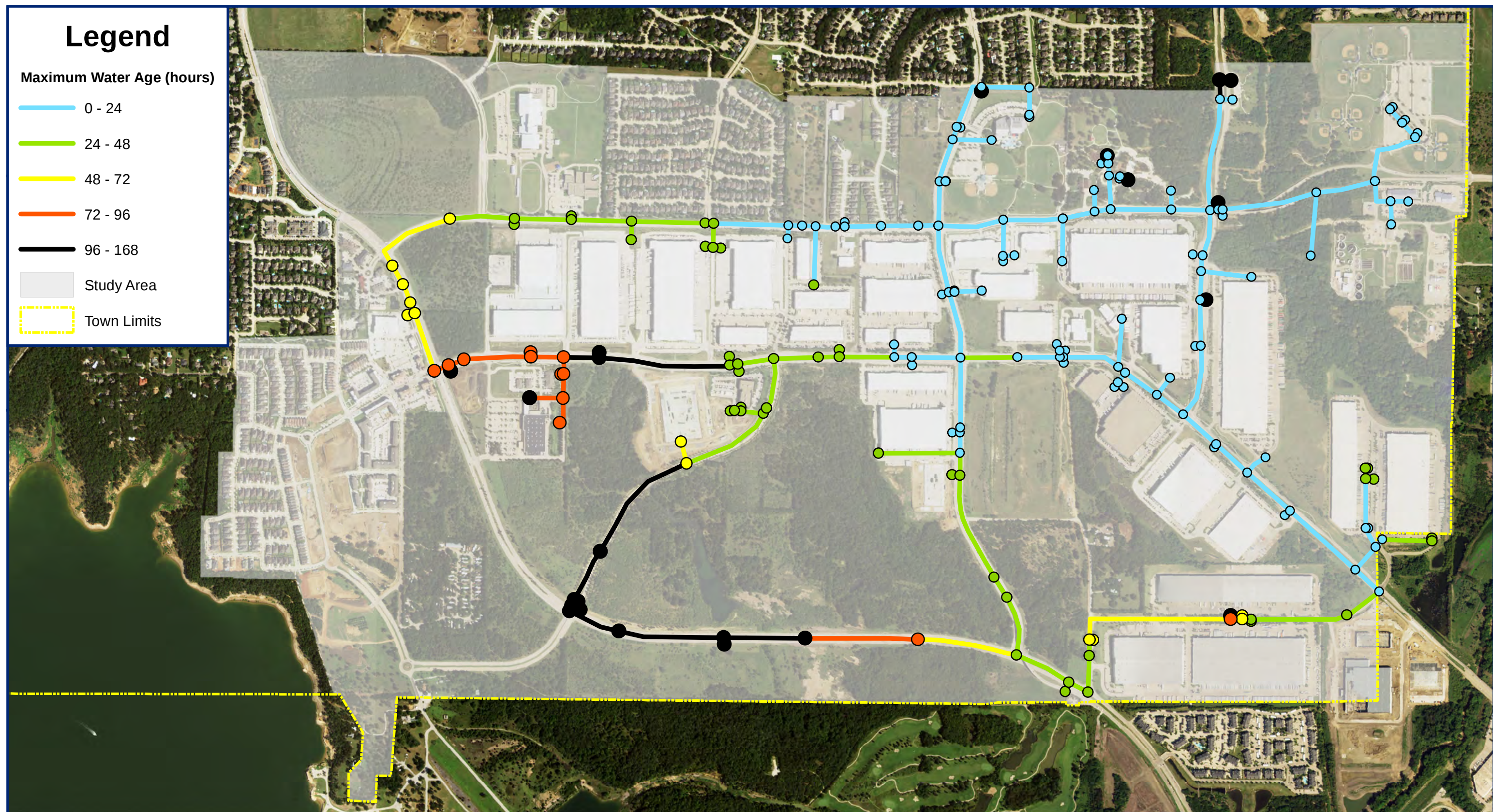
0 0.125 0.25 0.5 Miles

Date: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan Appendix E: Lakeside Reuse System Maximum Water Age Including Future Demand - Phase 4



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



# Legend

Maximum Water Age (hours)

0 - 24

24 - 48

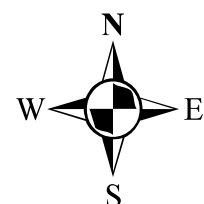
48 - 72

72 - 96

96 - 168

Study Area

Town Limits



0 0.125 0.25 0.5 Miles

Date: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan Appendix E: Lakeside Reuse System Maximum Water Age Not Including Future Demand - Phase 4



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



## Legend

### Maximum Water Age (hours)

0 - 24

24 - 48

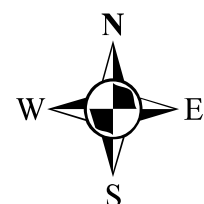
48 - 72

72 - 96

96 - 168

Study Area

Town Limits



0 0.125 0.25 0.5 Miles

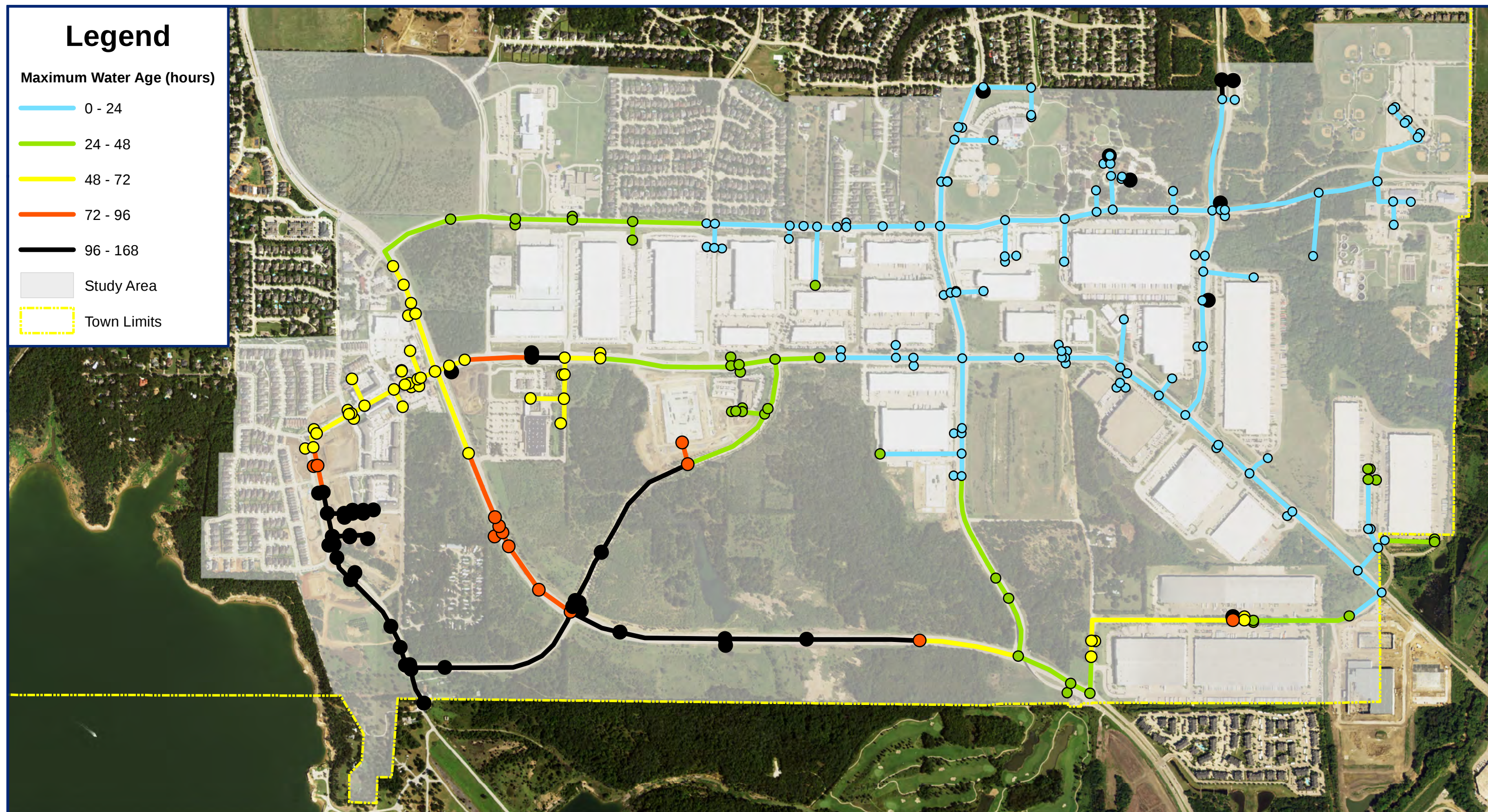
Date: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan

### Appendix E: Lakeside Reuse System Maximum Water Age Including Future Demand - Phase 5



1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



## Legend

### Maximum Water Age (hours)

0 - 24

24 - 48

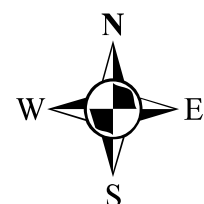
48 - 72

72 - 96

96 - 168

Study Area

Town Limits



0 0.125 0.25 0.5 Miles

Date: 5/15/2018

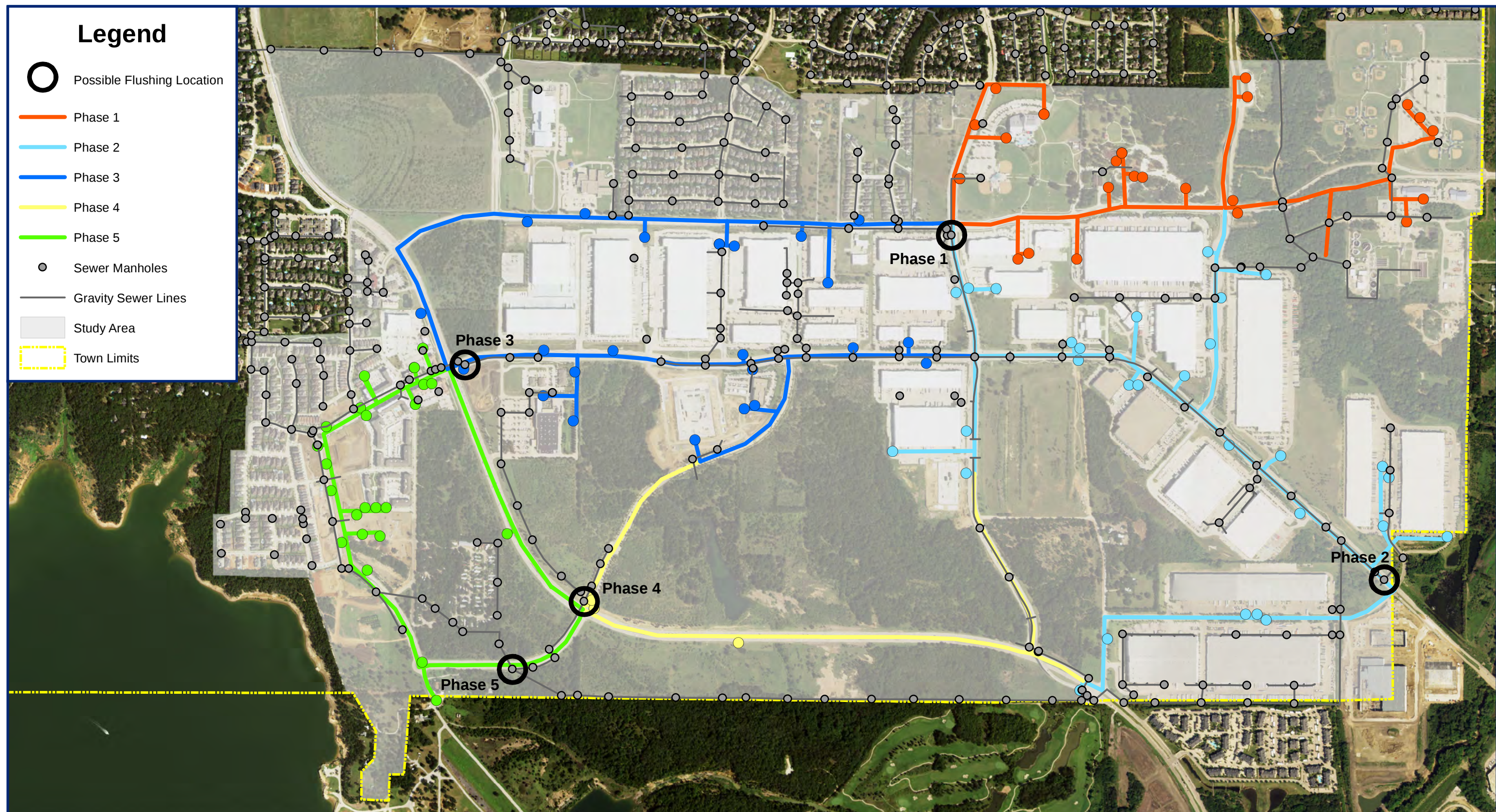
## Town of Flower Mound Lakeside Reuse Water Master Plan

### Appendix E: Lakeside Reuse System Maximum Water Age

### Not Including Future Demand - Phase 5

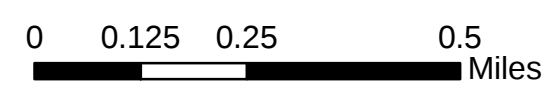
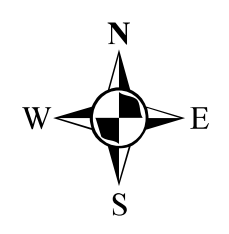


1320 S. UNIVERSITY DRIVE  
SUITE 300  
FORT WORTH, TEXAS 76107  
PHONE: (817) 806-1700  
FAX: (817) 870-2536



### Legend

- Possible Flushing Location
- Phase 1
- Phase 2
- Phase 3
- Phase 4
- Phase 5
- Sewer Manholes
- Gravity Sewer Lines
- Study Area
- Town Limits



Date: 5/15/2018

## Town of Flower Mound Lakeside Reuse Water Master Plan

### Appendix E: Possible Flushing Device Locations

**ALAN PLUMMER ASSOCIATES, INC.**  
 ENVIRONMENTAL ENGINEERS AND SCIENTISTS  
 1320 S. UNIVERSITY DRIVE  
 SUITE 300  
 FORT WORTH, TEXAS 76107  
 PHONE: (817) 806-1700  
 FAX: (817) 870-2536

## Appendix F – Flower Mound Reclaimed Water Authorization

---

Kathleen Hartnett White, *Chairman*  
R. B. "Ralph" Marquez, *Commissioner*  
Larry R. Soward, *Commissioner*  
Glenn Shankle, *Executive Director*



## TEXAS COMMISSION ON ENVIRONMENTAL QUALITY

*Protecting Texas by Reducing and Preventing Pollution*

April 5, 2006

Mr. Brian K. McDonald, P.E.  
Alan Plummers Associates, Inc.  
7524 Mosier View Court  
Suite 200  
Fort Worth, Texas 76118

Re: Reclaimed Water Project - Town of Flower Mound  
Texas Commission on Environmental Quality (TCEQ) Permit No. R11321-001  
WWPR R11321-001  
Denton County, Texas  
CN600639835 RN101251619

Dear Mr. McDonald:

We are updating above-referenced authorization. I am enclosing is a copy of the updated authorization. The authorization consists of the reuse of wastewater effluent from the Town of Flower Mound Wastewater Treatment Plant (TCEQ Permit No. R11321-001).

The treated effluent will be used for: residential irrigation, including landscape irrigation at individual homes; urban uses, including irrigation of public parks, golf courses, school yards, or athletic fields; use of reclaimed water for fire protection, either in internal sprinkler systems or external fire hydrants; maintenance of impoundments or natural water bodies; toilet or urinal flush water; other similar activities where the potential for unintentional human exposure may occur; cooling tower makeup water; irrigation of sod farms, silviculture, limited access highway rights of way; and soil compaction or dust control in construction areas.

The enclosure for this letter indicates the approved sites and conditions that apply to this approval. If you have any questions please contact me at (512) 239-4552.

Sincerely,

A handwritten signature in dark ink, appearing to read "Louis C. Herrin, III".

Louis C. Herrin, III, P.E.  
Wastewater Permitting Section  
Water Quality Division

cc: Town of Flower Mound, w/attachments  
TCEQ Region 4 Office, w/attachments  
TCEQ Water Quality Application Review and Processing Team (MC 148) , w/attachments



Authorization No. R11321-001  
This authorization supersedes  
and replaces WWPR R11321-001  
approved April 10, 2003

AUTHORIZATION FOR RECLAIMED WATER

Producer: Town of Flower Mound  
2121 Cross Timbers Road  
Flower Mound, Texas 75028

Provider: Town of Flower Mound  
2121 Cross Timbers Road  
Flower Mound, Texas 75028

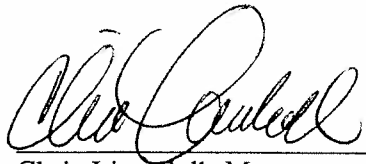
Users: The Users that the Town of Flower Mound, permitted as distributors and bulk users of the reclaimed water.

Location: The plant site is located at 1101 Duncan Lane, approximately two miles east and one mile south of the intersection of Farm-to-Market Road 2499 and Farm-to-Market Road 3040, in the Town of Flower Mound, in Denton County, Texas.

Authorization: Reclaimed water from the Town of Flower Mound's Wastewater Treatment Plant (Permit No. R11321-001), to be used for residential irrigation, including landscape irrigation at individual homes; urban uses, including irrigation of public parks, golf courses, school yards, or athletic fields; use of reclaimed water for fire protection, either in internal sprinkler systems or external fire hydrants; maintenance of impoundments or natural water bodies; toilet or urinal flush water; other similar activities where the potential for unintentional human exposure may occur; cooling tower makeup water; irrigation of sod farms, silviculture, limited access highway rights of way; and soil compaction or dust control in construction areas. The service area is shown on Attachment A.

This authorization contained the conditions that apply for the uses of the reclaimed water.

Issued Date: April 5, 2006

  
Chris Linendoll, Manager  
Wastewater Permitting Section  
Water Quality Division

Limitations: The authorization is subjected to the following requirements:

I. General Requirements.

- (a) No wastewater treatment plant operator (producer) shall transfer to a user reclaimed water without first notifying the commission.
- (b) Irrigation with untreated wastewater is prohibited.
- (c) Food crops that may be consumed raw by humans shall not be spray irrigated. Food crops including orchard crops that will be substantially processed prior to human consumption may be spray irrigated. Other types of irrigation that avoid contact of reclaimed water with edible portions of food crops are acceptable.
- (d) There shall be no nuisance conditions resulting from the distribution, the use, and/or storage of reclaimed water.
- (e) Reclaimed water shall not be utilized in a way that degrades ground water quality to a degree adversely affecting its actual or potential uses.
- (f) Reclaimed water managed in ponds for storage must be prevented from discharge into waters in the state, except for discharges directly resulting from rainfall events, in accordance with a permit issued by the commission, or as authorized under the Town of Flower Mound's Wastewater Treatment Plant (Permit No. 11321-001). All other discharges are unauthorized. If any unauthorized overflow of a holding pond occurs causing discharge into or adjacent to waters in the state, the user or provider, as appropriate, shall report any noncompliance. A written submission of such information shall also be provided to the commission regional office and to the Austin Office, Water Enforcement Section (MC-149), within five (5) working days of becoming aware of the overflow. The written submission shall contain a description of the noncompliance and its cause; the potential danger to human health or safety, or the environment; the period of noncompliance, including exact dates and times; if the noncompliance has not been corrected, the anticipated time it is expected to continue; and, steps taken or planned to reduce, eliminate, and prevent recurrence of the noncompliance, and to mitigate its adverse effects.
- (g) Unless otherwise provided in this authorization, there shall be no off-site discharge, either airborne or surface runoff, of reclaimed water from the user's property except to a wastewater treatment system or wastewater treatment collection system unless the reclaimed water user applies for and obtains a permit from the commission which authorizes discharge of the water.
- (h) Signs in both English and Spanish shall be posted at storage areas, hose bibs and faucets reading "Reclaimed Water, Do Not Drink" or similar warnings. Alternately, the area may be secured to prevent access by the public.
- (i) All new reclaimed water piping shall be separated from potable water piping when trenched by a distance of at least nine feet. All new exposed piping, hose bibs and faucets shall be painted purple and designed to prevent connection to a standard water hose. All piping shall be stenciled with a warning reading "NON-POTABLE WATER".
- (j) The design of any new distribution systems which will convey reclaimed water to a user shall be approved by the executive director. Materials shall be submitted for approval by the executive director in accordance with the Texas Engineering Practice Act (Article 3271a, Vernon's Annotated Texas Statutes). The plans and specifications for any new distribution systems constructed pursuant to this authorization must be approved pursuant to state law, and failure to secure approval before commencing construction of such works or making a transfer of reclaim water therefrom is a violation of this authorization, and each day of a transfer is an additional violation until approval has been secured.

- (k) Nothing in this authorization modifies any requirements of the Texas Department of Health found in Title 25 Texas Administrative Code (TAC), Chapter 337.
- (l) Major changes from a prior notification for use of reclaimed water must be approved by the executive director. A major change includes:
  - (1) A change in the boundary of the approved service area not including the conversion of individual lots within a subdivision to reclaimed water use;
  - (2) The addition of a new producer;
  - (3) Major changes in the intended use, such as conversion from irrigation of a golf course to residential irrigation; or
  - (4) Changes from either Type I or Type II uses to the other.
- (m) The reclaimed water producer and user shall maintain on the sites a current operation and maintenance plan. The operation and maintenance plan which shall contain, as a minimum the following:
  - (1) A labeling and separation plan for the prevention of cross connections between reclaimed water distribution lines and potable water lines;
  - (2) The measures that will be implemented to prevent unauthorized access to reclaimed water facilities (eg., secured valves);
  - (3) Procedures for monitoring reclaimed water;
  - (4) A plan for how reclaimed water use will be scheduled to minimize the risk of inadvertent human exposure;
  - (5) Schedules for routine maintenance;
  - (6) A plan for worker training and safety; and
  - (7) Contingency plan for system failure or upsets.

## II. Storage Requirements for Reclaimed Water

- (a) All initial holding ponds designed to contain Type I effluent shall conform to the following requirements:
  - (1) The ponds, whether constructed of earthen or other impervious materials, shall be designed and constructed so as to prevent groundwater contamination;
  - (2) Soils used for pond lining shall be free from foreign material such as paper, brush, trees, and large rocks;
  - (3) All soil liners must be of compacted material having a permeability less than or equal to  $1 \times 10^{-4}$  cm/sec, at least 24 inches thick, compacted in lifts no greater than 6 inches each;
  - (4) Synthetic membrane linings shall have a minimum thickness of 40 mils. In situ liners at least 24 inches thick meeting a permeability less than or equal to  $1 \times 10^{-4}$  cm/sec are acceptable alternatives;
  - (5) Certification shall be furnished by a Texas Registered Professional Engineer that the pond lining meets the appropriate criteria prior to utilization of the facilities; and
  - (6) Soil embankment walls shall have a top width of at least five feet. The interior and exterior slopes of soil embankment walls shall be no steeper than one foot vertical to three feet horizontal unless alternate methods of slope stabilization are utilized. All soil embankment walls shall be protected by a vegetative cover or other stabilizing material to prevent erosion. Erosion stops and water seals shall be installed on all piping penetrating the embankments.
  - (7) An alternative method of pond lining which provides equivalent or better water quality protection than provided under this section may be utilized with the prior approval of the executive director.

- (8) A specific exemption may be obtained from the executive director if, after the review of data submitted by the reclaimed water provider or user, as appropriate, the executive director determines containment of the reclaimed water is not necessary, considering:
- (A) Soil and geologic data, and ground water data, including its quality, uses, quantity and yield; and
  - (B) Adequate demonstration that impairment of ground water for its actual or potential use will be prevented.
- (b) Reclaimed water may be stored in leak-proof, fabricated tanks.
- (c) Subsequent holding ponds utilized for the receipt and storage of reclaimed water of a quality that could cause or causes a violation of a surface water quality standard or impairment of ground water for its actual or intended use will be also subject to the storage requirements of this section.

### III. Specific Uses and Quality Standards for Reclaimed Water

Numerical parameter limits pertaining to specific reclaimed water use categories are contained in this section. These limits apply to reclaimed water before discharge to initial holding ponds or a reclaimed water distribution system. It shall be the responsibility of the reclaimed water producer to establish that the reclaimed water meets the quality limits at the sample point for the intended use in accordance with the monitoring requirements identified in Section IV relating to Sampling and Analysis.

- (a) Any new construction shall conform to Type I use which includes irrigation or other uses where the public is not present during the time when irrigation activities occur or other uses where the public would not come in contact with the reclaimed water.
- (b) Type I Reclaimed Water Use. The type of use where the public will not come in contact with the reclaimed water. The following use is allowed by this authorization: residential irrigation, including landscape irrigation at individual homes; urban uses, including irrigation of public parks, golf courses, school yards, or athletic fields; use of reclaimed water for fire protection, either in internal sprinkler systems or external fire hydrants; maintenance of impoundments or natural water bodies; toilet or urinal flush water; other similar activities where the potential for unintentional human exposure may occur; cooling tower makeup water; irrigation of sod farms, silviculture, limited access highway rights of way; and soil compaction or dust control in construction areas.
- (b) The following conditions apply to this type of use of reclaimed water. At a minimum, the reclaimed water producer shall only transfer reclaimed water of the following quality as described for Type I reclaimed water use, reclaimed water on a 30-day average shall have a quality of:

|                                |                 |
|--------------------------------|-----------------|
| CBOD <sub>5</sub>              | 5 mg/l          |
| Turbidity                      | 3 NTU           |
| Fecal Coliform                 | 20 CFU/100 ml*  |
| Fecal Coliform (not to exceed) | 75 CFU/100 ml** |
| * geometric mean               |                 |
| ** single grab sample          |                 |

### IV. Sampling and Analysis.

The reclaimed water producer shall sample the reclaimed water prior to distribution to user to assure that the water quality is in accord with the intended contracted use. Analytical methods shall be in accord with those specified in Chapter 319 (relating to Monitoring and Reporting). The

minimum sampling and analysis frequency for Type I reclaimed water is twice per week.

The monitoring shall be done after the final treatment unit. These records shall be maintained on a monthly basis and be available at the plant site for inspection by authorized representatives of the Commission for at least five years.

#### V. Record Keeping and Reporting.

- (a) The reclaimed water provider and user shall maintain records on site for a period of five years.
  - (1) Records to be maintained by the provider include:
    - (A) Copies of notifications made to the commission concerning reclaimed water projects.
    - (B) As applicable, copies of contracts made with each reclaimed water user (this requirement does not include reclaimed water users at residences that have separate distribution lines for potable water).
    - (C) Records of volume of water delivered to each reclaimed water user per delivery (this requirement does not apply to reclaimed water users at residences that have separate distribution lines for potable water).
    - (D) Reclaimed water quality analyses.
  - (2) The reclaimed water producer shall report to the commission on a monthly basis the following information on forms furnished by the executive director. Such reports are due to the commission by the 20th day of the month following the reporting period.
    - (A) Volume of reclaimed water delivered to provider.
    - (B) Quality of reclaimed water delivered to a user or provider reported as a monthly average for each quality criteria except those listed as "not to exceed" which shall be reported as individual analyses.

#### VI. Transfer of Reclaimed Water.

Reclaimed water transferred from a provider to a user shall be done on a demand only basis. This means that the reclaimed water user may refuse delivery of such water at any time. All reclaimed water transferred to a user must be of at least the treatment quality specified in Section IV. Transfer shall be accomplished via pipes or tank trucks.

#### VII. General Prohibitions.

Except for on-channel ponds, storage facilities for retaining reclaimed water prior to use shall not be located within the floodway and shall be protected from the 100-year flood.

#### VIII. Restrictions.

This authorization does not convey any property right and does not grant any exclusive privilege.

#### IX. Responsibilities and Contracts.

- (a) The producer of reclaimed water will not be liable for misapplication of reclaimed water by users, except as provided in this section. Both the reclaimed water provider and user

have, but are not limited to, the following responsibilities:

- (1) The reclaimed water producer shall:
  - (A) Transfer reclaimed water of at least the minimum quality required by this chapter at the point of delivery to the user for the specified use;
  - (B) Sample and analyze the reclaimed water and report such analyses in accordance with Sections IV and V relating to Sampling and Analysis and Record keeping and Reporting, respectively; and
  - (C) Notify the executive director in writing within five (5) days of obtaining knowledge of reclaimed water use not authorized by the executive director's reclaimed water use approval.
- (2) The reclaimed water provider shall:
  - (A) Assure construction of reclaimed water distribution lines/systems in accordance with 30 TAC Chapter 317 and in accordance with approved plans and specifications;
  - (B) Transfer reclaimed water of at least the minimum quality required by this chapter at the point of delivery to the user for the specified use;
  - (C) Notify the executive director in writing within five (5) days of obtaining knowledge of reclaimed water use not authorized by the executive director's reclaimed water use approval; and
  - (D) Not be found in violation of this chapter for the misuse of the reclaimed water by the user if transfer of such water is shut off promptly upon knowledge of misuse regardless of contract provisions.
- (3) The reclaimed water user shall:
  - (A) Use the reclaimed water in accordance with this authorization; and
  - (B) Maintain and provide records as required by Section III relating to Record Keeping and Reporting.

#### X. Enforcement.

If the producer, provider and/or user fails to comply with the terms of this authorization, the executive director may take enforcement action provided by the Texas Water Code, §§26.019 and 26.136.

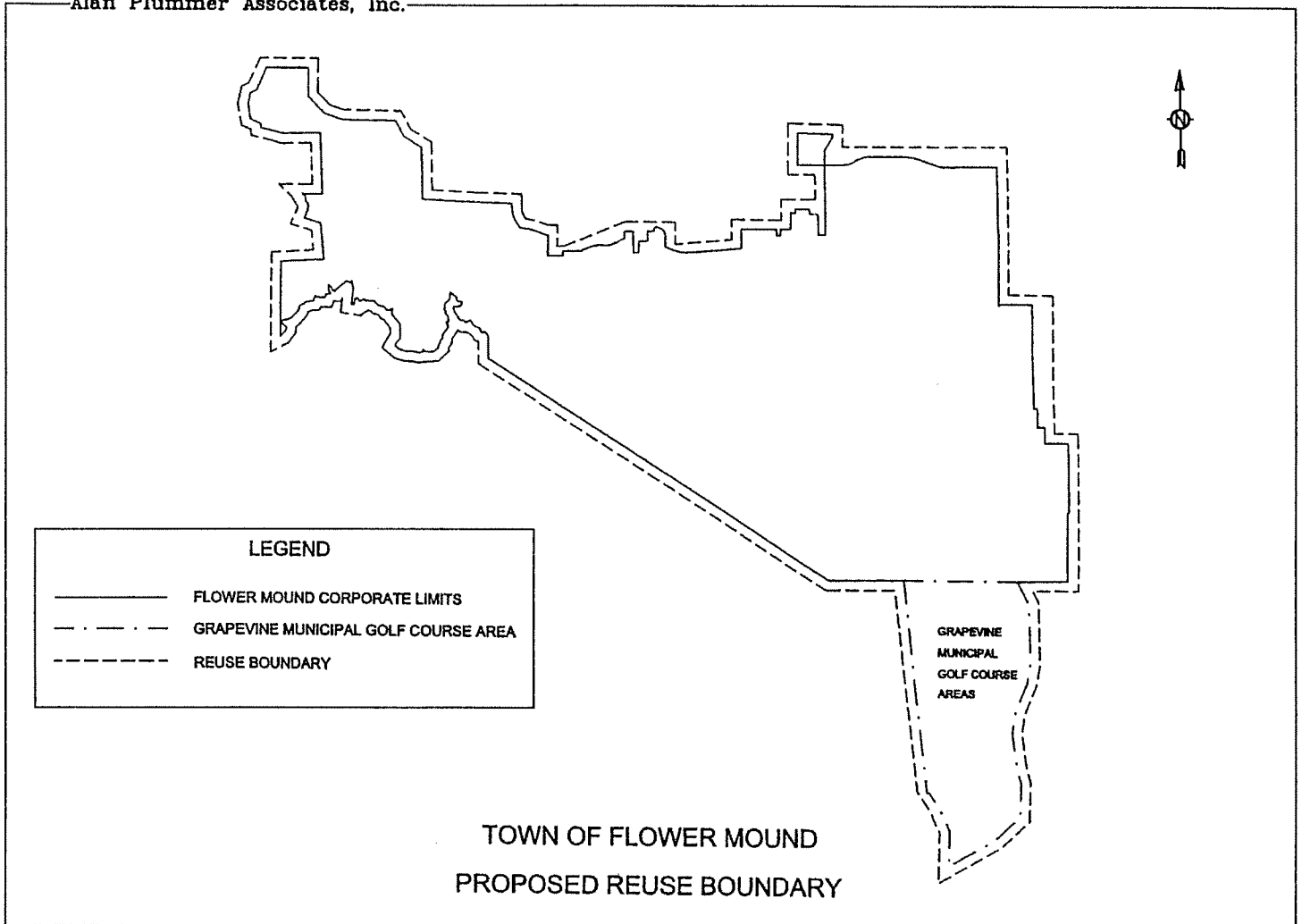
#### XI. STANDARD PROVISIONS:

- (a) This authorization is granted in accordance with the Texas Water Code and the rules and other Orders of the Commission and the laws of the State of Texas.
- (b) Acceptance of this authorization constitutes an acknowledgment and agreement that the provider and user will comply with all the terms, provisions, conditions, limitations and restrictions embodied in this authorization and with the rules and other Orders of the Commission and the laws of the State of Texas. Agreement is a condition precedent to the granting of this authorization.

The Town of Flower Mound  
Reclaimed Water Project  
Authorization No. R11321-001  
Page 7

## Attachment "A"

Alan Plummer Associates, Inc.



## Appendix G – Financial Evaluation

---

|                                     |              |                                     |                   |                                               | 75% of Potable Charge                       | 80% of Potable Charge                       | 85% of Potable Charge                       |            | 90% of Potable Charge                       |
|-------------------------------------|--------------|-------------------------------------|-------------------|-----------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|------------|---------------------------------------------|
| Customer                            | Meter Number | Average Consumption (gal per month) | Meter Size (inch) | Est. Avg Potable Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | % Decrease | Est. Avg Reuse Monthly Water Bill (2018 \$) |
| TOWN METER                          | 55-0265-99   | 959,900                             | 2.00              | \$6,347                                       | \$4,794                                     | \$5,105                                     | \$5,415                                     | 14.7%      | \$5,726                                     |
| TOWN METER                          | 55-0055-99   | 886,700                             | 4.00              | \$6,115                                       | \$4,682                                     | \$4,969                                     | \$5,256                                     | 14.1%      | \$5,542                                     |
| TOWN METER                          | 55-0165-99   | 527,080                             | 2.00              | \$3,516                                       | \$2,671                                     | \$2,840                                     | \$3,009                                     | 14.4%      | \$3,178                                     |
| TOWN METER                          | 86-0380-99   | 450,400                             | 2.00              | \$3,015                                       | \$2,295                                     | \$2,439                                     | \$2,583                                     | 14.3%      | \$2,727                                     |
| CHI / SILVERON LP                   | 86-2995-99   | 385,025                             | 2.00              | \$2,587                                       | \$1,974                                     | \$2,097                                     | \$2,220                                     | 14.2%      | \$2,342                                     |
| BIG BOX PROPERTY OWNER              | 86-9210-99   | 314,926                             | 2.00              | \$2,129                                       | \$1,631                                     | \$1,730                                     | \$1,830                                     | 14.0%      | \$1,930                                     |
| DUKE REALTY LMTD PARTNERSHIP        | 86-3445-99   | 287,230                             | 2.00              | \$1,948                                       | \$1,495                                     | \$1,585                                     | \$1,676                                     | 14.0%      | \$1,766                                     |
| LIT INDUSTRIAL LIMITED              | 86-3260-99   | 282,990                             | 2.00              | \$1,920                                       | \$1,474                                     | \$1,563                                     | \$1,652                                     | 13.9%      | \$1,742                                     |
| SCG LAKESIDE COMMERCE CENTER        | 86-5971-99   | 281,499                             | 2.00              | \$1,910                                       | \$1,467                                     | \$1,555                                     | \$1,644                                     | 13.9%      | \$1,733                                     |
| THE HOME DEPOT                      | 86-5962-99   | 280,593                             | 2.00              | \$1,904                                       | \$1,462                                     | \$1,551                                     | \$1,639                                     | 13.9%      | \$1,727                                     |
| LIT HW1 LP                          | 86-6024-99   | 267,978                             | 2.00              | \$1,822                                       | \$1,400                                     | \$1,485                                     | \$1,569                                     | 13.9%      | \$1,653                                     |
| TOWN METER                          | 86-0326-99   | 267,500                             | 2.00              | \$1,819                                       | \$1,398                                     | \$1,482                                     | \$1,566                                     | 13.9%      | \$1,650                                     |
| TAF DALLAS INDUSTRIAL PORTIFOLIO LP | 86-4026-99   | 258,997                             | 2.00              | \$1,763                                       | \$1,356                                     | \$1,438                                     | \$1,519                                     | 13.8%      | \$1,600                                     |
| NATIONAL INDUSTRIAL HOLDINGS        | 86-5215-99   | 246,925                             | 2.00              | \$1,684                                       | \$1,297                                     | \$1,374                                     | \$1,452                                     | 13.8%      | \$1,529                                     |
| TOWN METER                          | 55-0185-99   | 246,440                             | 2.00              | \$1,681                                       | \$1,295                                     | \$1,372                                     | \$1,449                                     | 13.8%      | \$1,526                                     |
| TOWN METER                          | 86-0320-99   | 242,500                             | 2.00              | \$1,655                                       | \$1,275                                     | \$1,351                                     | \$1,427                                     | 13.8%      | \$1,503                                     |
| STACY FAMILIES ENTERPRISES          | 86-6040-99   | 231,533                             | 2.00              | \$1,583                                       | \$1,221                                     | \$1,294                                     | \$1,366                                     | 13.7%      | \$1,439                                     |
| CHI / SILVERON LP                   | 86-2990-99   | 231,211                             | 2.00              | \$1,581                                       | \$1,220                                     | \$1,292                                     | \$1,364                                     | 13.7%      | \$1,437                                     |
| LMEG WIRELESS LLC                   | 86-2890-99   | 230,960                             | 2.00              | \$1,580                                       | \$1,219                                     | \$1,291                                     | \$1,363                                     | 13.7%      | \$1,435                                     |
| MI WINDOWS AND DOORS                | 86-9870-99   | 229,340                             | 1.50              | \$1,525                                       | \$1,167                                     | \$1,239                                     | \$1,310                                     | 14.1%      | \$1,382                                     |
| KOHLER CO                           | 86-3470-99   | 222,077                             | 2.00              | \$1,522                                       | \$1,175                                     | \$1,244                                     | \$1,314                                     | 13.7%      | \$1,383                                     |
| WAYFAIR LLC                         | 86-9880-99   | 221,124                             | 1.50              | \$1,472                                       | \$1,127                                     | \$1,196                                     | \$1,265                                     | 14.1%      | \$1,334                                     |
| TOWN METER                          | 55-0085-99   | 208,920                             | 4.00              | \$1,683                                       | \$1,358                                     | \$1,423                                     | \$1,488                                     | 11.6%      | \$1,553                                     |
| SCG LAKESIDE COMMERCE CENTER        | 86-4260-99   | 200,576                             | 2.00              | \$1,381                                       | \$1,070                                     | \$1,132                                     | \$1,194                                     | 13.5%      | \$1,256                                     |
| EASTGROUP PROPERTIES                | 86-9920-99   | 195,496                             | 2.00              | \$1,348                                       | \$1,045                                     | \$1,105                                     | \$1,166                                     | 13.5%      | \$1,227                                     |
| TOWN METER                          | 55-0195-99   | 194,740                             | 2.00              | \$1,343                                       | \$1,041                                     | \$1,101                                     | \$1,162                                     | 13.5%      | \$1,222                                     |
| IPT LAKESIDE CORPORATE CENTER       | 86-9220-99   | 192,540                             | 2.00              | \$1,328                                       | \$1,030                                     | \$1,090                                     | \$1,150                                     | 13.5%      | \$1,209                                     |
| IPT LAKESIDE CORPORATE CENTER       | 86-9240-99   | 189,992                             | 2.00              | \$1,312                                       | \$1,018                                     | \$1,077                                     | \$1,135                                     | 13.4%      | \$1,194                                     |

|                                |              |                                     |                   |                                               | 75% of Potable Charge                       | 80% of Potable Charge                       | 85% of Potable Charge                       |            | 90% of Potable Charge                       |
|--------------------------------|--------------|-------------------------------------|-------------------|-----------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|------------|---------------------------------------------|
| Customer                       | Meter Number | Average Consumption (gal per month) | Meter Size (inch) | Est. Avg Potable Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | % Decrease | Est. Avg Reuse Monthly Water Bill (2018 \$) |
| BEST BUY STORES LP             | 86-6033-99   | 184,385                             | 2.00              | \$1,275                                       | \$990                                       | \$1,047                                     | \$1,104                                     | 13.4%      | \$1,161                                     |
| SPEARS MANUFACTURING           | 86-3855-99   | 184,188                             | 2.00              | \$1,274                                       | \$989                                       | \$1,046                                     | \$1,103                                     | 13.4%      | \$1,160                                     |
| BIG BOX PROPERTY OWNER         | 86-4116-99   | 180,805                             | 2.00              | \$1,252                                       | \$973                                       | \$1,028                                     | \$1,084                                     | 13.4%      | \$1,140                                     |
| TOWN METER                     | 55-0285-99   | 179,300                             | 3.00              | \$1,358                                       | \$1,082                                     | \$1,137                                     | \$1,192                                     | 12.2%      | \$1,248                                     |
| KOHLER CO                      | 86-3505-99   | 178,883                             | 2.00              | \$1,239                                       | \$963                                       | \$1,018                                     | \$1,074                                     | 13.4%      | \$1,129                                     |
| AZURE LAKESIDE                 | 86-0945-99   | 169,383                             | 1.00              | \$1,097                                       | \$837                                       | \$889                                       | \$941                                       | 14.2%      | \$993                                       |
| WIFPIR PROPERTIES LLC          | 86-8860-99   | 164,847                             | 2.00              | \$1,147                                       | \$894                                       | \$945                                       | \$996                                       | 13.2%      | \$1,046                                     |
| HEAT AND CONTROL INC           | 86-3830-99   | 160,305                             | 1.00              | \$1,038                                       | \$792                                       | \$841                                       | \$890                                       | 14.2%      | \$939                                       |
| MI WINDOWS AND DOORS           | 86-9865-99   | 154,287                             | 1.50              | \$1,035                                       | \$799                                       | \$846                                       | \$893                                       | 13.7%      | \$940                                       |
| DUKE REALTY LMTD PARTNERSHIP   | 86-3455-99   | 153,472                             | 2.00              | \$1,073                                       | \$839                                       | \$885                                       | \$932                                       | 13.1%      | \$979                                       |
| EASTGROUP PROPERTIES           | 86-9900-99   | 151,472                             | 2.00              | \$1,060                                       | \$829                                       | \$875                                       | \$921                                       | 13.1%      | \$967                                       |
| IPT LAKESIDE CORPORATE CENTER  | 86-5265-99   | 143,542                             | 2.00              | \$1,008                                       | \$790                                       | \$834                                       | \$877                                       | 13.0%      | \$921                                       |
| LISANTI FOODS                  | 86-9890-99   | 132,476                             | 1.50              | \$892                                         | \$692                                       | \$732                                       | \$772                                       | 13.5%      | \$812                                       |
| COMMUNICATIONS TEST DESIGN INC | 86-9205-99   | 132,229                             | 2.00              | \$934                                         | \$734                                       | \$774                                       | \$814                                       | 12.8%      | \$854                                       |
| LIT INDUSTRIAL LIMITED         | 86-3285-99   | 131,404                             | 2.00              | \$929                                         | \$730                                       | \$770                                       | \$810                                       | 12.8%      | \$849                                       |
| MORTGAGE FINALCIAL SERVICES    | 86-8825-99   | 130,964                             | 2.00              | \$926                                         | \$728                                       | \$768                                       | \$807                                       | 12.8%      | \$847                                       |
| TOWN METER                     | 55-0365-99   | 130,760                             | 2.00              | \$924                                         | \$727                                       | \$767                                       | \$806                                       | 12.8%      | \$846                                       |
| TOWN METER                     | 86-0390-99   | 128,400                             | 1.00              | \$829                                         | \$636                                       | \$674                                       | \$713                                       | 14.0%      | \$752                                       |
| IPT LAKESIDE CORPORATE CENTER  | 86-5230-99   | 128,125                             | 2.00              | \$907                                         | \$714                                       | \$753                                       | \$791                                       | 12.8%      | \$830                                       |
| WIFPIR PROPERTIES LLC          | 86-8855-99   | 120,187                             | 2.00              | \$855                                         | \$675                                       | \$711                                       | \$747                                       | 12.6%      | \$783                                       |
| TOWN METER                     | 55-0245-99   | 120,000                             | 1.50              | \$810                                         | \$631                                       | \$667                                       | \$703                                       | 13.3%      | \$739                                       |
| MORTGAGE FINALCIAL SERVICES    | 86-4705-99   | 113,193                             | 2.00              | \$809                                         | \$641                                       | \$675                                       | \$708                                       | 12.5%      | \$742                                       |
| IPT LAKESIDE CORPORATE CENTER  | 86-5270-99   | 113,113                             | 2.00              | \$809                                         | \$641                                       | \$674                                       | \$708                                       | 12.5%      | \$742                                       |
| LIT INDUSTRIAL LIMITED         | 86-3290-99   | 110,442                             | 2.00              | \$792                                         | \$628                                       | \$660                                       | \$693                                       | 12.4%      | \$726                                       |
| LIT INDUSTRIAL LIMITED         | 86-3270-99   | 105,934                             | 2.00              | \$762                                         | \$605                                       | \$637                                       | \$668                                       | 12.3%      | \$699                                       |
| AZURE LAKESIDE                 | 86-3515-99   | 102,419                             | 1.00              | \$659                                         | \$508                                       | \$538                                       | \$569                                       | 13.7%      | \$599                                       |
| EASTGROUP PROPERTIES           | 86-9910-99   | 102,184                             | 2.00              | \$737                                         | \$587                                       | \$617                                       | \$647                                       | 12.2%      | \$677                                       |
| TOWN METER                     | 55-0215-99   | 95,700                              | 2.00              | \$695                                         | \$555                                       | \$583                                       | \$611                                       | 12.1%      | \$639                                       |

|                                     |              |                                     |                   |                                               | 75% of Potable Charge                       | 80% of Potable Charge                       | 85% of Potable Charge                       |            | 90% of Potable Charge                       |
|-------------------------------------|--------------|-------------------------------------|-------------------|-----------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|------------|---------------------------------------------|
| Customer                            | Meter Number | Average Consumption (gal per month) | Meter Size (inch) | Est. Avg Potable Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | % Decrease | Est. Avg Reuse Monthly Water Bill (2018 \$) |
| GREYSTAR DEV                        | 86-3391-99   | 91,465                              | 1.00              | \$587                                         | \$454                                       | \$481                                       | \$508                                       | 13.6%      | \$534                                       |
| CCA                                 | 86-5145-99   | 90,411                              | 2.00              | \$661                                         | \$529                                       | \$556                                       | \$582                                       | 11.9%      | \$608                                       |
| MOVIE HOUSE & EATERY                | 86-3590-99   | 82,624                              | 2.00              | \$610                                         | \$491                                       | \$515                                       | \$538                                       | 11.7%      | \$562                                       |
| TOWN METER                          | 55-0105-99   | 77,700                              | 2.00              | \$577                                         | \$467                                       | \$489                                       | \$511                                       | 11.5%      | \$533                                       |
| TOWN METER                          | 55-0135-99   | 75,900                              | 2.00              | \$566                                         | \$458                                       | \$480                                       | \$501                                       | 11.4%      | \$523                                       |
| TOWN METER                          | 55-0315-99   | 74,520                              | 2.00              | \$557                                         | \$451                                       | \$472                                       | \$493                                       | 11.3%      | \$514                                       |
| TITAN CORRUGATED INC                | 86-9195-99   | 72,027                              | 2.00              | \$540                                         | \$439                                       | \$459                                       | \$480                                       | 11.2%      | \$500                                       |
| TAF DALLAS INDUSTRIAL PORTIFOLIO LP | 86-4042-99   | 69,022                              | 1.50              | \$477                                         | \$381                                       | \$400                                       | \$419                                       | 12.1%      | \$438                                       |
| AZURE LAKESIDE                      | 86-3566-99   | 68,085                              | 1.00              | \$434                                         | \$340                                       | \$359                                       | \$378                                       | 13.1%      | \$397                                       |
| TOWN METER                          | 55-0225-99   | 67,160                              | 2.00              | \$508                                         | \$415                                       | \$434                                       | \$453                                       | 11.0%      | \$471                                       |
| TAF DALLAS INDUSTRIAL PORTIFOLIO LP | 86-4041-99   | 66,189                              | 1.50              | \$458                                         | \$367                                       | \$385                                       | \$403                                       | 12.0%      | \$422                                       |
| TOWN METER                          | 86-0430-99   | 63,200                              | 2.00              | \$483                                         | \$396                                       | \$413                                       | \$431                                       | 10.8%      | \$448                                       |
| SCG LAKESIDE COMMERCE CENTER        | 86-4270-99   | 56,408                              | 2.00              | \$438                                         | \$362                                       | \$378                                       | \$393                                       | 10.4%      | \$408                                       |
| AZURE LAKESIDE                      | 86-3520-99   | 47,556                              | 0.75              | \$280                                         | \$219                                       | \$231                                       | \$243                                       | 13.2%      | \$255                                       |
| AZURE LAKESIDE                      | 86-0940-99   | 45,386                              | 0.75              | \$267                                         | \$209                                       | \$221                                       | \$232                                       | 13.1%      | \$244                                       |
| TOWN METER                          | 86-0385-99   | 42,508                              | 1.00              | \$273                                         | \$218                                       | \$229                                       | \$240                                       | 11.9%      | \$251                                       |
| GREYSTAR DEV                        | 86-0970-99   | 39,614                              | 1.00              | \$256                                         | \$206                                       | \$216                                       | \$226                                       | 11.7%      | \$236                                       |
| TOWN METER                          | 55-0345-99   | 37,580                              | 2.00              | \$324                                         | \$277                                       | \$286                                       | \$296                                       | 8.7%       | \$305                                       |
| TOWN METER                          | 86-0631-99   | 28,546                              | 1.00              | \$191                                         | \$157                                       | \$164                                       | \$171                                       | 10.6%      | \$178                                       |
| ONCOR ELECTRIC DEELIVERY            | 86-3915-99   | 26,967                              | 2.00              | \$262                                         | \$230                                       | \$237                                       | \$243                                       | 7.2%       | \$249                                       |
| LAKESIDE DFW RETAIL                 | 86-3186-99   | 24,747                              | 1.00              | \$169                                         | \$141                                       | \$146                                       | \$152                                       | 10.1%      | \$158                                       |
| AZURE LAKESIDE                      | 86-3573-99   | 23,948                              | 1.00              | \$164                                         | \$137                                       | \$143                                       | \$148                                       | 9.9%       | \$153                                       |
| TOWN METER                          | 86-0570-99   | 23,000                              | 2.00              | \$239                                         | \$213                                       | \$218                                       | \$223                                       | 6.5%       | \$228                                       |
| TOWN METER                          | 86-0655-99   | 18,526                              | 1.00              | \$133                                         | \$113                                       | \$117                                       | \$121                                       | 8.7%       | \$125                                       |
| AZURE LAKESIDE                      | 86-3574-99   | 17,689                              | 0.75              | \$106                                         | \$88                                        | \$92                                        | \$95                                        | 10.2%      | \$99                                        |
| TOWN METER                          | 86-0410-99   | 15,900                              | 2.00              | \$197                                         | \$182                                       | \$185                                       | \$188                                       | 4.7%       | \$191                                       |
| GREYSTAR DEV                        | 86-5480-99   | 15,030                              | 0.75              | \$91                                          | \$76                                        | \$79                                        | \$82                                        | 9.4%       | \$85                                        |
| AZURE LAKESIDE                      | 86-3246-99   | 13,986                              | 0.75              | \$85                                          | \$72                                        | \$75                                        | \$77                                        | 9.0%       | \$80                                        |

|                               |              |                                     |                   |                                               | 75% of Potable Charge                       | 80% of Potable Charge                       | 85% of Potable Charge                       |            | 90% of Potable Charge                       |
|-------------------------------|--------------|-------------------------------------|-------------------|-----------------------------------------------|---------------------------------------------|---------------------------------------------|---------------------------------------------|------------|---------------------------------------------|
| Customer                      | Meter Number | Average Consumption (gal per month) | Meter Size (inch) | Est. Avg Potable Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | Est. Avg Reuse Monthly Water Bill (2018 \$) | % Decrease | Est. Avg Reuse Monthly Water Bill (2018 \$) |
| KOHLER CO                     | 86-3510-99   | 13,793                              | 2.00              | \$186                                         | \$173                                       | \$176                                       | \$178                                       | 4.1%       | \$181                                       |
| GREYSTAR DEV                  | 86-5470-99   | 12,603                              | 0.75              | \$78                                          | \$67                                        | \$69                                        | \$71                                        | 8.5%       | \$74                                        |
| IPT LAKESIDE CORPORATE CENTER | 86-5973-99   | 6,757                               | 2.00              | \$154                                         | \$149                                       | \$150                                       | \$151                                       | 1.8%       | \$152                                       |
| AZURE LAKESIDE                | 86-3370-99   | 4,820                               | 0.75              | \$45                                          | \$42                                        | \$43                                        | \$43                                        | 3.7%       | \$44                                        |
| TOWN METER                    | 55-0035-99   | 2,300                               | 4.00              | \$384                                         | \$384                                       | \$384                                       | \$384                                       | 0.0%       | \$384                                       |
| TOWN METER                    | 55-0255-99   | 1,300                               | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| TOWN METER (NEW)              | 55-0735-99   | 200                                 | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| TOWN METER                    | 55-0325-99   | 36                                  | 0.75              | \$34                                          | \$34                                        | \$34                                        | \$34                                        | 0.0%       | \$34                                        |
| LIT HW1 LP                    | 86-6017-99   | 4                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| GREYSTAR DEV                  | 86-3523-99   | 0                                   | 1.00              | \$56                                          | \$56                                        | \$56                                        | \$56                                        | 0.0%       | \$56                                        |
| TOWN METER (NEW)              | 55-0725-99   | 0                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| TOWN METER                    | 86-0585-99   | 0                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| TOWN METER                    | 55-0145-99   | 0                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| TOWN METER                    | 86-0420-99   | 0                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| TOWN METER                    | 55-0175-99   | 0                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| TOWN METER                    | 86-0405-99   | 0                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| TOWN METER                    | 86-0395-99   | 0                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| TOWN METER                    | 86-0580-99   | 0                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| GREYSTAR DEV                  | 86-3521-99   | 0                                   | 1.00              | \$56                                          | \$56                                        | \$56                                        | \$56                                        | 0.0%       | \$56                                        |
| TOWN METER                    | 86-0322-99   | 0                                   | 2.00              | \$136                                         | \$136                                       | \$136                                       | \$136                                       | 0.0%       | \$136                                       |
| GREYSTAR DEV                  | 86-3393-99   | 0                                   | 1.00              | \$56                                          | \$56                                        | \$56                                        | \$56                                        | 0.0%       | \$56                                        |
| GREYSTAR DEV                  | 86-3394-99   | 0                                   | 1.00              | \$56                                          | \$56                                        | \$56                                        | \$56                                        | 0.0%       | \$56                                        |

| Payback Year, Interest Rate 1.5%                       |     |                                              |      |      |      |
|--------------------------------------------------------|-----|----------------------------------------------|------|------|------|
|                                                        |     | Percent of Potable Charge<br>for Reuse Water |      |      |      |
|                                                        |     | 75%                                          | 80%  | 85%  | 90%  |
| Principal Forgiveness - Over<br>Entire Project Capital | 0%  | 2043                                         | 2041 | 2039 | 2037 |
|                                                        | 5%  | 2042                                         | 2039 | 2037 | 2035 |
|                                                        | 10% | 2040                                         | 2037 | 2035 | 2033 |
|                                                        | 20% | 2035                                         | 2033 | 2030 | 2027 |
|                                                        | 30% | 2030                                         | 2027 | 2026 | 2025 |

| Payback Year, Interest Rate 2.0%                       |     |                                              |      |      |      |
|--------------------------------------------------------|-----|----------------------------------------------|------|------|------|
|                                                        |     | Percent of Potable Charge<br>for Reuse Water |      |      |      |
|                                                        |     | 75%                                          | 80%  | 85%  | 90%  |
| Principal Forgiveness - Over<br>Entire Project Capital | 0%  | 2044                                         | 2043 | 2041 | 2039 |
|                                                        | 5%  | 2043                                         | 2041 | 2039 | 2037 |
|                                                        | 10% | 2042                                         | 2039 | 2037 | 2035 |
|                                                        | 20% | 2037                                         | 2035 | 2032 | 2029 |
|                                                        | 30% | 2032                                         | 2028 | 2027 | 2026 |

| Payback Year, Interest Rate 3.0%                       |     |                                              |      |      |      |
|--------------------------------------------------------|-----|----------------------------------------------|------|------|------|
|                                                        |     | Percent of Potable Charge<br>for Reuse Water |      |      |      |
|                                                        |     | 75%                                          | 80%  | 85%  | 90%  |
| Principal Forgiveness - Over<br>Entire Project Capital | 0%  | 2046                                         | 2045 | 2044 | 2042 |
|                                                        | 5%  | 2045                                         | 2044 | 2042 | 2040 |
|                                                        | 10% | 2044                                         | 2043 | 2040 | 2038 |
|                                                        | 20% | 2041                                         | 2038 | 2036 | 2034 |
|                                                        | 30% | 2036                                         | 2033 | 2030 | 2027 |