

# TECHNICAL MEMORANDUM



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**TO:** Rick Shaffer, P.E., City of Weatherford

**CC:** Bill Smith, P.E., City of Weatherford

**FROM:** Jessica Brown, P.E., Freese and Nichols, Inc.  
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**SUBJECT:** Water Master Plan Update

**DATE:** November 9, 2017



## 1.0 Introduction

The City of Weatherford retained Freese and Nichols, Inc. (FNI) to prepare a technical memorandum to update the 2013 Water Master Plan for the western portion of the City. The goal of the study was to evaluate and analyze the water distribution system, specifically the Franklin and Miller Pressure Planes, to measure existing performance, identify deficiencies, and determine improvements needed to meet projected future conditions. The City has made modifications to the boundary of the Franklin and Miller Pressure Planes, moving more connections into the Miller Pressure Plane. Additional growth has also occurred in this pressure plane that was not anticipated in the previous water master plan. To stay ahead of Texas Commission on Environmental Quality (TCEQ) requirements to provide adequate storage capacity in the Miller Pressure Plane, the City asked FNI to evaluate a less cost prohibitive alternative to the Ward Street Ground Storage Tank and Pump Station proposed in the 2013 Water Master Plan (Project 2), which was a central component to the future water distribution system. As part of this study, FNI reviewed historical water usage to establish trends and project demands for future system evaluations. Based on the evaluation, FNI developed an amended 10-year Capital Improvement Plan (CIP) to serve growth through the 10-year planning period. The recommended improvements will serve as a basis for the design, construction and financing of water lines and facilities required to meet Weatherford's future system needs.

## 2.0 Population and Water Demands

To plan for future residential and non-residential demands, FNI utilized population and land use projections developed as part of the 2016 Wastewater Master Plan. **Table 2-1** presents the historical population for the City of Weatherford. The projected population for each planning year is presented in **Table 2-2**. The City estimated the population in 2016 to be around 31,000 people, which is approximately 4,000 more people than the North Central



Texas Council of Governments (NCTCOG) projection of 27,080 that is used in this analysis. The additional people will only affect the resulting per-capita calculated, and will not have an effect on the total volume of water projected. The actual populations will be confirmed during the next Census.

**Table 2-1 Historical Population**

Year	Population	Growth Rate
2000	19,000	-
2001	19,296	1.56%
2002	19,699	2.09%
2003	20,203	2.56%
2004	21,252	5.19%
2005	22,144	4.20%
2006	22,882	3.33%
2007	23,658	3.39%
2008	24,396	3.12%
2009	24,939	2.23%
2010	25,250	1.25%
2011	25,300	0.20%
2012	25,440	0.55%
2013	25,940	1.97%
2014	26,200	1.00%
2015	26,600	1.53%
2016	27,080	1.80%
Average	--	2.25%

*\*2000 to 2010 population from 2013 Water Master Plan*

*\*\*2011 to 2016 population from NCTCOG estimates*

**Table 2-2 Projected Population**

Year	Population	Growth Rate	Non-Residential Acreage (Acres)
2017	27,773	-	1,655
2022	31,712	2.7%	1,927
2027	35,879	2.5%	2,345

Historical water treatment plant production and consumption data provided by the City was analyzed from 2011 to 2016. Historical annual average day demands, maximum day peaking factors and residential and non-residential per



capita are summarized in **Table 2-3**. A per capita is the average consumption of water in gallons per day by a person or acre of commercial land. The evaluation of historical data in **Table 2-3** provided a basis for determining the design criteria used to project water demands. The average citywide residential per capita of 98 gallons per capita per day (gpcd) and non-residential per capita of 976 gallons per acre per day (gpac) provided the basis for determining the recommended residential and non-residential usage. Based on the review of this data and the need to plan for low rainfall (dry) years, FNI recommends a citywide residential per capita of 110 gpcd and a non-residential usage of 1,000 gpac. These per capita are slightly lower than those used in the 2013 Master Plan due to a decrease in the historical per capita over the last six years. This decrease is most likely due to water conservation efforts.

A water utility must be able to supply water at rates that fluctuate over a wide range. Yearly, monthly, daily, and hourly variations in water use occur, with higher use during dry years and in hot months. Rates most important to the hydraulic design and operation of a water treatment plant and distribution system are average day, maximum day, and peak hour. Average day use is the total annual water use divided by the number of days in the year. The average day rate is used as a basis for estimating maximum day and peak hour demands. Maximum day demand is the maximum quantity of water used on any one day of the year. Treatment facilities are typically designed based on the maximum day rate. Peak hour use is the peak rate at which water is required during any one hour of the year. Since minimum distribution pressures are usually experienced during peak hour, the sizes and locations of distribution facilities are generally determined based on this condition. In selecting a peaking factor to project maximum day and peak hour demands, FNI reviewed historical water treatment plant production peaking factors. Historical water usage data indicated the maximum day to average day peaking factor ranged from 1.64 to 2.11 with an average of 1.85 over the last six years. A peaking factor of 2.0 was selected for future years and is in-line with the 2013 Master Plan. An overall maximum day to peak hour peaking factor of 1.5 was utilized based on prior modeling experience and is in-line with other similar sized cities in the Metroplex. **Table 2-4** summarizes the total system wide historical and projected water demands. **Table 2-5** summarizes the design criteria used to project water demands.

Table 2-3  
Historical Water  
Treatment Plant Production



Historical Water Treatment Plant Production											
Year	Population	Non Residential Acreage (acre)	Weatherford Average Day Demand (MGD)	Residential Average Day Demand (MGD)*	Residential Per Capita (gpcd)	Non Residential Average Day Demand (MGD)*	Non Residential Per Capita (gpad)	Hudson Oaks Average Day Demand (MGD)**	Hudson Oaks Maximum Day Demand (MGD)**	Weatherford Maximum Day Demand (MGD)	Weatherford Max. Day to Avg. Day Peaking Factor
2011	25,300	1,463	4.52	2.83	112	1.69	1,155	0.17	0.69	8.38	1.85
2012	25,440	1,482	4.11	2.57	101	1.54	1,039	0.17	0.69	7.56	1.84
2013	25,940	1,513	3.92	2.46	95	1.46	965	0.12	0.67	7.04	1.80
2014	26,200	1,544	4.03	2.56	98	1.47	952	0.04	0.41	6.59	1.64
2015	26,600	1,575	3.85	2.45	92	1.40	889	0.09	0.59	7.09	1.84
2016	27,080	1,614	3.79	2.41	89	1.38	855	0.13	0.64	7.98	2.11
Average	--	--	--	--	98	--	976	--	--	--	1.85

\*Water billing meter data used to appropriate residential and commercial demands  
\*\*Hudson Oaks 2011 demands were unavailable and assumed to be equal to the maximum demand recorded



**Table 2-4 Historical and Projected System Wide Water Demands**

Year	Total Average Day Demand (MGD)	Total Max Day Demand (MGD)
2011	4.69	9.07
2012	4.28	8.25
2013	4.04	7.71
2014	4.07	7.00
2015	3.94	7.68
2016	3.92	8.62
2017	4.94	9.87
2022	5.78	12.29
2027	6.66	14.05

**Table 2-5 Water Demand Design Criteria**

Residential Per Capita (gpcd)	Non-Residential Per Capita (gpad)	AD to MD Peaking Factor	MD to PH Peaking Factor
110	1,000	2.0	1.5

Water demands were projected for existing (2017), 2022 and 2027 conditions. **Table 2-6** summarizes the projected Weatherford water demands by usage type.

**Table 2-6 Projected Weatherford Water Demands**

Year	Population	Non-Residential Acreage (acre)	Residential Average Day Demand (MGD)	Non-Residential Average Day Demand (MGD)	Total Average Day Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
2017	27,773	1,655	3.06	1.66	4.72	9.44	14.16
2022	31,712	1,927	3.49	1.93	5.42	10.84	16.26
2027	35,879	2,345	3.95	2.35	6.30	12.60	18.90

The City of Hudson Oaks is the only wholesale water customer of the City of Weatherford. The projected Hudson Oaks demands are based on projections provided by the City of Hudson Oaks to the City of Weatherford. **Table 2-7** summarizes the total system wide projected water demands. **Table 2-8** shows the projected water demands by pressure plane.



**Table 2-7 Projected System Wide Water Demands**

<b>Year</b>	<b>Weatherford Average Day Demand (MGD)</b>	<b>Wholesale Average Day Demand (MGD)</b>	<b>Total Average Day Demand (MGD)</b>
2017	4.72	0.22	4.94
2022	5.42	0.36	5.78
2027	6.30	0.36	6.66
<b>Year</b>	<b>Weatherford Maximum Day Demand (MGD)</b>	<b>Wholesale Maximum Day Demand (MGD)</b>	<b>Total Maximum Day Demand (MGD)</b>
2017	9.44	0.43	9.87
2022	10.84	1.45	12.29
2027	12.60	1.45	14.05
<b>Year</b>	<b>Weatherford Peak Hour Demand (MGD)</b>	<b>Wholesale Peak Hour Demand (MGD)</b>	<b>Total Peak Hour Demand (MGD)</b>
2017	14.16	0.65	14.81
2022	16.26	2.18	18.44
2027	18.90	2.18	21.08



**Table 2-8 Projected Water Demands by Pressure Plane**

2017						
Pressure Plane	Population	Connections	Non-Residential Acreage (acre)	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
Central	11,769	5,119	711	2.01	4.02	6.03
Franklin	2,164	941	53	0.29	0.58	0.87
Dubellette	6,303	2,741	674	1.37	2.74	4.11
Miller	5,212	2,267	210	0.79	1.58	2.37
Oak Ridge	1,310	570	6	0.15	0.30	0.45
West Lake	1,015	441	1	0.11	0.22	0.33
Hudson Oaks*	--	--	--	0.22	0.43	0.65
<b>Total</b>	<b>27,773</b>	<b>12,079</b>	<b>1,655</b>	<b>4.94</b>	<b>9.87</b>	<b>14.81</b>
2022						
Pressure Plane	Population	Connections	Non-Residential Acreage (acre)	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
Central	13,027	5,666	749	2.18	4.36	6.54
Franklin	2,261	983	51	0.30	0.60	0.90
Dubellette	7,406	3,221	779	1.59	3.18	4.77
Miller	6,233	2,711	341	1.03	2.06	3.09
Oak Ridge	1,623	706	6	0.19	0.38	0.57
West Lake	1,162	505	1	0.13	0.26	0.39
Hudson Oaks*	--	--	--	0.36	1.45	2.18
<b>Total</b>	<b>31,712</b>	<b>13,792</b>	<b>1,927</b>	<b>5.78</b>	<b>12.29</b>	<b>18.44</b>
2027						
Pressure Plane	Population	Connections	Non-Residential Acreage (acre)	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
Central	14,238	6,193	859	2.43	4.86	7.29
Franklin	2,263	984	52	0.30	0.60	0.90
Dubellette	8,568	3,727	922	1.86	3.72	5.58
Miller	7,291	3,171	505	1.31	2.62	3.93
Oak Ridge	2,022	879	6	0.23	0.46	0.69
West Lake	1,497	651	1	0.17	0.34	0.51
Hudson Oaks*	--	--	--	0.36	1.45	2.18
<b>Total</b>	<b>35,879</b>	<b>15,605</b>	<b>2,345</b>	<b>6.66</b>	<b>14.05</b>	<b>21.08</b>

\*Hudson Oaks served from the Central Pressure Plane



### 3.0 Water Model Update

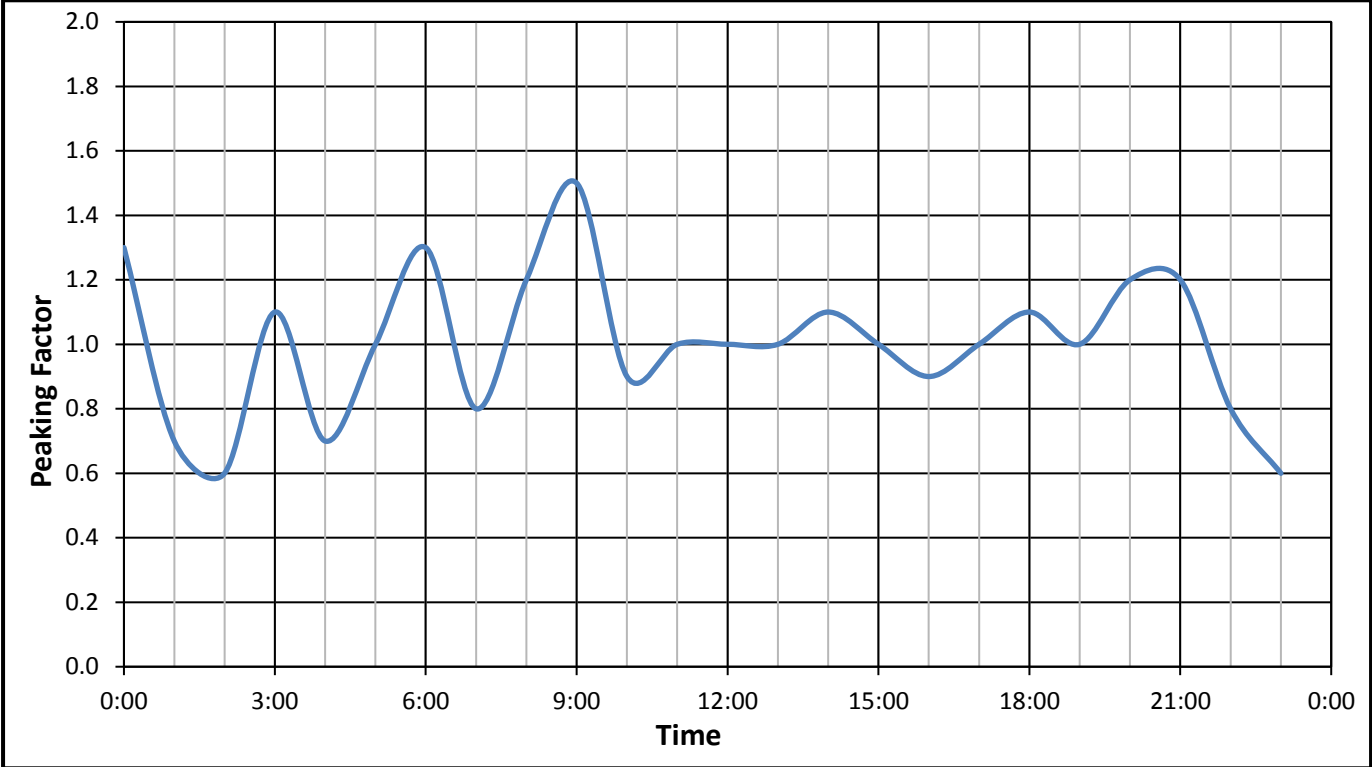
FNI updated the hydraulic model developed as part of the 2013 Water Master Plan to include the most current facility information such as pumping rates and storage tank operation. New water lines built, removed or replaced since the last model update were incorporated into the model based on updated GIS provided by the City. The proposed 30-inch Oak Street water line was also included in the water model, as this project will begin construction in the near term and is a key project for moving water from the Water Treatment Plant (WTP) to the Dubellette Ground Storage Tank (GST) that feeds the Miller Pressure Plane.

#### 3.1 Diurnal Curve Development

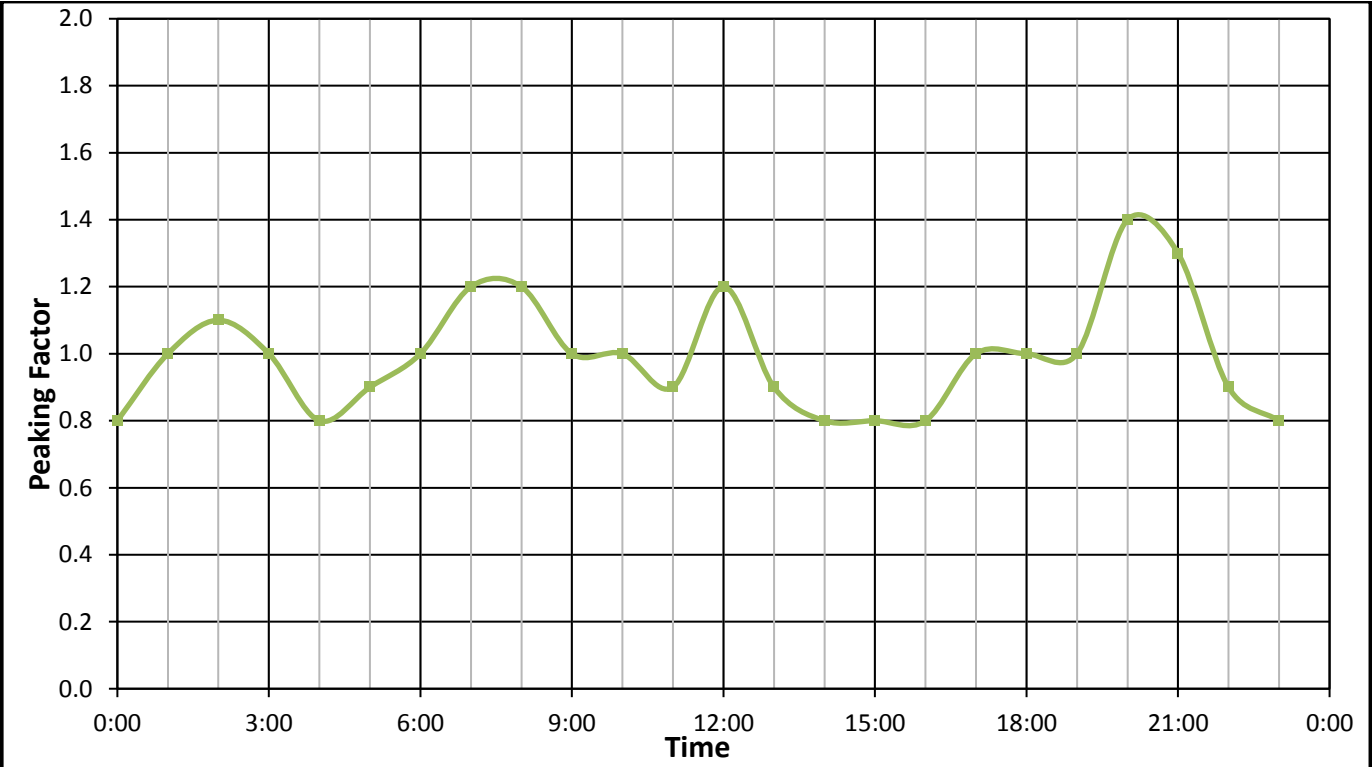
The City provided SCADA data during a peak summer usage month as well as a typical average day usage month. The SCADA reports included ground and elevated storage tank levels and discharge flows and on/off status for system pumps. Flow and tank level data were utilized to develop diurnal curves by calculating water going into (supply) and out of (demand) the distribution system. Maximum day diurnal curves were developed using the SCADA data for the Miller and Franklin Pressure Planes and updated in the existing model in one-hour increments. For future model updates, the City's Advanced Meter Infrastructure (AMI) data can be used to refine the diurnal patterns. **Figures 3-1** and **3-2** present the updated diurnal curves for the Miller and Franklin Pressure Planes, respectively. The diurnal curves show that the Miller and Franklin Pressure Planes see a peak hour to max day peaking factor of about 1.5, which is consistent with the projection design criteria. The Miller Pressure Plane experiences more water usage in the morning than is typical, which could be a result of early morning irrigation or industrial users.



**Figure 3-1 Miller Pressure Plane Maximum Day Diurnal Curve**



**Figure 3-2 Franklin Pressure Plane Maximum Day Diurnal Curve**





### 3.2 Water Model Calibration

In order to verify that the hydraulic model accurately represented the distribution system operation, the model calibration performed as part of the 2013 Water Master Plan was updated based on SCADA data provided by the City for April 6-13 and July 20-26, 2016. The calibration update focused on the Miller and Franklin Pressure Planes. The calibration process involved adjusting system operations, demand allocation, and diurnal curves to match a known condition. During calibration, time based controls were used on the pumps and valves because a known condition was matched from the SCADA data. For system analysis, the model controls were based on parameters such as tank levels or modulated valve settings (i.e. at the Dubellette and Harberger Hill ground storage tanks), unless a certain facility has a regularly specified time control (i.e. a pump is on during a specific time every day). The SCADA values are an instantaneous reading at 20-minute time intervals and do not account for changes in between data points; therefore, minor adjustments to the settings at the pumps and valves were necessary to account for fluctuations between calibration points. Results from the calibration of the model are presented in **Figures 3-3 through 3-7**.



Figure 3-3  
0.25 MG Miller EST Level  
July 20, 2016

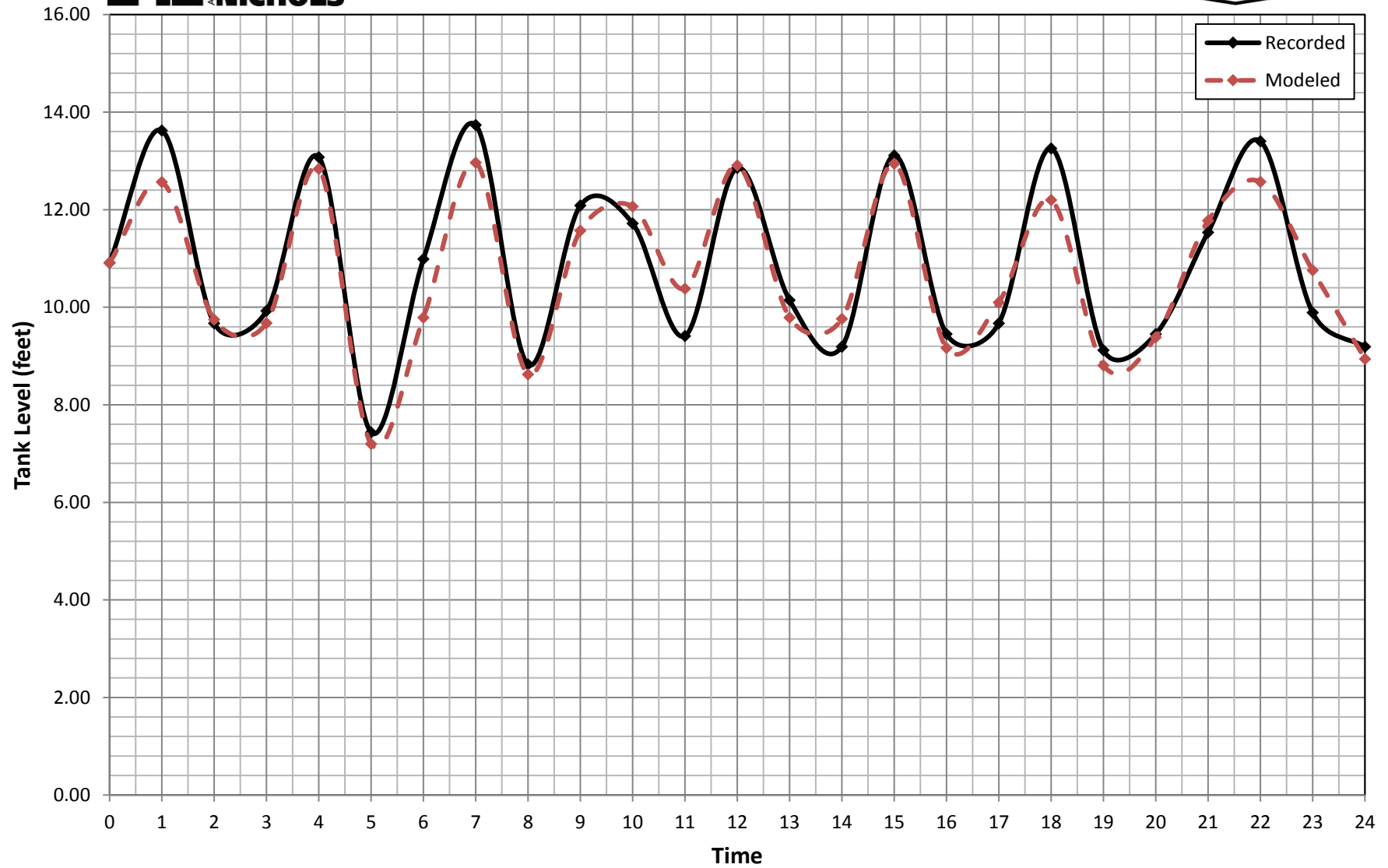




Figure 3-4  
0.25 MG Franklin EST Level  
July 20, 2016

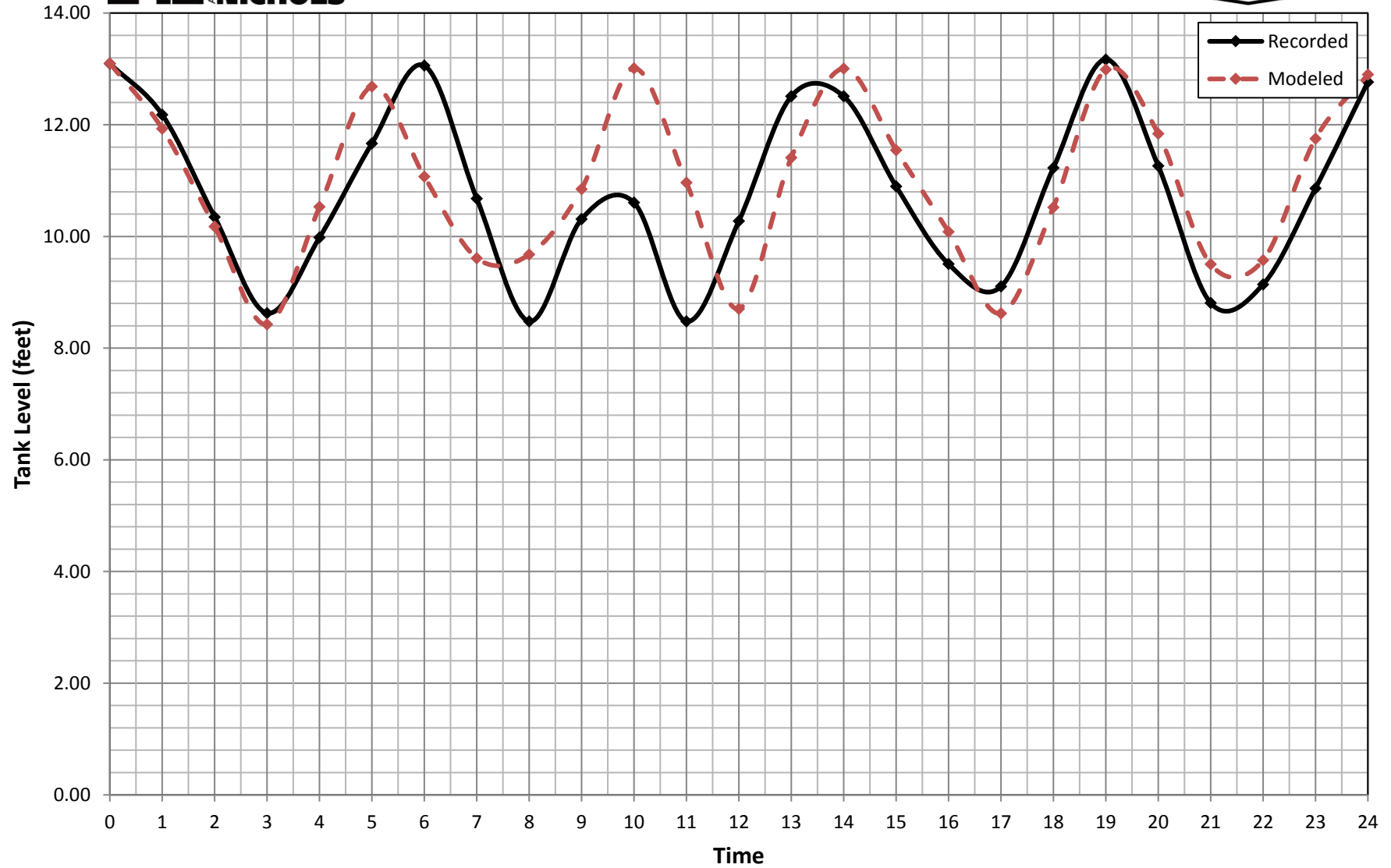


Figure 3-5  
1.0 MG Dubellette GST Level  
July 20, 2016

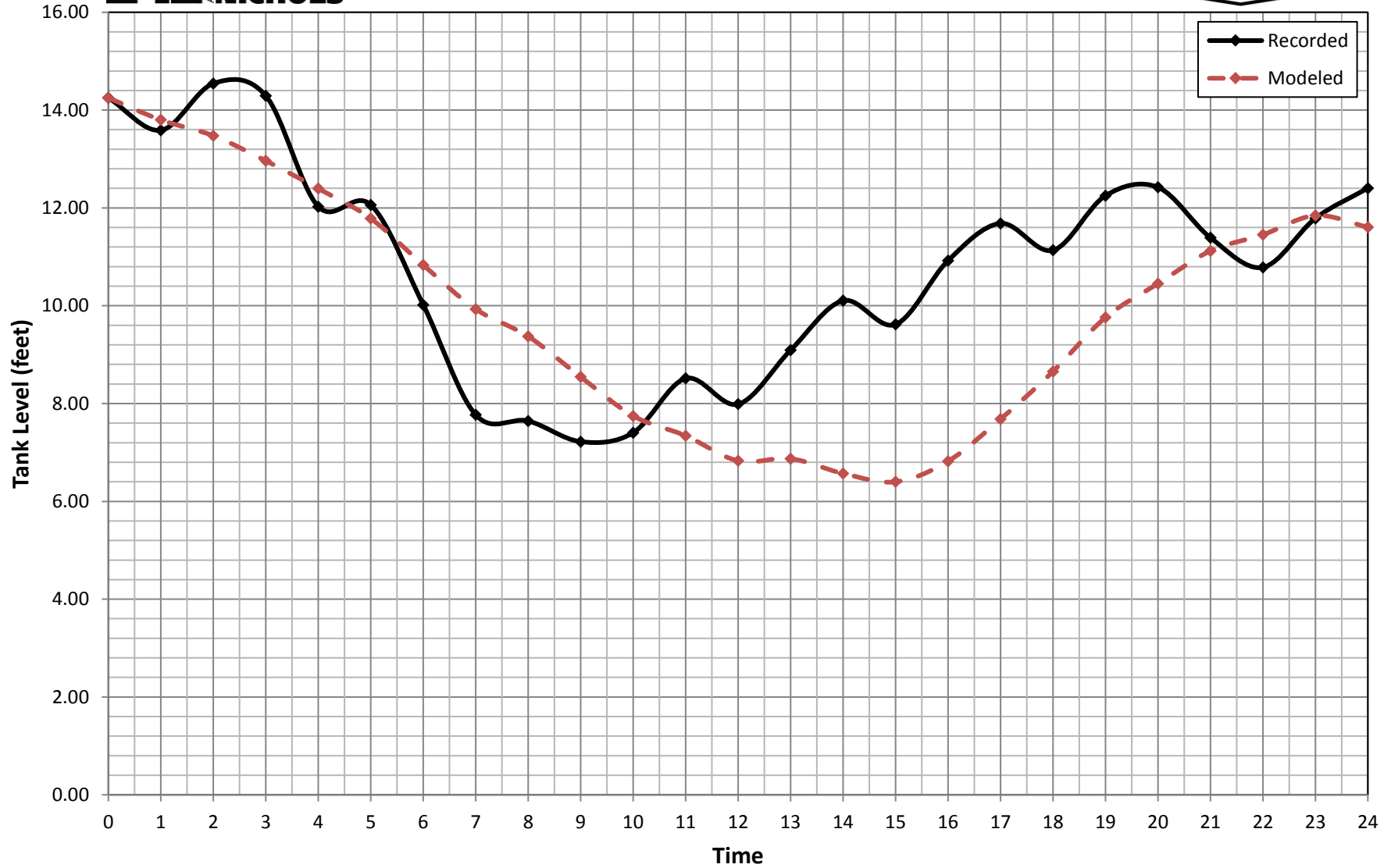


Figure 3-6  
2.0 MG Harberger Hill GST Level  
July 20, 2016

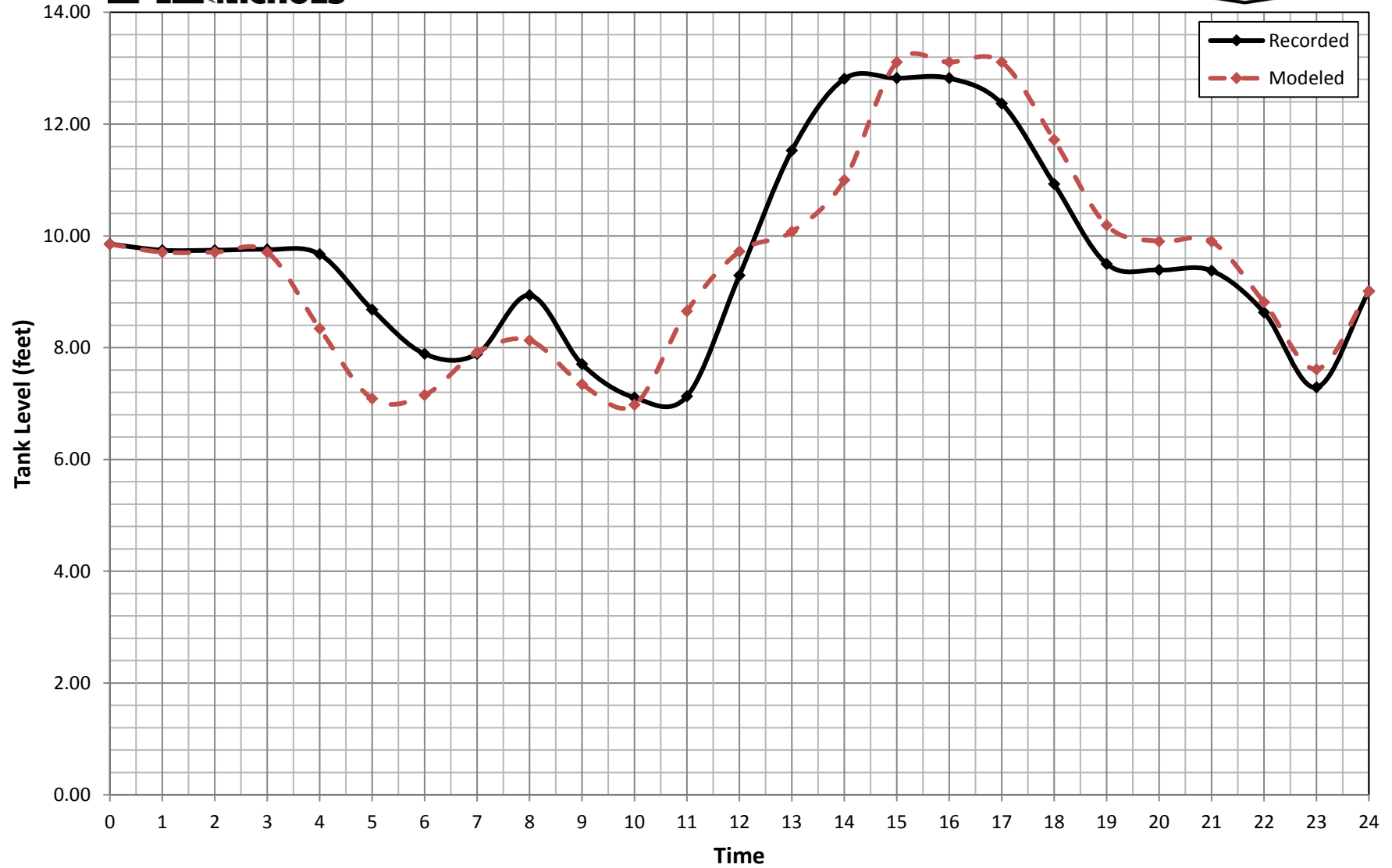
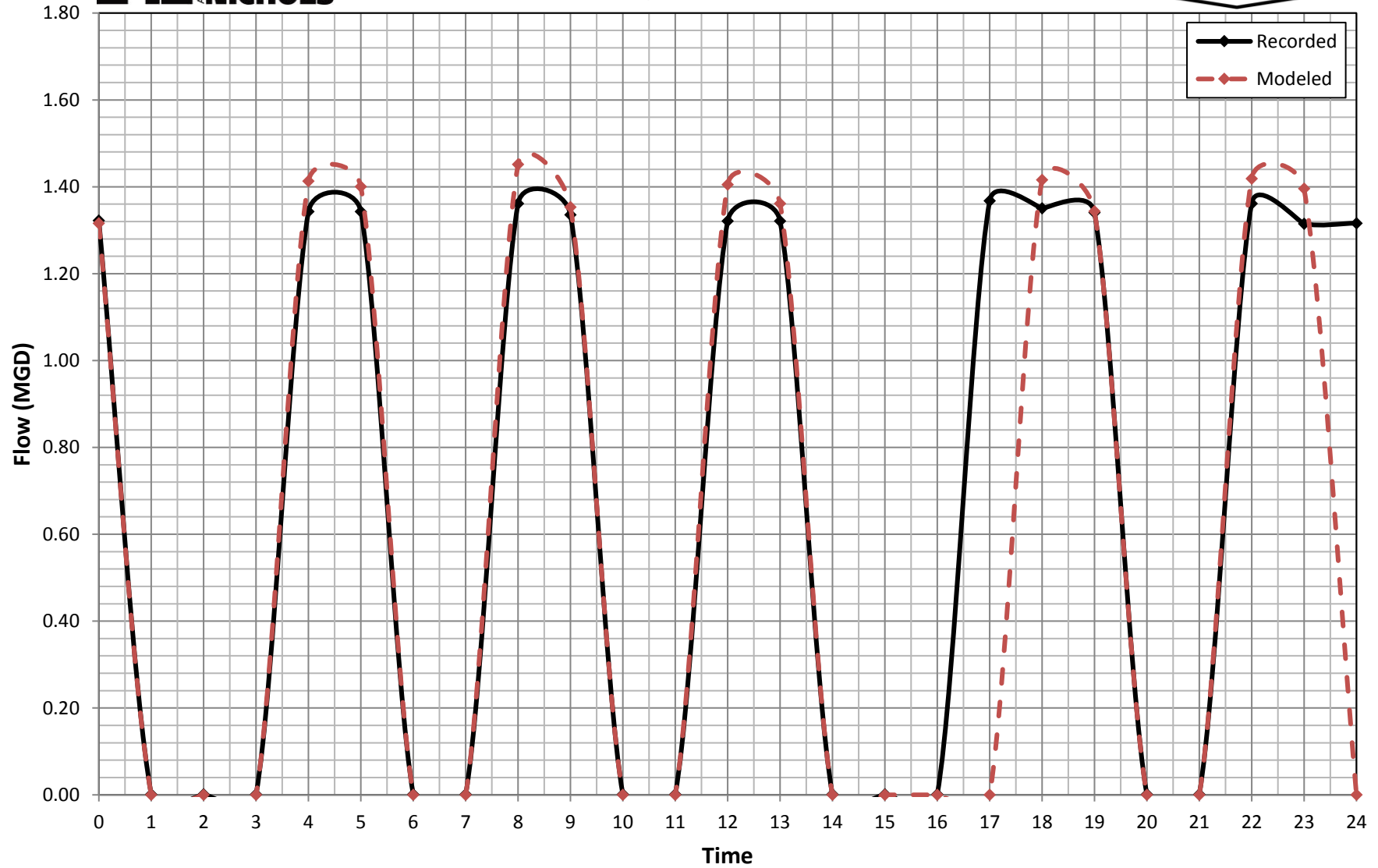




Figure 3-7  
Harberger Hill PS Flow  
July 20, 2016



## 4.0 Hydraulic Analysis

In order to plan for the future, it is important to know how the system performs under existing conditions. The primary methods for analyzing the existing system with an extended period simulation hydraulic model are: peak hour pressure analysis, fire flow analysis, and pumping and storage facility capacity analysis. Each analysis gives important insight as to how the system is functioning, where deficiencies may exist and where there is a need for expansions of pumping and storage facilities.

### 4.1 Peak Hour Pressure Analysis

The water system was predominantly analyzed for maximum day demand operating conditions. By examining the water system over a 24-hour period, it is possible to determine if pressure issues occur, tanks are filling or draining properly, and the pumping facilities are adequate to meet the required demand at acceptable pressures. A color-coded pressure map was prepared to illustrate the pressures calculated at model junctions. The map helped identify potential problem areas in the system, such as the northeast Franklin Pressure Plane and near the Hudson Oaks delivery point, and were used as a tool to determine if the desired range of pressures (greater than 35 psi and less than 100 psi) were maintained throughout the system. **Figure 4-1** shows the modeled minimum pressures under maximum day and peak hour demands. Minimum pressures shown on the maps represent the lowest value of the pressures experienced during the 24-hour simulation, typically occurring during the peak hour demand. In addition to documenting minimum pressures under these demands, FNI evaluated the existing system pipes based on a maximum friction loss of 5 feet per 1,000 feet of pipeline length. This was done to determine the areas which are stressed under higher demands. Areas experiencing headloss greater than the design criteria will typically have older pipe with tuberculation or other factors which increase pipe roughness or are pushing more water through the pipe than it was originally designed to handle, and can be the cause of pressure issues in the distribution system. **Figure 4-1** highlights the areas which exceed the design headloss criteria in red.

### 4.2 Fire Flow Analysis

To evaluate the fire suppression capabilities of the system, a fire flow analysis was conducted under maximum day demand conditions. TCEQ requires a minimum residual pressure of 20 psi be maintained while delivering fire flow under maximum day demand conditions. For this analysis, a steady-state model run was utilized to calculate the available fire flow at each fire hydrant node in the system with a pressure of 20 psi. The recommended minimum conditions for fire flow in the City of Weatherford are 1,000 gpm of available flow at each hydrant. A fire flow map showing the available fire flow throughout the distribution system is presented in **Figure 4-2**.

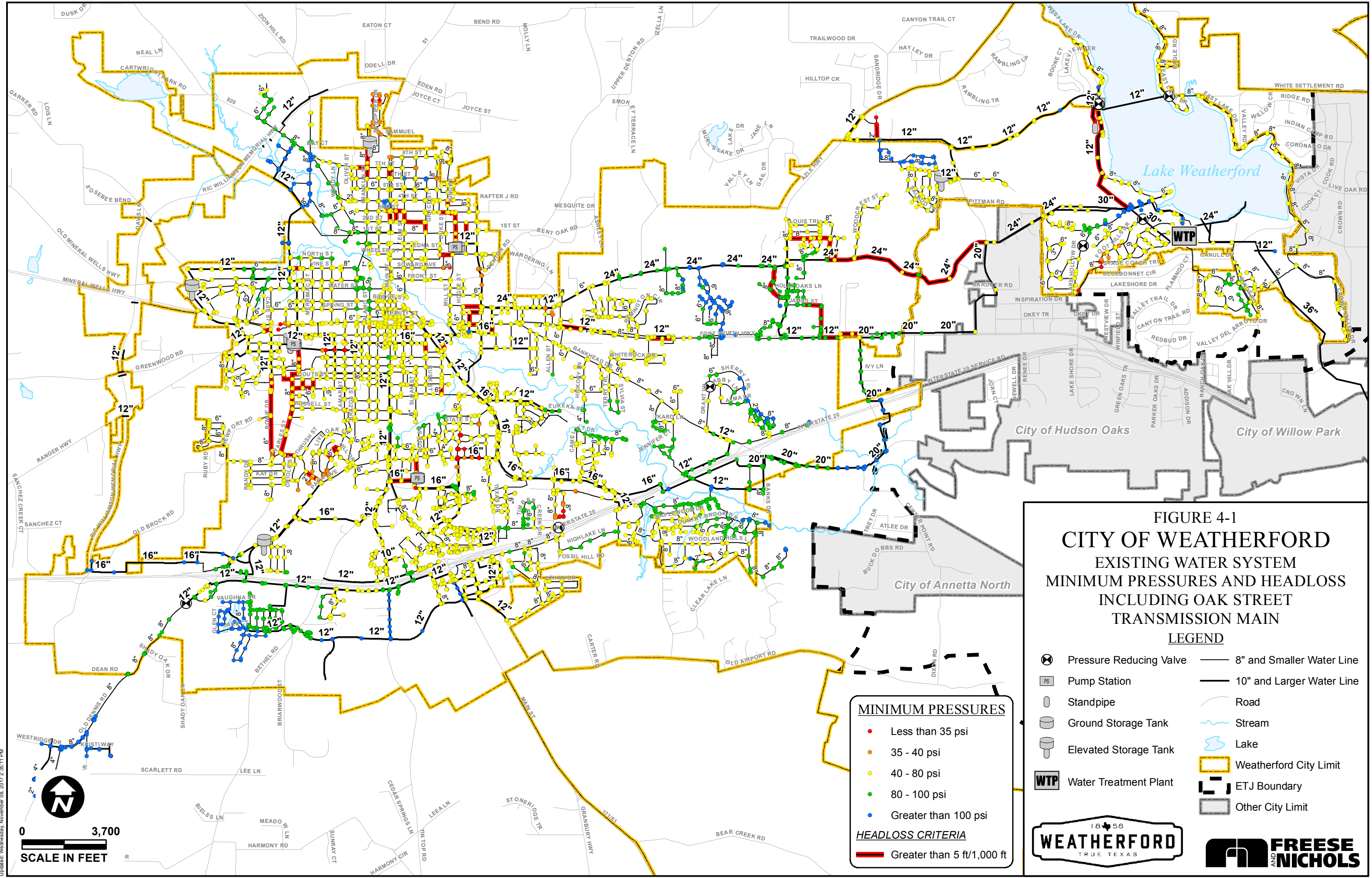


FIGURE 4-1  
CITY OF WEATHERFORD  
EXISTING WATER SYSTEM  
MINIMUM PRESSURES AND HEADLOSS  
INCLUDING OAK STREET  
TRANSMISSION MAIN  
LEGEND

- Pressure Reducing Valve
- Pump Station
- Standpipe
- Ground Storage Tank
- Elevated Storage Tank
- Water Treatment Plant
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Stream
- Lake
- Weatherford City Limit
- ETJ Boundary
- Other City Limit

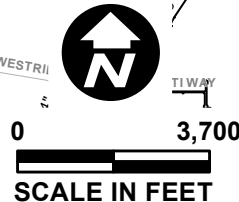
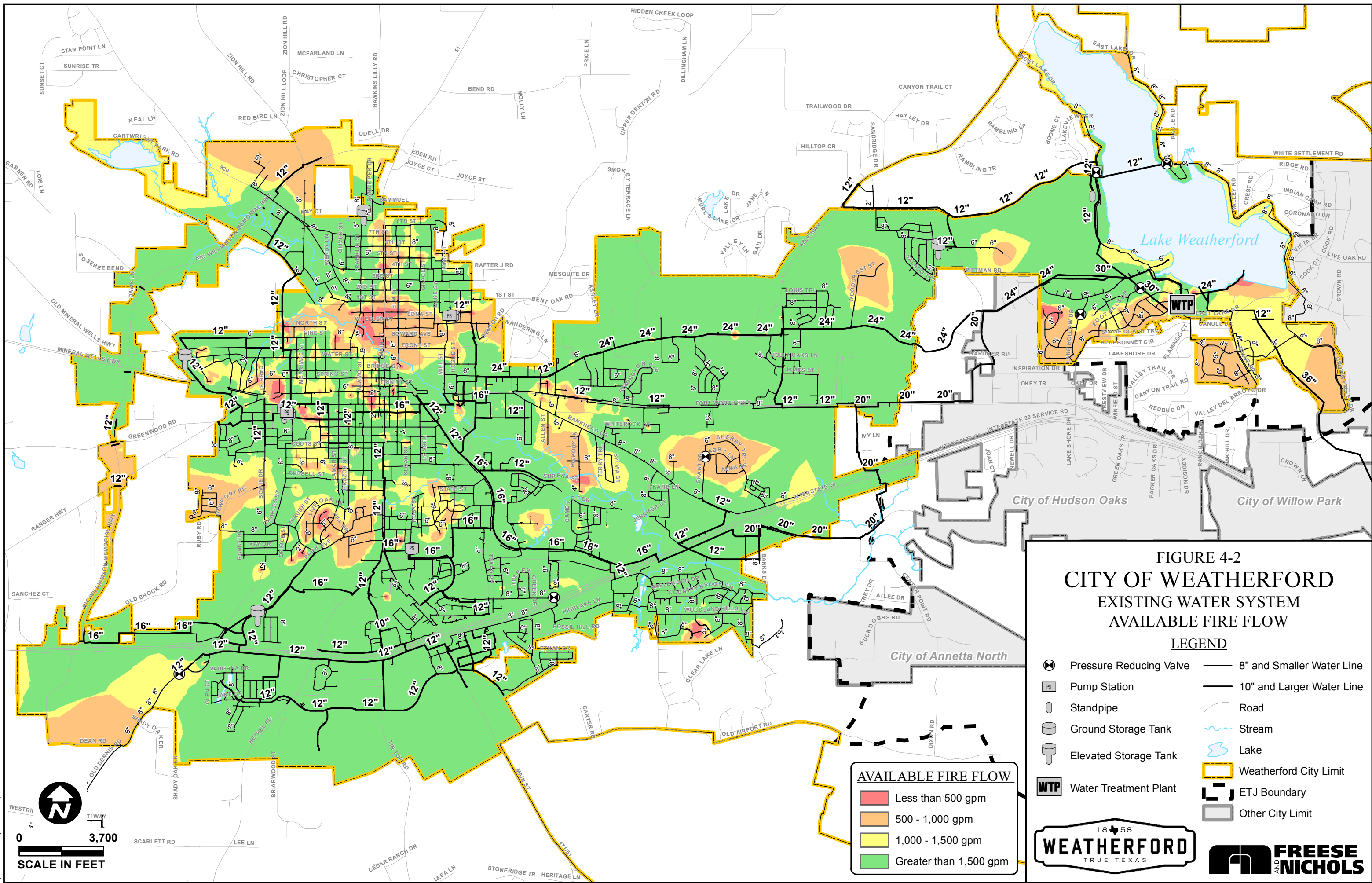
**MINIMUM PRESSURES**

- Less than 35 psi
- 35 - 40 psi
- 40 - 80 psi
- 80 - 100 psi
- Greater than 100 psi

**HEADLOSS CRITERIA**

- Greater than 5 ft/1,000 ft







### 4.3 Pumping and Storage Requirements

As a public water utility, the City of Weatherford must comply with the rules and regulations for public water systems set forth by TCEQ in Texas Administrative Code (TAC) Chapter 290, regarding system pumping and storage capacity. Desktop and hydraulic modeling analyses were conducted to identify deficiencies in the Miller and Franklin Pressure Planes.

In order to properly plan and provide water service for future planning periods, it is necessary to know how much water is needed for storage and distribution. FNI created the graphs on **Figures 4-3** through **4-8** for the Miller and Franklin Pressure Planes showing required vs. proposed ground storage, elevated storage and pumping capacity. The vertical bars represent the water demand for the planning period, and the horizontal red line is the capacity in the system at the given time. The capacity changes over time with the proposed expansion or decommissioning of facilities in order to meet the design criteria.

The TCEQ requirements for elevated storage and pumping capacity are summarized in **Table 4-1**. The amount of elevated storage affects the minimum required TCEQ pumping capacity. Elevated storage capacity equal to or greater than 200 gallons per connection decreases the amount of required pumping to 0.6 gpm per connection. TCEQ also requires public water systems to meet a total storage (elevated and ground) requirement of 200 gallons per connection.

**Table 4-1 TCEQ Pumping Requirements**

Elevated Storage Capacity	Service Pumping Capacity Requirement <sup>(1)</sup>
≥ 200 gallons per connection	(1) Two service pumps with a minimum combined capacity of 0.6 gpm per connection at each pressure plane.
< 200 gallons per connection	(2) The lesser of (a) or (b):
	(a) Total pumping capacity of 2.0 gpm per connection
	(b) Total capacity of at least 1,000 gpm and the ability to meet peak hourly demands with the largest pump out of service
<sup>(1)</sup> According to 30 TAC §290.45(b)(2)(F)	

FNI developed facility sizing criteria that are typically more stringent than the TCEQ requirements and take into consideration many additional factors including operation flexibility, fire suppression and energy efficiency.



The design criteria used to determine required ground storage tank capacity is providing adequate storage for maximum day demands for 8 hours.

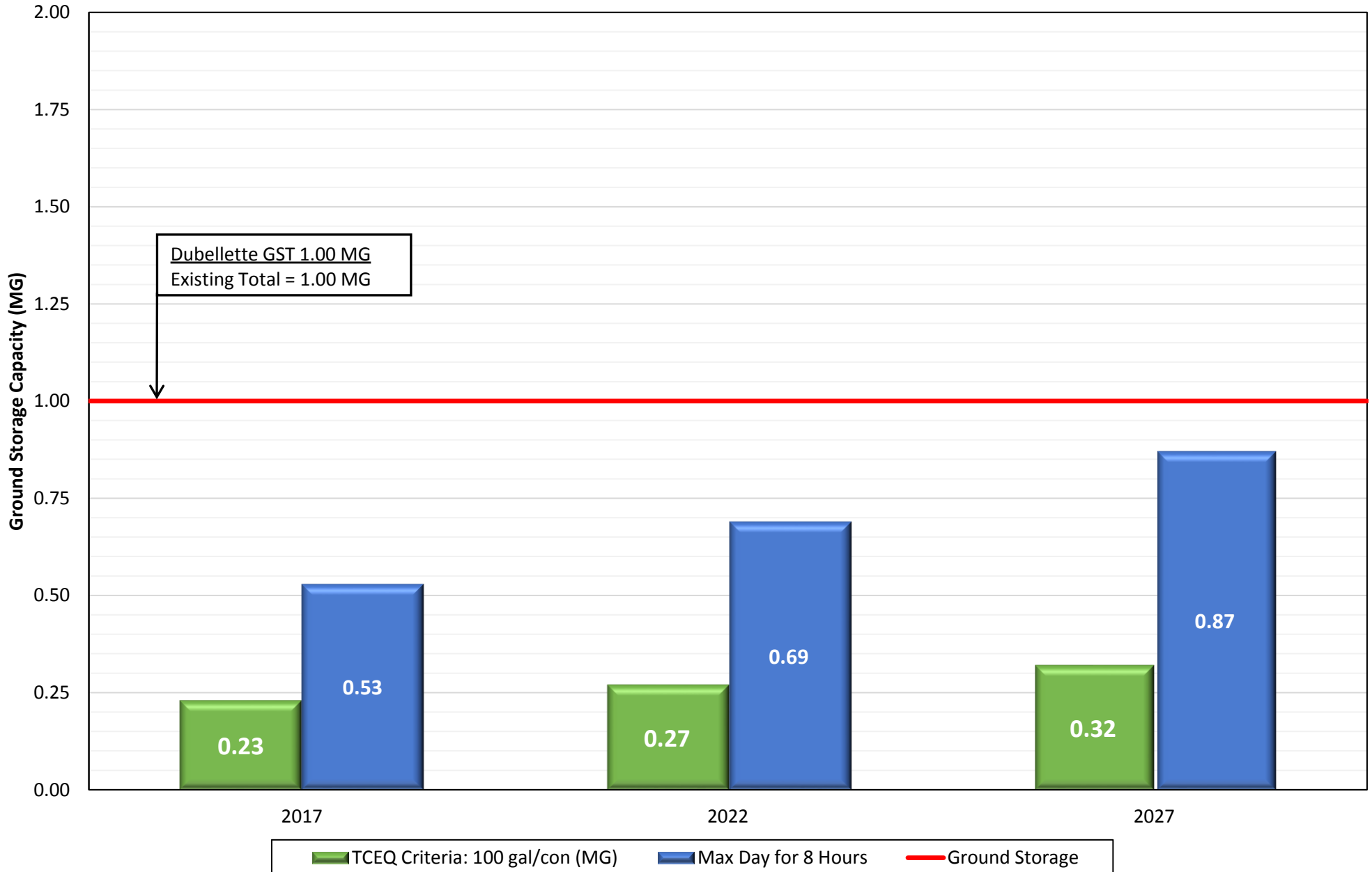
The design criteria used to determine the required elevated storage tank capacity is to maintain enough capacity to provide adequate storage for peak hour demands plus emergency storage for fire protection. The capacity is based on meeting the greater of either (a) two times 40% of the peak hour demand for 3 hours or (b) fire flow storage. The required capacity for emergency fire protection storage is calculated as the volume of water needed to meet a 1,500 gpm fire for a 3-hour time period.

The design criteria used to determine required firm pumping capacity is meeting 125% of the maximum day demand.

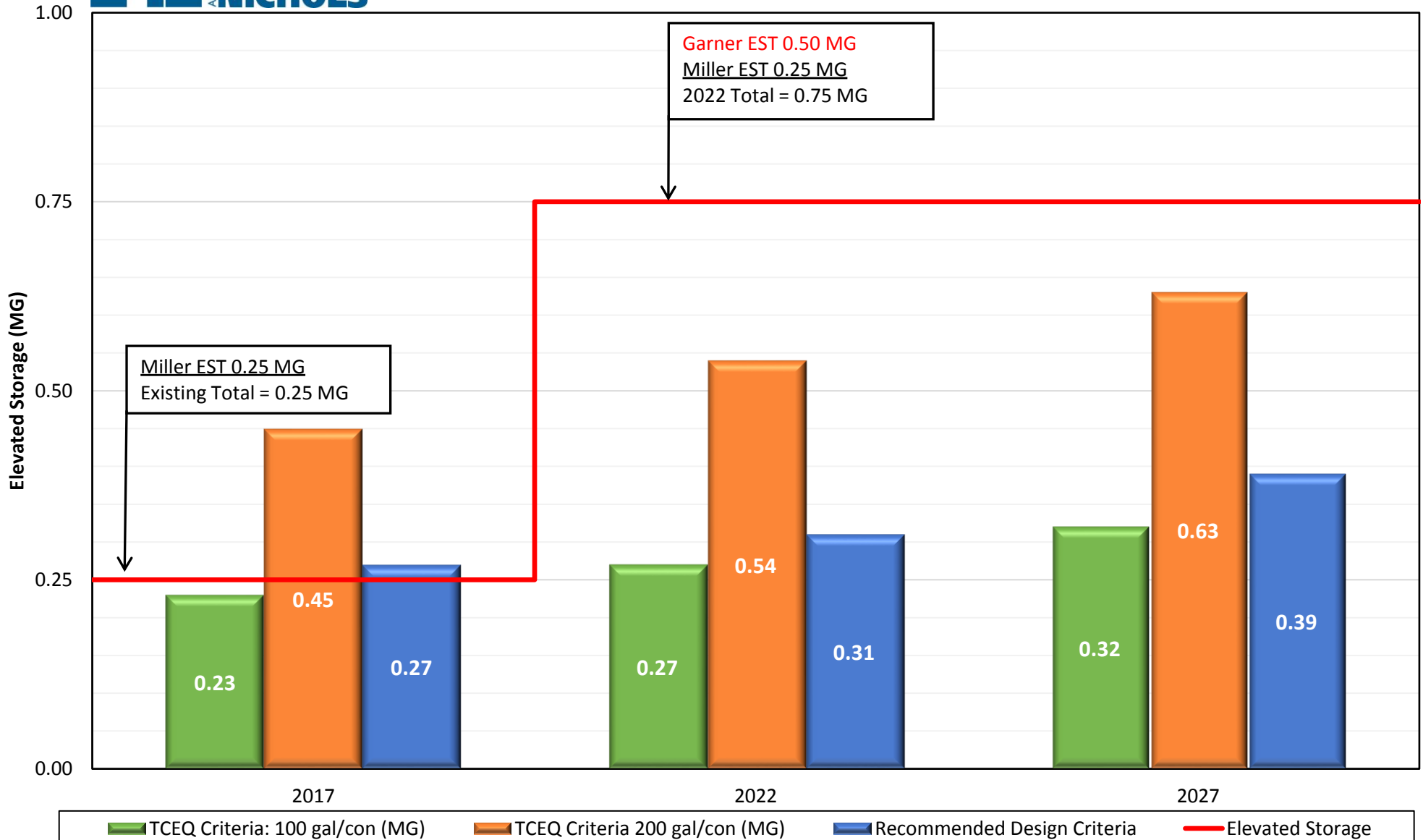
**Figures 4-3** through **4-5** show the recommended storage and pumping needs for the Miller Pressure Plane. The Miller Pressure Plane has enough ground storage to meet maximum day requirements through the 2027 planning period. Due to additional growth and an altered pressure plane boundary, however, the Miller Pressure Plane does not have enough pumping and elevated storage capacity to meet future demand conditions. FNI recommends adding a 0.5 MG EST in the pressure plane and a 2.0 MGD pump station expansion at the Dubellette Pump Station.

**Figures 4-6** through **4-8** show the recommended storage and pumping needs for the Franklin Pressure Plane. The Franklin Pressure Plane has enough ground storage, elevated storage, and pumping capacity to meet maximum day and peak hour requirements through the 2027 planning period. FNI does not recommend any facility improvements in this pressure plane.

**Figure 4-3**  
**Miller Pressure Plane**  
**Ground Storage Requirements**



**Figure 4-4**  
**Miller Pressure Plane**  
**Elevated Storage Requirements**

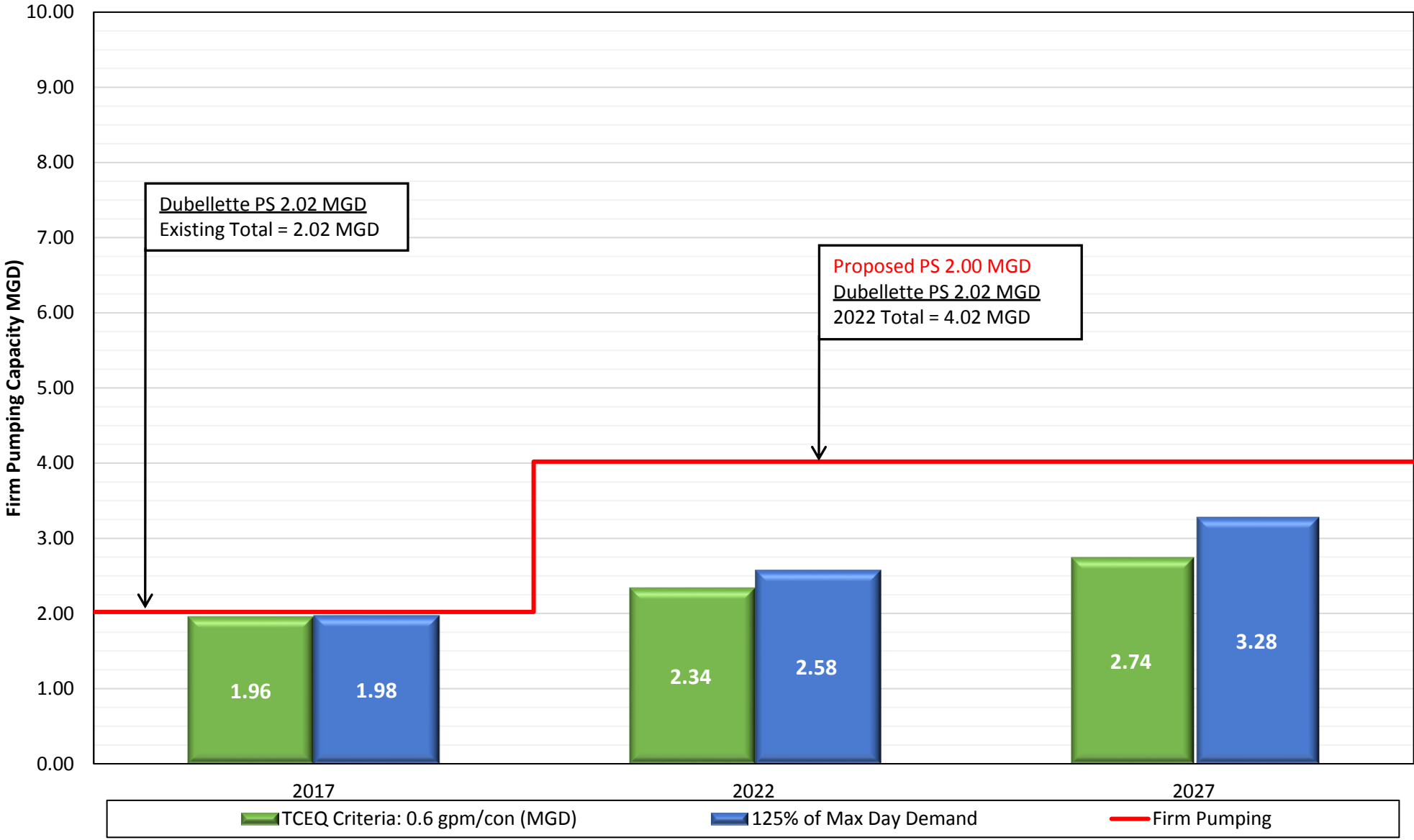


\*The City does not meet 200 gal/con of elevated storage or 2.0 gpm/con of firm pumping capacity. Therefore, TCEQ requires additional elevated storage capacity.

# Figure 4-5

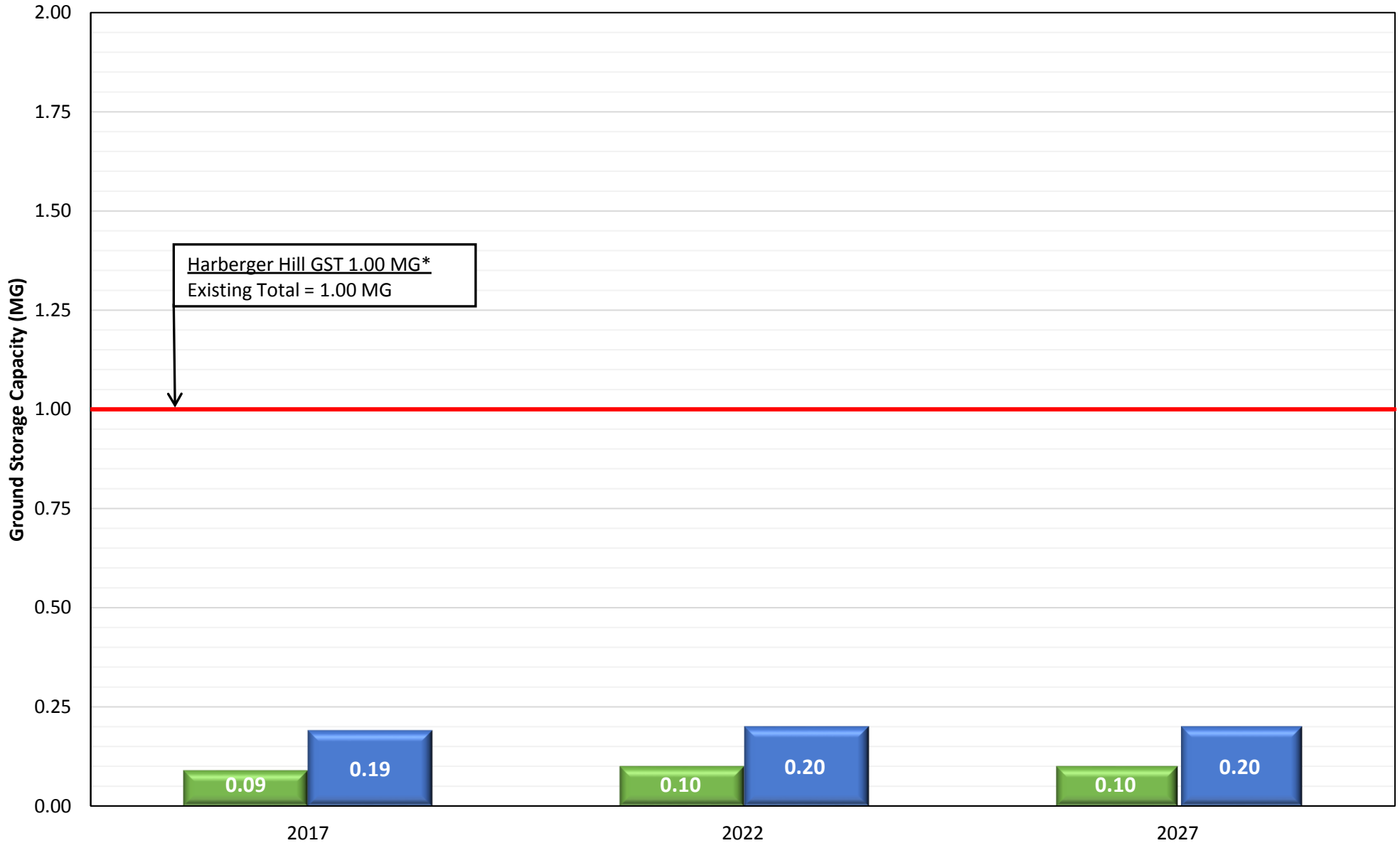
## Miller Pressure Plane

### Firm Pumping Requirements

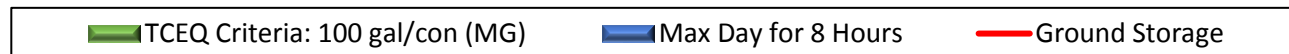


\*The City does not meet 200 gal/con of elevated storage or 2.0 gpm/con of firm pumping capacity.

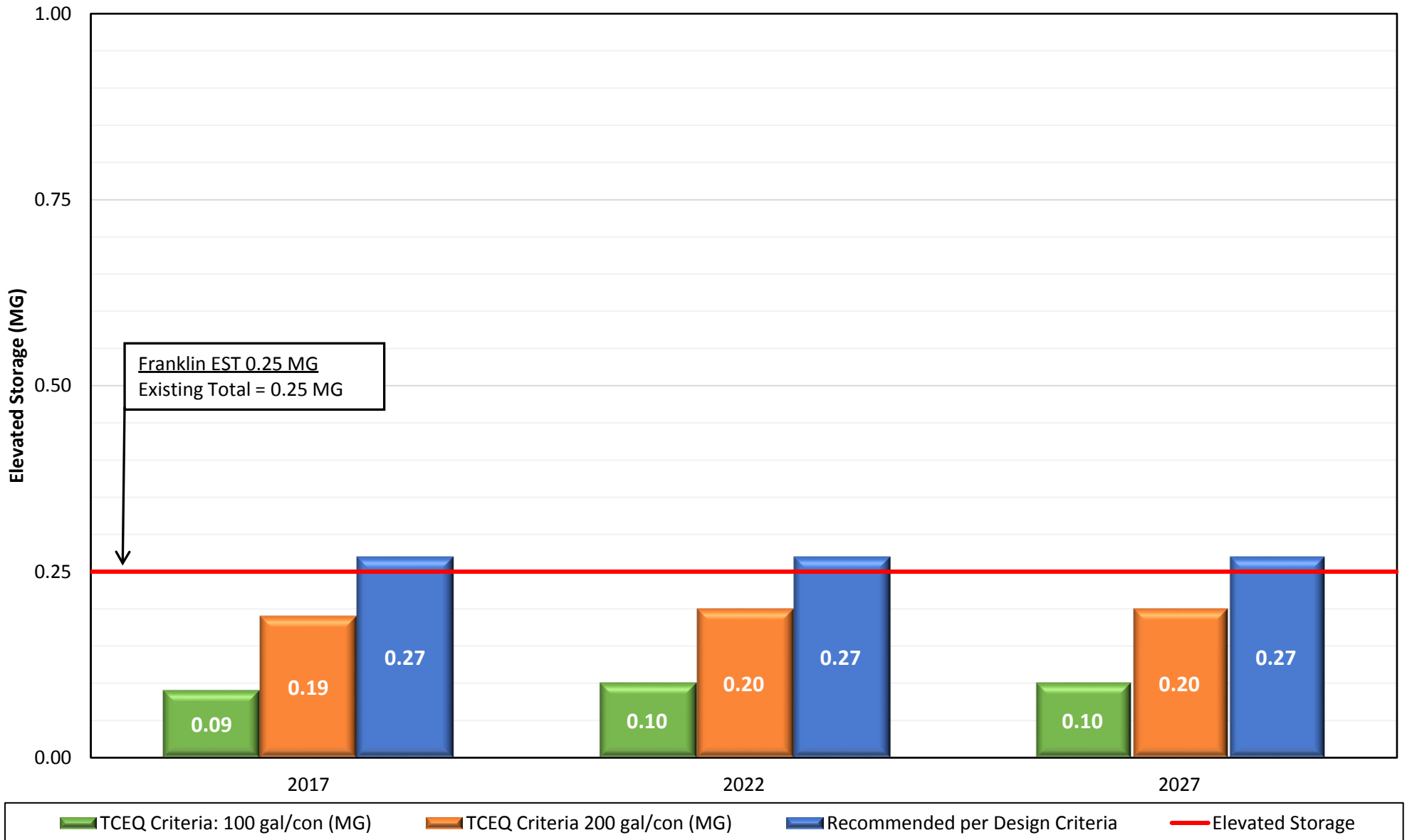
**Figure 4-6**  
**Franklin Pressure Plane**  
**Ground Storage Requirements**



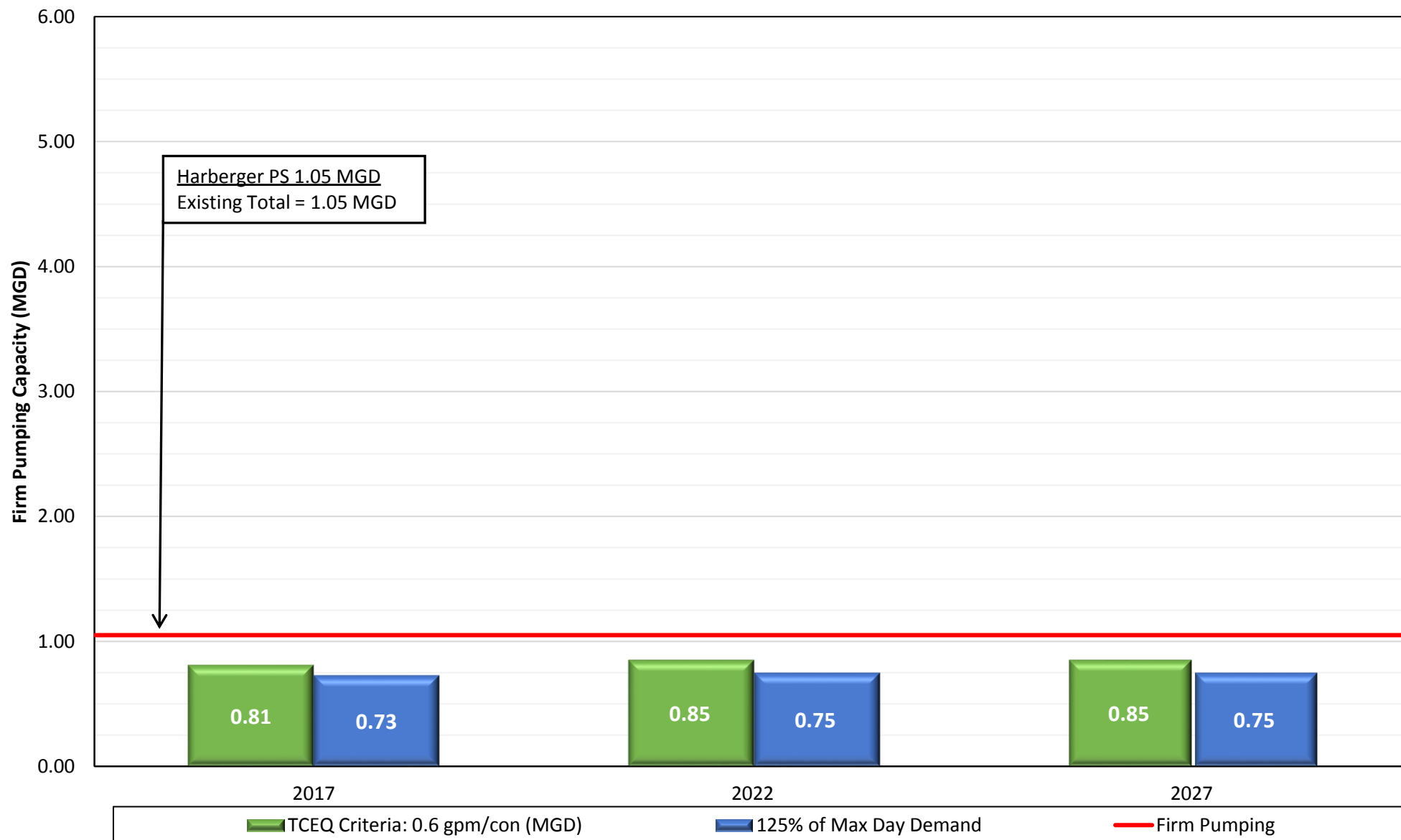
\*Total capacity of Harberger = 2.00 MG



**Figure 4-7**  
**Franklin Pressure Plane**  
**Elevated Storage Requirements**



**Figure 4-8**  
**Franklin Pressure Plane**  
**Firm Pumping Requirements**





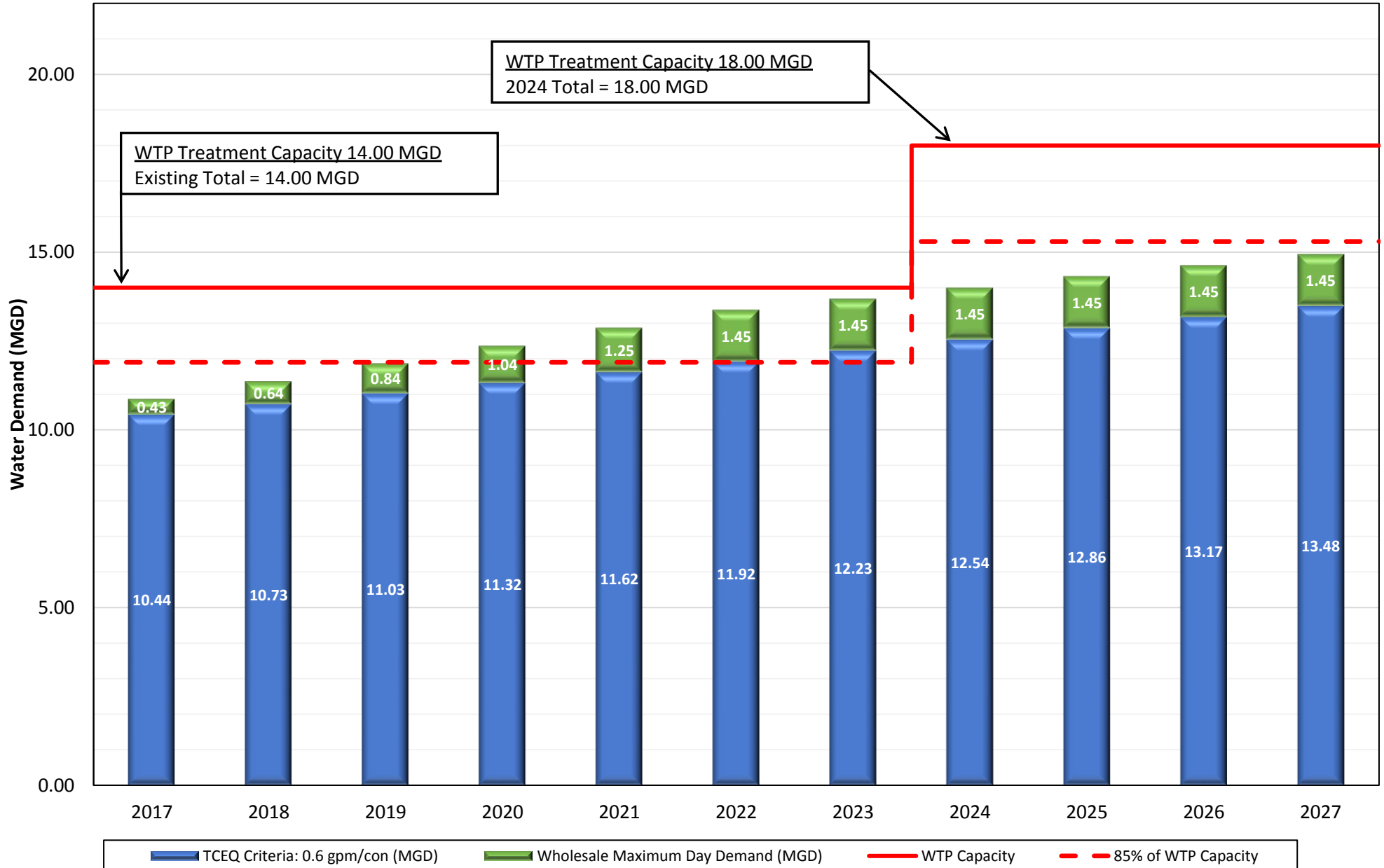
#### 4.4 Water Treatment Plant Capacity

FNI evaluated the City's Water Treatment Plant (WTP) and High Service Pump Station (HSPS) capacity to meet future demands. **Figure 4-9** illustrates the required treatment plant capacity through the 2027 planning period. The projected capacity is based on the TCEQ requirement of 0.6 gpm per connection. **Figure 4-9** also shows when City will reach 85% of its treatment capacity, which will trigger the need to begin preparations to provide sufficient capacity due to TCEQ requirements. The 2027 required capacity of the WTP is 18 MGD.

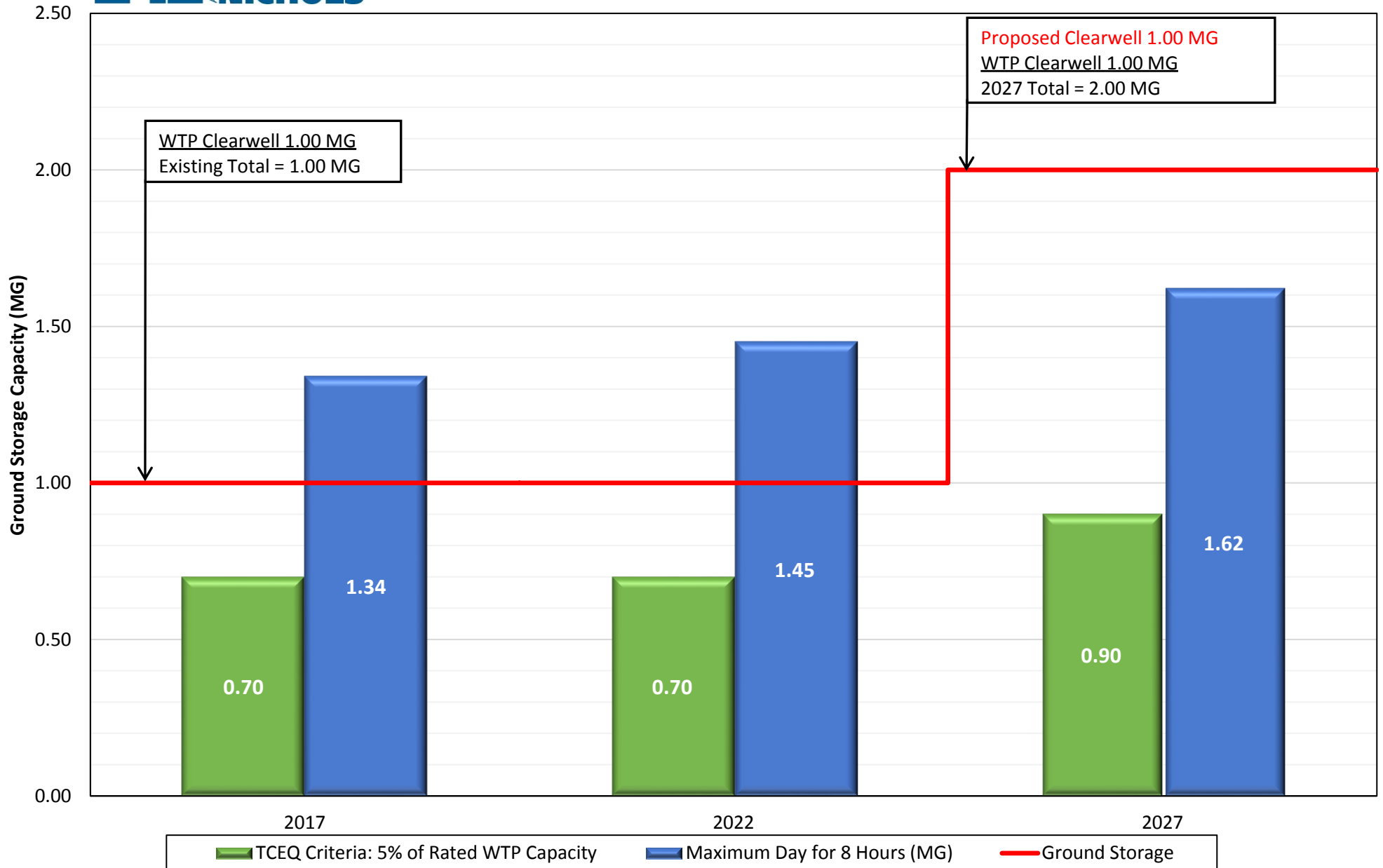
The design criteria used to determine required HSPS ground storage and pumping capacity are similar to the criteria discussed in **Section 4.3**. TCEQ requires clearwell storage capacity of 5% of the rated treatment capacity of the WTP. **Figures 4-10** and **4-11** show the recommended storage and pumping needs for the HSPS. The City meets the TCEQ requirements for storage and pumping. However, FNI recommends additional storage and pumping in order to meet more stringent operational criteria. Since the Central Pressure Plane is served directly from the HSPS, the clearwell not only serves as clearwell storage for the WTP, but also as ground storage for the Central Pressure Plane. The FNI recommended criteria of 8 hours of maximum day demand for the ground storage capacity, shown on the blue bar on **Figure 4-10**, is based on providing emergency storage capacity to allow response time to address issues affecting the WTP. The timing and sizing of the recommended WTP projects are similar to those included in the 2013 Water Master Plan. Based on these projections, FNI recommends the proposed WTP expansion be in service by 2024, in order to stay in compliance with TCEQ requirements. The exact timing of the WTP expansion will be determined when the plant has reached 85% of its capacity.

Figure 4-9

# Water Treatment Plant Requirements TCEQ WTP Capacity Requirement

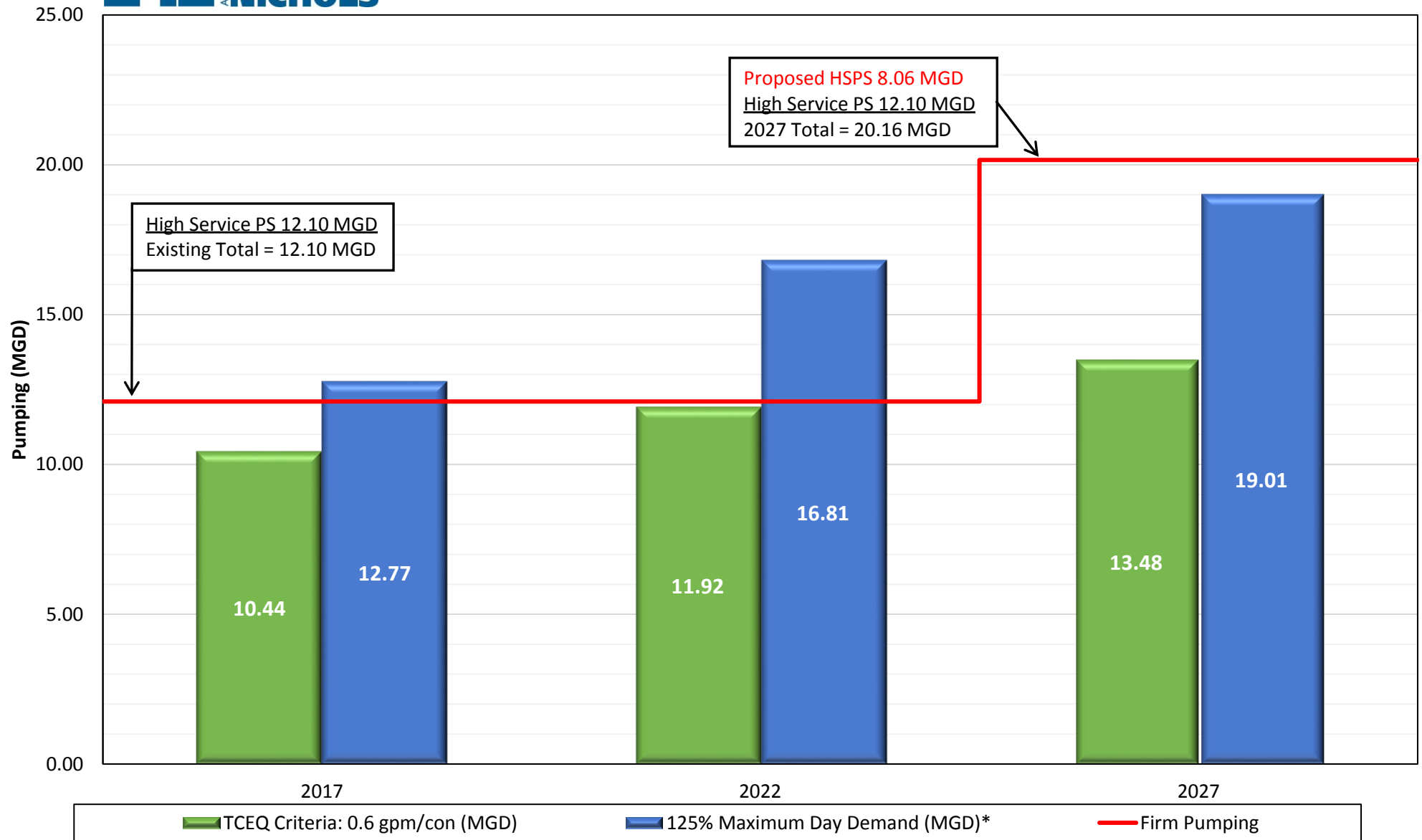


**Figure 4-10**  
**Water Treatment Plant**  
**Ground Storage Requirements**



Note: The City meets TCEQ requirements for Clearwell storage. FNI recommends additional storage in order to meet more stringent operational criteria for the Central Pressure Plane.

**Figure 4-11**  
**Water Treatment Plant**  
**HSPS Pumping Requirements**



Note: The City meets TCEQ requirements for pumping. FNI recommends additional pumping in order to meet more stringent operational criteria.

\*125% of City of Weatherford Maximum Day Demands plus Wholesale Customer Max Day Demands.



## 4.5 Miller Elevated Storage Tank Analysis

As discussed in **Section 4.3**, the design criteria result in the need for an additional 0.5 MG of elevated storage in the Miller Pressure Plane in order to meet demand conditions brought about from additional growth and the altered pressure plane boundary between Franklin and Miller. FNI evaluated three location options for the proposed EST and analyzed the impact each location would have on tank cycling and the water age of the Miller Pressure Plane ESTs.

Water age modeling was conducted under projected maximum day demands to determine water age in the ESTs over a 21-day period. While water age does not directly cause poor water quality, it is known that chlorine residual degrades over time, and disinfection byproduct levels increase over time; therefore, increasing water age can lead to the loss of chlorine residual and the formation of disinfection byproducts. This analysis calculated the water age within Weatherford's system based on hydraulics and how usage affects the rate of flow over time throughout the system. To simulate how the proposed EST cycles with the existing Miller EST hydraulically, the analyses were performed without an altitude valve at the existing Miller EST.

### Option A: Sosebee Bend and Garner Road

**Option A** evaluates building the proposed EST on a hill near the intersection of Sosebee Bend and Garner Road. This includes installing a 12-inch water line to connect it to the existing water system and a 16-inch water line that provides looping to the proposed tank. FNI evaluated this option with and without the 16-inch loop in order to determine how much of an effect it would have on the water quality. **Figures 4-12** and **4-13** show the hydraulic grade line of each EST over a 24-hour period and the water age in each EST over a 21-day period under **Option A** without the 16-inch loop. **Figures 4-14** and **4-15** show the hydraulic grade line of each EST over a 24-hour period and the water age in each EST over a 21-day period under **Option A** including the 16-inch loop. Without looping, the proposed EST does not float well with the existing Miller EST and causes the Dubellette Pump Station to pump over the existing Miller EST. The lack of looping also doesn't allow the water from the proposed EST to mix with the rest of the pressure plane and causes the water age to continuously increase. An altitude valve may be necessary at the existing Miller EST in order to help cycle the proposed EST.



### **Option B: Ric Williamson Memorial Highway**

**Option B** evaluates building the proposed EST at one of two locations near the intersection of Garner Road and Ric Williamson Memorial Highway. Both locations are hydraulically similar and produce approximately the same water age results. **Figures 4-16** and **4-17** show the hydraulic grade line of each EST over a 24-hour period and the water age in each EST over a 21-day period under **Option B**. This location is closer to the existing water system and would require fewer improvements to incorporate the proposed EST into the water distribution operations. Similar to **Option A**, however, the existing Miller EST will fill faster than the proposed EST, and an altitude valve may be necessary at the existing Miller EST in order to help cycle the proposed EST.

### **Option C: Existing Miller EST Site**

**Option C** evaluates decommissioning the existing Miller EST and building a 0.75 MG EST on the same site. **Figures 4-18** and **4-19** show the hydraulic grade line of each EST over a 24-hour period and the water age in each EST over a 21-day period under **Option C**. This option eliminates the need to purchase land for the proposed tank and would simplify operations for the Miller Pressure Plane. With just one tank in service, the water system will operate similar to how it does now, and water is less likely to sit in the tank for too long, resulting in a low water age. Option C does not provide the redundancy Options A and B do, and could be a problem should the proposed EST experience an emergency or needed to be temporarily taken out of service for maintenance.



Figure 4-12  
Elevated Storage HGL  
Option A-1: No Looping (Project 7)

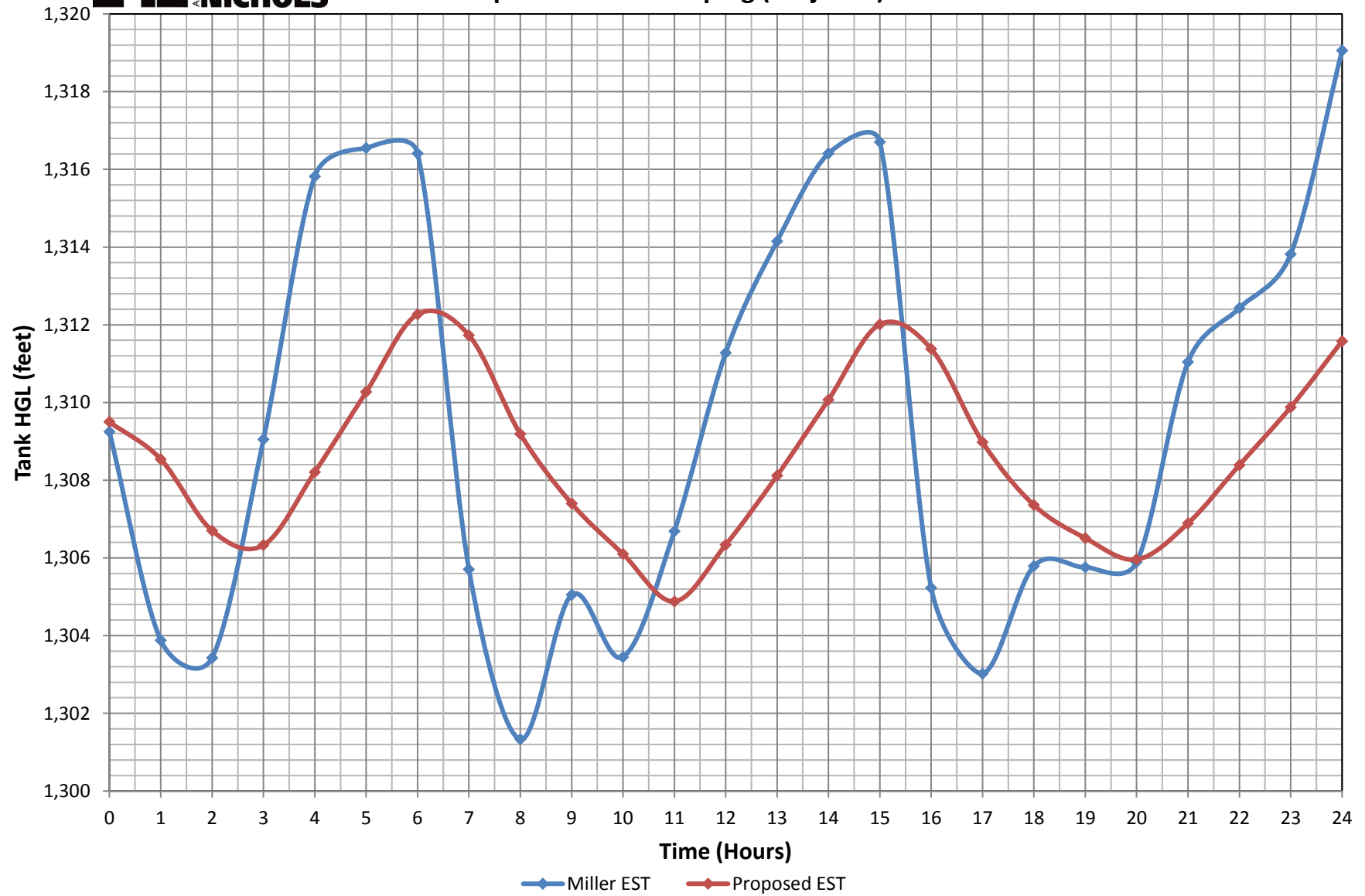
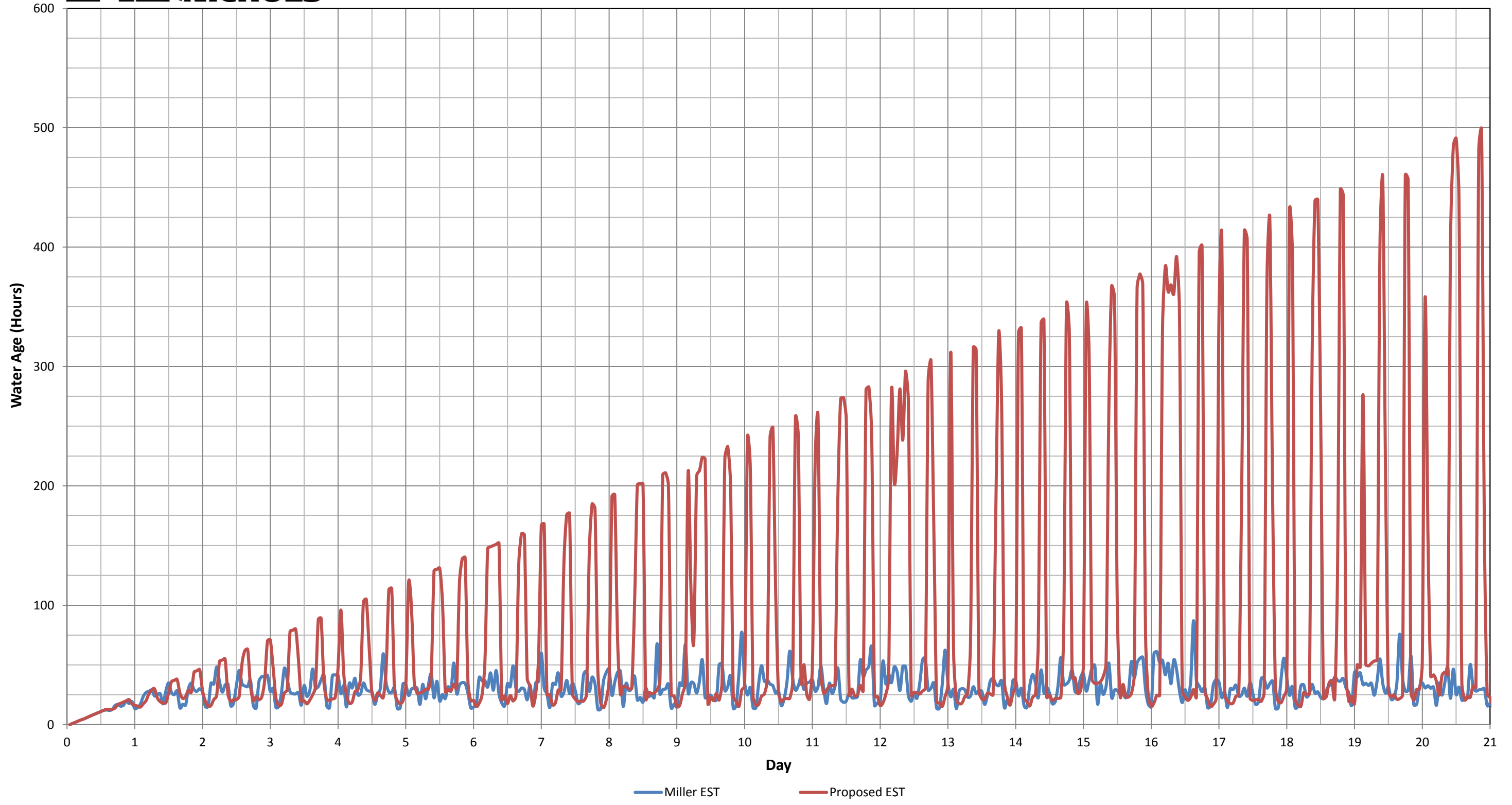
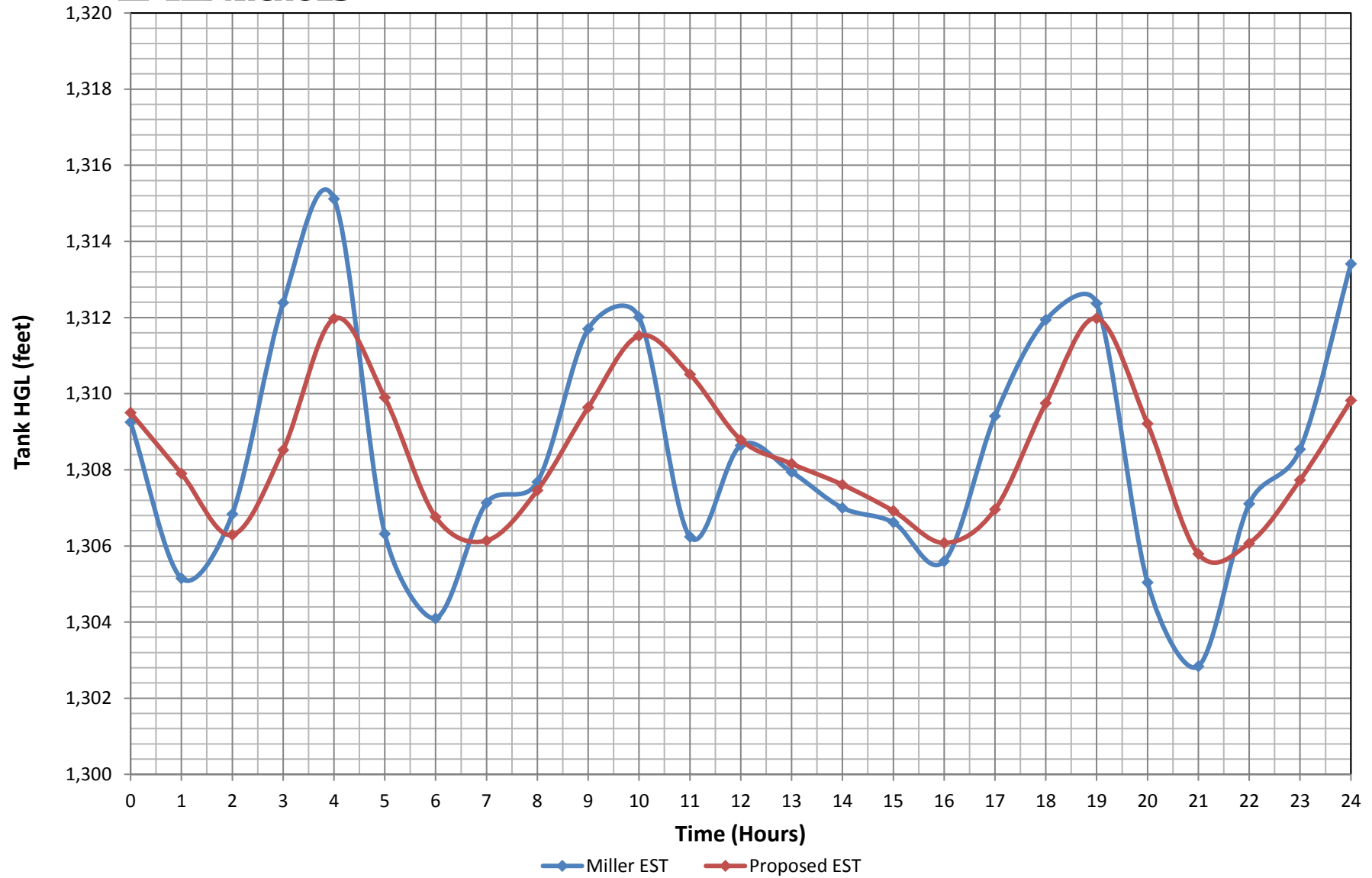




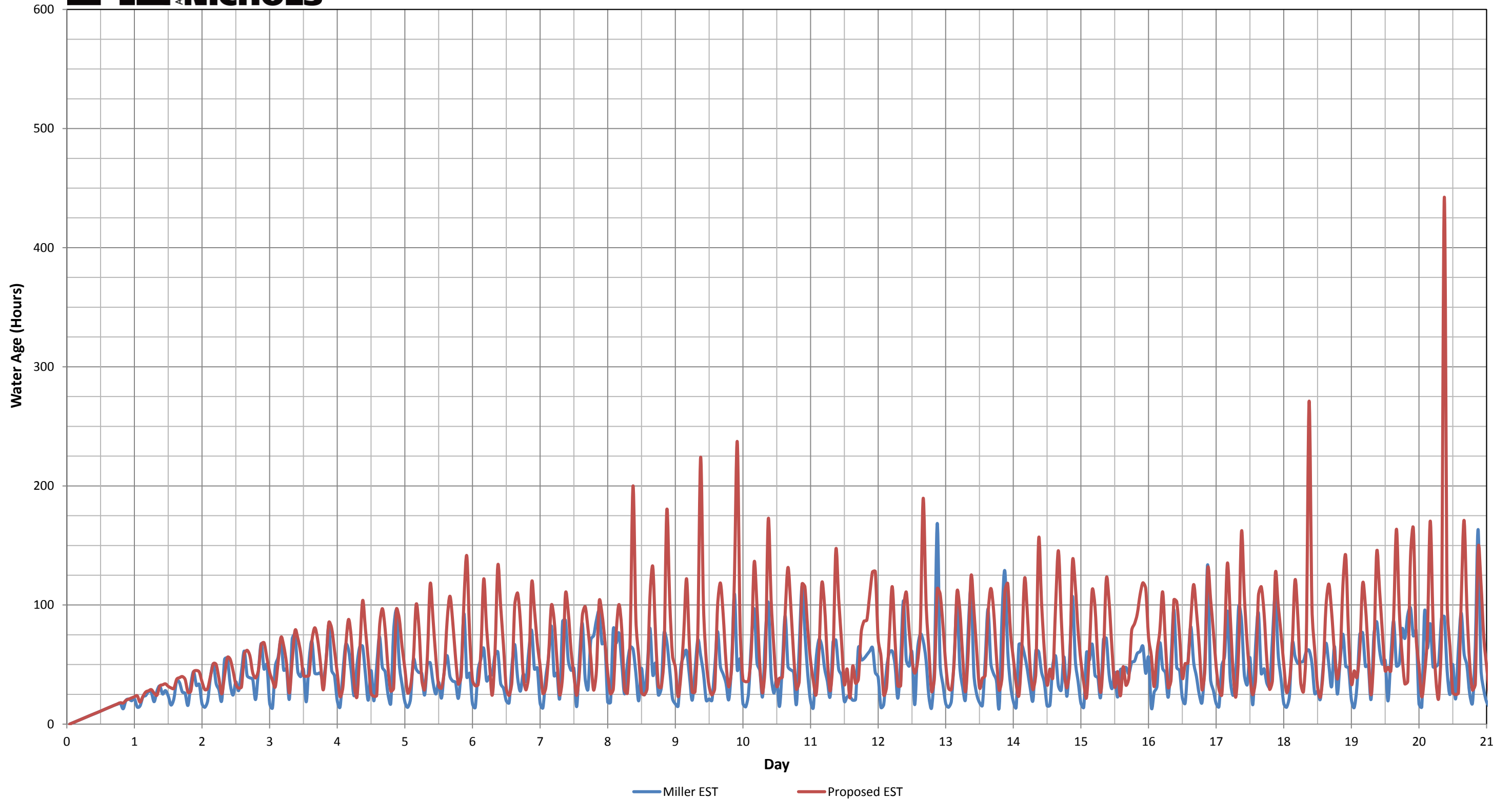
Figure 4-13  
Elevated Storage Water Age  
Option A-1: No Looping (Project 7)



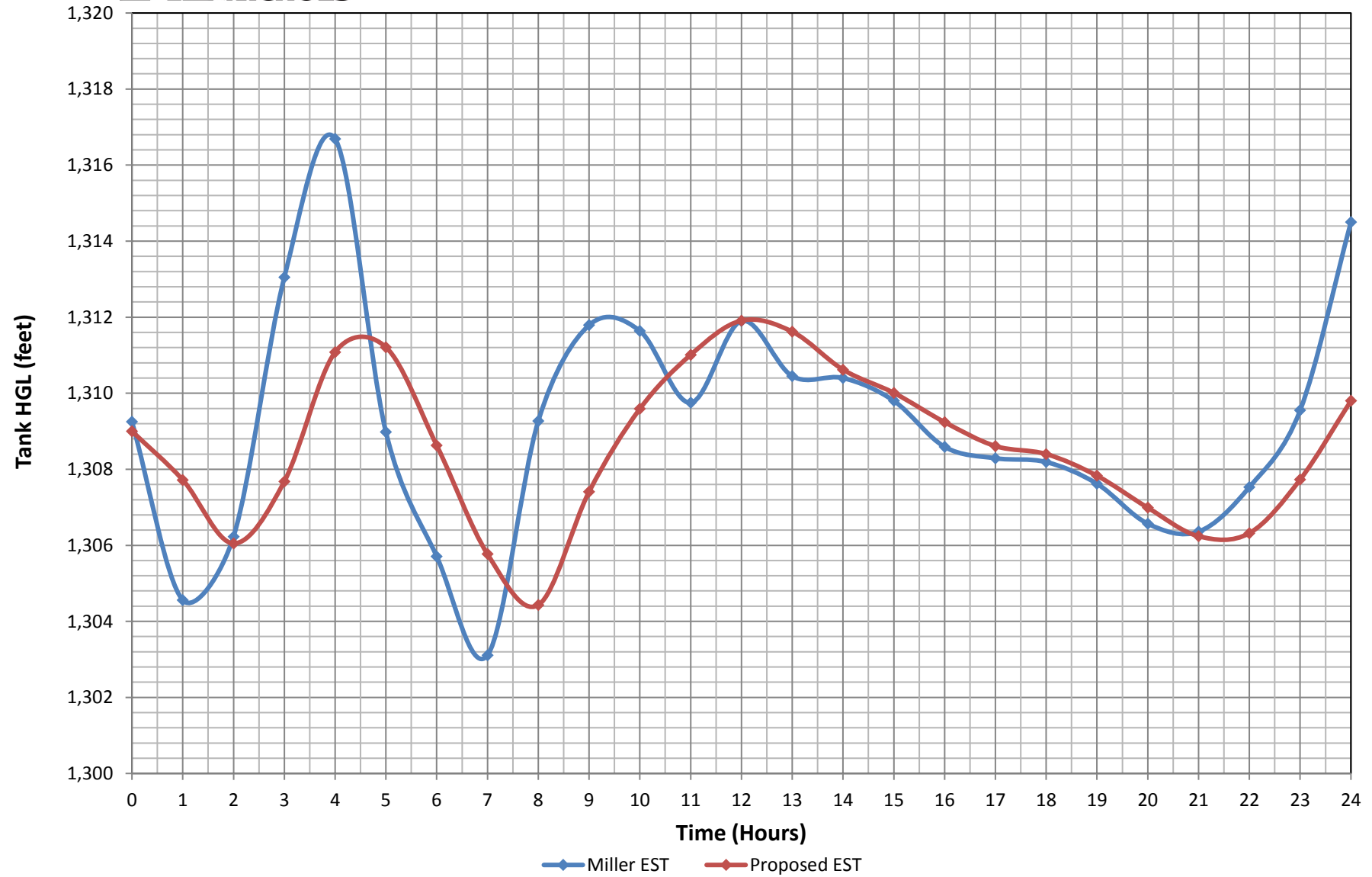
**Figure 4-14**  
**Elevated Storage HGL**  
**Option A-2: Including Looping (Project 7)**



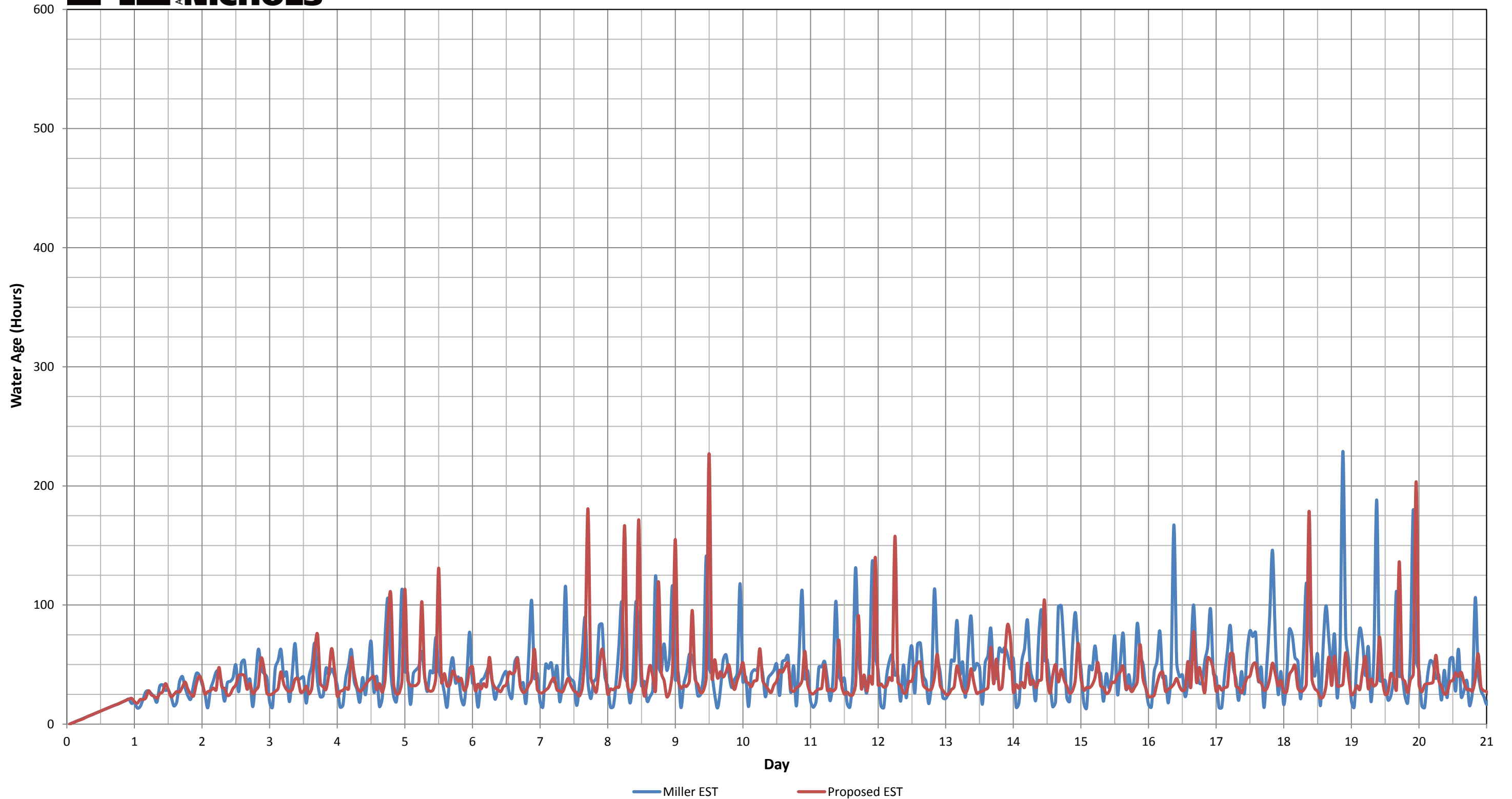
**Figure 4-15**  
**Elevated Storage Water Age**  
**Option A-2: Including Looping (Project 7)**



**Figure 4-16**  
**Elevated Storage HGL**  
**Option B: Along Highway**



**Figure 4-17**  
**Elevated Storage Water Age**  
**Option B: Along Highway**





**Figure 4-18**  
**Elevated Storage HGL**  
**Option C: Existing Miller EST Site**

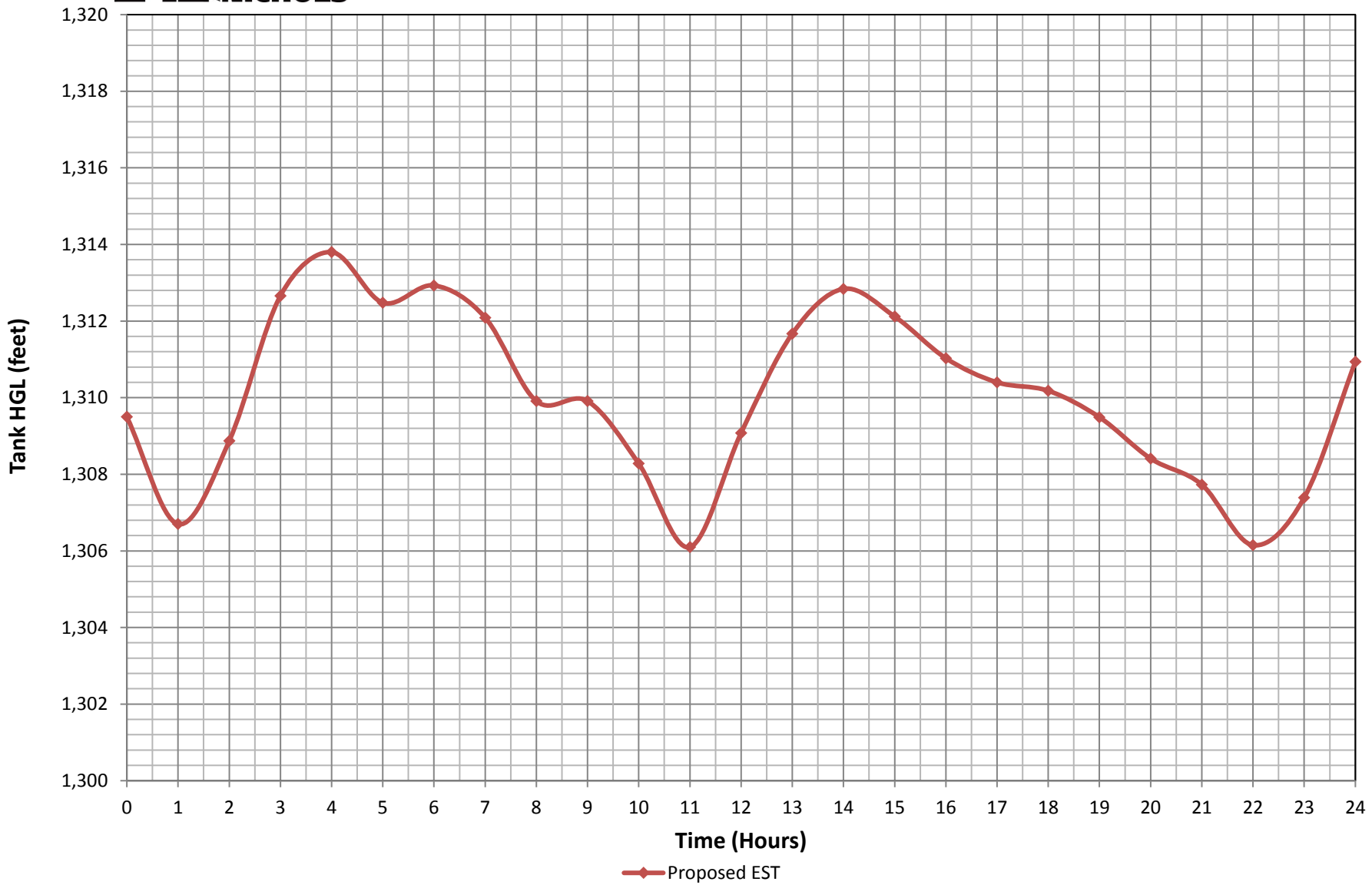
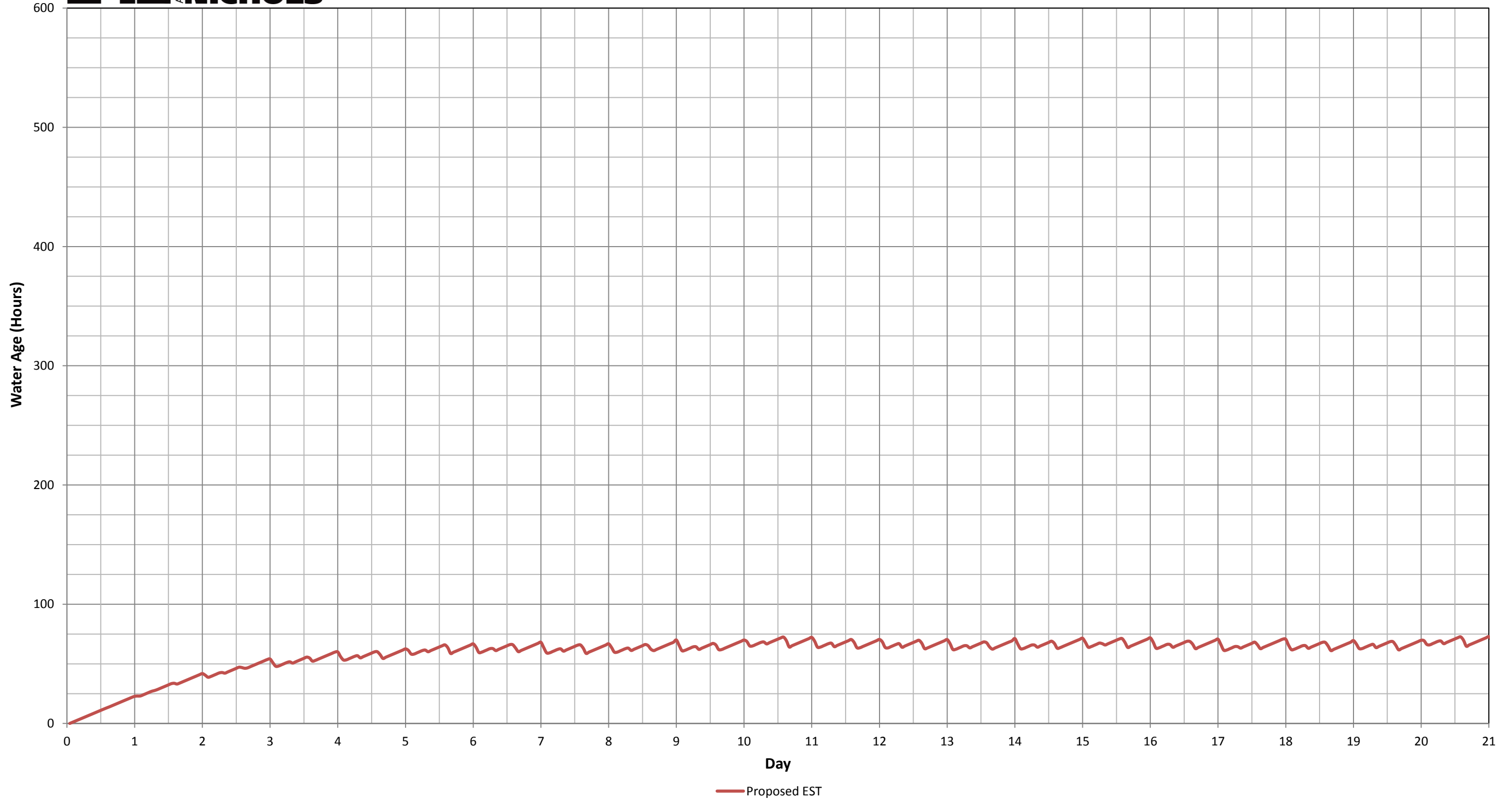




Figure 4-19  
Elevated Storage Water Age  
Option C: Existing Miller EST Site





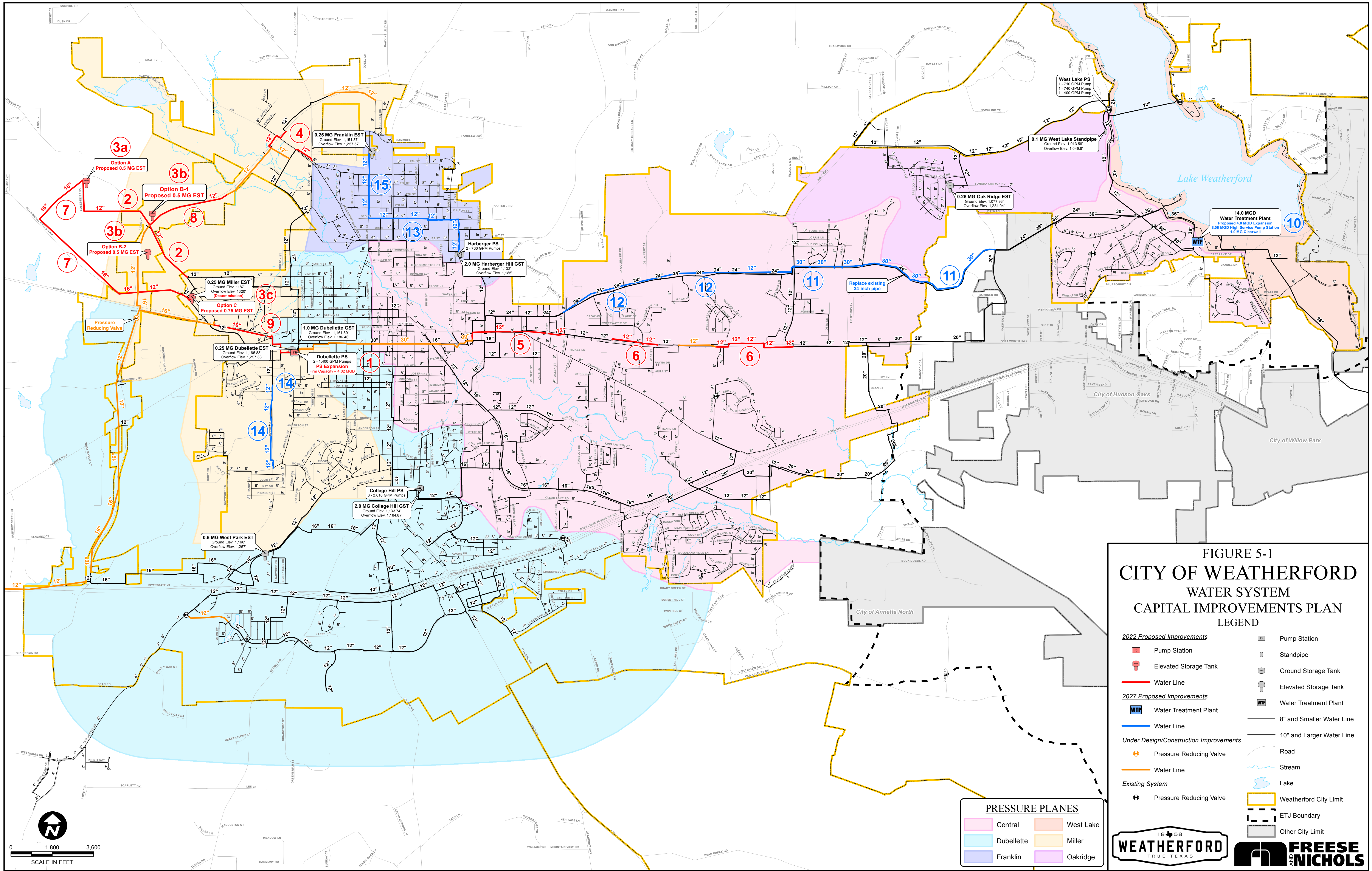
## 5.0 Capital Improvement Plan

The water distribution system CIP developed as part of the 2013 Water Master Plan was updated to reflect the modifications to the boundary of the Miller and Franklin Pressure Planes as well as the additional growth experienced in the Miller Pressure Plane. The recommended projects for the water distribution system are presented on **Figure 5-1**. Locations shown for new mains and other recommended improvements were generalized for hydraulic analyses. Specific alignments and sites will be determined as part of the design process. It is recommended that these projects be constructed generally in the order listed; however, changes in development patterns may make it necessary to construct some projects sooner than anticipated. Planning level capital costs were calculated for the recommended improvements. The costs are in 2017 dollars and include an allowance for engineering, surveying, and contingencies. **Table 5-1** summarizes the cost of the water system CIP by planning period for the City of Weatherford. **Appendix A** contains a detailed cost description of each individual project.

**Table 5-1 Capital Improvements Plan Costs**

Project Number	Project Name	Cost
<b>2017 through 2022</b>		
1	Dubellette Pump Station Expansion	\$110,400
2	12-inch Water Line along Garner Road	\$1,315,400
3	Proposed 0.5 MG Elevated Storage Tank in Miller Pressure Plane	\$1,207,500
4	12-inch Water Lines in North Miller Pressure Plane	\$537,200
5	12-inch Water Line along Fort Worth Highway	\$932,800
6	12-inch Water Line Replacement along Fort Worth Highway	\$840,000
7	12/16-inch Water Line along Old Mineral Wells Highway	\$2,233,600
8	12-inch Water Line along Ric Williamson Memorial Highway	\$626,100
9	16-inch Transmission Main along Mineral Wells Highway	\$1,523,200
<b>2017 through 2022 Total</b>		<b>\$9,326,200</b>
<b>2023 through 2027</b>		
10	4.0 MGD Water Treatment Plant Expansion	--*
11	30-inch Transmission Line Replacement along Meadowview Drive and Suzanne Trail	\$4,951,500
12	12-inch Parallel Transmission Line along Old Dickey Road	\$2,897,200
13	12-inch Water Line Replacement along 3rd Street	\$1,598,500
14	12-inch Water Line in along Bowie Drive	\$760,700
15	12-inch Water Line along Franklin Street	\$781,700
<b>2023 through 2027 Total</b>		<b>\$10,989,600</b>
<b>CIP Total</b>		<b>\$20,315,800</b>

\*Refer to the Water Treatment Plant Master Plan for detailed costs.





## 5.1 2017 Through 2022 Capital Improvement Plan

### 1. Dubellette Pump Station Expansion

Based on the TCEQ requirement of providing 0.6 gpm per connection of pumping capacity, this project will consist of a 1.5 MGD expansion of the Dubellette Pump Station. The purpose of this project is to increase the pumping capacity in the Miller Pressure Plane. As the pressure plane expands, more capacity is necessary to meet maximum day and peak hour pressure requirements.

### 2. 12-inch Water Line along Garner Road

This project consists of a 12-inch water line in the Miller Pressure Plane along Garner Road from the Miller EST to the proposed Garner Road EST (Project 3). The purpose of this project is to increase redundancy and extend water service in the Miller Pressure Plane. This project will vary depending on the selected EST location.

### 3. Proposed 0.5 MG Elevated Storage Tank in Miller Pressure Plane

Based on the TCEQ requirement of meeting 200 gallons per connection of elevated storage capacity, this project consists of 0.5 MG EST in the Miller Pressure Plane along Garner Road. The purpose of this project is to expand the elevated storage capacity in the Miller Pressure Plane to meet the growing demand deficiencies caused by additional growth and an altered pressure plane boundary.

### 4. 12-inch Water Lines in North Miller Pressure Plane

This project will consist of two 12-inch water lines in the Franklin Pressure Plane along the Ric Williamson Memorial Highway and parallel to the existing 8-inch line along FM 920 to the pressure plane division between the Franklin and Miller Pressure Plane. This project will connect the under design 12-inch water line along the Ric Williamson Memorial Highway to the existing water distribution system north of FM 920. The new water line will allow the City to meet maximum day and peak hour pressure water demands along the Ric Williamson Memorial Highway as well as providing fire flow protection to new commercial customers.



**5. 12-inch Water Line along Fort Worth Highway**

The proposed 12-inch line will parallel the existing 6/8-inch line along the Fort Worth Highway from Ward Street to Weiland Street and connect to the under design 30-inch Oak Street water line. This project will increase transmission capacity from the Water Treatment Plant to the under design 30-inch Oak Street water line. This project will supply more flow to the Dubellette and Harberger Hill Pump Stations.

**6. 12-inch Water Line Replacement along Fort Worth Highway**

The proposed 12-inch line will run along the Fort Worth Highway in the Central Pressure Plane. It will replace the existing 8-inch line along Fort Worth Highway between Willow Creek Drive and Azle Highway. The proposed 12-inch line will provide greater redundancy in the Central Pressure Plane and will provide increased transmission capacity to the Dubellette Pump Station.

**7. 12/16-inch Water Line along Old Mineral Wells Highway**

This project consists of a 12/16-inch water line in the Miller Pressure Plane along Old Mineral Wells Highway connecting to the proposed Garner Road EST (Project 3a). The purpose of this project is to provide looping and increased fire flow protection and extend water service in the Miller Pressure Plane. This project is only necessary if the proposed EST is located along Garner Road. If this location is not selected, Project 7 may be postponed until required by future development.

**8. 12-inch Water Line along Ric Williamson Memorial Highway**

This project consists of a 12-inch water line along Ric Williamson Memorial Highway from the under design 12-inch line at Garner Road to the under design 12-inch line to the Northeast. The purpose of this project is to provide looping and increased fire flow protection and extend water service in the Miller Pressure Plane.

**9. 16-inch Transmission Main along Mineral Wells Highway**

This project is a 16-inch transmission main from the Dubellette Pump Station parallel to the existing lines along Mineral Wells Highway to the under design 16-inch line along Mineral Wells Highway. The purpose of this project is to provide increased transmission capacity from the Dubellette Pump Station further west in the Miller Pressure Plane.



## 5.2 2023 Through 2027 Capital Improvement Plan

### 10. 4.0 MGD Water Treatment Plant Expansion

This project consists of a 4.0 MGD expansion to the Water Treatment Plant, an 8.06 MGD High Service Pump Station expansion, and a 1.0 MG Clearwell. The water demands for the City of Weatherford are projected to exceed the existing plant capacity by 2024. The exact timing of the WTP expansion will be determined when the plant has reached 85% of its capacity.

### 11. 30-inch Transmission Line Replacement along Meadowview Drive and Suzanne Trail

This project consists of a 30-inch transmission main along Meadowview Drive and Suzanne Trail. This project will replace the existing 24-inch line built in 1955. Model results indicate that due to age and material of the existing 24-inch line, high head losses occur in the pipe. Prior to the design of this proposed water line, additional analysis should be performed to determine if a potential alignment along the East Loop Ric Williamson Memorial Highway would be beneficial to provide water service to future development along the highway.

### 12. 12-inch Parallel Transmission Line along Old Dicey Road

This project consists of a 12-inch parallel transmission main along Old Dicey Road from Azle Highway to Ward Street. This project will provide increased transmission capacity from the Water Treatment Plant to the Dubellette and Harberger Hill Pump Stations.

### 13. 12-inch Water Line Replacement along 3rd Street

This project consists of a 12-inch water line replacement of the existing 6-inch water line along King Street from Common Street to Third Street and the existing 6-inch water line along Third Street from King Street to Franklin Street. This project will increase the supply of water through the middle of the Franklin Pressure Plane by replacing some of the smaller, older lines. This will increase the supply of water to the Franklin EST and will increase the fire flow protection to commercial and industrial customers.



#### **14. 12-inch Water Line in along Bowie Drive**

This project consists of a 12-inch water line replacement of the existing 6-inch water line along Bowie Drive from Winona Street to Charles Street. The purpose of this project is to increase fire flow protection in the middle and southern portion of the Miller Pressure Plane. The 12-inch line replacement will also increase the water supply to the south to meet maximum day and peak hour pressure demand conditions.

#### **15. 12-inch Water Line along Franklin Street**

This project consists of a 12-inch water line along Franklin Street from Third Street to the Franklin EST. This project will increase the supply of water through the middle of the Franklin Pressure Plane by replacing some of the smaller, older lines. This will increase the supply of water to the Franklin EST and will increase the fire flow protection to commercial and industrial customers.

# **Appendix A**

## **Detailed Cost Sheets**

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 1

Phase: 2022

Project Name: Dubellette Pump Station Expansion

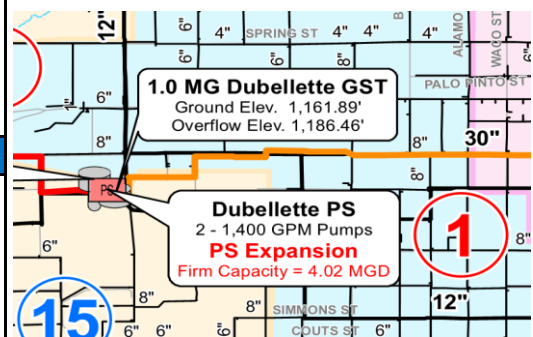
## Project Description:

Based on the TCEQ requirement of providing 0.6 gpm per connection of pumping capacity, this project will consist of a 2.0 MGD expansion of the Dubellette Pump Station.

## Project Drivers:

The purpose of this project is to increase the pumping capacity in the Miller Pressure Plane. As the pressure plane expands, more capacity is necessary to meet maximum day and peak hour pressure requirements.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Pump Station - Expans 2 MGD	1	LS	\$ 80,000	\$ 80,000
<b>SUBTOTAL:</b>					<b>\$ 80,000</b>
CONTINGENCY				20%	\$ 16,000
<b>SUBTOTAL:</b>					<b>\$ 96,000</b>
ENG/SURVEY				15%	\$ 14,400
<b>SUBTOTAL:</b>					<b>\$ 110,400</b>
<b>Estimated Project Total:</b>					<b>\$ 110,400</b>

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 2

Phase: 2022

Project Name: 12-inch Water Line along Garner Road

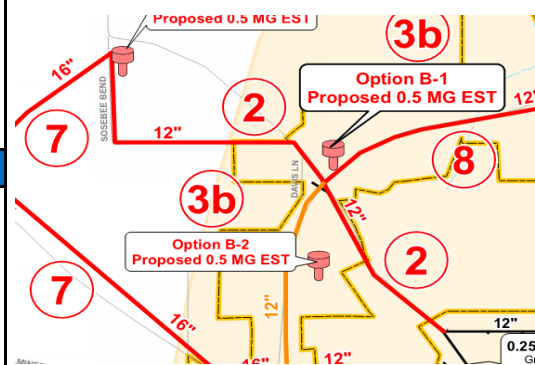
## Project Description:

This project consists of a 12-inch water line in the Miller Pressure Plane along Garner Road from the Miller EST to the proposed Garner Road EST (Project 3).

## Project Drivers:

The purpose of this project is to increase redundancy and extend water service in the Miller Pressure Plane. This project will vary depending on the selected EST location.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	8,200	LF	\$ 108	\$ 885,600
2	Water Pavement Repair	900	LF	\$ 75	\$ 67,500
SUBTOTAL:					\$ 953,100
CONTINGENCY				20%	\$ 190,700
SUBTOTAL:					\$ 1,143,800
ENG/SURVEY				15%	\$ 171,600
SUBTOTAL:					\$ 1,315,400
Estimated Project Total:					\$ 1,315,400

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 3

Phase: 2022

Project Name: Proposed 0.5 MG Elevated Storage Tank in Miller Pressure Plane

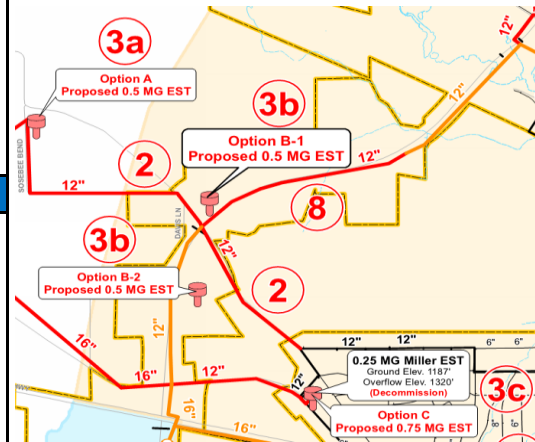
## Project Description:

Based on the TCEQ requirement of meeting 200 gallons per connection of elevated storage capacity, this project consists of 0.5 MG EST in the Miller Pressure Plane.

## Project Drivers:

The purpose of this project is to expand the elevated storage capacity in the Miller Pressure Plane to meet the growing demand deficiencies caused by additional growth and an altered pressure plane boundary.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	0.5 MG Elevated Storage Tank	1	LS	\$ 875,000	\$ 875,000
SUBTOTAL:					\$ 875,000
CONTINGENCY				20%	\$ 175,000
SUBTOTAL:					\$ 1,050,000
ENG/SURVEY				15%	\$ 157,500
SUBTOTAL:					\$ 1,207,500
Estimated Project Total:					\$ 1,207,500

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 4

Phase: 2022

Project Name: 12-inch Water Lines in North Miller Pressure Plane

## Project Description:

This project will consist of two 12-inch water lines in the Franklin Pressure Plane along the Ric Williamson Memorial Highway and parallel to the existing 8-inch line along FM 920 to the pressure plane division between the Franklin and Miller Pressure Plane.

## Project Drivers:

This project will connect the under design 12-inch water line along the Ric Williamson Memorial Highway to the existing water distribution system north of FM 920. The new water line will allow the City to meet maximum day and peak hour pressure water demands along the Ric Williamson Memorial Highway as well as providing fire flow protection to new commercial customers.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	2,400	LF	\$ 108	\$ 259,200
2	Water Pavement Repair	800	LF	\$ 75	\$ 60,000
3	20" Boring and Casing	200	LF	\$ 350	\$ 70,000
<b>SUBTOTAL:</b>					<b>\$ 389,200</b>
CONTINGENCY				20%	\$ 77,900
<b>SUBTOTAL:</b>					<b>\$ 467,100</b>
ENG/SURVEY				15%	\$ 70,100
<b>SUBTOTAL:</b>					<b>\$ 537,200</b>
<b>Estimated Project Total:</b>					<b>\$ 537,200</b>

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 5

Phase: 2022

Project Name: 12-inch Water Line along Fort Worth Highway

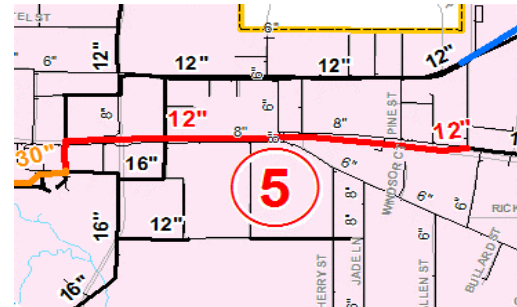
## Project Description:

The proposed 12-inch line will parallel the existing 6/8-inch line along the Fort Worth Highway from Ward Street to Weiland Street and connect to the under design 30-inch Oak Street water line.

## Project Drivers:

This project will increase transmission capacity from the Water Treatment Plant to the under design 30-inch Oak Street water line. This project will supply more flow to the Dubellette and Harberger Hill Pump Stations.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	4,800	LF	\$ 108	\$ 518,400
2	Water Pavement Repair	2,100	LF	\$ 75	\$ 157,500
<b>SUBTOTAL:</b>					<b>\$ 675,900</b>
CONTINGENCY				20%	\$ 135,200
<b>SUBTOTAL:</b>					<b>\$ 811,100</b>
ENG/SURVEY				15%	\$ 121,700
<b>SUBTOTAL:</b>					<b>\$ 932,800</b>
<b>Estimated Project Total:</b>					<b>\$ 932,800</b>

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 6

Phase: 2022

Project Name: 12-inch Water Line Replacement along Fort Worth Highway

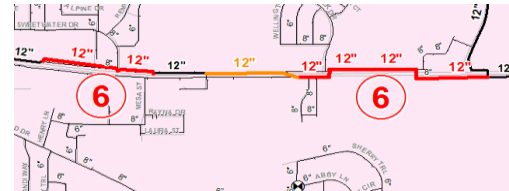
## Project Description:

The proposed 12-inch line will run along the Fort Worth Highway in the Central Pressure Plane. It will replace the existing 8-inch line along Fort Worth Highway between Willow Creek Drive and Azle Highway.

## Project Drivers:

The proposed 12-inch line will provide greater redundancy in the Central Pressure Plane and will provide increased transmission capacity to the Dubellette Pump Station.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	4,200	LF	\$ 108	\$ 453,600
2	Water Pavement Repair	200	LF	\$ 75	\$ 15,000
3	20" Boring and Casing	400	LF	\$ 350	\$ 140,000
		SUBTOTAL:			\$ 608,600
		CONTINGENCY		20%	\$ 121,800
		SUBTOTAL:			\$ 730,400
		ENG/SURVEY		15%	\$ 109,600
		SUBTOTAL:			\$ 840,000
Estimated Project Total:					\$ 840,000

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 7

Phase: 2022

Project Name: 12/16-inch Water Line along Old Mineral Wells Highway

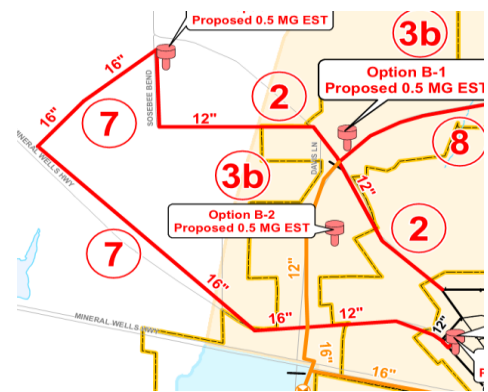
## Project Description:

This project consists of a 12/16-inch water line in the Miller Pressure Plane along Old Mineral Wells Highway connecting to the proposed Garner Road EST (Project 3a).

## Project Drivers:

The purpose of this project is to provide looping and increased fire flow protection and extend water service in the Miller Pressure Plane, and will help with water age and tank hydraulics. This project is only necessary if the proposed EST is located along Garner Road. If this location is not selected, Project 7 may be postponed until required by future development.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	2,500	LF	\$ 108	\$ 270,000
2	16" WL & Appurtenances	9,000	LF	\$ 144	\$ 1,296,000
3	Water Pavement Repair	700	LF	\$ 75	\$ 52,500
<b>SUBTOTAL:</b>					<b>\$ 1,618,500</b>
CONTINGENCY				20%	\$ 323,700
<b>SUBTOTAL:</b>					<b>\$ 1,942,200</b>
ENG/SURVEY				15%	\$ 291,400
<b>SUBTOTAL:</b>					<b>\$ 2,233,600</b>
<b>Estimated Project Total:</b>					<b>\$ 2,233,600</b>

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 8

Phase: 2022

Project Name: 12-inch Water Line along Ric Williamson Memorial Highway

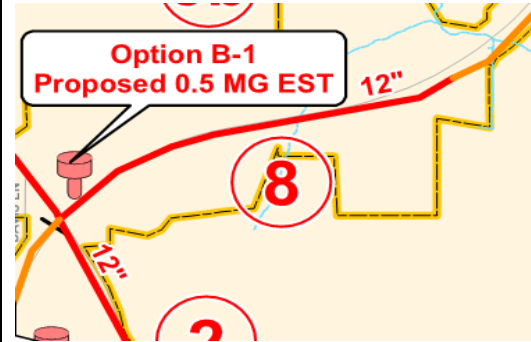
## Project Description:

This project consists of a 12-inch water line along Ric Williamson Memorial Highway from the under design 12-inch line at Garner Road to the under design 12-inch line to the Northeast.

## Project Drivers:

The purpose of this project is to provide looping and increased fire flow protection and extend water service in the Miller Pressure Plane

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	4,200	LF	\$ 108	\$ 453,600
SUBTOTAL:					\$ 453,600
	CONTINGENCY			20%	\$ 90,800
SUBTOTAL:					\$ 544,400
	ENG/SURVEY			15%	\$ 81,700
SUBTOTAL:					\$ 626,100
Estimated Project Total:					\$ 626,100

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 9

Phase: 2022

Project Name: 16-inch Transmission Main along Mineral Wells Highway

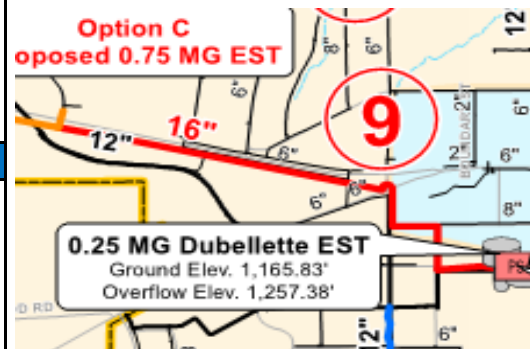
## Project Description:

This project is a 16-inch transmission main from the Dubellette Pump Station parallel to the existing lines along Mineral Wells Highway to the under design 16-inch line along Mineral Wells Highway.

## Project Drivers:

The purpose of this project is to provide increased transmission capacity from the Dubellette Pump Station further west in the Miller Pressure Plane.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	16" WL & Appurtenances	4,800	LF	\$ 144	\$ 691,200
2	Water Pavement Repair	4,800	LF	\$ 75	\$ 360,000
3	30" Boring and Casing	100	LF	\$ 525	\$ 52,500
SUBTOTAL:					\$ 1,103,700
CONTINGENCY				20%	\$ 220,800
SUBTOTAL:					\$ 1,324,500
ENG/SURVEY				15%	\$ 198,700
SUBTOTAL:					\$ 1,523,200
Estimated Project Total:					\$ 1,523,200

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 10

Phase: 2027

Project Name: 4.0 MGD Water Treatment Plant Expansion

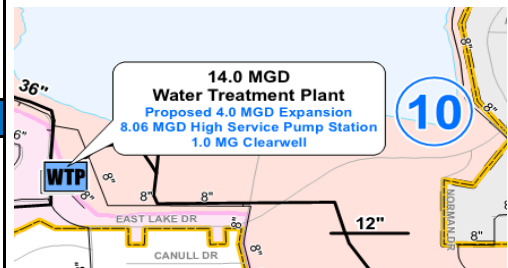
## Project Description:

This project consists of a 4.0 MGD expansion to the Water Treatment Plant, an 8.06 MGD High Service Pump Station expansion, and a 1.0 MG Clearwell.

## Project Drivers:

The water demands for the City of Weatherford are projected to exceed the existing plant capacity by 2024. The exact timing of the WTP expansion will be determined when the plant has reached 85% of its capacity.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	--	--	--	--	
				<b>SUBTOTAL:</b>	\$ -
				CONTINGENCY	20% \$ -
				<b>SUBTOTAL:</b>	\$ -
				ENG/SURVEY	15% \$ -
				<b>SUBTOTAL:</b>	\$ -
<b>Estimated Project Total:</b>					<b>\$ -</b>

Refer to the Water Treatment Plant Master Plan for detailed costs.

Comments:

# City of Weatherford



**Capital Improvement Cost Estimate**

**November 9, 2017**

**Construction Project Number: 11**

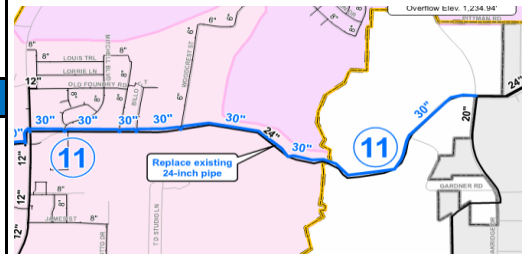
**Phase: 2027**

**Project Name: 30-inch Transmission Line Replacement along Meadowview Drive and Suzanne Trail**

## Project Description:

This project consists of a 30-inch transmission main replacement of the 24-inch transmission line along Meadowview Drive and Suzanne Trail.

## Vicinity Map



## Project Drivers:

This project will replace the existing 24-inch line built in 1955. Model results indicate that due to age and material of the existing 24-inch line, high head losses occur in the pipe. Prior to the design of this proposed water line, additional analysis should be performed to determine if a potential alignment along the East Loop Ric Williamson Memorial Highway would be beneficial to provide water service to future development along the highway.

## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	30" WL & Appurtenances	11,400	LF	\$ 270	\$ 3,078,000
2	Water Pavement Repair	6,800	LF	\$ 75	\$ 510,000
<b>SUBTOTAL:</b>					<b>\$ 3,588,000</b>
CONTINGENCY				20%	\$ 717,600
<b>SUBTOTAL:</b>					<b>\$ 4,305,600</b>
ENG/SURVEY				15%	\$ 645,900
<b>SUBTOTAL:</b>					<b>\$ 4,951,500</b>
<b>Estimated Project Total:</b>					<b>\$ 4,951,500</b>

**Comments:**

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 12

Phase: 2027

Project Name: 12-inch Parallel Transmission Line along Old Dickey Road

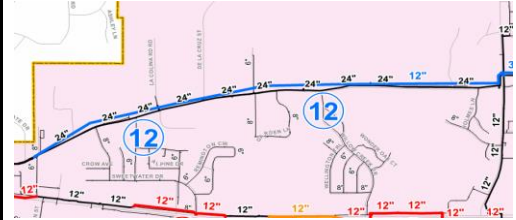
## Project Description:

This project consists of a 12-inch parallel transmission main along Old Dickey Road from Azle Highway to Ward Street.

## Project Drivers:

This project will provide increased transmission capacity from the Water Treatment Plant to the Dubellette and Harberger Hill Pump Stations.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	11,800	LF	\$ 108	\$ 1,274,400
2	Water Pavement Repair	11,000	LF	\$ 75	\$ 825,000
				<b>SUBTOTAL:</b>	<b>\$ 2,099,400</b>
				CONTINGENCY	20%
				<b>SUBTOTAL:</b>	<b>\$ 2,519,300</b>
				ENG/SURVEY	15%
				<b>SUBTOTAL:</b>	<b>\$ 2,897,200</b>
				<b>Estimated Project Total:</b>	<b>\$ 2,897,200</b>

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 13

Phase: 2027

Project Name: 12-inch Water Line Replacement along 3rd Street

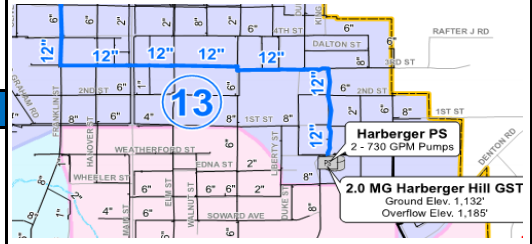
## Project Description:

This project consists of a 12-inch water line replacement of the existing 6-inch water line along King Street from Common Street to Third Street and the existing 6-inch water line along Third Street from King Street to Franklin Street.

## Project Drivers:

This project will increase the supply of water through the middle of the Franklin Pressure Plane by replacing some of the smaller, older lines. This will increase the supply of water to the Franklin EST and will increase the fire flow protection to commercial and industrial customers.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	6,100	LF	\$ 108	\$ 658,800
2	Water Pavement Repair	6,100	LF	\$ 75	\$ 457,500
3	24" Boring and Casing	100	LF	\$ 420	\$ 42,000
				<b>SUBTOTAL:</b>	<b>\$ 1,158,300</b>
				CONTINGENCY	20%
					\$ 231,700
				<b>SUBTOTAL:</b>	<b>\$ 1,390,000</b>
				ENG/SURVEY	15%
					\$ 208,500
				<b>SUBTOTAL:</b>	<b>\$ 1,598,500</b>
<b>Estimated Project Total:</b>					<b>\$ 1,598,500</b>

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 14

Phase: 2027

Project Name: 12-inch Water Line in along Bowie Drive

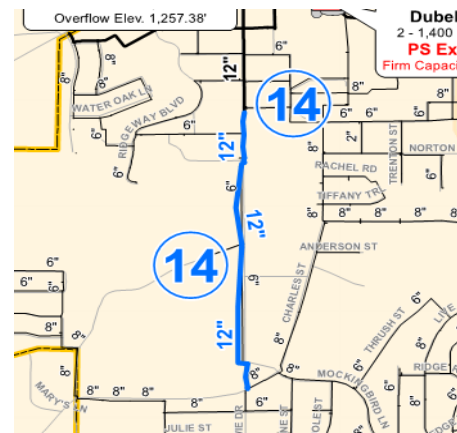
## Project Description:

This project consists of a 12-inch water line replacement of the existing 6-inch water line along Bowie Drive from Winona Street to Charles Street.

## Project Drivers:

The purpose of this project is to increase fire flow protection in the middle and southern portion of the Miller Pressure Plane. The 12-inch line replacement will also increase the water supply to the south to meet maximum day and peak hour pressure demand conditions.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	4,200	LF	\$ 108	\$ 453,600
2	Water Pavement Repair	1,300	LF	\$ 75	\$ 97,500
<b>SUBTOTAL:</b>					<b>\$ 551,100</b>
CONTINGENCY				20%	\$ 110,300
<b>SUBTOTAL:</b>					<b>\$ 661,400</b>
ENG/SURVEY				15%	\$ 99,300
<b>SUBTOTAL:</b>					<b>\$ 760,700</b>
<b>Estimated Project Total:</b>					<b>\$ 760,700</b>

Comments:

# City of Weatherford



Capital Improvement Cost Estimate

November 9, 2017

Construction Project Number: 15

Phase: 2027

Project Name: 12-inch Water Line along Franklin Street

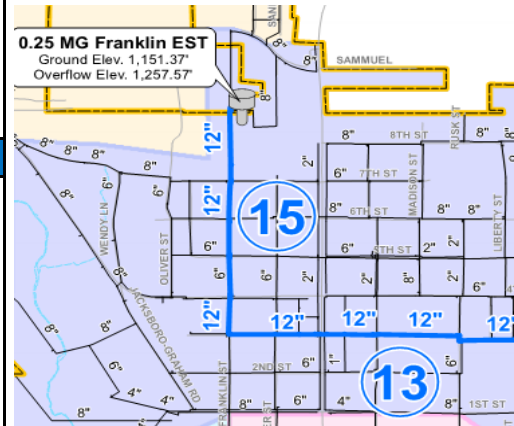
## Project Description:

This project consists of a 12-inch water line along Franklin Street from Third Street to the Franklin EST.

## Project Drivers:

This project will increase the supply of water through the middle of the Franklin Pressure Plane by replacing some of the smaller, older lines. This will increase the supply of water to the Franklin EST and will increase the fire flow protection to commercial and industrial customers.

## Vicinity Map



## Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	3,300	LF	\$ 108	\$ 356,400
2	Water Pavement Repair	2,800	LF	\$ 75	\$ 210,000
<b>SUBTOTAL:</b>					<b>\$ 566,400</b>
CONTINGENCY				20%	\$ 113,300
<b>SUBTOTAL:</b>					<b>\$ 679,700</b>
ENG/SURVEY				15%	\$ 102,000
<b>SUBTOTAL:</b>					<b>\$ 781,700</b>
<b>Estimated Project Total:</b>					<b>\$ 781,700</b>

Comments: