Control Number: 51864

Item Number: 10

Addendum StartPage: 0

Harkins Engineering, Inc.

April 19, 2021

2021 APR 23 AM 9:37

Filing Clerk
Texas Public Utility Commission
1701 North Congress
P.O. Box 13326
Austin, Texas 78711-3326

RE: Application of the City of Midlothian to amend CCN Number 11706 in Ellis County, Texas

Docket: 51864

Dear Filing Clerk:

Per Commission Staff's First Request for Information to the City of Midlothian, please see the following response and requested attachments.

Question Staff 1-1: Please provide a capital improvement plan, including a budget and an estimated timeline for construction, of all facilities necessary to provide full service to the requested area, keyed to a map showing where such facilities will be located to provide service.

Response: Please see the attached CIP for the City of Midlothian.

Sponsor: Mike Adams, P.E. Exec. Director of Engineering & Utilities, City of Midlothian

Please let me know if you need any further information or have any additional questions. Thank you for your time.

Sincerely,

Victoria Harkins

Victoria Richards Harkins, Ph.D., P.E.
President

2413 Belaire East Lane, Granite Shoals, Texas 78654 Phone: (512) 784-8511

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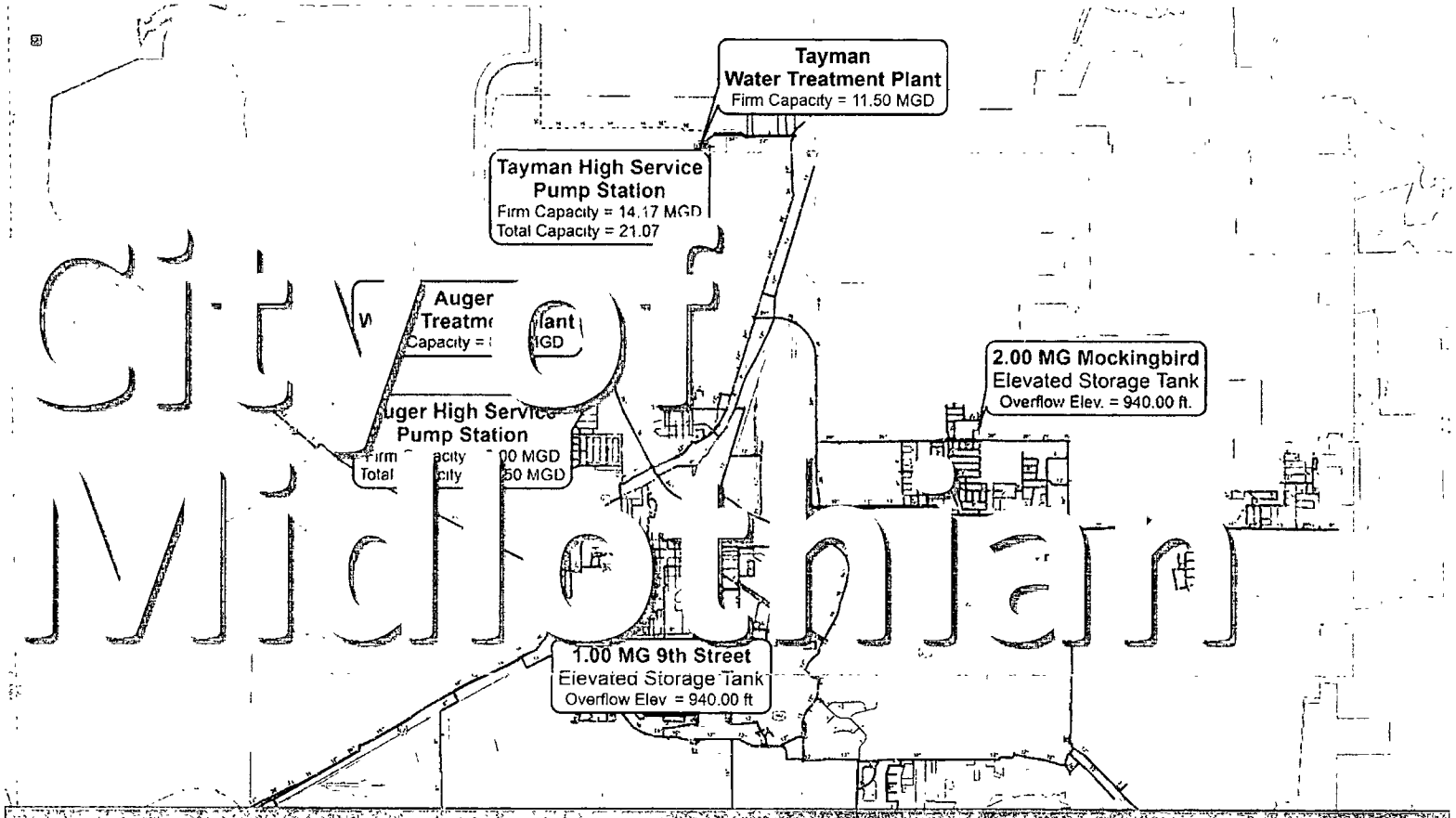
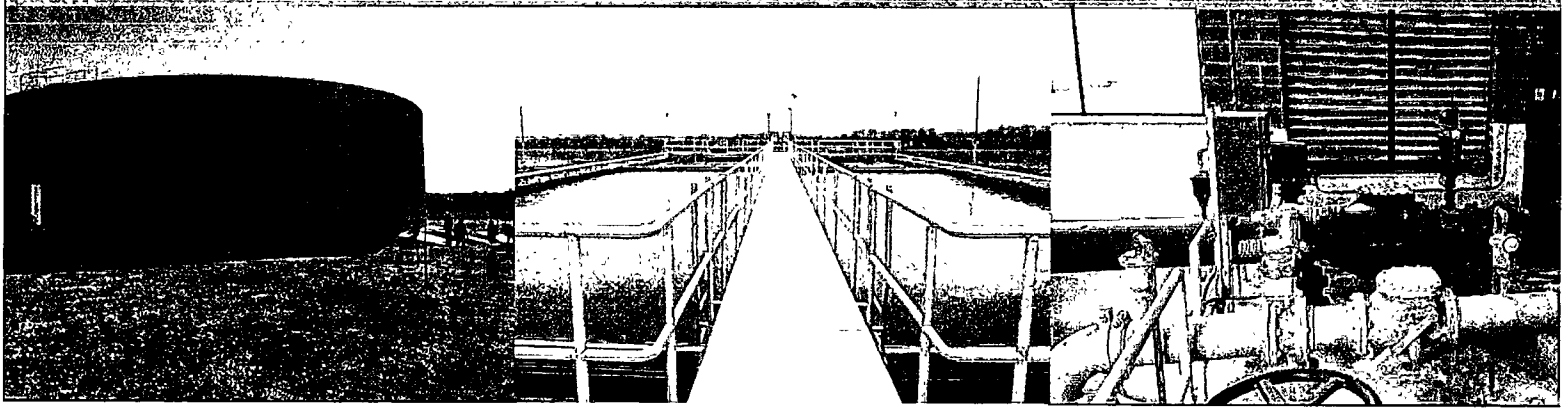


City of Midlothian

2019 WATER MODEL UPDATE AND 10-YEAR CIP



August 2019

PREPARED FOR:

City of Midlothian

PREPARED BY:

Freese and Nichols, Inc.
2711 North Haskell Ave., Suite 3300
Dallas, Texas 75204

Midlothian
DFW's Southern Star

2019 WATER MODEL UPDATE AND 10-YEAR CIP

Prepared for:

City of Midlothian

FREESE AND NICHOLS, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-2144

Prepared by:

FREESE AND NICHOLS, INC.
2711 North Haskell Ave., Suite 3300
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FNI Project Number: MDL17643

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EXECUTIVE SUMMARY

1.0 INTRODUCTION

The City of Midlothian (City) is a growing community located in the Dallas-Fort Worth Metroplex. The City's population is projected to grow more than 12,000 people by 2030. This report has been prepared to provide the City of Midlothian with a planning tool to serve as a guide for 10-year improvements to the water infrastructure.

The major elements of the scope of this *Water Model Update and 10-Year CIP* project included:

- Field pressure testing, water model update, and calibration
- Water demand projections
- Distribution system hydraulic capacity analysis, including pumping and storage requirements
- 10-Year water system capital improvement plan and water master plan report

2.0 POPULATION AND LAND USE

Historical population data and population projections developed in the *2018 Water Demand Update and Supply Planning Report* by Freese and Nichols, Inc. (FNI) were used in this *Water Model Update and 10-Year CIP* to maintain consistency between the two plans. Projected population data for the City of Midlothian is summarized in **Table ES-1**.

Table ES-1: Projected City Population within Water Service Area

Year	Population
2018	18,678
2020	20,371
2025	25,660
2030	31,028

3.0 WATER DEMAND PROJECTIONS

Water demands were projected for 2018 through 2070, as part of the *2018 Water Demand Update and Supply Planning Report* by FNI. Projected 2018 demands were used for existing condition demands, and 2030 demands were used for 10-Year demands. The water demands used in this *Water Model Update and 10-Year CIP* have been updated since the *2018 Water Demand Update and Water Supply Planning* report, following the receipt of additional information from the City regarding wholesale customer

contracts and expected developments. **Table ES-2** presents the projected maximum day water demand for each planning year used in this *Water Model Update and 10-Year CIP.*

Table ES-2: Maximum Day Projected Water Demands

Year	Retail Demand (MGD)	Wholesale Demand (MGD)	TOTAL (MGD)
2018	9.76	7.84	17.60
2030	21.12	15.5	36.62

4.0 EXISTING WATER SYSTEM

The City of Midlothian's water distribution system currently consists of a network of water lines ranging in size from 2-inch to 36-inch, two elevated storage tanks, and two high service pump stations (one at each water treatment plant). The City operates two water treatments plants, Tayman (Water Treatment Plant #1) and Auger (Water Treatment Plant #2). The service area operates on a single pressure plane.

5.0 MODEL UPDATE AND CALIBRATION

A hydraulic model was updated as a tool in the evaluation of the City of Midlothian's water distribution system. InfoWater software by *Innovyze®* was used to model the water system. The model network was developed from the City's geographic information system (GIS) and design plans. SCADA data was supplemented by temporary field pressure testing for the calibration of the model. The calibration process involved adjusting system operation, pipeline roughness coefficient (Hazen-Williams C-values), demand allocation, and peaking factors to match a known condition. The 24-hour period occurring on May 9, 2018 from 12:00 am to 12:00 am was selected for calibration. A close correlation between modeled and observed values was achieved, creating a high degree of confidence in the accuracy of the model.

6.0 WATER SYSTEM ANALYSIS AND HYDRAULIC MODELING

Hydraulic model analyses were conducted to identify deficiencies in the City of Midlothian's existing water distribution system and to analyze the capacity of the system under projected future demand conditions. Parameters used in evaluating the system through buildout conditions included meeting projected demands, increasing system reliability, meeting target fire flows, and maintaining proper residual pressures. FNI identified the following needs:

- Additional treatment capacity
- Additional pumping capacity
- Additional transmission capacity
- Additional storage capacity

7.0 WATER SYSTEM CAPITAL IMPROVEMENTS PLAN

The modeling and water system analysis results identified a need to improve system transmission, increase pumping capacity, and increase elevated storage to satisfy projected 10-year demand conditions. The recommended capital improvement projects are summarized in **Table ES-2**.

Table ES-2: Recommended CIP Projects

Project Number	Project Name	Cost
1	Phase 1: Capacity Expansion at the Auger HSPS/ Auger WTP Expansion/ Auger Clearwell Expansion	$ 13,161,200
2	20-inch Capacity Expansion along Hwy 67	$ 1,893,300
3	16-inch/24-inch Railport Expansion	$ 3,114,000
4	2.0 MG Railport Elevated Storage Tank	$ 6,352,500
5	36-inch/30-inch Western Transmission Main	$ 11,780,000
6	Phase 2: Capacity Expansion at Auger HSPS/Auger WTP Expansion/Auger Clearwell Expansion	$ 43,113,800
7	20-inch Upsize Railport Line and Railroad Crossing	$ 2,477,200
8	20-inch Parallel Water Line from Railport EST	$ 2,253,400
9	12-inch Grand Prairie Loop	$ 1,340,100
10	20-inch Transmission along Highway 287	$ 5,699,700
11	20-inch Water Line between Hwy 287 and FM 1387	$ 3,049,100
12	Diamond J Improvements	$ 2,976,200
13	16-inch Loop along New Shiloh Road	$ 5,317,200
14	Capacity Expansion at Tayman HSPS/ Transmission Line Expansion/ Capacity Expansion at the Tayman WTP/Tayman Clearwell Expansion	$ 41,633,900
15	12-inch Eastern Loop	$ 2,576,400
16	12-inch Loop to Rockett Delivery Point	$ 1,917,800
17	12-inch Connections	$ 270,400
18	New 1.5 MG EST	$ 5,630,700
	10-Year CIP Total	**$ 154,556,500**

1.0 INTRODUCTION

The City of Midlothian (City) is a growing community located in the Dallas-Fort Worth Metroplex. The City provides water to a service area of approximately 51 square miles, which includes residential, industrial, and wholesale customers. The City's population is projected to grow more than 12,000 people by 2030. The City of Midlothian's water service area is defined in greater detail in **Section 2.1**, but generally encompasses the city limits excluding areas served by Sardis-Lone Elm WSC and Mountain Peak SUD. The water service area represents the region in which the City maintains infrastructure and delivers water to customers. Accommodating this growth in an efficient and cost-effective manner, while maintaining a safe and reliable water supply for the citizens of Midlothian, is the focus of this *Water Model Update and 10-Year CIP*. This report has been prepared to provide the City of Midlothian with a planning tool to serve as a guide for 10-year improvements to the water infrastructure.

1.1 SCOPE OF WORK

Freese and Nichols, Inc. (FNI) was retained in October 2017 by the City of Midlothian to prepare a *Water Model Update and 10-Year CIP*. A *2018 Water Demand Update and Water Supply Planning* report was prepared under the same contract (Phase A). This *Water Model Update and 10-Year CIP* utilized the same demands projections and assumptions developed in the *2018 Water Demand Update and Water Supply Planning* report. The goals of this *Water Model Update and 10-Year CIP* were to update the City's existing water model to include new infrastructure, use the model to evaluate the performance of the existing and future water system, and recommend a 10-year Capital Improvements Plan (CIP). The recommended improvements will serve as a basis for the design, construction, and financing of facilities required to meet Midlothian's water capacity and system needs. The major elements of the scope of this *Water Model Update and 10-Year CIP* project included:

- Field pressure testing, water model update, and calibration
- Water demand projections
- Distribution system hydraulic capacity analysis, including pumping and storage requirements
- 10-Year water system capital improvement plan and water master plan report

1.2 LIST OF ABBREVIATIONS

Table 1-1 provides a list of abbreviations used in this report.

Table 1-1: Abbreviations

Abbreviation	Full Nomenclature
AD	Average Day Demand
CCN	Certificate of Convenience and Necessity
CIP	Capital Improvements Plan
EPS	Extended Period Simulation
EST	Elevated Storage Tank
ETJ	Extraterritorial Jurisdiction
ft/s	feet per second
FNI	Freese and Nichols, Inc.
GIS	Geographic Information System
gpcd	gallons per capita per day
gpm	gallons per minute
GST	Ground Storage Tank
MD	Maximum Day Demand
MG	Million Gallons
MGD	Million Gallons per Day
PH	Peak Hour Demand
PP	Pressure Plane
PS	Pump Station
psi	pounds per square inch
SCADA	Supervisory Control and Data Acquisition
SUD	Special Utility District
TCEQ	Texas Commission on Environmental Quality
TRA	Trinity River Authority
TRWD	Tarrant Regional Water District
TSZ	Traffic Survey Zones
TWDB	Texas Water Development Board
WSC	Water Supply Company

2.0 POPULATION AND LAND USE

Population and land use are important elements in the analysis of water distribution systems. Water demands depend on the residential population and commercial development served by the system and determine the sizing and location of system infrastructure. A thorough analysis of historical and projected populations, along with land use, provides the basis for projecting future water demands.

Phase A of this project—*2018 Water Demand Update and Water Supply Planning*—included a detailed analysis of population, land use, and water demands. The results of that evaluation were utilized in this *Water Model Update and 10-Year CIP*. A summary of the population and land use information presented in the *2018 Water Demand Update and Water Supply Planning* report is included in this section. For a description of detailed methodology, refer to the *2018 Water Demand Update and Water Supply Planning* report.

2.1 SERVICE AREA

The service area for the Midlothian's water system includes an area of approximately 51 square miles generally bounded the City of Grand Prairie to the west, the City of Cedar Hill to the north, Sardis-Lone Elm WSC to the east, and Mountain Peak SUD to the south. The City's water system operates on a single pressure plane to supply municipal, industrial, and wholesale customers. **Figure 2-1** illustrates the boundaries of the City's water service area and city limits. Sardis-Lone Elm WSC and Mountain Peak SUD both provide water service to areas within the Midlothian city limits.

2.2 HISTORICAL POPULATION

Historical population data and population projections developed in the *2018 Water Demand Update and Water Supply Planning* report were used in this *Water Model Update and 10-Year CIP* to maintain uniformity between the two plans. Historical and projected population data for the City of Midlothian is summarized in **Table 2-1** and **Table 2-2.**

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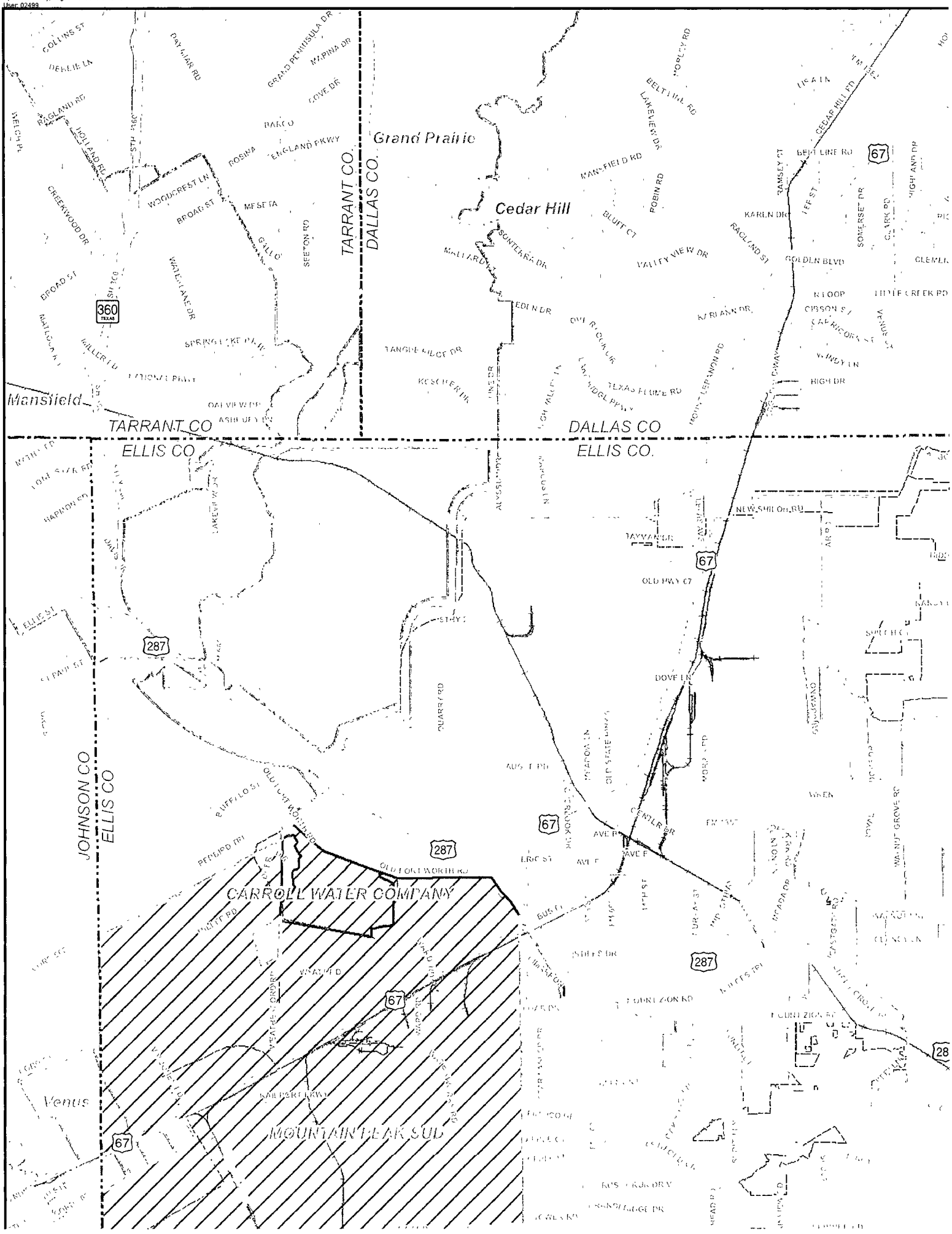


Table 2-1: Historical City Population

Year	Historical Population [1]	Growth Rate
2005	10,290	-
2006	10,727	4.2%
2007	11,165	4.1%
2008	11,602	3.9%
2009	12,039	3.8%
2010	12,477	3.6%
2011	12,822	2.8%
2012	13,672	6.6%
2013	14,577	6.6%
2014	15,543	6.6%
2015	16,573	6.6%
2016	16,728	0.9%

(1) Data from Table 3-1 of the *2018 Water Demand Update and Water Supply Planning* report.

Table 2-2: Projected City Population

Year	Projected Population [1]	Annual Growth Rate
2018	18,678	-
2020	20,371	4.4%
2025	25,660	4.7%
2030	31,028	3.9%

(1) Data from Table 3-2 of the *2018 Water Demand Update and Water Supply Planning* report.

3.0 WATER DEMAND PROJECTIONS

A water utility must be able to supply water at rates that fluctuate over time. Yearly, monthly, daily, and hourly variations in water use occur, with higher use during dry years and in hot months. Also, water use typically follows a diurnal pattern, being low at night and peaking in the early morning and evening. Flow rates most important to the hydraulic design and operation of a distribution system are average day (AD), maximum day (MD), and peak hour (PH) demands. Average day use is the total annual water use divided by the number of days in the year. The average day demand 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. Water supply facilities are typically designed based on the maximum day demand. 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.

A thorough evaluation of historical and projected water demands for the City of Midlothian was performed during the *2018 Water Demand Update and Water Supply Planning* (Phase A of this contract), and the results are summarized in this section. The water demands used in this *Water Model Update and 10-Year CIP* are consistent with the demand projections presented in the *2018 Water Demand Update and Water Supply Planning* report, with three exceptions following from the receipt of additional information from the City regarding wholesale customer contracts and expected developments.

3.1 HISTORICAL WATER DEMANDS

Reviewing historical water demands provides insight into selecting design criteria used to project future water demands. Historical water demand data was analyzed from 2005 through 2017. **Table 3-1** provides a breakdown of the historical water supply usage by source.

Table 3-1: Historical Water Usage[1]

Year	AVERAGE DAY DEMAND									Total Average Day Demand (MGD)	Total Maximum Day Demand (MGD)	Maximum Day: Average Day Peaking Factor
	Retail			Wholesale								
	Municipal (MGD)	Industrial[1] (MGD)	Total Retail (MGD)	Rockett SUD (MGD)	Grand Prairie (MGD)	Venus (MGD)	Mountain Peak SUD (MGD)	Sardis-Lone Elm (MGD)	Total Wholesale (MGD)			
2005	2.91	0.28	3.19	1.17	0.20	-	0.12	-	1.49	4.68	7.93	1.69
2006	3.20	0.28	3.48	1.38	0.25	0.06	0.13	-	1.81	5.30	9.72	1.84
2007	1.98	0.28	2.26	1.63	0.01	0.12	0.13	-	1.88	4.14	7.95	1.92
2008	2.05	0.30	2.35	1.95	0.17	0.18	0.20	-	2.50	4.85	9.25	1.91
2009	2.32	0.26	2.58	1.67	0.16	0.18	0.15	-	2.16	4.74	9.49	2.00
2010	2.37	0.27	2.64	2.04	0.11	0.20	0.25	-	2.61	5.25	8.29	1.58
2011	2.22	0.40	2.61	1.78	0.31	0.24	0.23	-	2.56	5.17	9.83	1.90
2012	2.61	0.25	2.86	2.19	0.26	0.25	0.20	-	2.90	5.75	9.11	1.58
2013	2.56	0.20	2.76	2.12	0.15	0.28	0.25	-	2.80	5.57	9.54	1.71
2014	2.23	0.39	2.63	2.12	0.22	0.27	0.37	-	2.97	5.60	8.47	1.51
2015	2.41	0.28	2.69	1.91	0.69	0.24	0.25	-	3.09	5.79	11.06	1.91
2016	2.16	0.23	2.38	1.97	0.94	0.26	0.31	0.23	3.71	6.09	12.54	2.06
2017	1.76	0.29	2.05	2.04	1.58	0.30	0.38	0.22	4.53	6.58	10.61	1.61
Avg.	**2.37**	**0.29**	**2.65**	**1.84**	**0.39**	**0.22**	**0.23**	**0.23**	**2.69**	**5.35**	**9.52**	**1.79**
Max.	**3.20**	**0.40**	**3.48**	**2.19**	**1.58**	**0.30**	**0.38**	**0.23**	**4.53**	**6.58**	**12.54**	**2.06**

(1) Data from Table 2-1 and Table 2-2 of *2018 Water Demand Update and Water Supply Planning* report.

3.2 WATER DEMAND PROJECTIONS

Water demands were projected for 2018 through 2070, as part of the *2018 Water Demand Update and Water Supply Planning* report. Projected 2018 demands were used for existing condition demands, and 2030 demands were used for 10-Year demands. The water demands used in this *Water Model Update and 10-Year CIP* are consistent with those used in the *2018 Water Demand Update and Water Supply Planning* report, with the exceptions noted below:

- *Sardis-Lone Elm WSC*: The City provided information that Sardis-Lone Elm WSC has requested an additional 1.86 MGD from TRWD to be treated and distributed by Midlothian. 2030 wholesale maximum day demand for Sardis-Lone Elm WSC was increased from 1.0 MGD to 2.86 MGD.

- *Venus*: The City provided information that Venus has requested an additional 1.00 MGD from TRWD to be treated and distributed by Midlothian. Venus's contract allows a peaking factor of 2.00. Therefore, the 2030 wholesale maximum day demand for Venus was increased to 4.00 MGD.

- *Windsor Hills Residential Development*: The City provided input that the expected number of lots to be served in this development had been reduced from 2,700 to 522 lots. To account for this adjustment, the residential demand assumption of 180 gpcd, and MD:AD peaking factor of 2.25 (from the *2018 Water Demand Update and Water Supply Planning* report), were used, along with an estimate of three people per lot, to estimate water demand for the 522 lots in Windsor Hills. 2030 Windsor Hills maximum day demand was estimated to be 440 gpm (0.63 MGD). It is assumed that the remainder of Windsor Hills demand will be met through the City's wholesale contract with Grand Prairie.

Table 3-2 and **Table 3-3** summarize the average day and maximum day water demand projections used in this *Water Model Update and 10-Year CIP*. **Figure 3-1** displays the historical and projected average and maximum day water demands.

Table 3-2: Average Day Water Demand Projections [1]

Year	RETAIL				WHOLESALE						TOTAL RETAIL & WHOLESALE (MGD)
	Municipal (MGD)	New Park (MGD)	Industrial (MGD)	Total Retail (MGD)	Rockett SUD (MGD)	Grand Prairie (MGD)	Venus (MGD)	Mountain Peak SUD (MGD)	Sardis-Lone Elm (MGD)	Total Wholesale (MGD)	
2018	3.36	0.20	0.46	4.02	2.00	1.50	0.42	0.27	0.25	4.44	8.46
2030	5.87	0.20	4.59	10.66	2.00	2.50	2.00[3]	0.27	2.86[4]	9.63	20.29

(1) Water demand projections from Table 7-1 of the Water Demand Update and Water Supply Planning Report, by FNI.

(2) 2030 municipal demands reflect an additional 0.28 MGD from Windsor Hills development (522 lots).

(3) 2030 Venus demands reflect an additional 1.00 MGD contracted amount (total 2030 contract= 2.00 MGD).

(4) 2030 Sardis-Lone Elm demands reflect an additional 1.86 MGD contracted amount (total 2030 contract= 2.86 MGD).

Table 3-3: Maximum Day Water Demand Projections [1]

Year	RETAIL				WHOLESALE						TOTAL RETAIL & WHOLESALE (MGD)
	Municipal (MGD)	New Park (MGD)	Industrial (MGD)	Total Retail (MGD)	Rockett SUD (MGD)	Grand Prairie (MGD)	Venus (MGD)	Mountain Peak SUD (MGD)	Sardis-Lone Elm (MGD)	Total Wholesale (MGD)	
2018[2]	7.56	0.76	1.44	9.76	2.50	3.00	0.84	1.00	0.50	7.84	17.60
2030[3]	13.20[4]	0.76	7.16	21.12	2.50	5.00	4.00[5]	1.00	2.86[6]	15.36	36.48

(1) Water demand projections from Table 7-2 of the Water Demand Update and Water Supply Planning Report, by FNI.

(2) 2018 demands were used as existing condition demands in the water model.

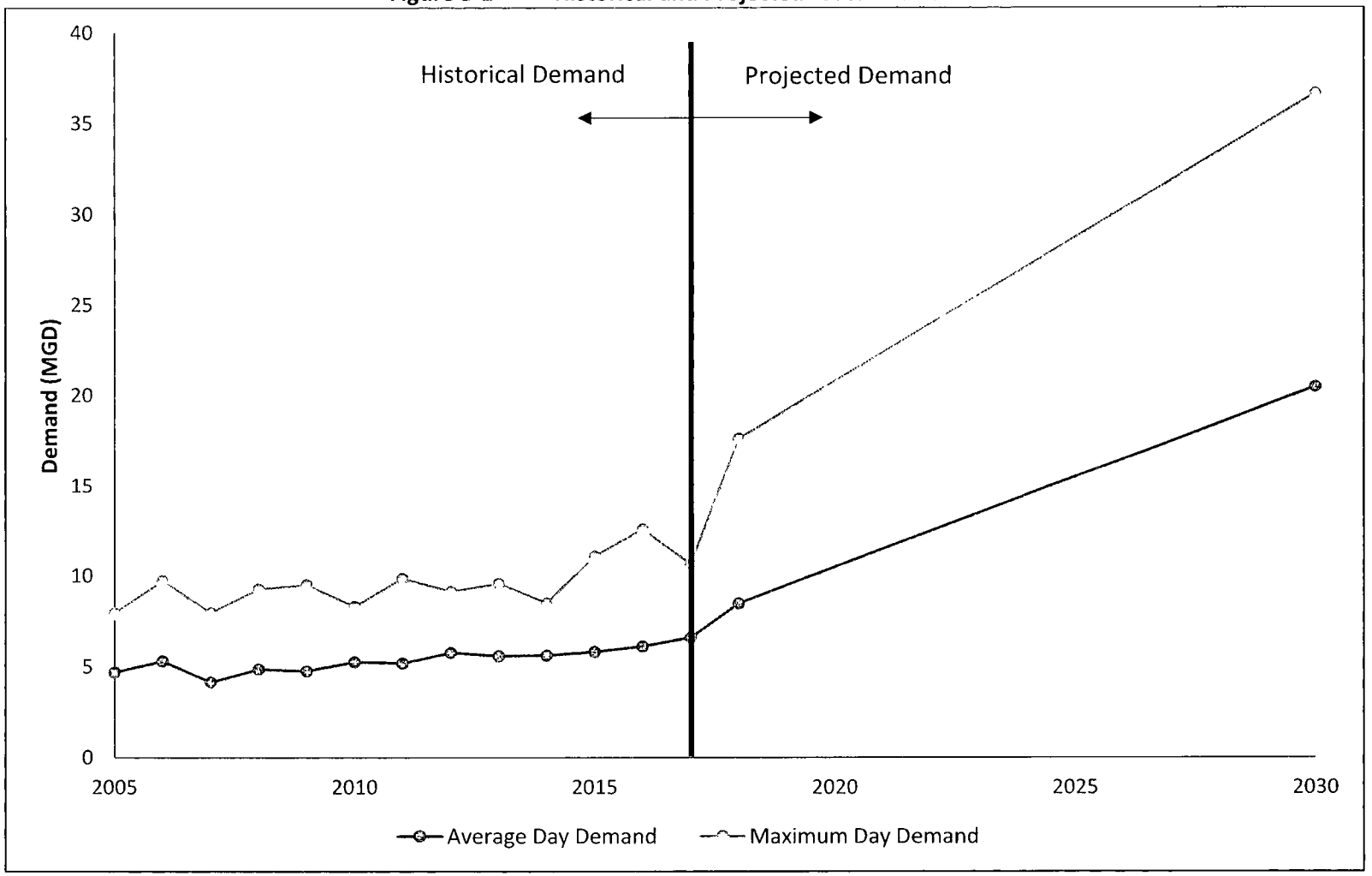
(3) 2030 demands were used as 10-year planning period demands in the water model.

(4) 2030 municipal demands reflect an additional 0.63 MGD from Windsor Hills development (522 lots).

(5) 2030 Venus demands reflect an additional 1.00 MGD contracted amount (total 2030 contract= 2.0 MGD) with an allowable peaking factor of 2.00.

(6) 2030 Sardis-Lone Elm demands reflect an additional 1.86 MGD contracted amount (total 2030 contract= 2.86 MGD)

Figure 3-1 Historical and Projected Water Demands



4.0 EXISTING WATER SYSTEM

The City of Midlothian's water distribution system currently consists of a network of water lines ranging in size from 2-inch to 36-inch, two water treatment plants each equipped with a high service pump station, and two elevated storage tanks. **Figure 4-1** shows the existing water distribution system for the City of Midlothian.

4.1 WATER TREATMENT

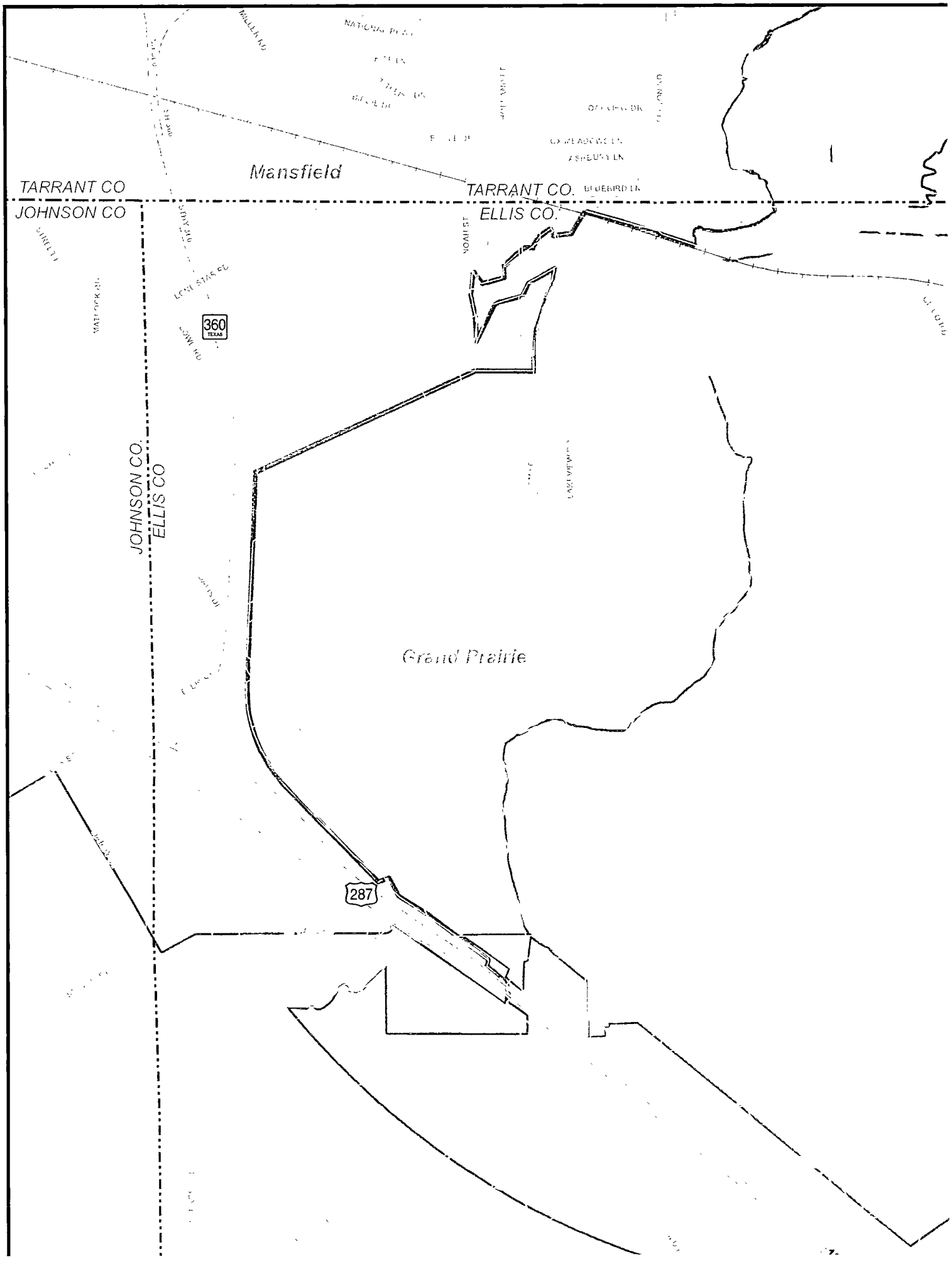
Midlothian currently obtains raw water from a contract with the Trinity River Authority (TRA) for water from Joe Pool Lake and from raw water supplied by the Tarrant Regional Water District (TRWD). The City has two separate water treatment facilities; the Tayman Plant (11.5 MGD capacity) to treat supplies from Joe Pool Lake and the Auger Plant (8 MGD capacity) to treat supplies from TRWD. **Table 4-1** summarizes the available treatment capacity at each WTP.

Table 4-1: Water Treatment Capacity

WTP	Treatment Capacity	
	(MGD)	(gpm)
Tayman	11.50	7,986
Auger	8.00	5,555
Total	**19.50**	**13,541**

4.2 PRESSURE PLANES

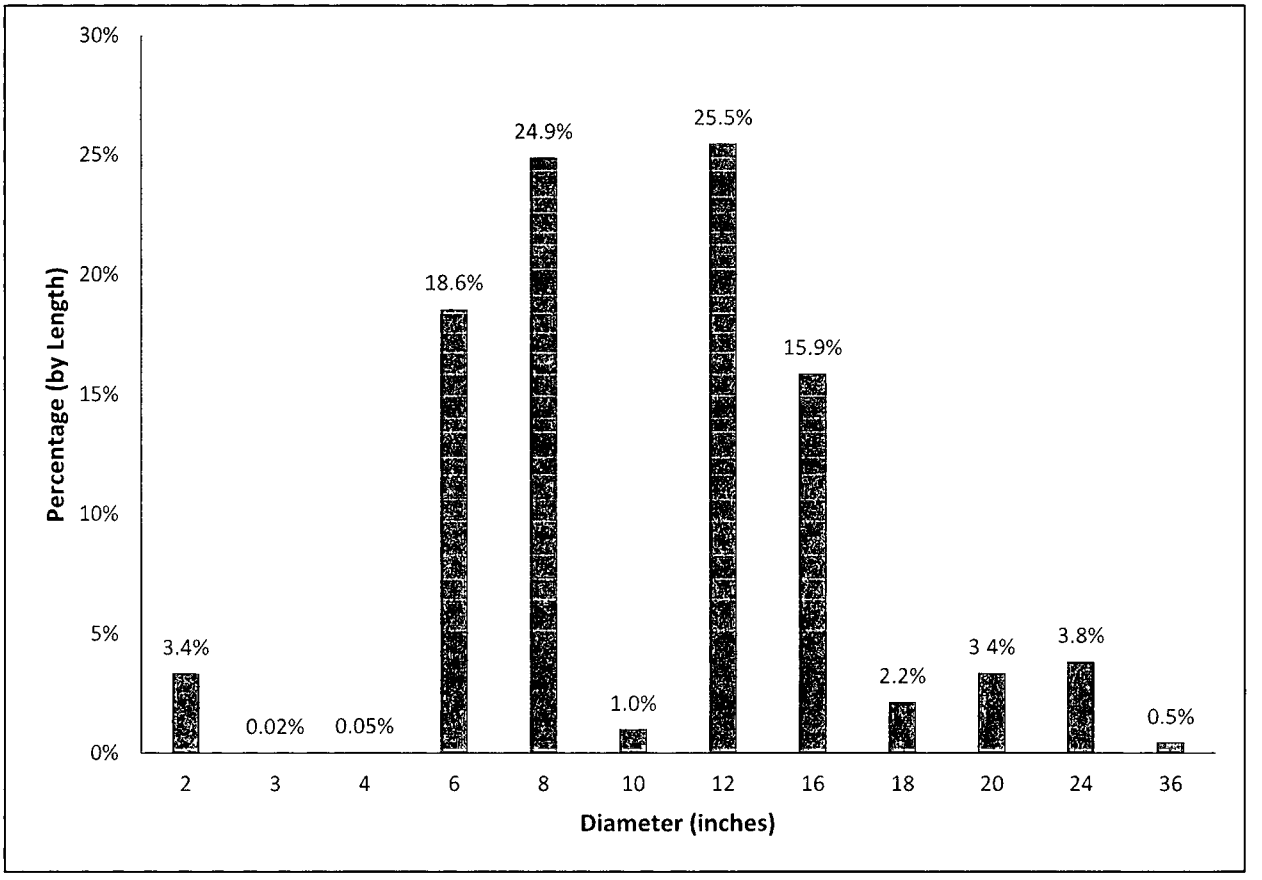
The distribution system is operated on a single pressure plane (PP). The PP has a static hydraulic gradient of 940 feet, and ground elevations range from approximately 560 feet to 840 feet. Water is pumped from the clear wells at the two WTPs to fill the two ESTs and deliver water throughout the distribution system.


Mansfield
TARRANT CO
JOHNSON CO
TARRANT CO.
ELLIS CO.
JOHNSON CO.
ELLIS CO
Grand Prairie
360
TEXAS
287

4.3 WATER LINES

The City of Midlothian's water model system consists of 155 miles of water lines, ranging in size from 2-inch to 36-inches. **Figure 4-2** illustrates the percentage of modeled water line length by diameter based on information from the City's Geographic Information System (GIS).

Figure 4-2: Water Line Length by Diameter



4.4 PUMP STATIONS

The City of Midlothian supplies water to the distribution system through high service pump stations at the Tayman and Auger WTPs. The Auger HSPS consists of three 3,125 gpm (4.50 MGD) pumps for a total capacity of 13.50 MGD with a firm capacity of 9.00 MGD. The Auger HSPS draws water from the clearwell at the Auger WTP. The Tayman HSPS consists of five pumps and has a total capacity of 21.10 MGD and a firm capacity of 14.20 MGD. The Tayman HSPS draws water from the clearwells at the Tayman WTP. Firm pumping capacity represents the pump station capacity with the largest pump out of service. **Table 4-2**

provides a summary of the City's pumping facilities in gallons per minute (gpm) and million gallons per day (MGD).

Table 4-2: Summary of Pump Stations

Pump Station	Pump Number	Rated Capacity (gpm)	Rated Capacity (MGD)
Auger HSPS	1	3,125	4.50
	2	3,125	4.50
	3	3,125	4.50
	Total Capacity	**9,375**	**13.50**
	Firm Capacity	**6,250**	**9.00**
Tayman HSPS	1	743	1.07
	2	2,430	3.50
	3	2,430	3.50
	4	4,236	6.10
	5	4,791	6.90
	Total Capacity	**14,630**	**21.07**
	Firm Capacity	**9,839**	**14.17**

4.5 STORAGE FACILITIES

The City currently utilizes three clearwells at the Auger WTP (1) and Tayman WTP (2) as ground storage for the distribution system. One 3.00 million gallon (MG) and one 1.00 MG clearwell are located at the Tayman WTP. The tanks are filled by the WTP. One 3.0 MG clearwell is located at the Auger WTP. The tank is filled by the Auger WTP. The City is currently planning construction of a second 3.0 MG clearwell at the Auger WTP.

Additionally, two elevated storage tanks (ESTs) are located in the distribution system. The Mockingbird EST has a capacity of 2.00 MG and is located on Mockingbird Lane in northeastern Midlothian. The 9th Street EST has a storage capacity 1.00 MG and is located on 9th Street south of downtown Midlothian. Both elevated tanks have an overflow elevation of 940 feet and serve Midlothian's single pressure plane. **Table 4-3** presents a summary of the City's existing ground storage tanks and **Table 4-4** shows the elevated storage facilities.

Table 4-3: Existing System Ground Storage Tank Facilities

Tank Name	Capacity (MG)	Sidewater Depth (ft)	Overflow Elevation (ft)
Auger WTP Clearwell	3.00	30.00	682.50
Tayman WTP Clearwells	3.00	18.00	798.40
	1.00	18.00	798.50
Total Ground Storage	**7.00**	-	-

Table 4-4: Existing System Elevated Storage Tank Facilities

Tank Name	Capacity (MG)	Sidewater Depth (ft)	Overflow Elevation (ft)
Mockingbird	2.00	40.00	940.00
9th Street	1.00	40.00	940.00
Total Elevated Storage	**3.00**	-	-

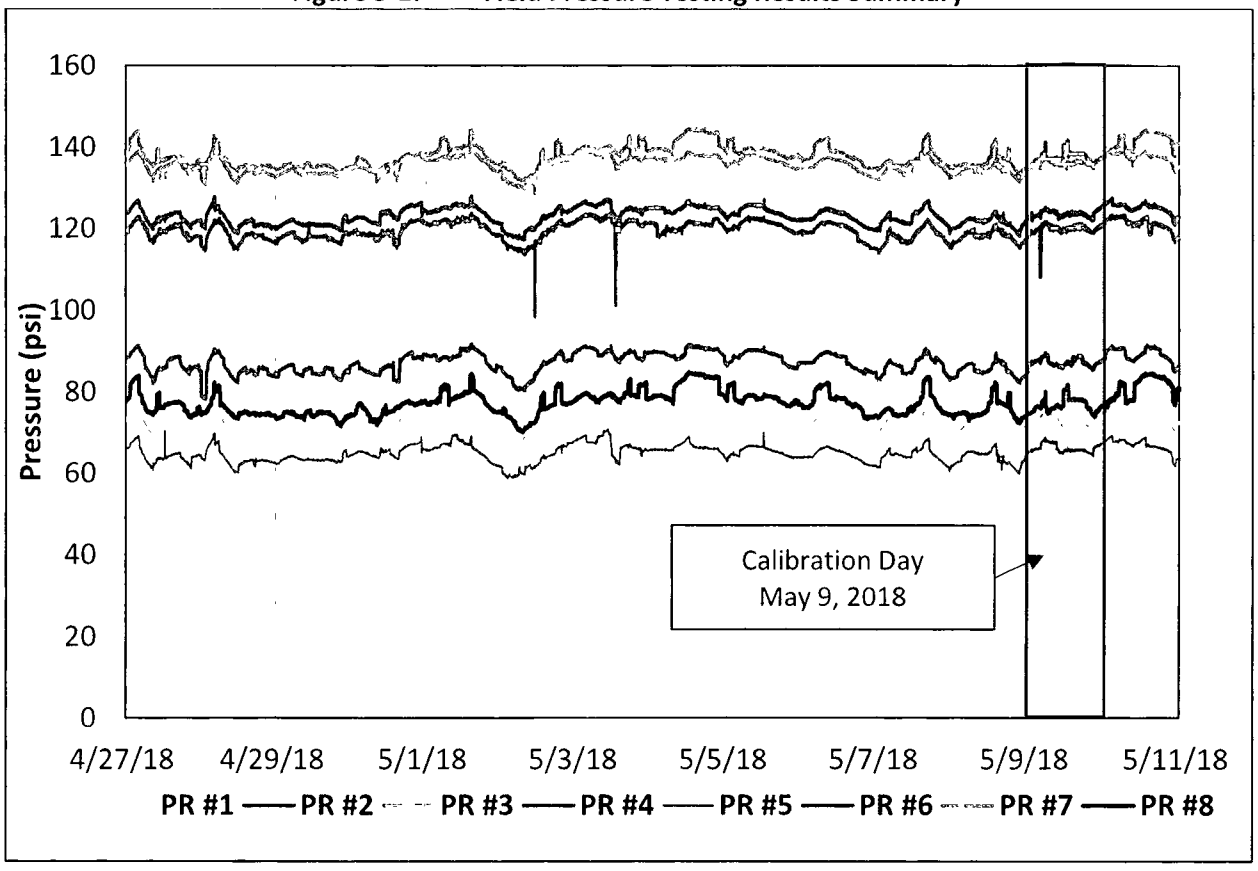
5.0 MODEL UPDATE AND CALIBRATION

The hydraulic model is one of the most critical elements in the analysis of water distribution systems. Field pressure testing was performed to assist with the calibration of the water system model. The calibrated water system model was then used to conduct hydraulic analyses to identify deficiencies in the City of Midlothian's existing water distribution system before analyzing projected future conditions.

5.1 FIELD TESTING

To assist with model calibration and supplement available operational data, field pressure testing was conducted April 27, 2018 - May 11, 2018. Eight pressure recorders were installed throughout the distribution system based on geographic coverage and areas of high and low elevations. **Figure 5-1** shows the field pressure testing results. Minimum, maximum, and average pressures were recorded every five minutes at each location. Pressure generally ranged from about 60 psi to 145 psi. **Appendix A** includes the locations of the pressure recorders and individual pressure recorder data for Pressure Recorders #1-8 from the field testing period.

Figure 5-1: Field Pressure Testing Results Summary



5.2 MODEL UPDATE AND CALIBRATION

5.2.1 Physical Network

The City's water model was updated using InfoWater by Innovyze® software and includes all pipes in the distribution system. FNI digitized recent project as-builts and final design plans into GIS to update the City's GIS records. New pipes were imported into the model from the City's updated GIS. The model includes 3,357 pipes, ranging in size from 2-inch to 36-inches. Pipelines were assigned a Hazen-Williams roughness coefficient of 120. All pumping and storage facilities were updated manually, as needed, based on as-built drawings and information provided by the City.

5.2.2 Demand Allocation

Existing demands were allocated to the model using customer billing accounts. The active water meters from April and May 2018 were spatially located and the associated consumption was assigned to the nearest model node. Approximately 99% of the meters (approximately 60 MG of monthly consumption) were able to be matched to locations within the City limit by geocoding. These geocoded water meters are shown on **Figure 5-2**.

Water demands for wholesale customers were assigned to the respective wholesale meters. Incremental 10-year increase in demand was allocated proportionally to population growth of TSZs in the service area.

5.2.3 Extended Period Simulation Calibration

To verify that the hydraulic model accurately represented the actual distribution system, a model calibration analysis was performed. The calibration process involves adjusting system operation, C-values, demand allocation, and peaking factors to match a known condition. The 24-hour period occurring on May 9, 2018 from midnight to midnight was selected for calibration. Demands assigned to model nodes were scaled up to match the calibration day demand of 8.66 MGD. The following sections provide a summary of the calibration process, the adjustments made during calibration, and the modeled results compared to the actual recorded values.

5.2.4 Diurnal Pattern

The City provided Supervisory Control and Data Acquisition (SCADA) readings for clear well levels, elevated storage tank levels, and pump station flow rates. Flow and tank level data were utilized to calculate an overall diurnal pattern by examining water going into (supply) and out of (demand) the distribution

system. For calibration, a diurnal curve was created for May 9, 2018. **Figure 5-3** shows the calculated system diurnal pattern which was used for calibration and maximum day analyses. Diurnal factors for the 24-hour calibration period ranged from 0.68 to 1.26.

_Billing_Meters_11x17.mxd

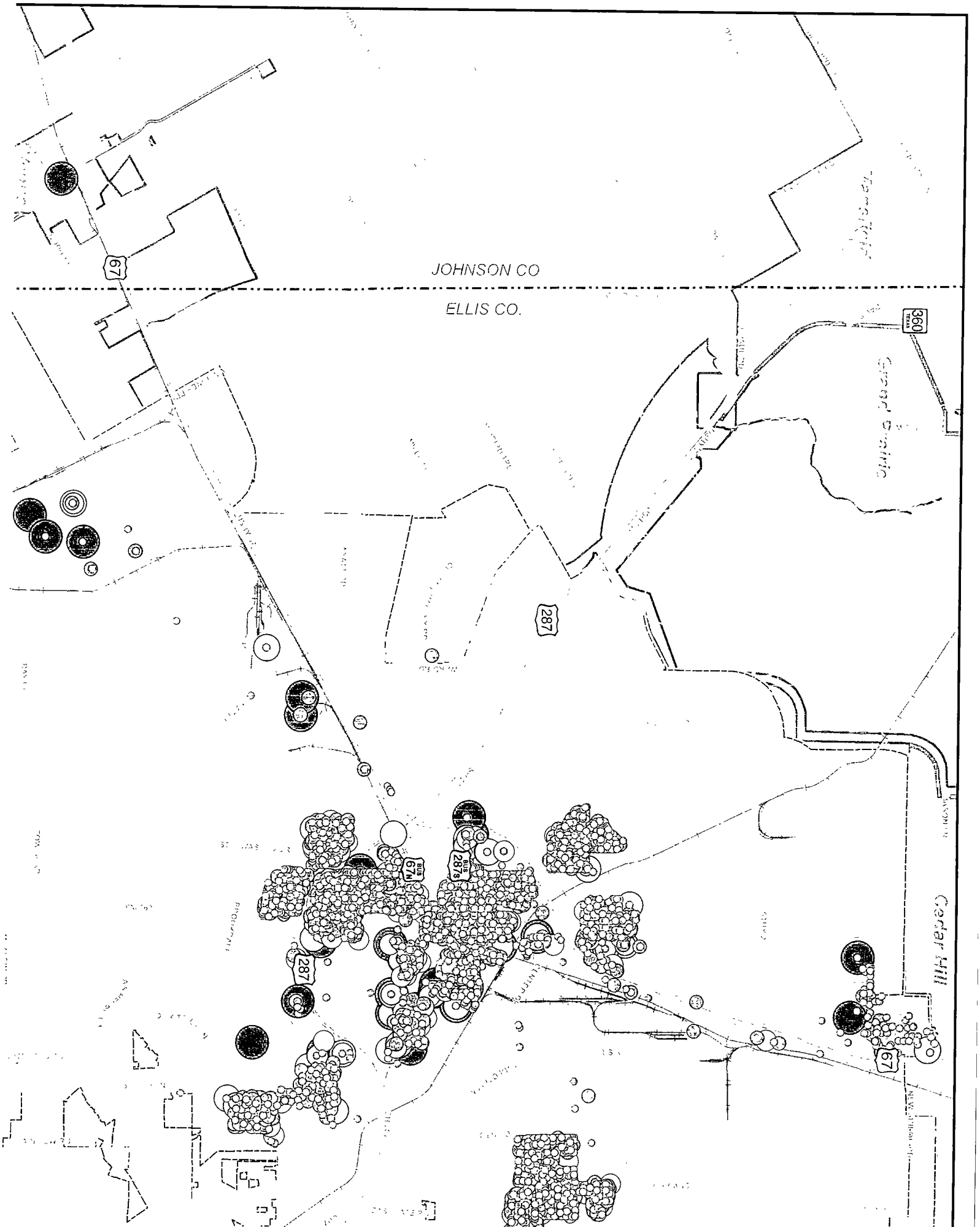
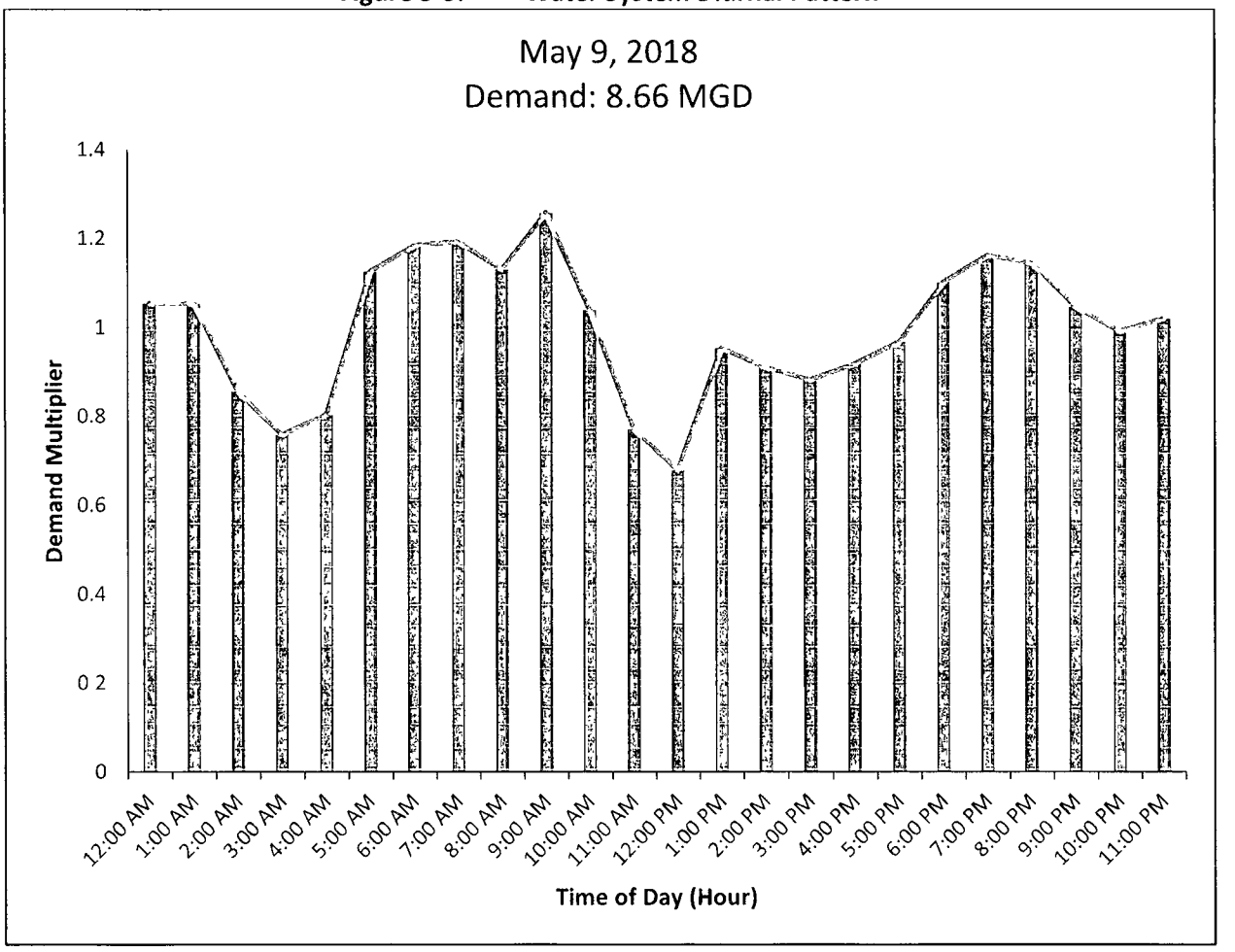


Figure 5-3: Water System Diurnal Pattern



5.2.5 Calibration Controls and Adjustments

During the extended period simulation (EPS) calibration, adjustments were made to the model to match the known conditions of May 9, 2018. The hourly SCADA values are an instantaneous reading of flows and tank levels at a given time and do not account for changes between readings. Wholesale users demands and patterns were adjusted based on observed data and input from City staff. For calibration, pump controls were set to turn pumps on and off according to the reported SCADA data.

5.2.6 Calibration Results

Figure 5-4, Figure 5-5, and **Figure 5-6** show representative calibration results graphs. The results suggest a good correlation between recorded and modeled values and provide confidence in the accuracy of the model. The flow, pressure, and tank modeled results versus City recorded SCADA data for the EPS calibration are summarized on the graphs included in **Appendix B**.

Figure 5-4: Mockingbird EST Calibration Results

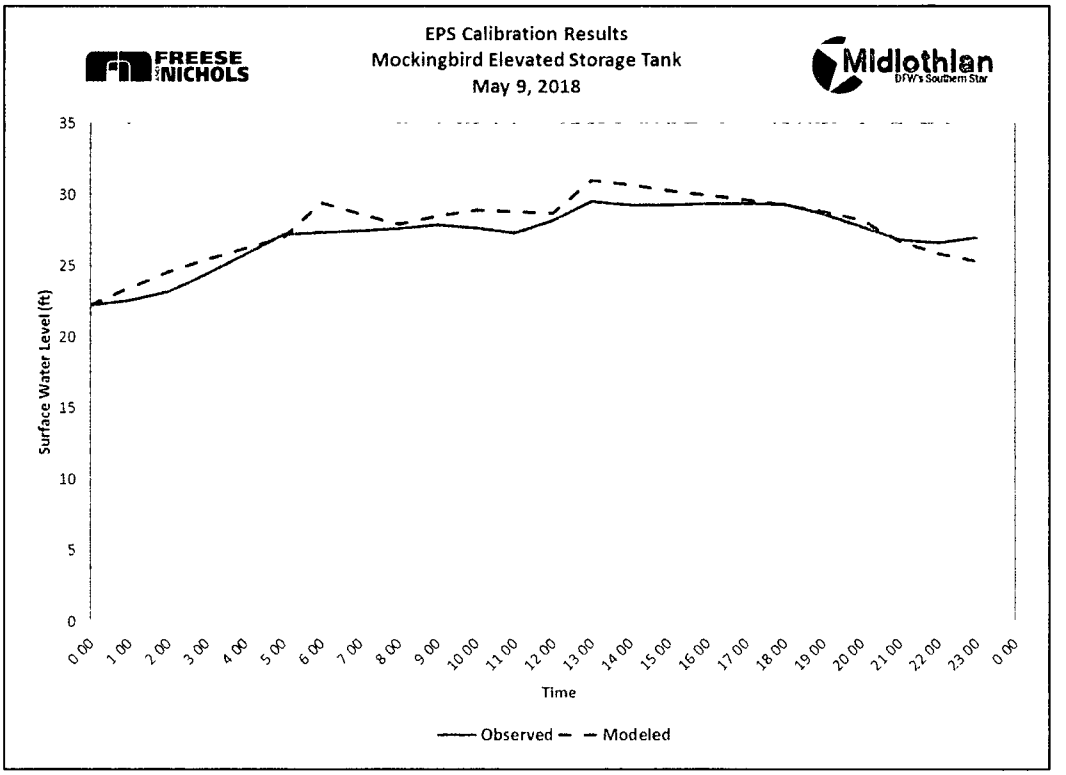


Figure 5-5: Pressure Recorder #5 Calibration Results

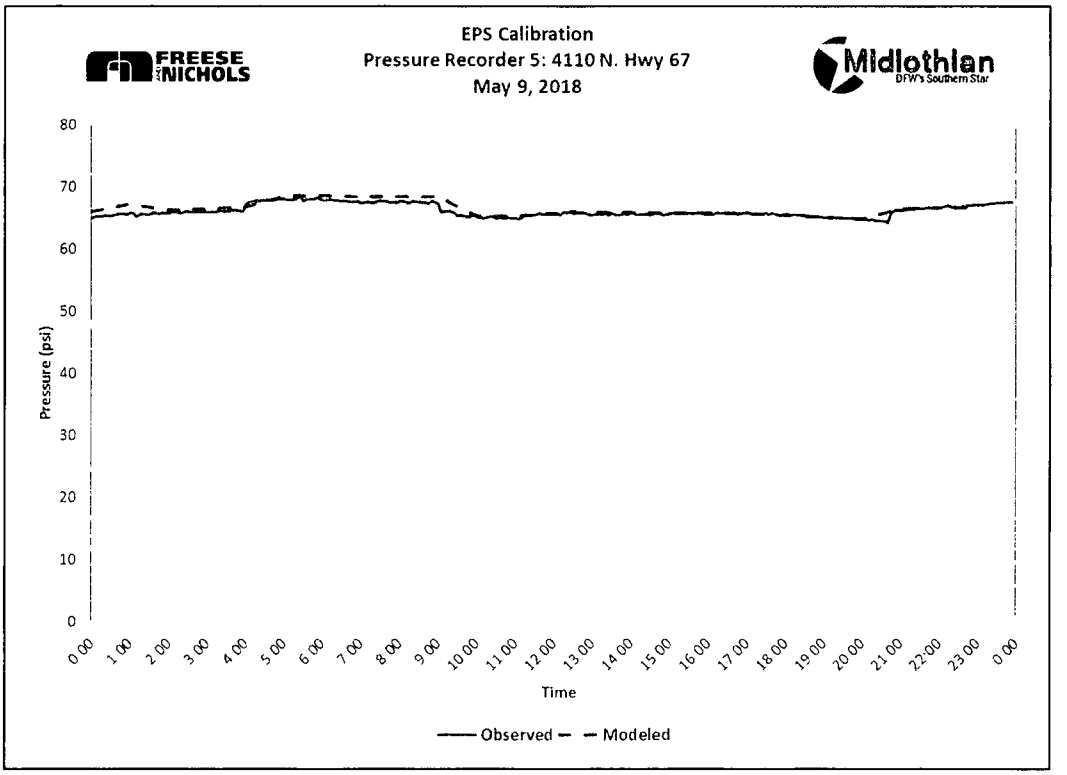
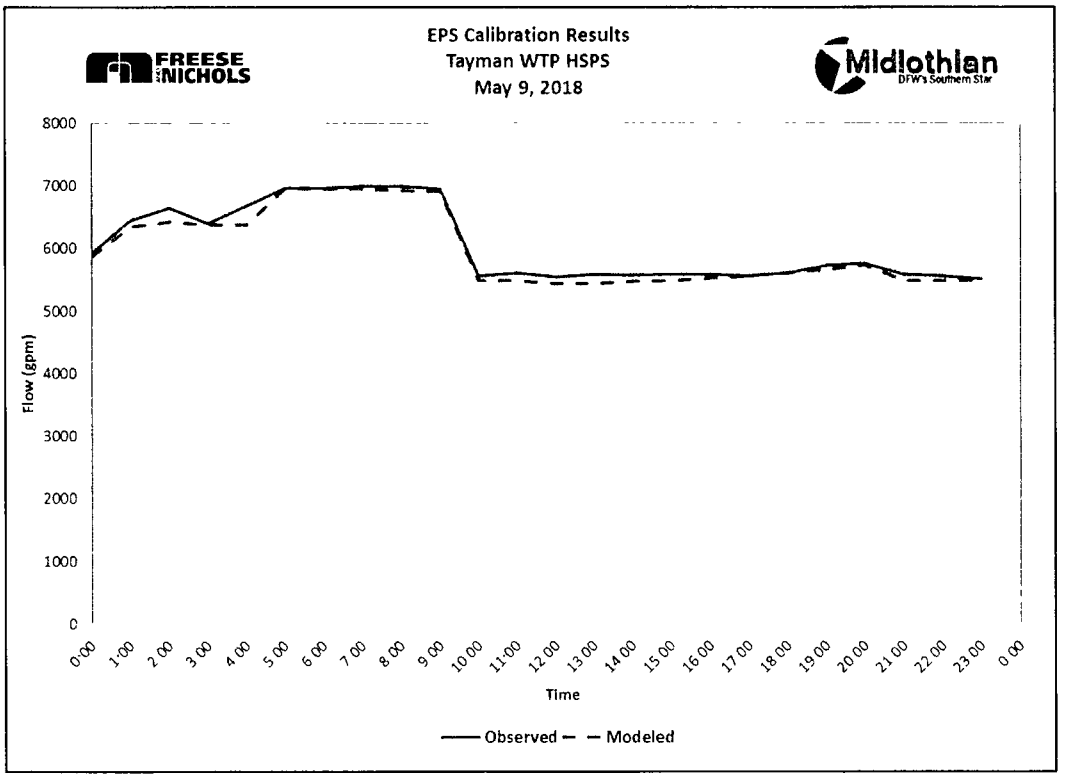


Figure 5-6: Tayman HSPS Flow Calibration



6.0 WATER SYSTEM ANALYSIS AND HYDRAULIC MODELING

As a public water utility, the City of Midlothian must comply with the rules and regulations for public water systems set forth by the Texas Commission on Environmental Quality (TCEQ) in Chapter 290. Hydraulic model analyses were conducted to identify any deficiencies in the City of Midlothian's existing water distribution system and to analyze future 10-year conditions. Parameters used in evaluating the system included increasing system reliability, meeting required fire flows, and maintaining proper residual pressures.

6.1 DESIGN CRITERIA

FNI developed and utilized design criteria to evaluate system operation under existing and future conditions. These criteria are typically more stringent than TCEQ requirements and take into consideration many additional factors including operational flexibility, fire suppression, and energy efficiency.

6.1.1 Service Pumping and Storage Capacity

FNI recommends a combination of pumping and elevated storage to meet peak hour demands with service pumping responsible for meeting 120% of the maximum day demands and elevated storage meeting the difference between peak hour demands and 120% of maximum day demands. The design criteria used to analyze elevated storage tank capacity is the volume required to provide adequate equalization storage for peak hour demands plus emergency storage for fire protection. It is typically assumed that half of the elevated storage tank capacity is used to meet peak hourly demands in excess of the maximum day rate (equalization volume), while the other half of the tank is used for fire protection and emergency conditions (fire/emergency volume). For Midlothian, an elevated storage capacity recommendation was developed based on the greater of:

40% of Peak Hour Demand for 3hours + 3 hours of Fire Flow Demand (3,500 gpm)

~ or ~

2 x 40% of Peak Hour Demand for 3 hours

For ground storage capacity, FNI recommends that Midlothian be able to store 8 to 12 hours of maximum day demand.

6.1.2 Pressure

TCEQ regulations state that under normal operating conditions, a minimum pressure of 35 psi must be maintained at all times throughout the system. The exception to this rule is under emergency fire flow situations where the pressure is then permitted to drop to 20 psi until the emergency is addressed.

6.1.3 Fire Flow

Residential and commercial fire flow requirements typically range from 1,000 to 1,500 gpm, while some industrial fire flows can approach 3,000 gpm or greater. According to ISO requirements, the maximum fire flow that a city is required to provide is 3,500 gpm. Fire flows needed in excess of 3,500 gpm, must be met by individual development.

6.1.4 Velocity and Headloss

A maximum water line velocity of 5 feet/second (ft/s) and a maximum friction loss of 3 feet (ft) per 1,000 ft of water line length are recommended for water transmission lines (diameter larger than 16-inches). A maximum water line velocity of 7 ft/s and a maximum friction loss of 7 ft/1,000 ft are recommended for water distribution lines (diameter 16-inches and smaller).

6.2 TCEQ CAPACITY REQUIREMENTS—EXISTING SYSTEM

6.2.1 Existing Water Supply Capacity

The City is required to meet the TCEQ total water supply requirements of 0.6 gpm per connection according to 30 Texas Administration Code (TAC) 290.45. The City of Midlothian obtains raw water from Joe Pool Lake by a contract with the TRA and from TRWD. The City has contracted for 39.19% of the conservation storage in Joe Pool Lake. According to the 2016 Region C Regional Water Plan, the City's reliable (firm yield) supply from Joe Pool Lake decreases from 5,833 acre-feet per year (ac-ft/yr) (5.20 MGD) in 2020 to 5,229 ac-ft/yr (4.88 MGD) in 2070. The yield from Joe Pool Lake decreases over time due to sedimentation. The City is allowed to divert up to 6,662.3 ac-ft/yr (39.19% of the original permitted diversion), but the reliable supply in a repeat of the drought of record would be limited to the firm yield. The City's current contract for TRWD raw water is for 11,571.08 ac-ft/yr. The City's current total average daily water supply is 15.53 MGD (17,407.37 ac-ft/yr).

The City also maintains two separate treatment facilities. The City's Tayman Plant is rated at 11.5 MGD and the Auger Plant is rated at 8.0 MGD. The City provided an estimated number of connections as of the

TCEQ inspection in April 2017. **Table 6-1** presents the TCEQ water supply requirements for the existing water system.

Table 6-1: Existing TCEQ Water Supply Capacity Requirements

Existing Retail Connections	TCEQ Requirement 0.6 gpm/connection (MGD)	Maximum Contracted Wholesale Demand (MGD)	TCEQ Water Supply Requirement (MGD)	Existing Average Daily Water Supply Capacity (MGD)	Meets TCEQ Requirement?
6,176	5.34	9.86	15.20	15.53	**Yes**

The City also serves several wholesale customers that are summarized with contracted subscription rates in **Table 6-2**. The City has adequate existing supply for retail connections as well as the contracted wholesale rates. The City is currently in compliance with the minimum water supply capacity requirement.

Table 6-2: Existing Wholesale Treated Water Customers

Public Water System Name	PWS ID#	Average Day Rate (MGD)	Peak Subscription Rate (MGD)
City of Venus	1260006	2.0	4.0
Rockett SUD	700033	2.0	2.5
Mountain Peak SUD	700042	0.5	1.0
City of Grand Prairie	570048	2.5	5.0
Sardis Lone Elm WSC	700034	2.86	2.86
Total Contractual Obligations		**9.86**	**15.36**

6.2.2 Existing Storage Capacity

The City is required to meet the TCEQ elevated storage capacity requirement of 100 gallons per connection and the total storage capacity requirement of 200 gallons per connection. The City's current estimated number of connections was used to calculate the TCEQ minimum required storage. A comparison of the City's existing storage to TCEQ requirements is shown in **Table 6-3**.

Table 6-3: Existing TCEQ Storage Requirements

Existing City Retail Connections	Total Storage (MG)		Elevated Storage (MG)		Meets TCEQ Requirement?	Elevated Storage per Connection (gallons/connection)
	Existing	Required	Existing	Required		
6,176	10.00	1.20	3.00	0.60	**Yes**	486

Based on the regulations, the City is compliant with the minimum amount of total and elevated storage capacity requirements.

6.2.3 Existing Pumping Capacity

In addition to storage and water supply requirements, the City is also required to meet the service pumping capacity requirements presented in **Table 6-4**.

Table 6-4: TCEQ Service Pumping Requirements

Condition	Service Pumping Capacity Requirement [1]
1. If providing at least 200 gallons per connection of elevated storage	Two service pumps with a minimum combined capacity of 0.6 gpm per connection at each pressure plane
2. If providing less than 200 gallons per connection of elevated storage	**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

[1] According to 290.45(b)(1)(D)(iii).

From **Table 6-3**, Midlothian has 486 gallons per connection of elevated storage; therefore, Condition 1 from **Table 6-4** applies. In addition to the TCEQ minimum retail service pumping requirements, Midlothian is required to have pumping capacity to meet the maximum amount of water obligated under all wholesale contracts. The maximum obligated rate for all wholesale customers is 11.5 MGD based on **Table 6-2**.

The City currently has enough firm pumping capacity to meet the TCEQ requirement as shown in **Table 6-5.**

Table 6-5: Firm Pumping Requirement

Existing Retail Connections	Existing Firm Pumping Capacity (MGD)	TCEQ Requirement (MGD)	Meets TCEQ Requirement?
6,176	23.17	16.84	**Yes**

6.3 FUTURE WATER SYSTEM ANALYSIS

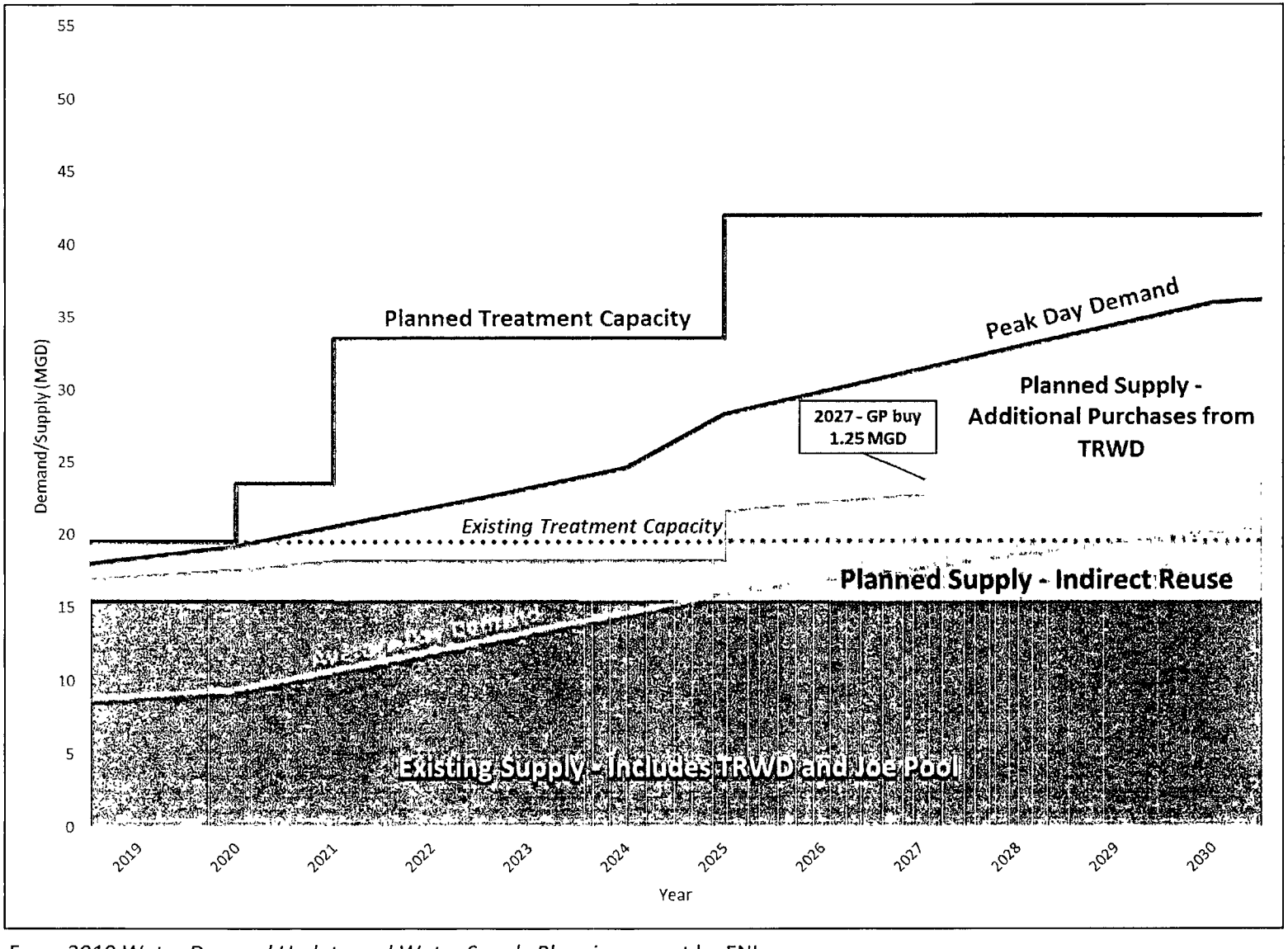
6.3.1 Future Required Water Supply Capacity

Table 6-6 shows the City's water supply capacity compared to TCEQ water supply requirements for future planning periods. This information is presented graphically on **Figure 6-1**.

Table 6-6: Projected Water Service Area Water Supply Capacity Requirements

Year	Number of Retail Connections	TCEQ Requirement 0.6 gpm/connection (MGD)	Maximum Contracted Wholesale Demand (MGD)	TCEQ Water Supply Requirement (MGD)	Water Supply Capacity (MGD)
2030	10,274	8.88	15.36	24.24	25.00

Figure 6-1: Required Future Supply Compared to Existing Supply [1]



(1) From *2018 Water Demand Update and Water Supply Planning* report by FNI.

6.3.2 Future Required Water Treatment Capacity

The City is required to meet the TCEQ water treatment requirement of 0.6 gpm per connection under normal rated design flow according to 30 Texas Administration Code (TAC) 290.45. Since Midlothian is a wholesale water supplier, the City must meet minimum water system capacity requirements based on the number of service connections, as well as the maximum amount of water obligated or pledged under all wholesale contracts. FNI recommends a water treatment plant capacity of at least 100% of the maximum day demand of the water distribution system. **Table 6-7** shows the City's water treatment capacity compared to TCEQ requirements for future planning periods. The maximum day demand is expected to grow from 17.60 MGD to 36.62 MGD by the year 2030. This growth in demand will require expansions of the Auger and Tayman WTPs. A 4.0 MGD expansion of the Auger WTP is currently in the preliminary design phase. An additional 10.0 MGD expansion at the Auger WTP is recommended in the year 2022. In 2028, it is recommended that the City expand the treatment capacity of the Tayman WTP by 8.5 MGD to meet the projected maximum day demand by the 2030 planning period. This information is presented graphically in **Figure 6-2**.

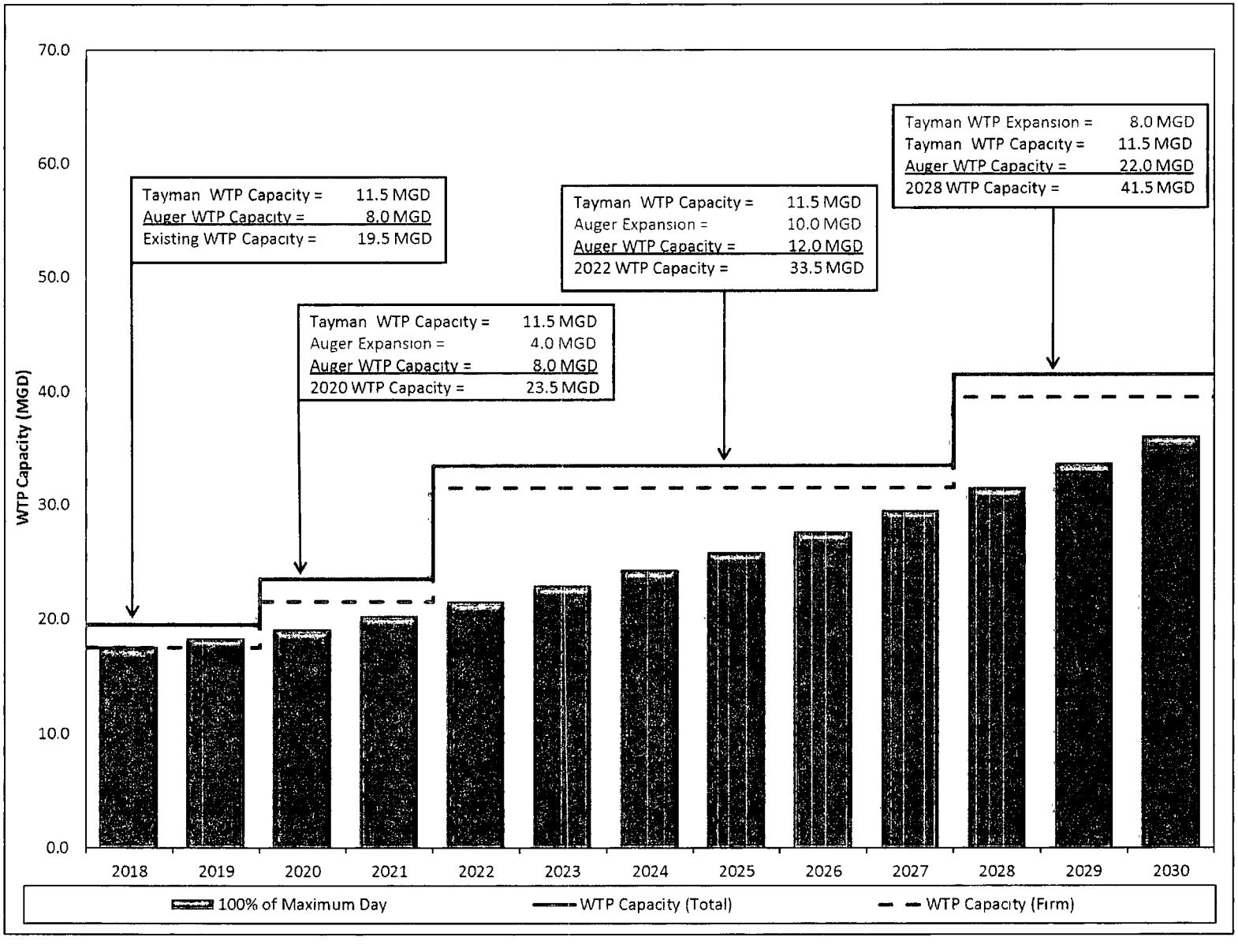
Table 6-7: Projected Water Treatment Capacity Requirements

Year	Number of Connections	Total Maximum Day Demand[1] (MGD)	TCEQ Water Treatment Requirement[2] (MGD)
2018	6,176	17.60	15.34
2030	10,274	36.62	24.38

[1] Retail and Wholesale Demand

[2] 0.6 gpm/connection plus Wholesale Maximum Data Contracted Rate

Figure 6-2: Required Future Water Treatment Capacity



6.3.3 Future Required Storage Capacity

Elevated Storage

The City is required to meet the TCEQ total storage requirements of 200 gallons per connection and elevated storage capacity requirement of 100 gallons per connection. **Table 6-8** shows the City's elevated storage capacities compared to TCEQ storage requirements for future planning periods.

Figure 6-3 shows FNI recommended elevated storage compared with existing elevated storage capacities. FNI design criteria are typically more stringent than TCEQ requirements as they incorporate maintaining adequate equalization volume for peak hour demands as well as storage for emergency situations such as fire suppression.

The existing elevated storage capacity of 3.0 MG allows the City to meet TCEQ minimum elevated storage requirements for existing conditions. However, based on the FNI recommended design criteria, an elevated storage shortfall is projected in 2022. Additional elevated storage (2.0 MG) is recommended in the Railport area to meet 2022 needs. The City's existing storage (elevated and ground) together with the additional recommended 2.0 MG elevated storage satisfies TCEQ total storage criteria through 2030 conditions. Growth just beyond the 2030 planning period is projected to exceed the elevated storage recommendation for the City. Therefore, an additional 1.5 MG elevated storage tank is recommended near Arbor Grove Trail to meet requirements beyond the 10 year planning period.

Table 6-8: Projected Storage Capacity Requirements

Year	Connections	TCEQ Required Total Storage 200 gal/con. (MG)	TCEQ Required Elevated Storage 100 gal/con. (MG)	Peak Volume[1] (MG)	Fire Volume[2] (MG)	Elevated Storage Design Criteria[3] (MG)	Recommended Elevated Storage[4] (MG)	Existing Elevated Storage (MG)
2018	6,176	1.24	0.62	1.12	0.63	2.24	3.00	3.0
2030	10,274	2.05	1.03	2.31	0.63	4.62	6.50	3.0

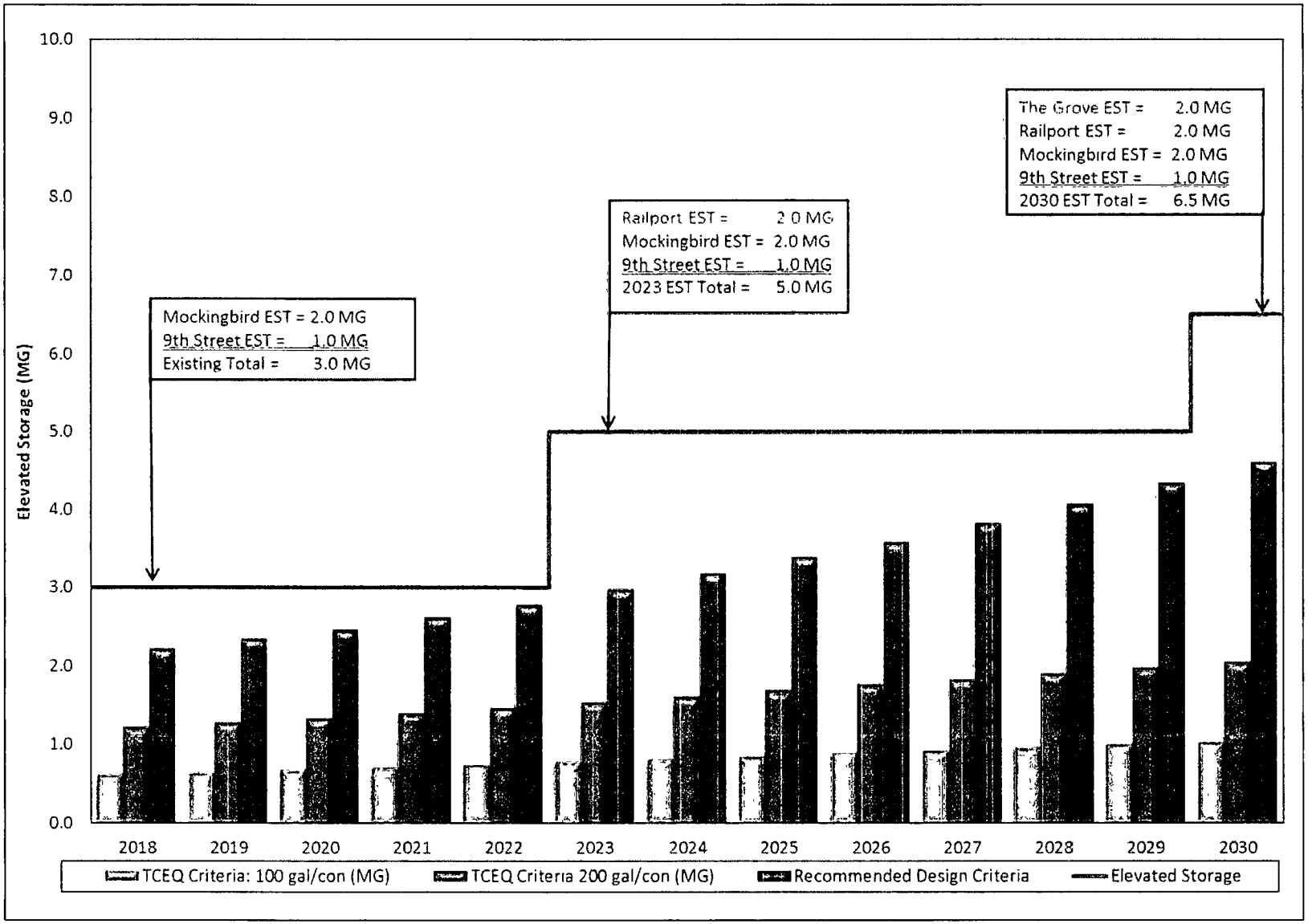
[1] Peak Volume = 40% of Peak Hour Demand for a duration of 3 hours.

[2] Fire Volume = 3,500 gpm for 3 hours.

[3] Greater of (2 X Peak Volume) or (Peak Volume + Fire Volume).

[4] Recommended storage capacities reflect existing system and phased improvements.

Figure 6-3: Recommended Elevated Storage Capacity



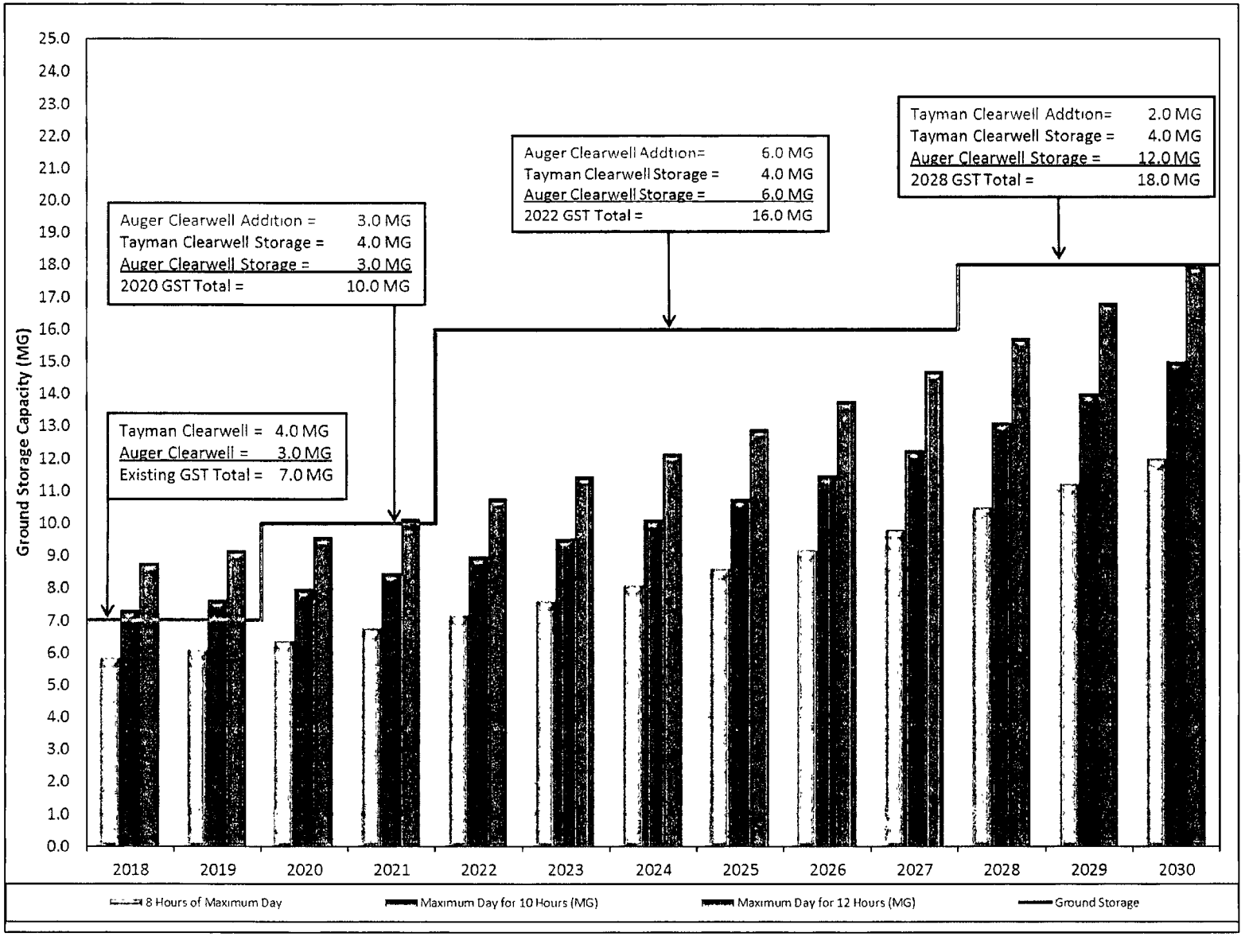
Clearwell Storage

The City of Midlothian is required to have a covered clearwell storage capacity at the treatment plant of 5.0% of the daily WTP capacity. The City of Midlothian has more than adequate capacity to meet the TCEQ requirements. FNI recommends having 8 to 12 hours of storage under maximum day demands for redundancy.

Figure 6-4 shows FNI recommended clearwell storage compared with maximum day demand volume for 8, 10, and 12 hours. FNI design criteria are typically more stringent than TCEQ requirements as they incorporate redundancy at the WTP to have adequate water supply in the case of an emergency at the plant.

The existing clearwell storage capacity of 4.0 MG allows the City to meet TCEQ minimum clearwell storage requirements for existing conditions. However, the City does not have enough storage to meet FNI recommendations. FNI recommends and additional 3.0 MG clearwell at the Auger WTP in conjunction with the 4.0 MGD WTP expansion in 2020. An additional 6.0 MG (2x 3.0 MG) of clearwell storage is recommended with the next Auger WTP expansion to 22.0 MGD in 2022. Finally, FNI recommends an additional 2.0 MG at the Tayman WTP along with the WTP expansion proposed in 2028.

Figure 6-4: Recommended Clearwell Storage Capacity



6.3.4 Future Required Pumping Capacity

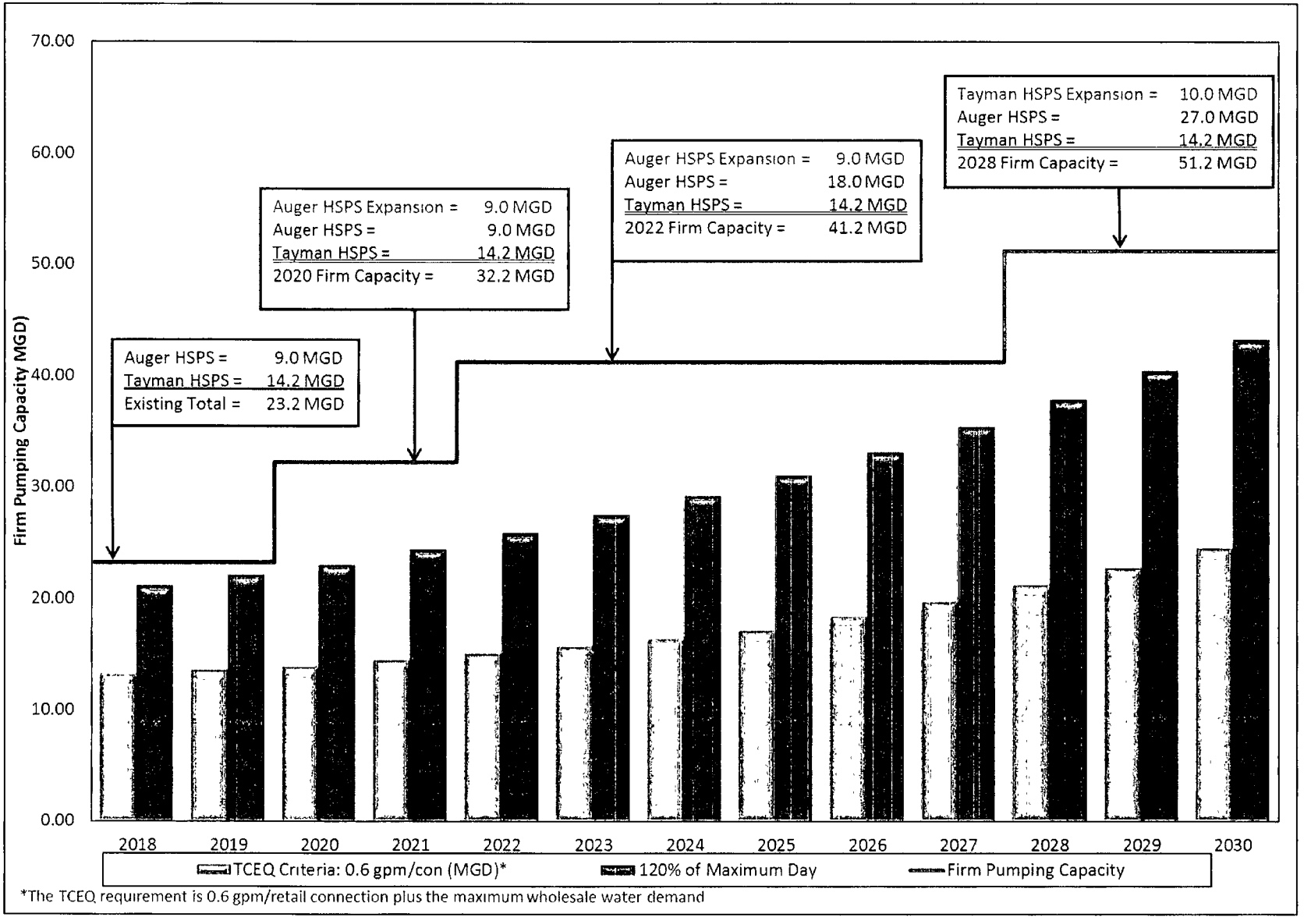
Table 6-9 along with **Figure 6-5** show existing pumping capacities compared to FNI recommended pumping. Based on FNI's design criteria that firm pumping capacity be equal or greater than 120% of maximum day demand, Midlothian will have a shortfall of firm pumping capacity in the year 2022. As part of the 4 mgd short-term expansion @ Auger WTP, Midlothian is adding two 4.5 MGD pumps in the two empty pump slots to increase the capacity by 9.0 MGD. Additionally, an 11.0 MGD expansion of the Tayman HSPS in 2027 is recommended as part of the proposed Tayman WTP expansion to meet the recommended pumping capacity through the 2030 planning period.

Table 6-9: Firm Pumping Recommendations

Year	Maximum Day Demand (MGD)	FNI Recommended Pumping Capacity[1] (MGD)	Existing Firm Pumping Capacity (MGD)
2018	17.60	21.12	23.17
2030	36.62	43.19	23.17

(1) FNI Recommended Pumping Capacity is 120% of Maximum Day Demand.

Figure 6-5: Recommended Pumping Capacity



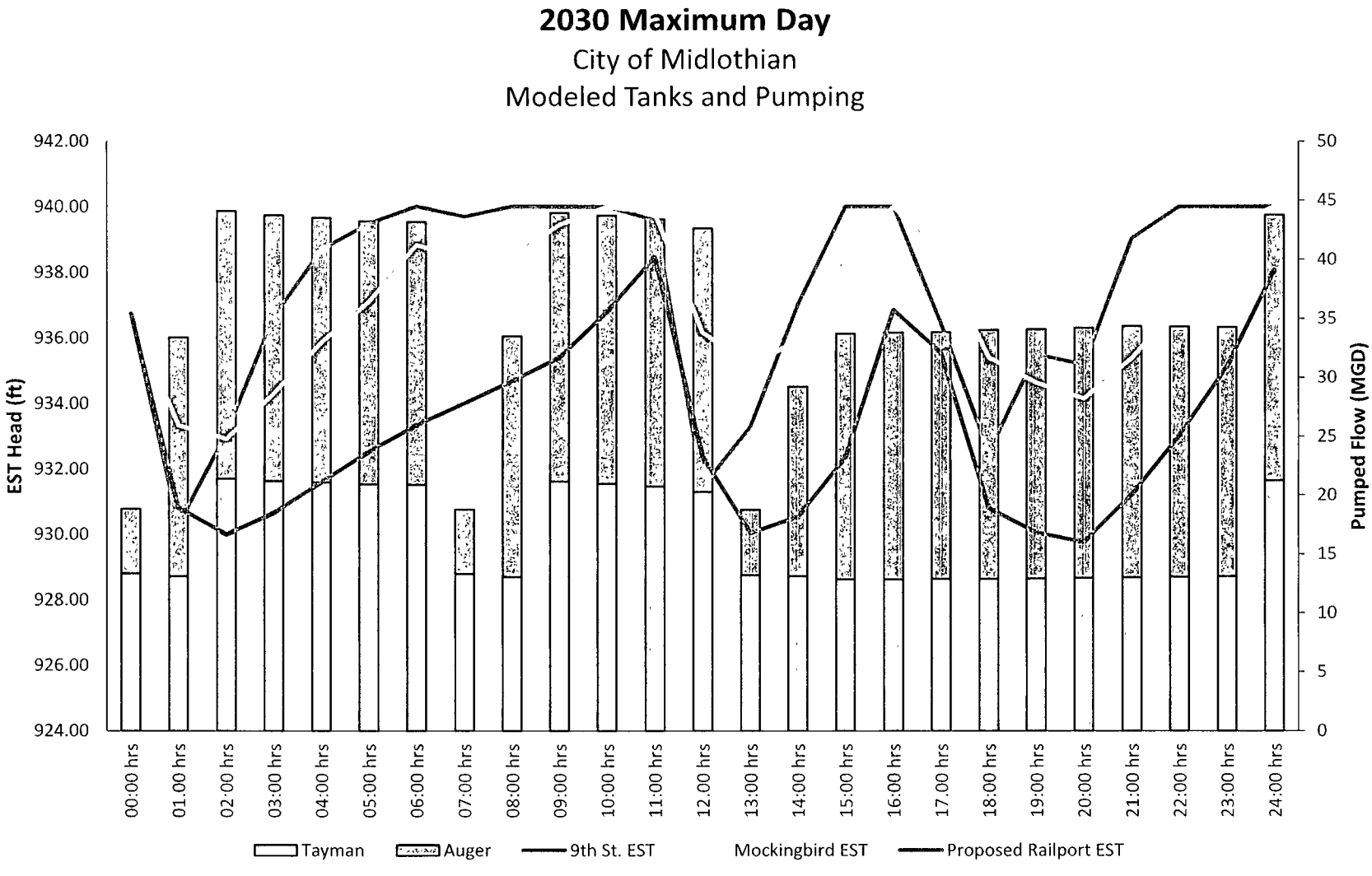
6.4 HYDRAULIC MODELING ANALYSIS

Hydraulic modeling analyses were performed on the distribution system under maximum day demand conditions. Twenty-four-hour EPS model runs were performed for maximum day demand conditions for the existing system and future 10-year (2030) scenarios to identify existing and potential future system deficiencies and size infrastructure. By examining the distribution system under these various operating conditions, it is possible to determine where issues with pressures occur, if tanks are filling or draining properly, and if the service pumping facilities are adequate to meet the required demand at acceptable pressures.

A maximum day EPS model run evaluates the ability of the system to provide adequate supply to meet demands while maintaining levels in storage facilities. During a maximum day EPS analysis, the peak hour demand is also simulated through the use of diurnal patterns. Peak hour demand represents the single hour of the year with the highest system demand. Peak hour simulations are used to assess the ability of the distribution system to maintain minimum residual pressures. Lower demand periods throughout the day are simulated in EPS modeling as well. This is when the system's ability to replenish storage tanks is evaluated.

The City provided SCADA data for the existing pumping station operations, elevated storage tank levels, and ground storage tank levels. The SCADA data was analyzed to determine the typical operating parameters for the water system including normal tank operating levels and the lead and lag pumping controls for each of the water pumping stations. Additional operational information was provided through discussions with City operations staff. These parameters were programed into the model to simulate a 24-hour EPS. Modeled pumping and storage operations for the 10-year (2030) system are shown in **Figure 6-6.**

Figure 6-6: Future 10-Year Conditions (2030)— Maximum Day Operations



Color-coded pressure maps were prepared to illustrate the residual pressure calculated at model junctions. The maps helped identify potential problem areas in the system and were used as a tool to evaluate pressure ranges that were maintained throughout the system. The maps showing the minimum pressures under maximum day demands can be found in **Appendix C.** Minimum pressures shown on the maps represent the lowest value of the pressures experienced during the 24-hour simulation, usually occurring during the peak hour demand.

In addition to documenting minimum pressures under maximum day demands, FNI analyzed and evaluated the existing system water lines based on the design velocity and headloss criteria. Mapping was created to display the results and can be found in **Appendix C**.

6.4.1 Fire Flow Analysis

To evaluate the fire suppression capabilities of the system, a fire flow analysis was conducted under maximum day demand conditions for the existing and buildout system. TCEQ requires a minimum residual pressure of 20 psi be maintained while delivering the fire flow demand. For this analysis, a steady-state model run was utilized to calculate the available fire flow at nodes in the system with a pressure of 20 psi and maintaining velocity of less than 10 feet per second in nearby water lines. A fire flow contour map was also prepared to show the available fire flow throughout the distribution system. The majority of the City has an available fire flow greater than 1,500 gpm. The fire flow map for existing and future system conditions can be found in **Appendix C**.

6.4.2 Water System Improvements

After modeling existing and future conditions, 16 water system improvement projects were identified. The need for additional elevated water storage to meet future demands was identified; therefore a new EST is proposed in the 10-year planning period.

Additionally, large increases in projected demands from wholesale customers, industrial users, and residential customers necessitate transmission improvements to efficiently convey water throughout the service area and supply future demands. Identified improvements are described in greater detail in the following section.

7.0 WATER SYSTEM CAPITAL IMPROVEMENTS PLAN AND RECOMMENDATIONS

7.1 CAPITAL IMPROVEMENTS PLAN

Throughout the existing and future system analysis process, 16 capital improvement projects were identified as necessary for the City of Midlothian to meet projected water demands. **Figure 7-1** presents a map of the proposed CIP projects and **Table 7-1** provides a summary of the CIP projects and associated cost estimates. Detailed cost estimates are provided for each CIP project in **Appendix D**.

CIP Project #1: Phase 1: Capacity Expansion at the Auger HSPS/ Auger WTP Expansion/ Auger Clearwell Expansion— This project will expand the capacity of the WTP to 12 MGD and the clearwell storage capacity to 6 MG. This project will also expand the capacity of the Auger HSPS to 18 MGD to meet future demands.

CIP Project #2: 20-inch Capacity Expansion along Hwy 67— A need to add transmission capacity along the Highway 67 corridor was identified in order to reduce velocity and friction losses and increase transmission from the Auger HSPS to the Grand Prairie wholesale delivery point and south to the Railport industrial area.

CIP Project #3:16-inch/24-inch Railport Expansion—This project will extend a 16-inch water line along Highway 67 from an existing 16-inch to Cottonwood Creek. From there, a 24-inch line will replace an existing 8-inch water line along Ward Road to connect with an existing 16-inch waterline. This project will expand transmission capacity to the industrial area and provide a supply line for the future Railport EST.

CIP Project #4: 2.0 MG Railport Elevated Storage Tank— A new 2.0 MG elevated storage tank is recommended to satisfy elevated storage criteria for 10-year projected demands. The proposed EST will bolster system reliability and help maintain operating pressures during periods of peak demands.

CIP Project #5: 36-inch/30-inch Western Transmission Main— A new 36-inch/30-inch transmission main is proposed along the western limits of the service area from the Auger HSPS to the Railport area. This large diameter transmission main is needed to increase transmission capacity to the Grand Prairie wholesale delivery point and the Railport area.

CIP Project #6: Phase 2: Capacity Expansion at Auger HSPS/Auger WTP Expansion/Auger Clearwell Expansion— This project will add 9 MGD of additional pumping capacity to the Auger HSPS, bringing the

firm pumping capacity to 27 MGD. This project will also expand capacity at the Auger WTP to 22-24 MGD and clearwell capacity to 10-12 MG to provide supply to meet future projected demands.

CIP Project #7: 20-inch Upsize Railport Line and Railroad Crossing— This project will extend a new 20-inch waterline across Highway 67 and the railroad tracks along Miller Road/Railport Parkway. The new 20-inch crossing will connect to an existing 18-inch on the southern side of the railroad tracks. The existing 12-inch which runs southwest to supply the Venus wholesale meter will be upsized to 20-inch waterline.

CIP Project #8: Parallel 20-inch Waterline from Railport EST— This project will extend a 20-inch water line segment along the southern side of Highway 67 between an existing 18-inch waterline and the proposed 24-inch waterline. This project will increase transmission capacity and reduce friction losses in the Railport industrial area.

CIP Project #9: 12-inch Grand Prairie Loop— This project will extend a new 12-inch waterline from the proposed 30-inch Western Transmission Main at Quarry Road to the existing 12-inch waterline along Highway 287. The project will provide looping and a redundant supply line to serve Grand Prairie's wholesale demands.

CIP Project #10: 20-inch Transmission along Highway 287— This project will extend a 20-inch transmission line along Highway 287 from Walnut Grove Road to Midlothian Parkway. From there, the 20-inch line will extend westward to E. Avenue East (FM 1387).

CIP Project #11: 20-inch Water Line Between Highway 287 and FM 1387— This project will extend a 20-inch water line between Highway 287 near Enterprise Drive north to connect to an existing 12-inch water line along FM1387. A 20-inch water line will also be extended between the existing 16-inch water line along Walnut Grove Road and the new 20-inch line between Highway 287 and FM 1387. This project will increase transmission capacity in the eastern service area.

CIP Project #12: Diamond J Area Improvements— This project will extend 12-inch waterlines along the main thoroughfares in the Diamond J Area to serve future development.

CIP #13: 16-inch Loop Along New Shiloh Road— This project will extend a new 16-inch water line east along Shiloh Road, Tar Road, and Onward Road. The 16-inch line will provide redundant, looped transmission capacity from the Tayman HSPS to the Mockingbird EST to supply future demands.

CIP Project #14: Capacity Expansion at Tayman HSPS/ Transmission Line Expansion/ Capacity Expansion at the Tayman WTP/ Tayman Clearwell Expansion—This project will add 10 MGD pumping capacity to the Tayman HSPS, bringing firm pumping capacity to 24.17 MGD. The parallel 20-inch transmission main will reduce friction losses and add transmission capacity. The WTP expansion will add 8.0 MGD of additional treatment capacity, bringing the firm treatment capacity to 19.50 MGD. 2 MG of additional clearwell storage will be added to the WTP, bringing total Tayman clearwell storage to 6 MG. This expansion is necessary to satisfy projected 10-year maximum day demands.

CIP #15: 12-inch Eastern Loop This project will extend a 12-inch water line between the existing 12-inch along Rex Odom Road to connect with the existing 12-inch water line along FM 1387 near the Rockett SUD wholesale meter. This project is needed to add capacity for future growth and provide a redundant, looped supply to serve Rockett SUD's wholesale demands.

CIP #16: 12-inch Loop to Rockett Delivery Point— This project will extend a 12-inch line north approximately 0.7 miles from the existing 12-inch line along FM 1387 which supplies Rockett's wholesale meter. From there, the line will turn west and connect with a 16-inch line currently under construction.

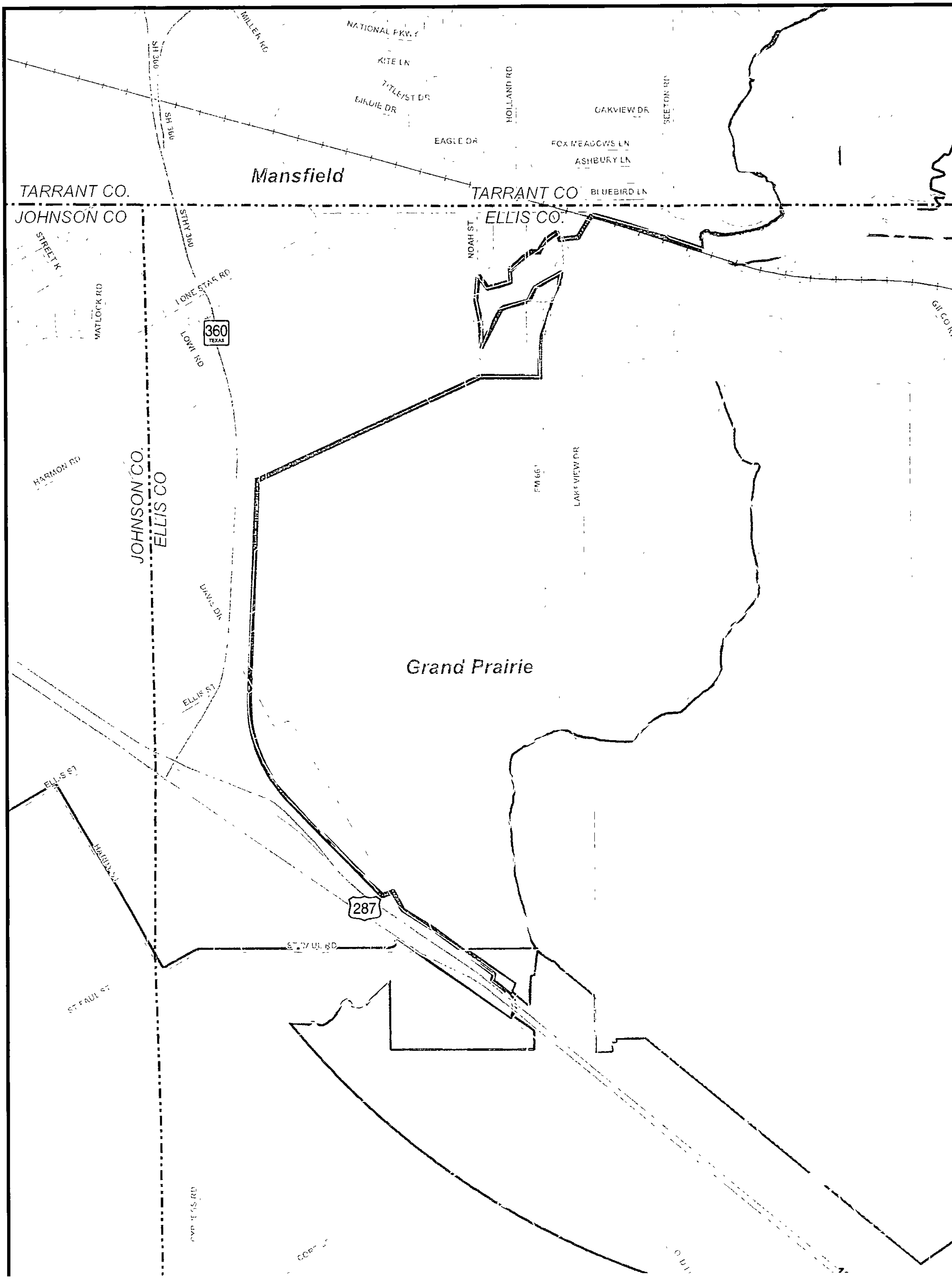
CIP #17: 12-inch Connections— This project will extend two 12-inch water main connections beneath Highway 287 to connect with existing water mains and provide looping.

CIP #18: New 1.5 MG EST— A new 1.5 MG elevated storage tank is recommended to meet future water demands anticipated near the end of the 10-year planning horizon.

Table 7-1: CIP Summary

Project Number	Project Name	Cost
1	Phase 1: Capacity Expansion at the Auger HSPS/ Auger WTP Expansion/ Auger Clearwell Expansion	$ 13,161,200
2	20-inch Capacity Expansion along Hwy 67	$ 1,893,300
3	16-inch/24-inch Railport Expansion	$ 3,114,000
4	2.0 MG Railport Elevated Storage Tank	$ 6,352,500
5	36-inch/30-inch Western Transmission Main	$ 11,780,000
6	Phase 2: Capacity Expansion at Auger HSPS/Auger WTP Expansion/Auger Clearwell Expansion	$ 43,113,800
7	20-inch Upsize Railport Line and Railroad Crossing	$ 2,477,200
8	20-inch Parallel Water Line from Railport EST	$ 2,253,400
9	12-inch Grand Prairie Loop	$ 1,340,100
10	20-inch Transmission along Highway 287	$ 5,699,700
11	20-inch Water Line between Hwy 287 and FM 1387	$ 3,049,100
12	Diamond J Improvements	$ 2,976,200
13	16-inch Loop along New Shiloh Road	$ 5,317,200
14	Capacity Expansion at Tayman HSPS/ Transmission Line Expansion/ Capacity Expansion at the Tayman WTP/Tayman Clearwell Expansion	$ 41,633,900
15	12-inch Eastern Loop	$ 2,576,400
16	12-inch Loop to Rockett Delivery Point	$ 1,917,800
17	12-inch Connections	$ 270,400
18	New 1.5 MG EST	$ 5,630,700
	10-Year CIP Total	**$ 154,556,500**

The proposed system will provide the required capacity and reliability to meet projected water demands through 2030.


Mansfield
TARRANT CO.
JOHNSON CO
TARRANT CO
ELLIS CO.
JOHNSON CO.
ELLIS CO
Grand Prairie
360
287
NATIONAL PKWY
KITE LN
SH 360
HOLLAND RD
OAKVIEW DR
EAGLE DR
FOX MEADOWS LN
ASHBURY LN
BLUEBIRD LN
NOAH ST
LONE STAR RD
MATLOCK RD
HARMON RD
LAKEVIEW DR
ELLIS ST

7.2 RECOMMENDATIONS FOR FURTHER STUDY

The City operates and maintains a well-developed water distribution system. Large increases in demand from wholesale customers and industrial use are projected over the next ten years as the City continues to grow and develop. The CIP has identified several improvement projects needed to meet increased future demands. In addition to the CIP projects, the City could also benefit from additional water system evaluations.

Water Asset Management Plan and Risk Based Analysis- An inventory of the City's water system assets in an asset management tool can help provide the means to track problem areas and identify potential system improvements or repairs before failure occurs. In addition to a central database for tracking work order history and asset condition, an asset management database can also provide the opportunity to perform a risk analysis for the City's assets and identify system facilities (including pumps, tanks, pipes, etc.) that are most critical to the water system based on likelihood of failure and consequence of failure. A risk-based approach to prioritized system maintenance and repairs can help save the City repair costs in the long term.

GIS Improvements/Gap Analysis- The City maintains a GIS database of its water system infrastructure including water lines, pump stations, and tanks. Performing a thorough Gap analysis on the City's GIS records would help to identify errors and inconsistencies, missing information, and recommended information to maintain. For example, using as-builts to verify pipe location, connectivity, and diameter as well as adding information such as installation date, pipe material would be valuable to improve the City's water line GIS records. Recommended additions to the City's GIS tank records include installation year, volume, diameter, and overflow elevation. The City could improve their pump station GIS records by including information such as number of pumps, pump manufacturer, and pump capacity.

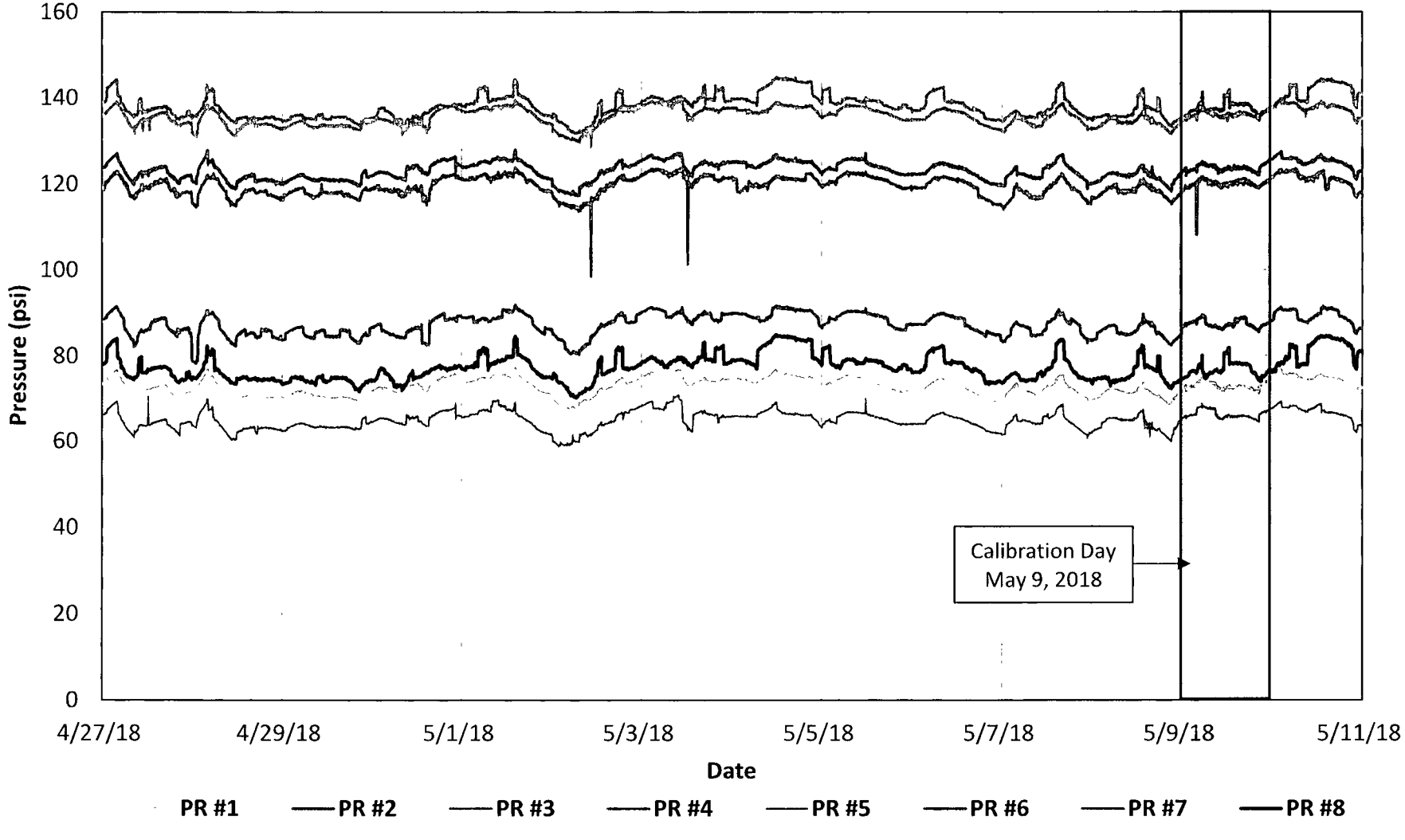
Water Audit- A water audit allows a utility to systematically track water uses and identify sources of water loss or other nonrevenue water. Certain areas of the City's water system operate at high pressures, which may increase the risk of leaks and pipe failure. Real losses are water losses due to leakage and excess system pressure. Real losses can be reduced by managing leaks, system maintenance, and improved pressure management.

APPENDIX A
Pressure Recorder Data

FREESE AND NICHOLS

Figure A-1
Pressure Testing Results
April 27, 2018 - May 11, 2018

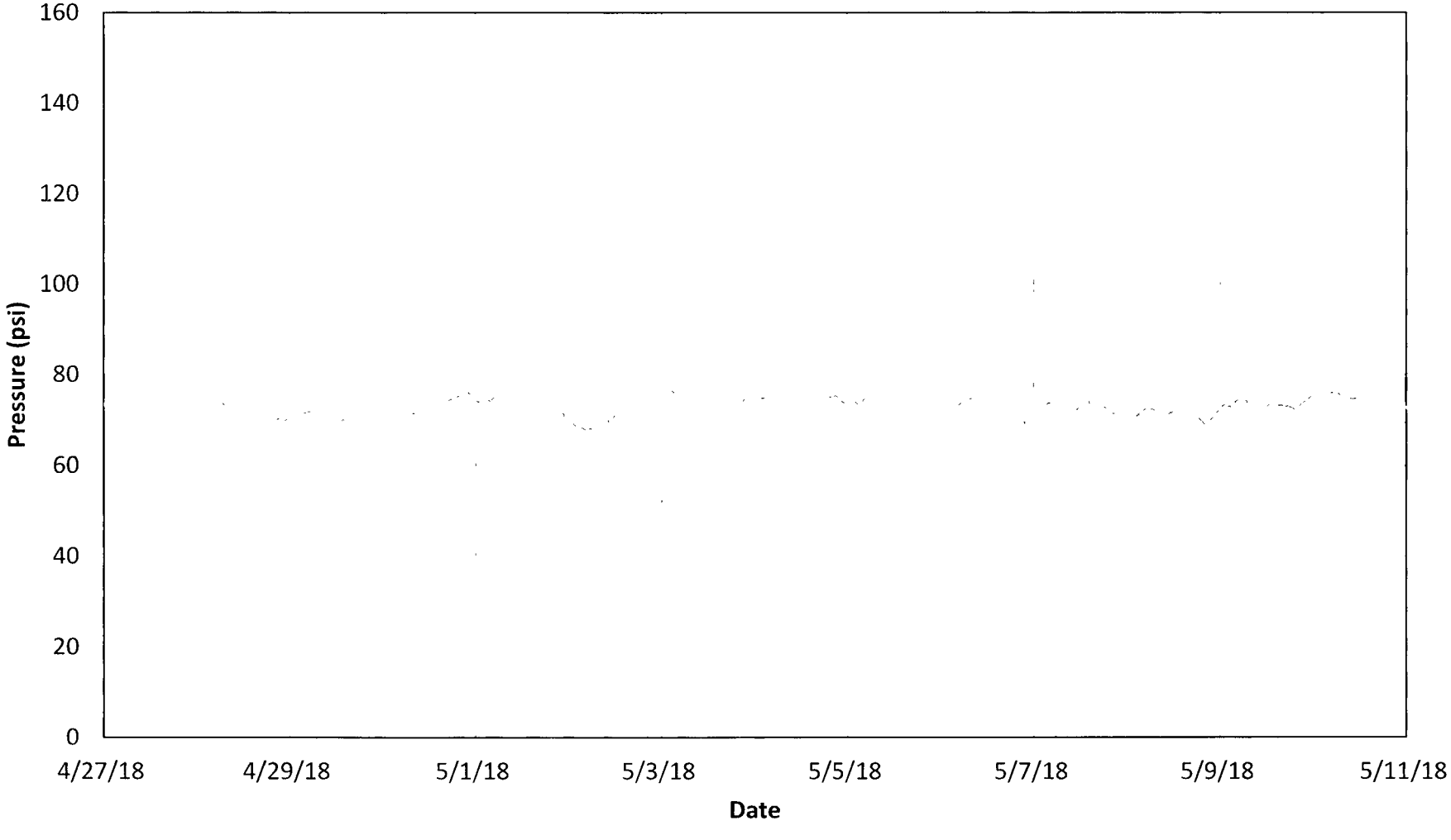
Midlothian
DFW's Southern Star



FREESE AND NICHOLS

Figure A-2
Pressure Recorder #1
Pressure Recorder ID: 341253
North 5th Street and West Avenue F
April 27, 2018 - May 11, 2018

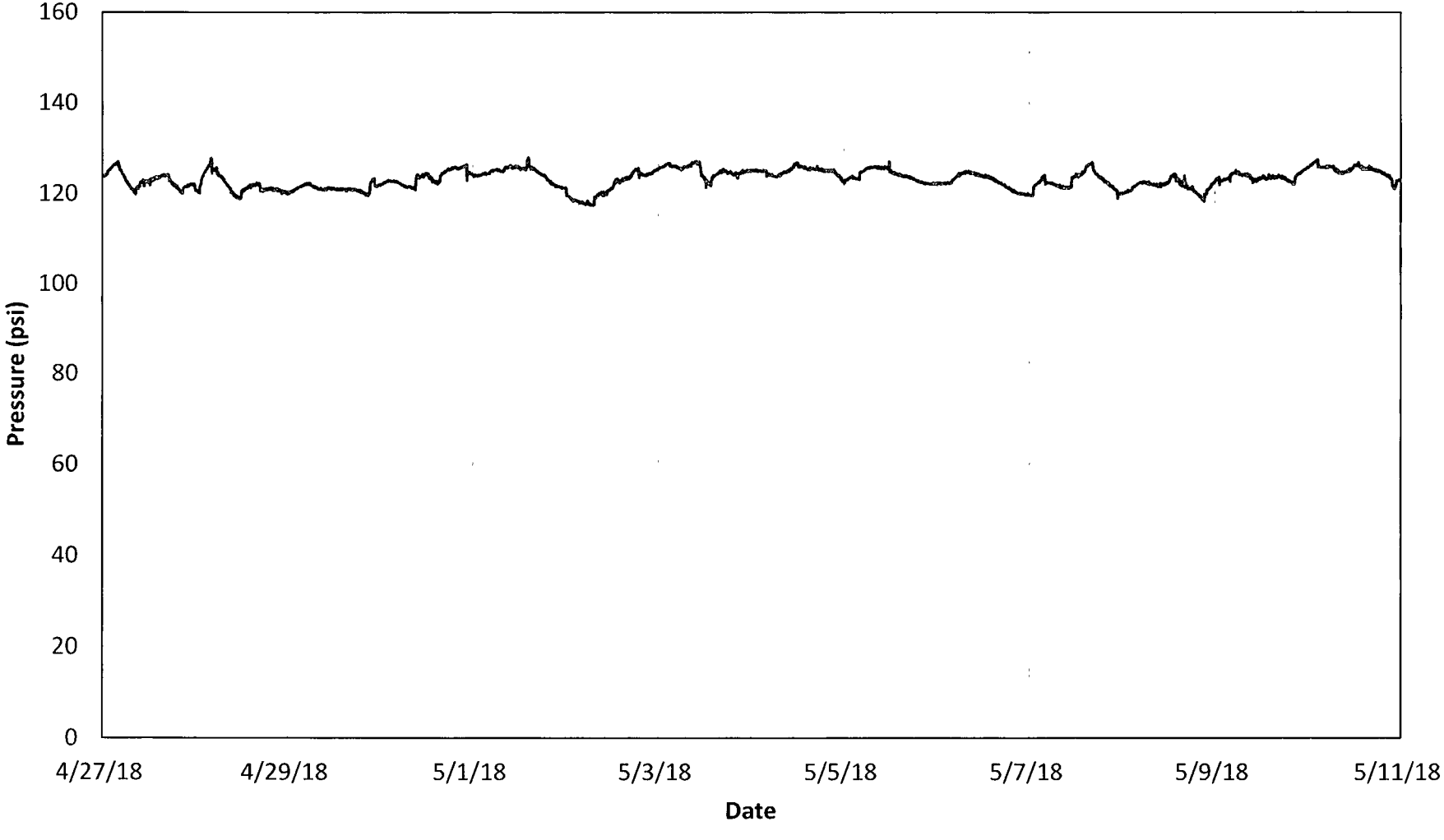
Midlothian
DFW's Southern Star



FREESE AND NICHOLS

Figure A-3
Pressure Recorder #2
Pressure Recorder ID: 205938
1406 Rye Glen
April 27, 2018 - May 11, 2018

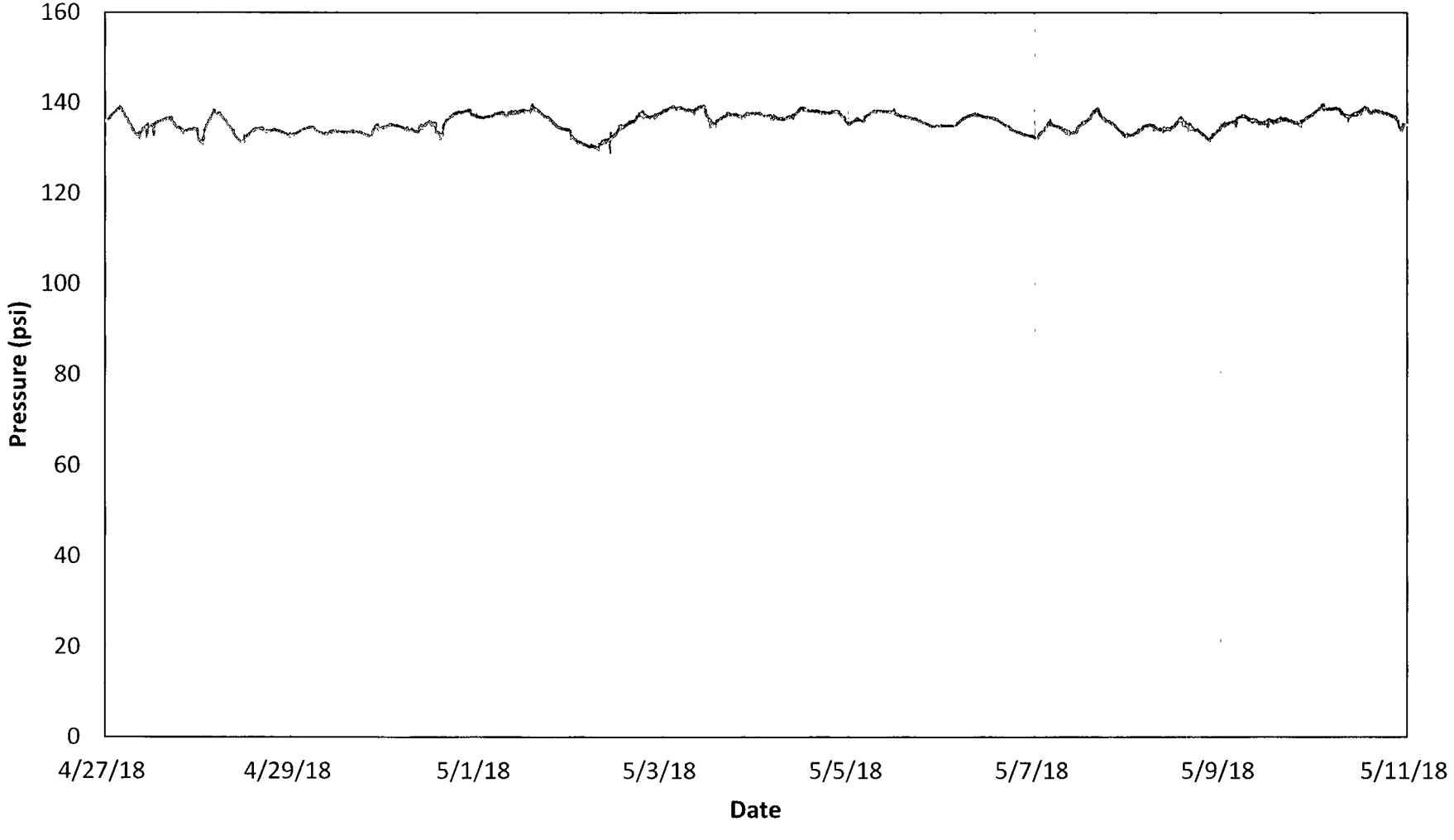
Midlothian
DFW's Southern Star



FREESE AND NICHOLS

Figure A-4
Pressure Recorder #3
Pressure Recorder ID: 1666
Padera Lake North Bound 287
April 27, 2018 - May 11, 2018

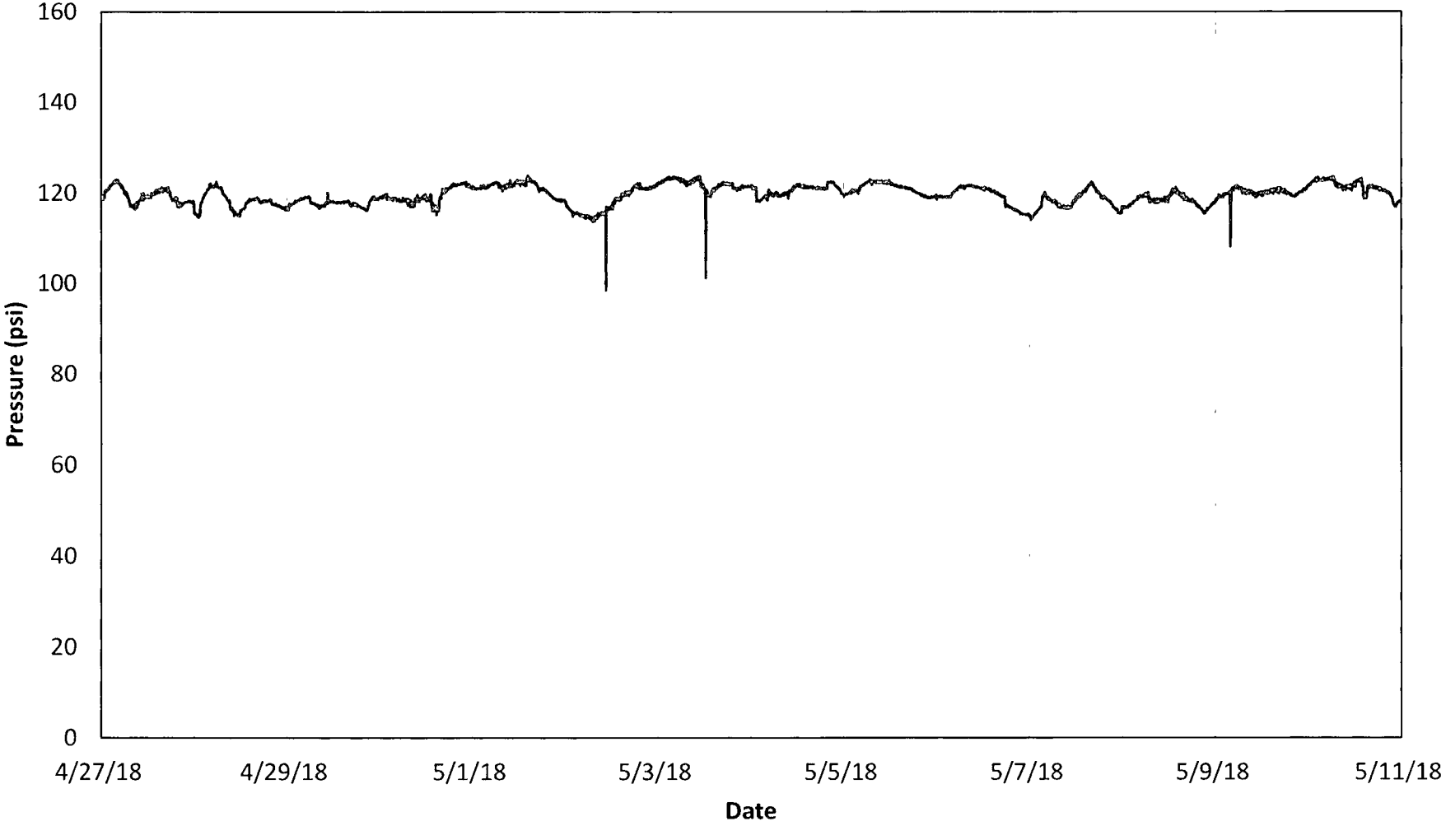
Midlothian
DFW's Southern Star



FREESE AND NICHOLS

Figure A-5
Pressure Recorder #4
Pressure Recorder ID: 1671
4333 Power Way and Railport Parkway
April 27, 2018 - May 11, 2018

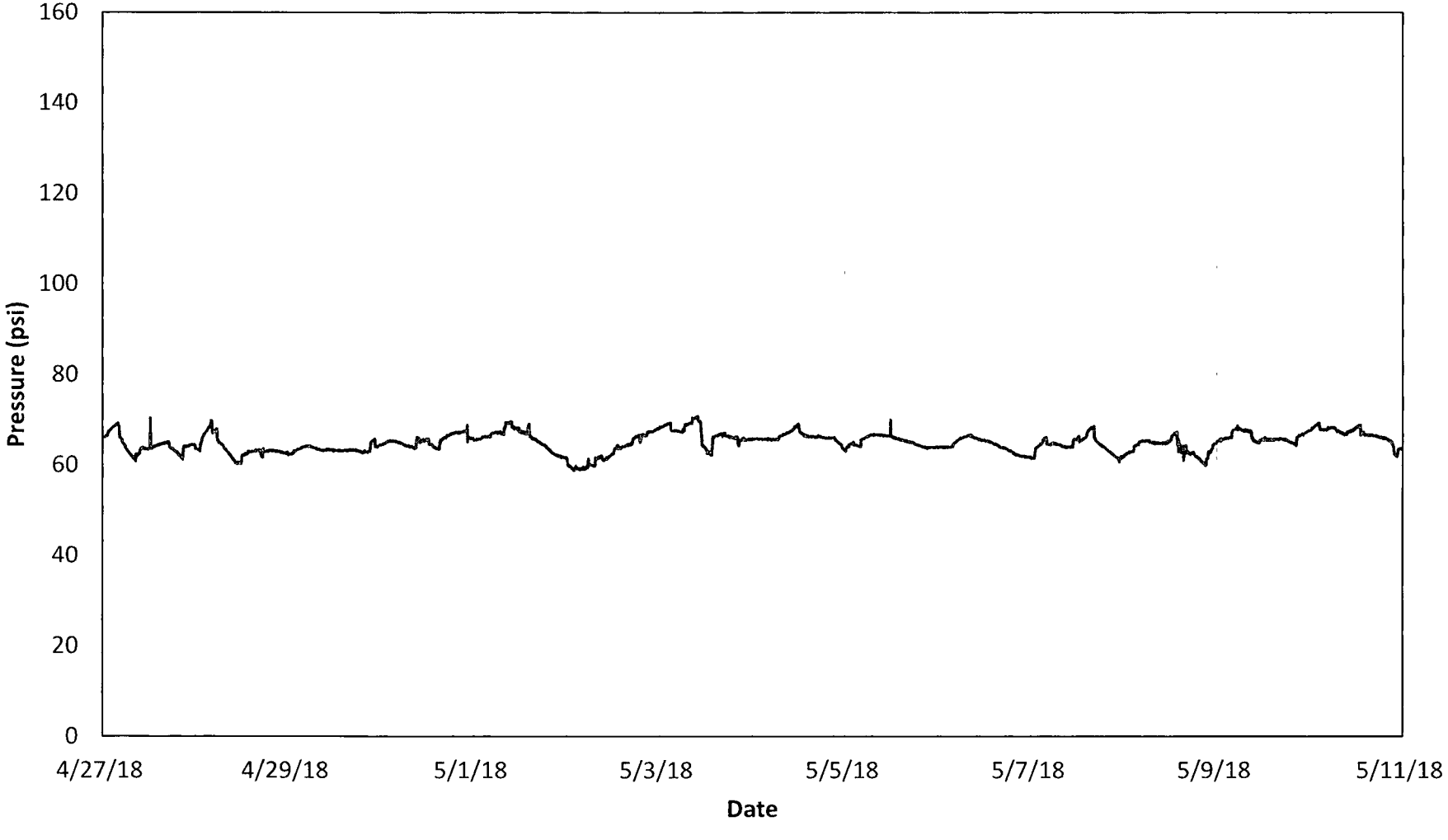
Midlothian
DFW's Southern Star



FREESE AND NICHOLS

Figure A-6
Pressure Recorder #5
Pressure Recorder ID: 205544
4110 North Highway 67
April 27, 2018 - May 11, 2018

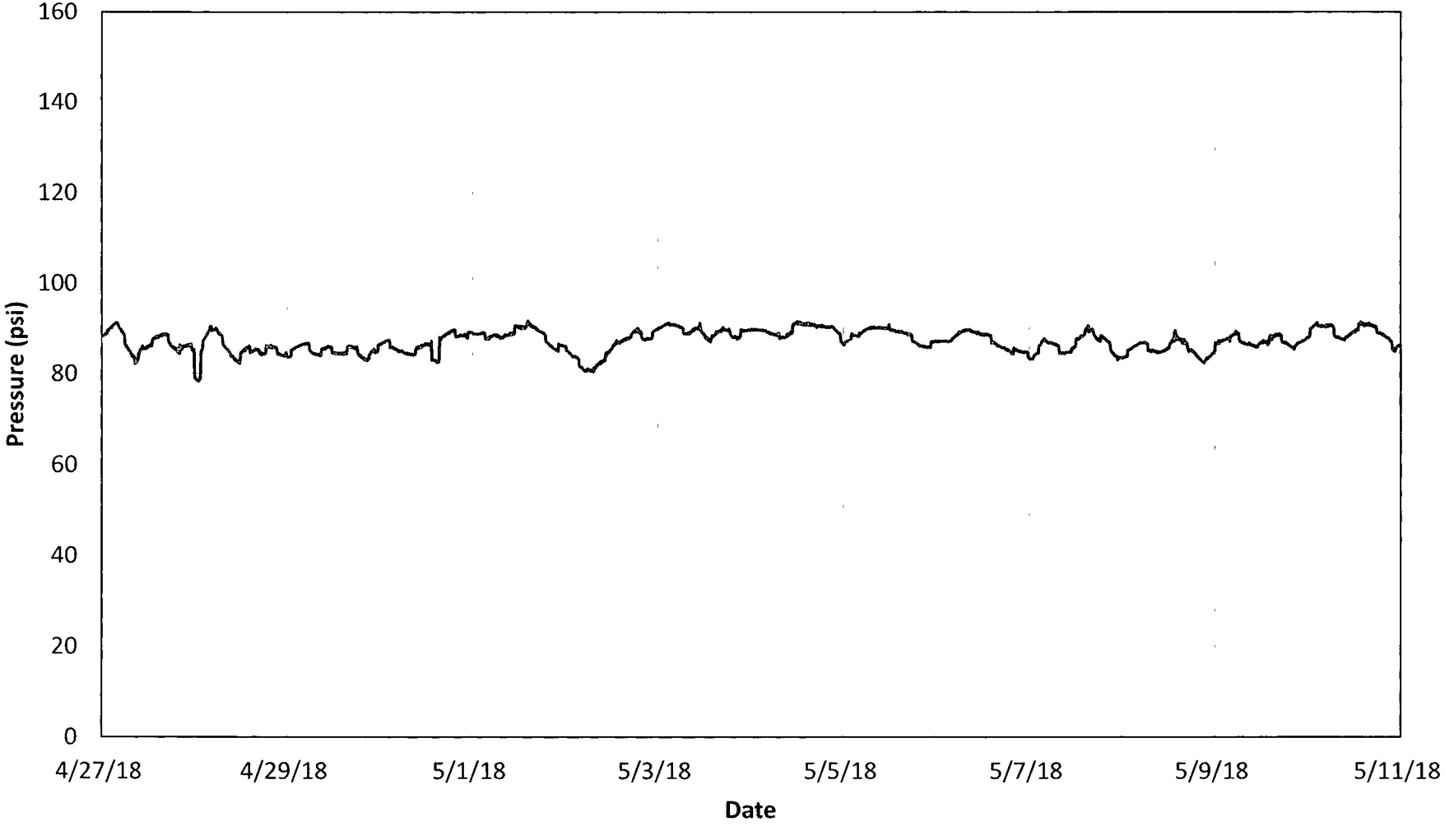
Midlothian
DFW's Southern Star



FREESE AND NICHOLS

Figure A-7
Pressure Recorder #6
Pressure Recorder ID: 204229
2217 Woodlands Circle and Somerset
April 27, 2018 - May 11, 2018

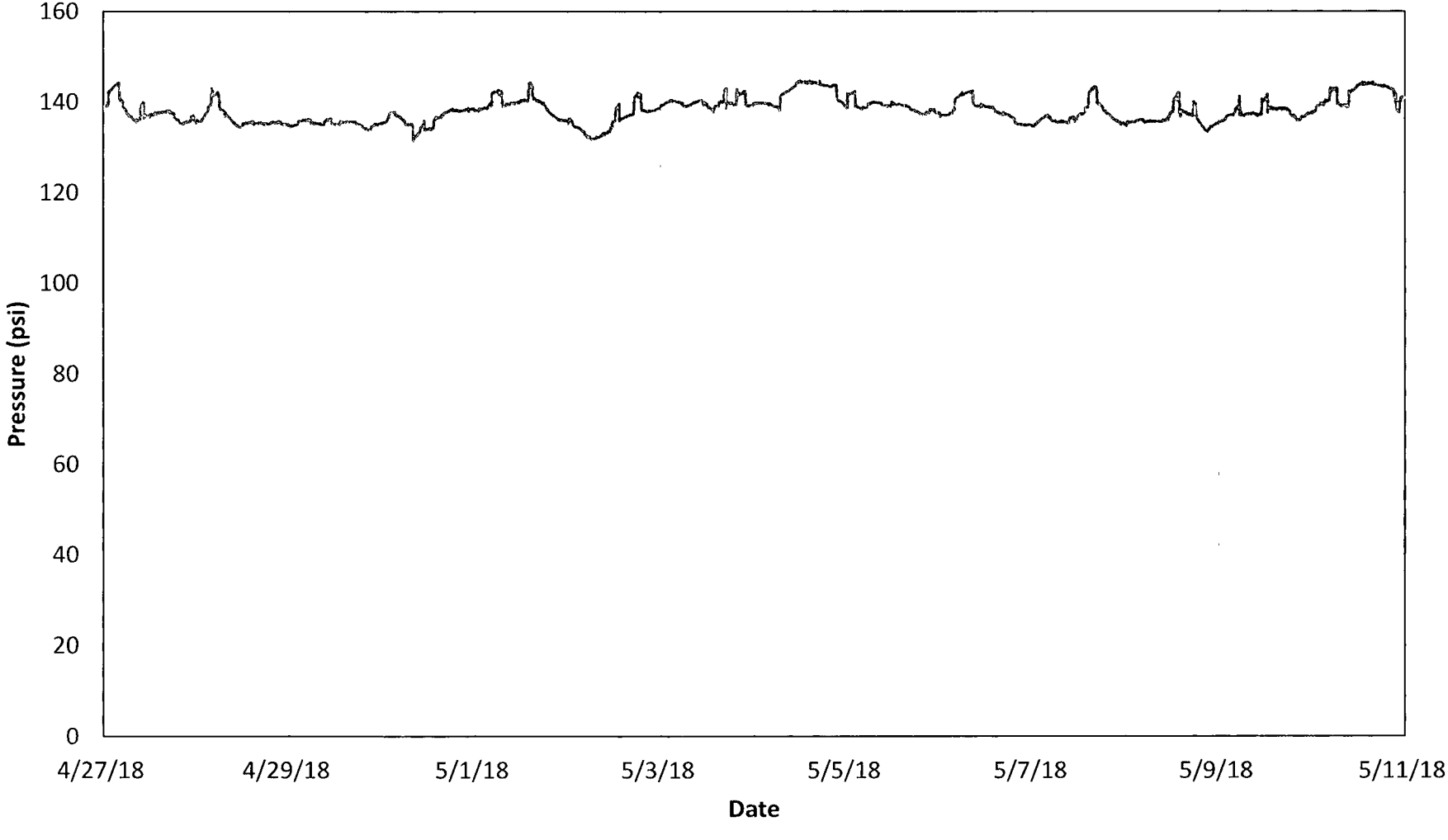
Midlothian
DFW's Southern Star



FREESE AND NICHOLS

Figure A-8
Pressure Recorder #7
Pressure Recorder ID: 205545
650 Rex Odom Drive and Airport
April 27, 2018 - May 11, 2018

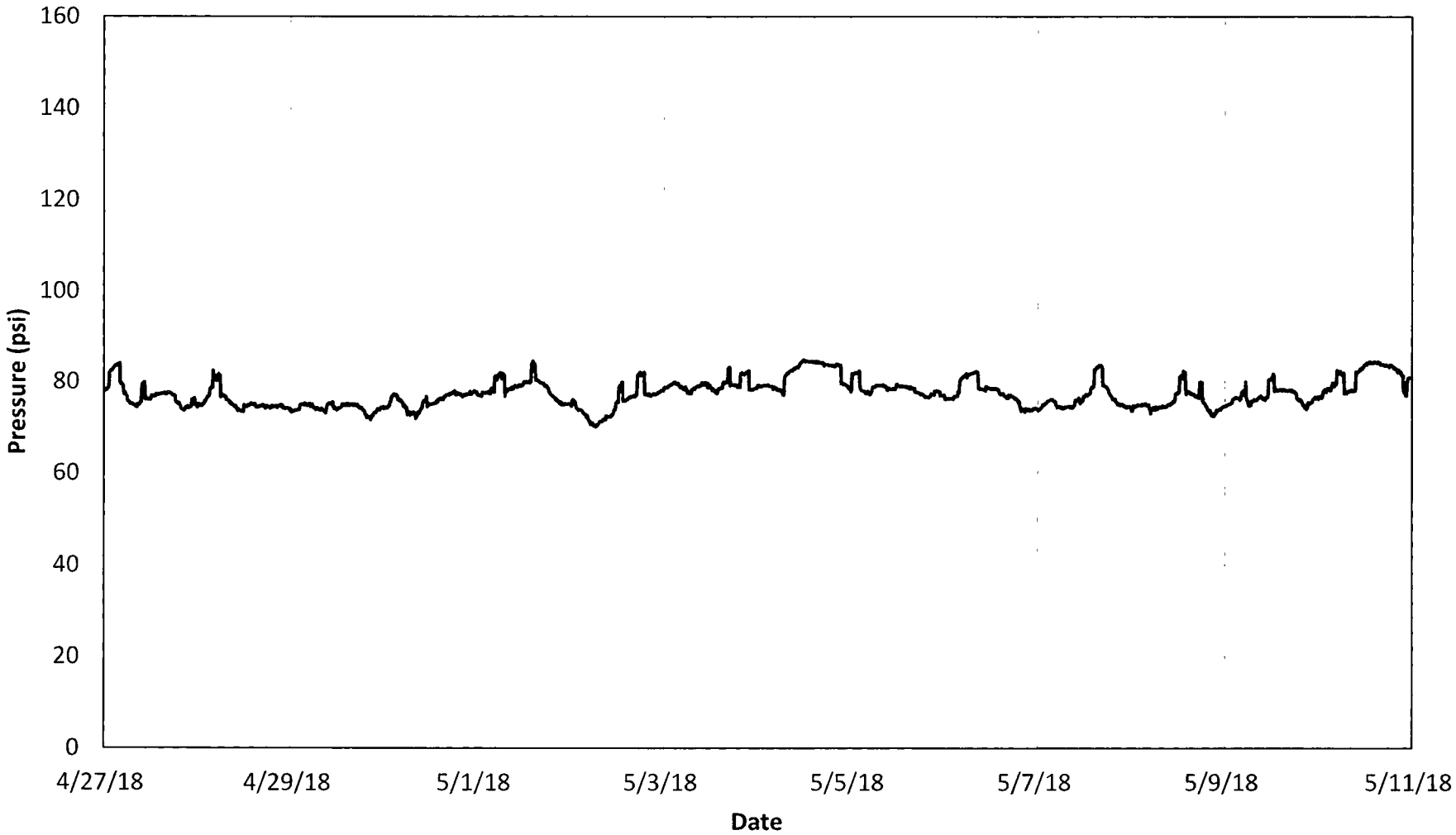
Midlothian
DFW's Southern Star

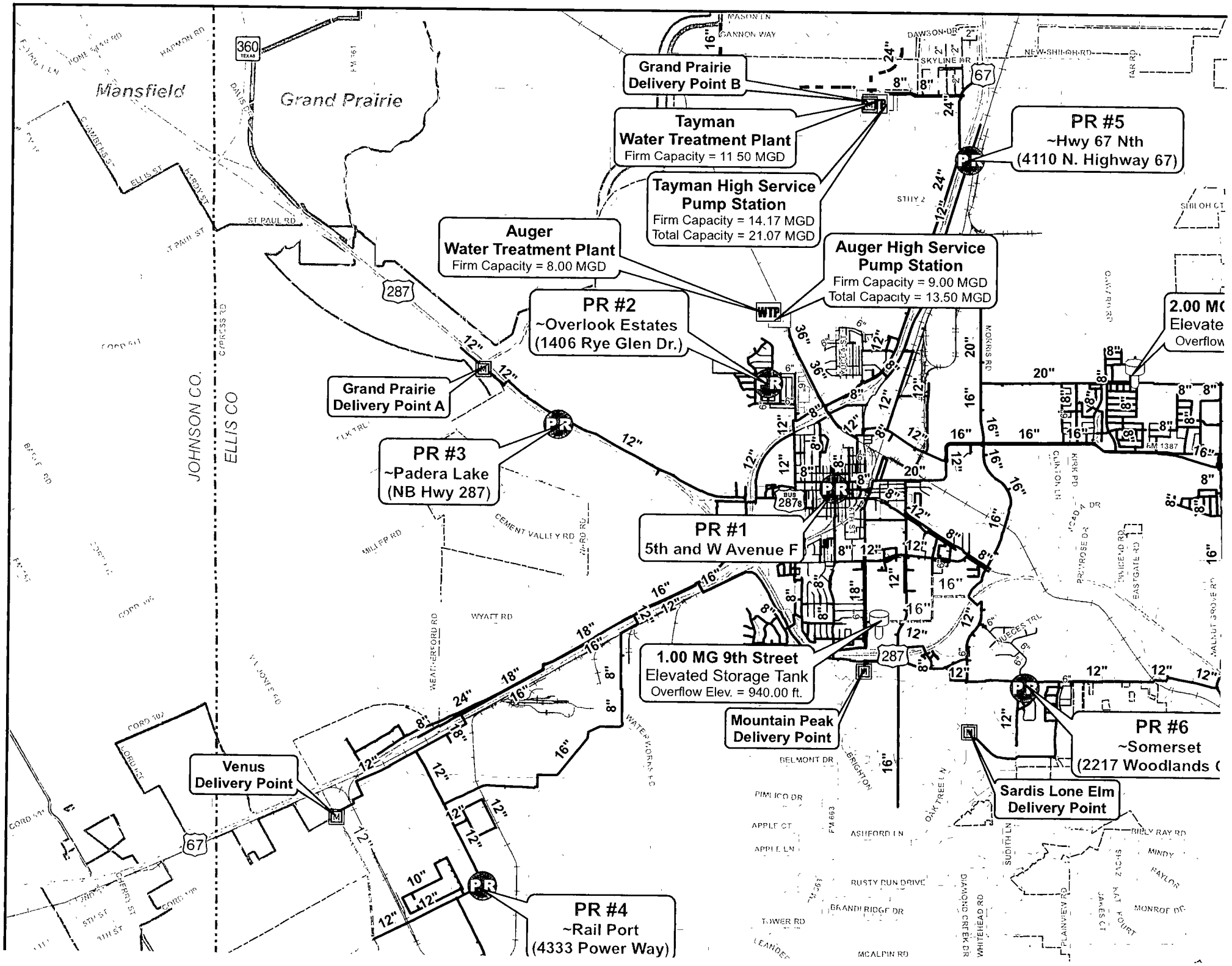


FREESE AND NICHOLS

Figure A-9
Pressure Recorder #8
Pressure Recorder ID: 1670
6213 Bentwood Drive and Long Branch
April 27, 2018 - May 11, 2018

Midlothian DFW's Southern Star

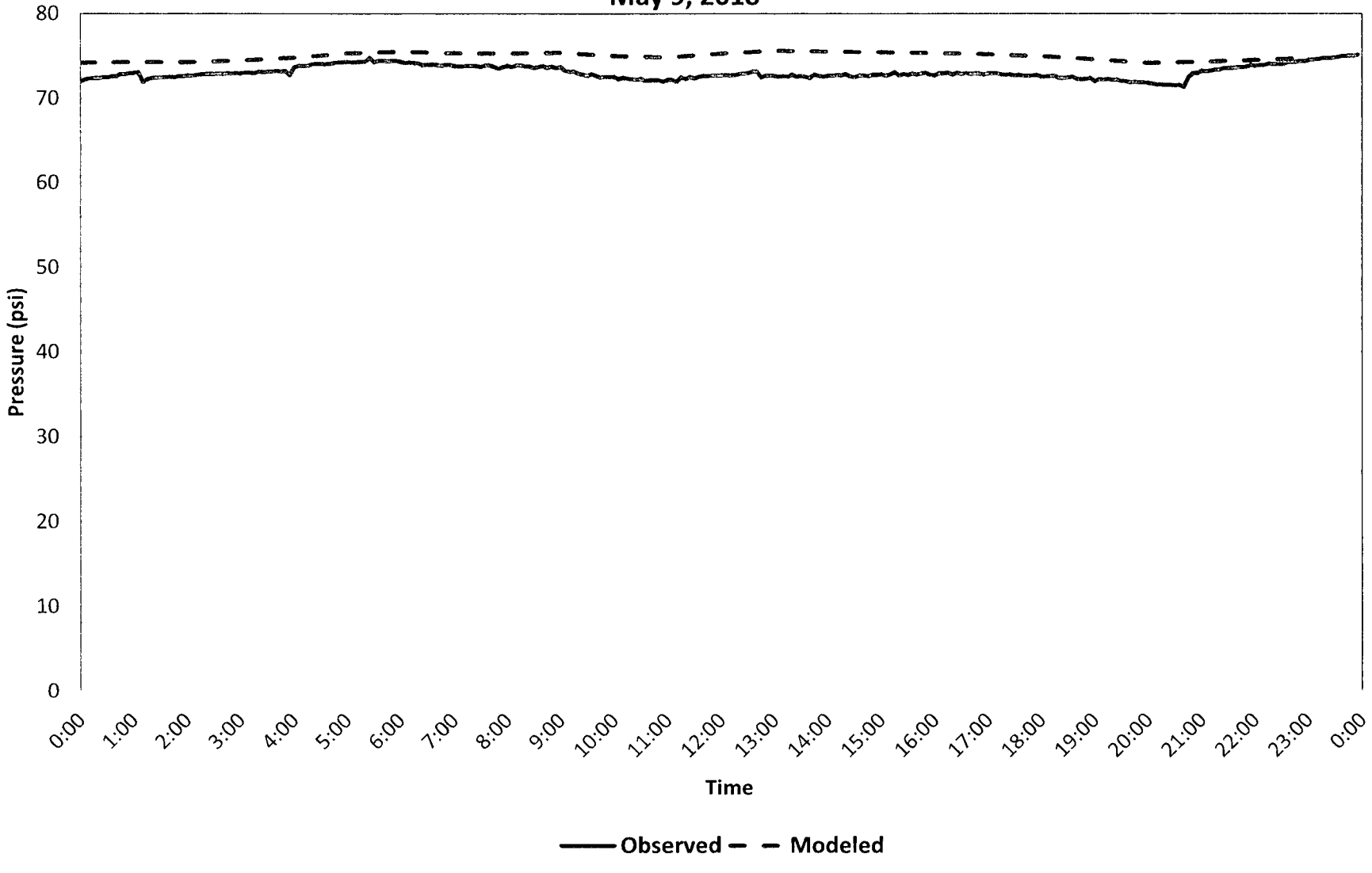




(Figure_A-10)_Pressure_Recorder_Locations_11x17.mxd

APPENDIX B
Water Model Calibration Results

Figure B-1
EPS Calibration Results
Pressure Recorder 1: N. 5th St. & W. Avenue F
May 9, 2018



FREESE AND NICHOLS

Figure B-2
EPS Calibration Results
Pressure Recorder 2: 1406 Rye Glen
May 9, 2018

Midlothian
DFW's Southern Star

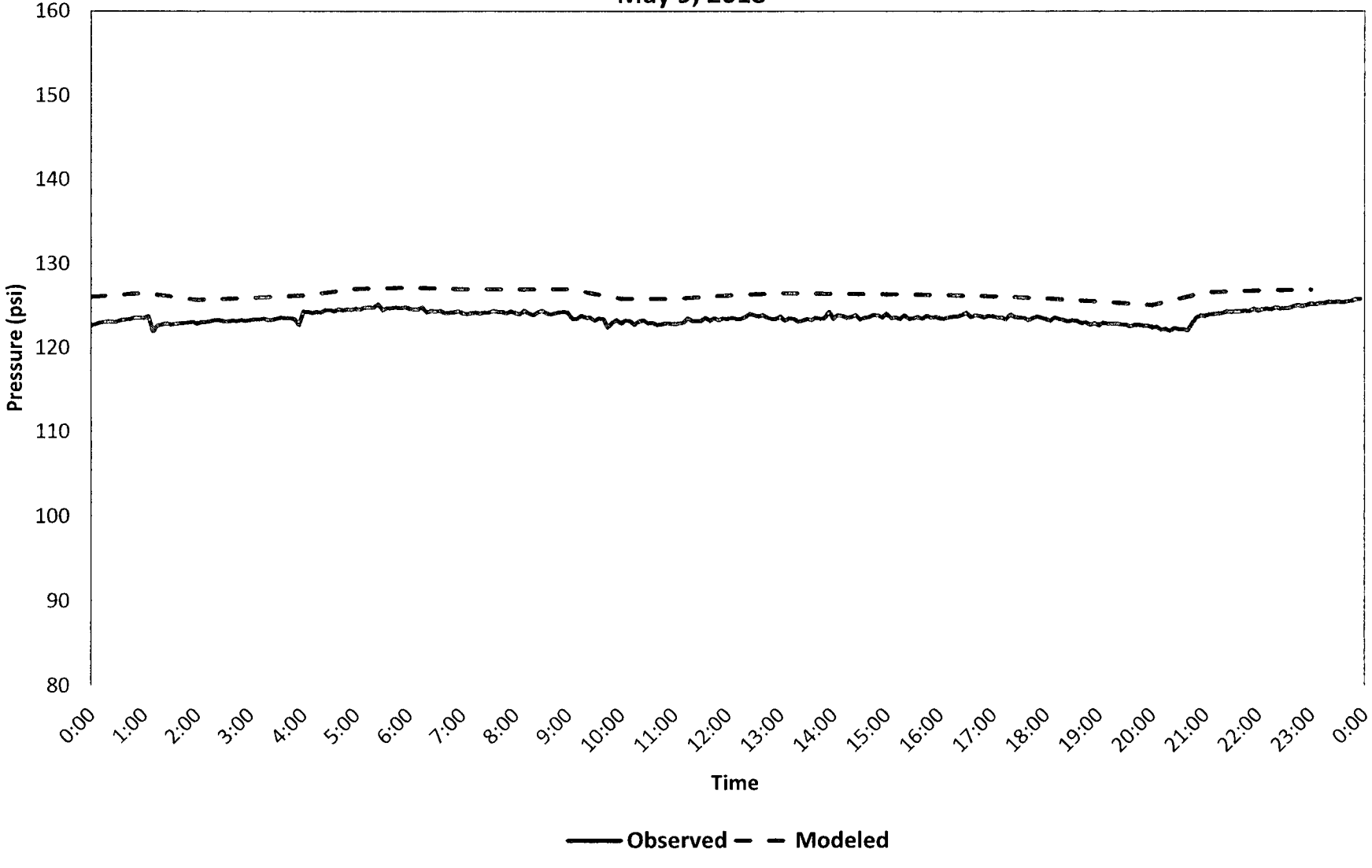


Figure B-3
EPS Calibration Results
Pressure Recorder 3: Padera Lake N. Bound 287
May 9, 2018

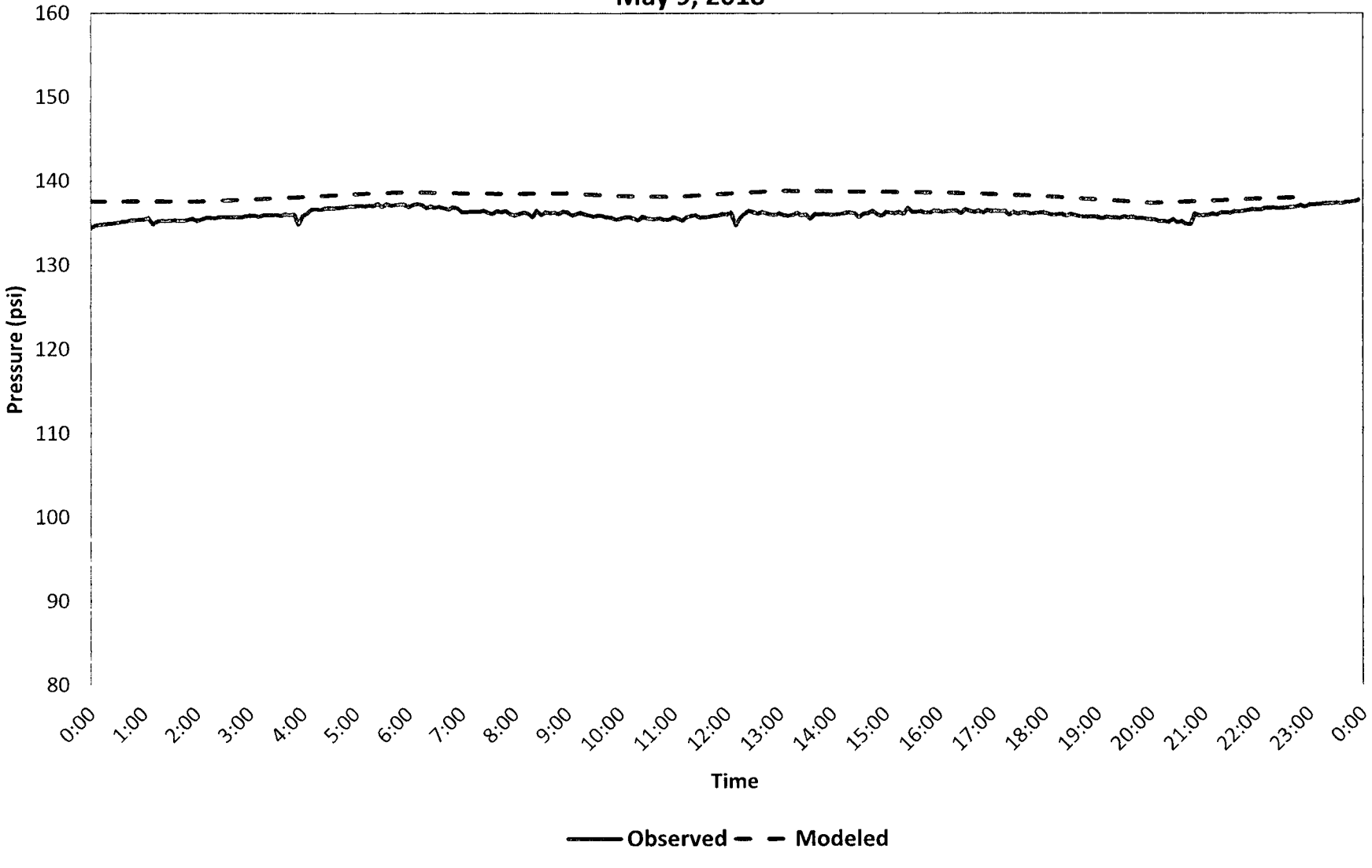
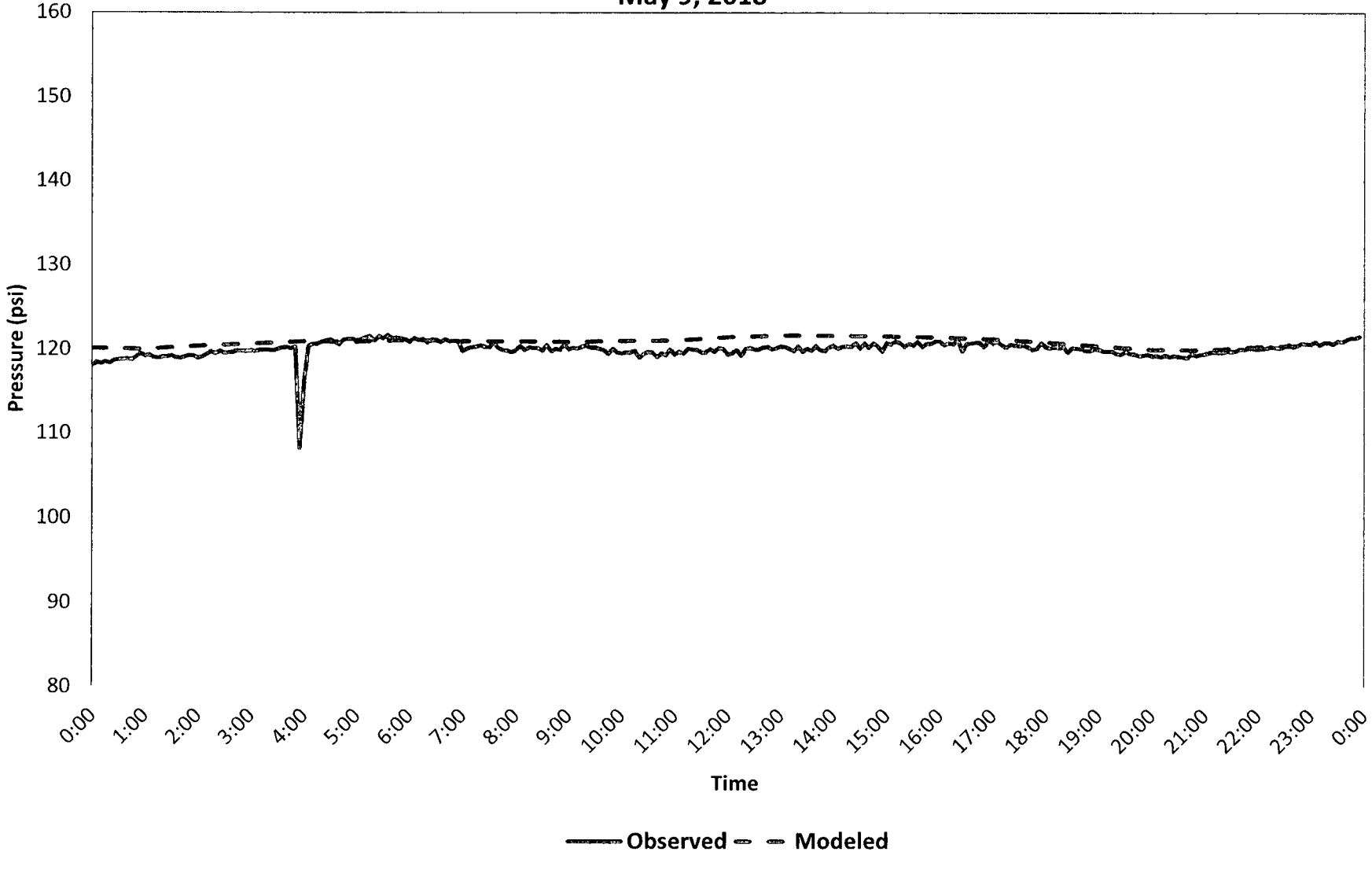


Figure B-4
EPS Calibration Results
Pressure Recorder 4: 4333 Power Way & Railport Pkwy
May 9, 2018



FREESE AND NICHOLS

Figure B-5
EPS Calibration
Pressure Recorder 5: 4110 N. Hwy 67
May 9, 2018

Midlothian
DFW's Southern Star

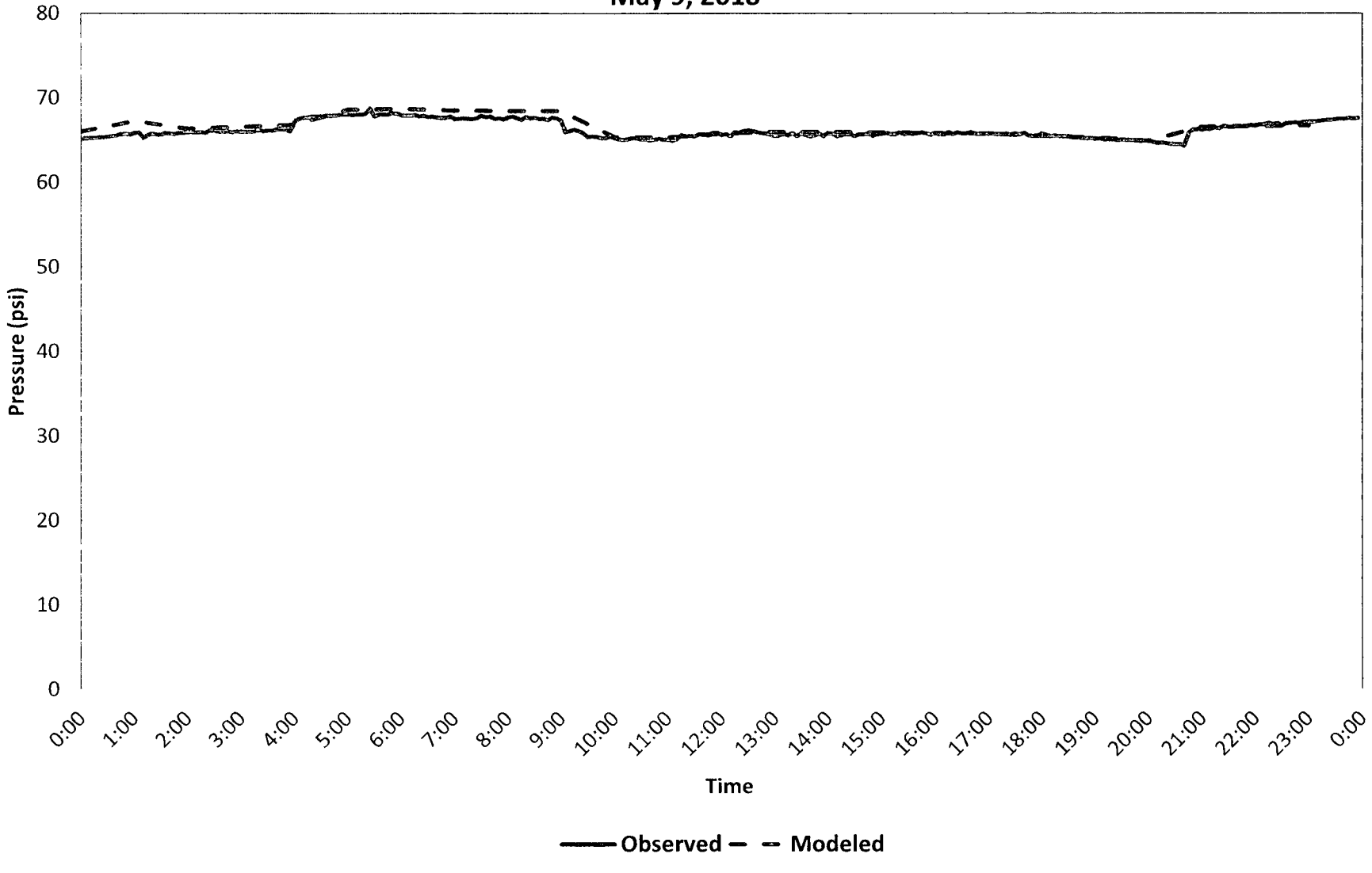


Figure B-6
EPS Calibration Results
Pressure Recorder 6: 2217 Woodlands Circle & Somerset
May 9, 2018

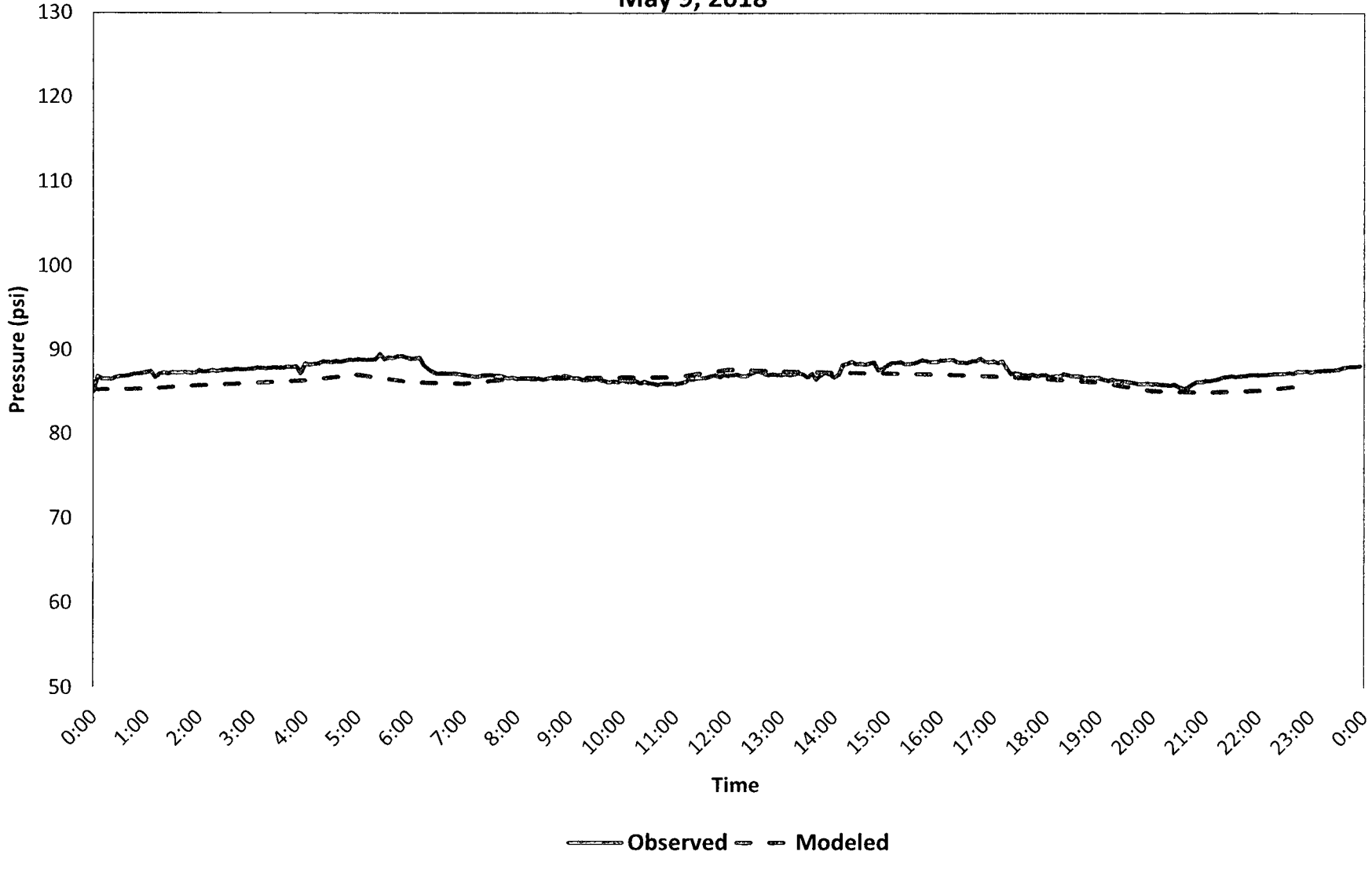


Figure B-7
EPS Calibrationn Results
Pressure Recorder 7: 650 Rex Odom Dr. and Airport
May 9, 2018

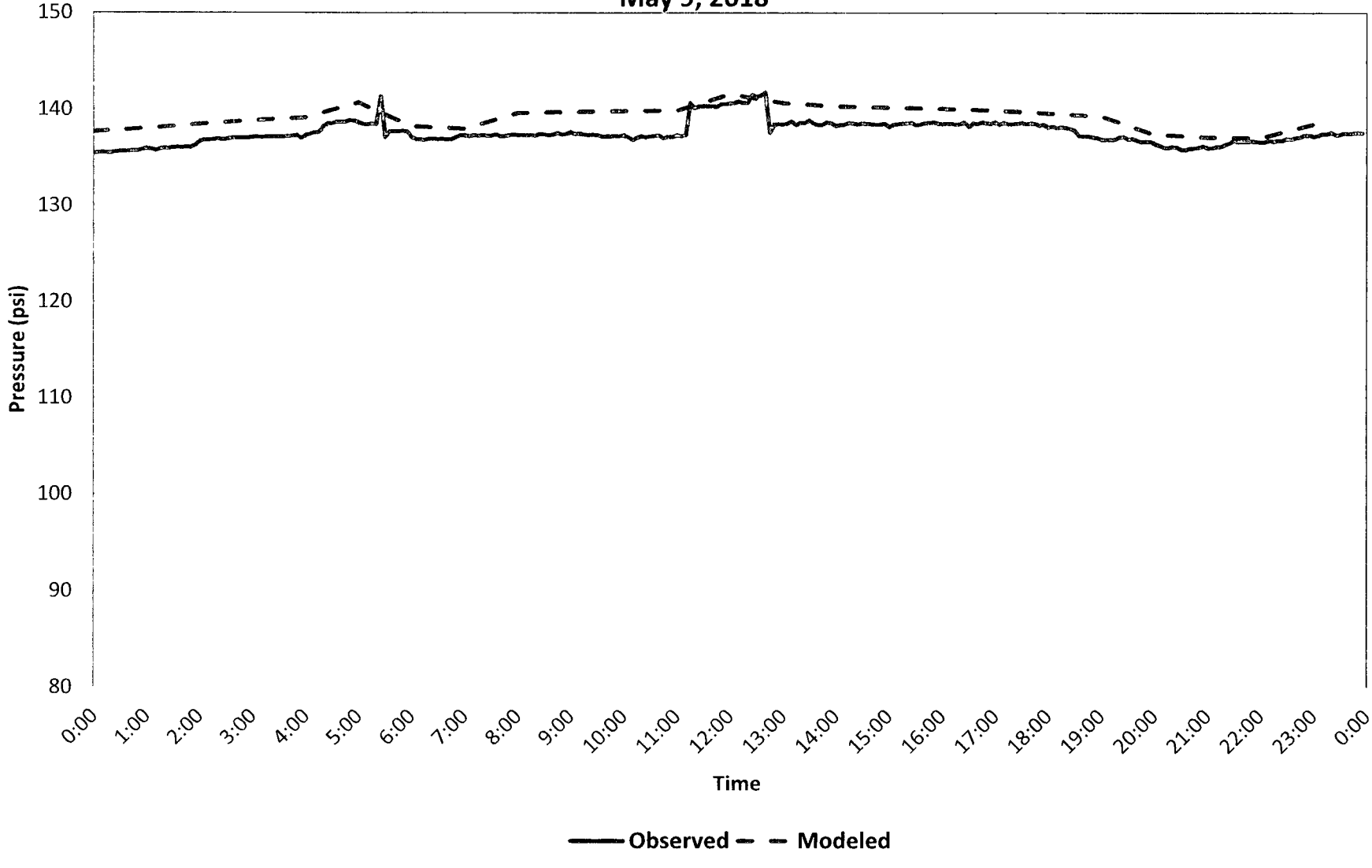
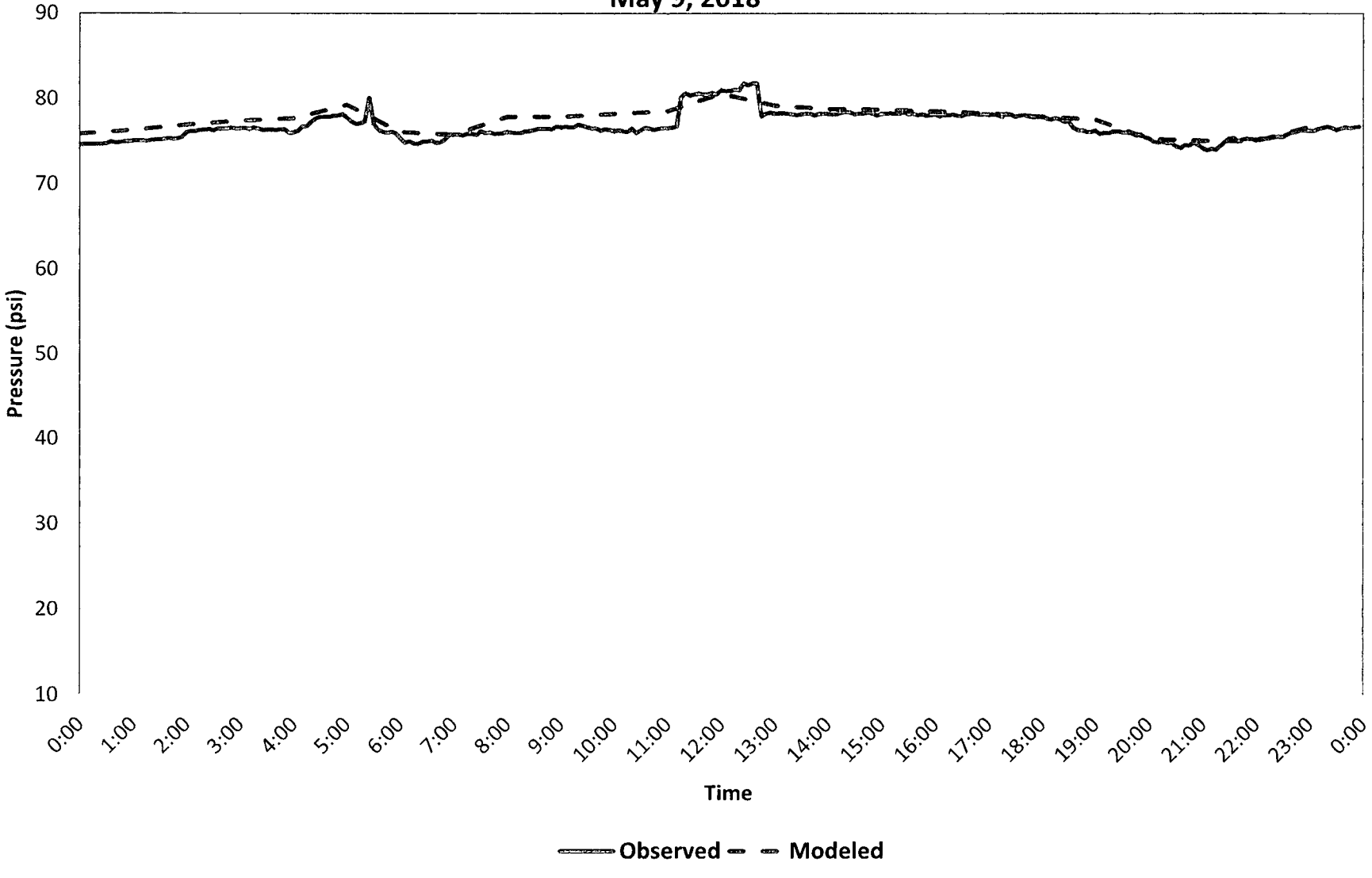


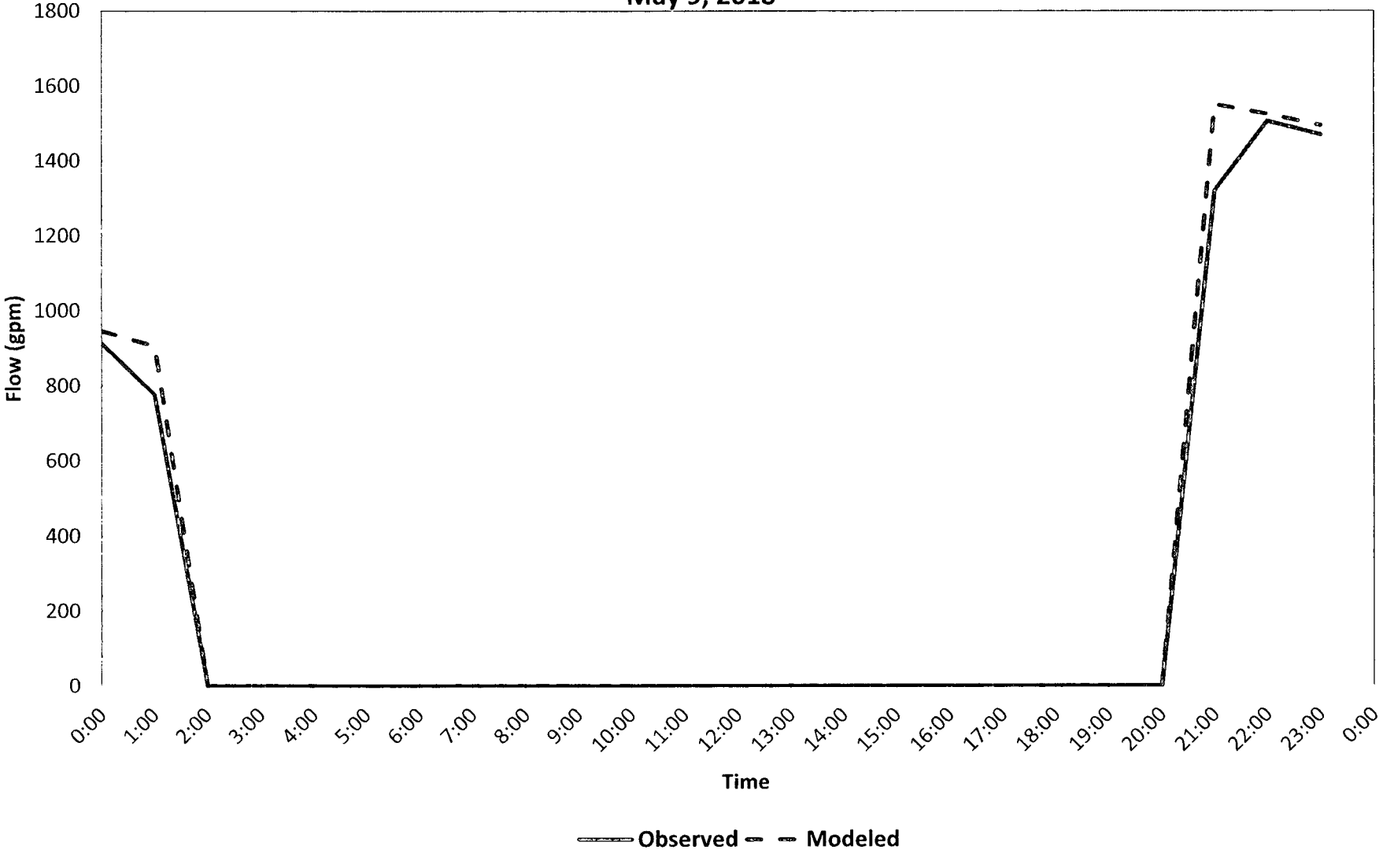
Figure B-8
EPS Calibration Results
Pressure Recorder 8: 6213 Bentwood Dr. and Longbranch
May 9, 2018



FREESE AND NICHOLS

Figure B-9
EPS Calibration Results
Auger WTP HSPS
May 9, 2018

Midlothian
DFW's Southern Star



FREESE AND NICHOLS

Figure B-10
EPS Calibration Results
Tayman WTP HSPS
May 9, 2018

Midlothian
DFW's Southern Star

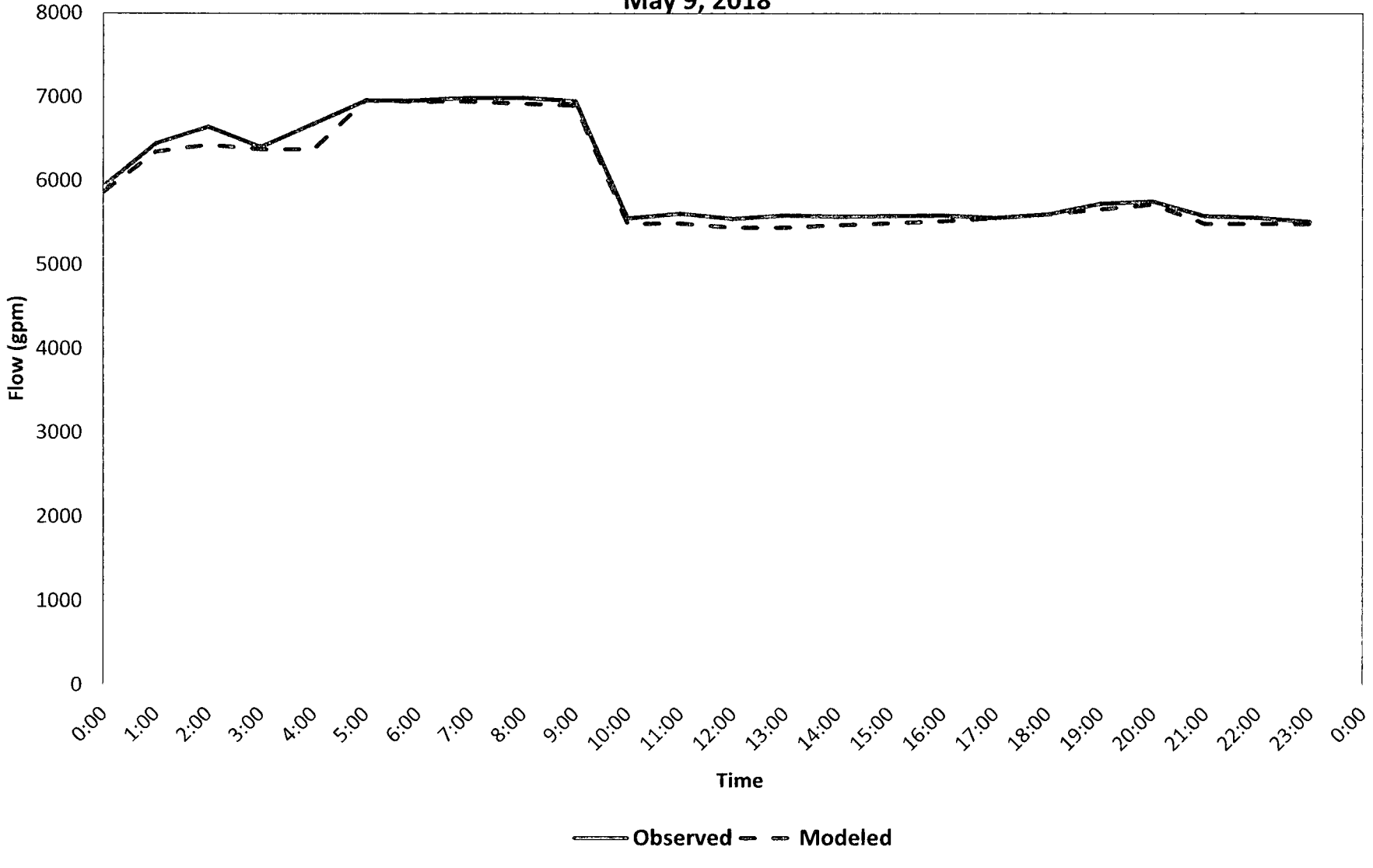


Figure B-11
EPS Calibration Results
9th Street Elevated Storage Tank
May 9, 2018

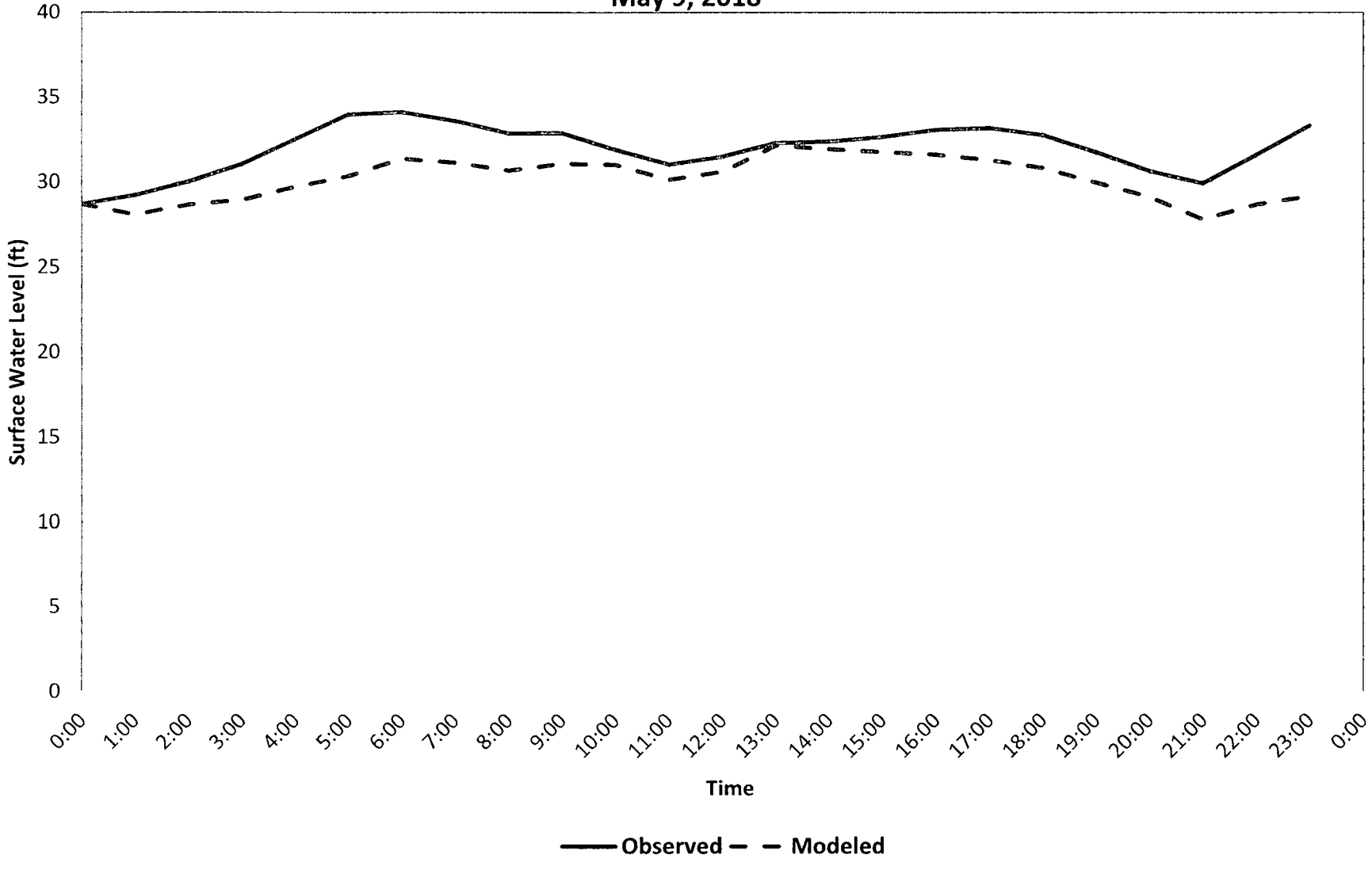
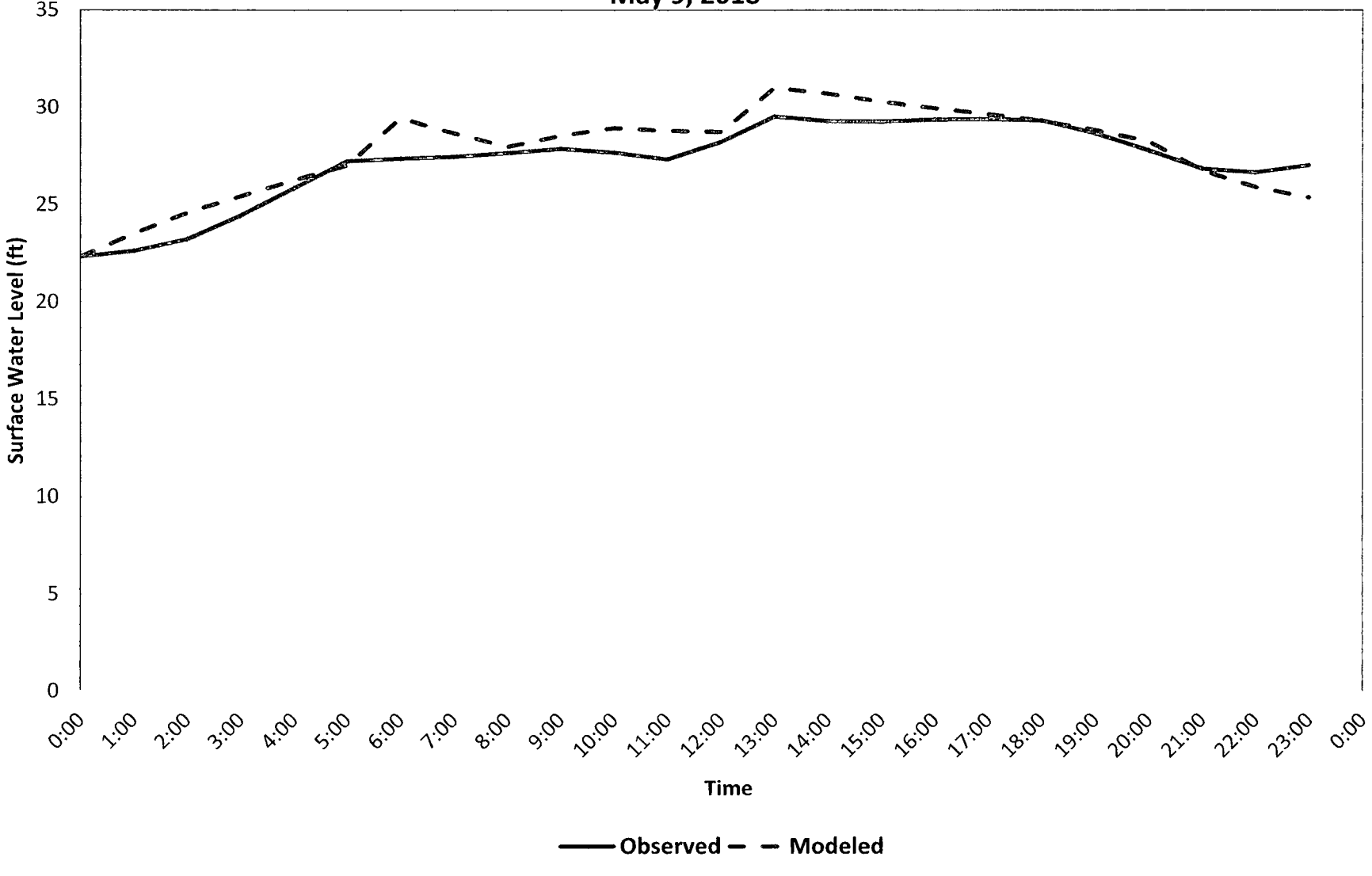
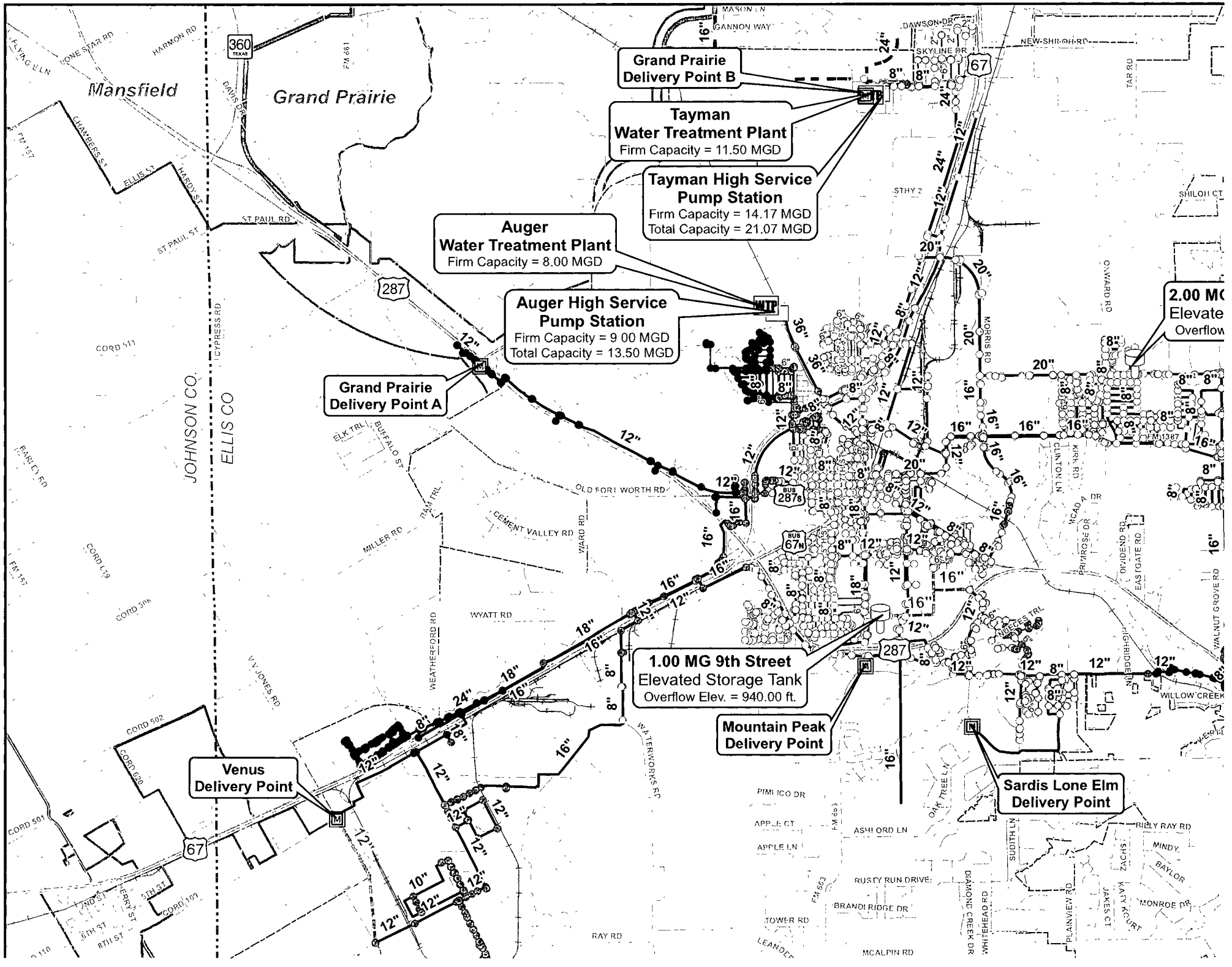


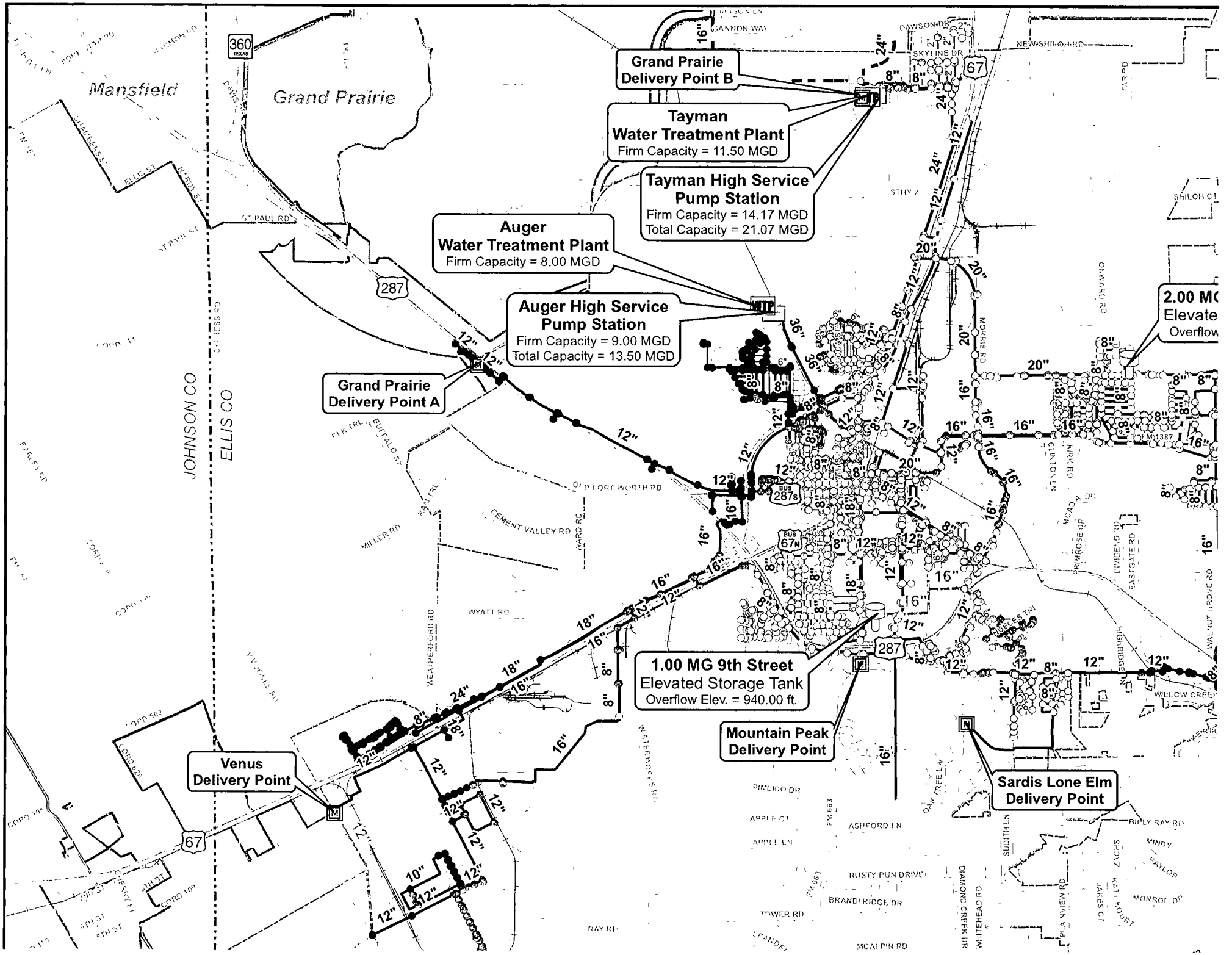
Figure B-12
EPS Calibration Results
Mockingbird Elevated Storage Tank
May 9, 2018



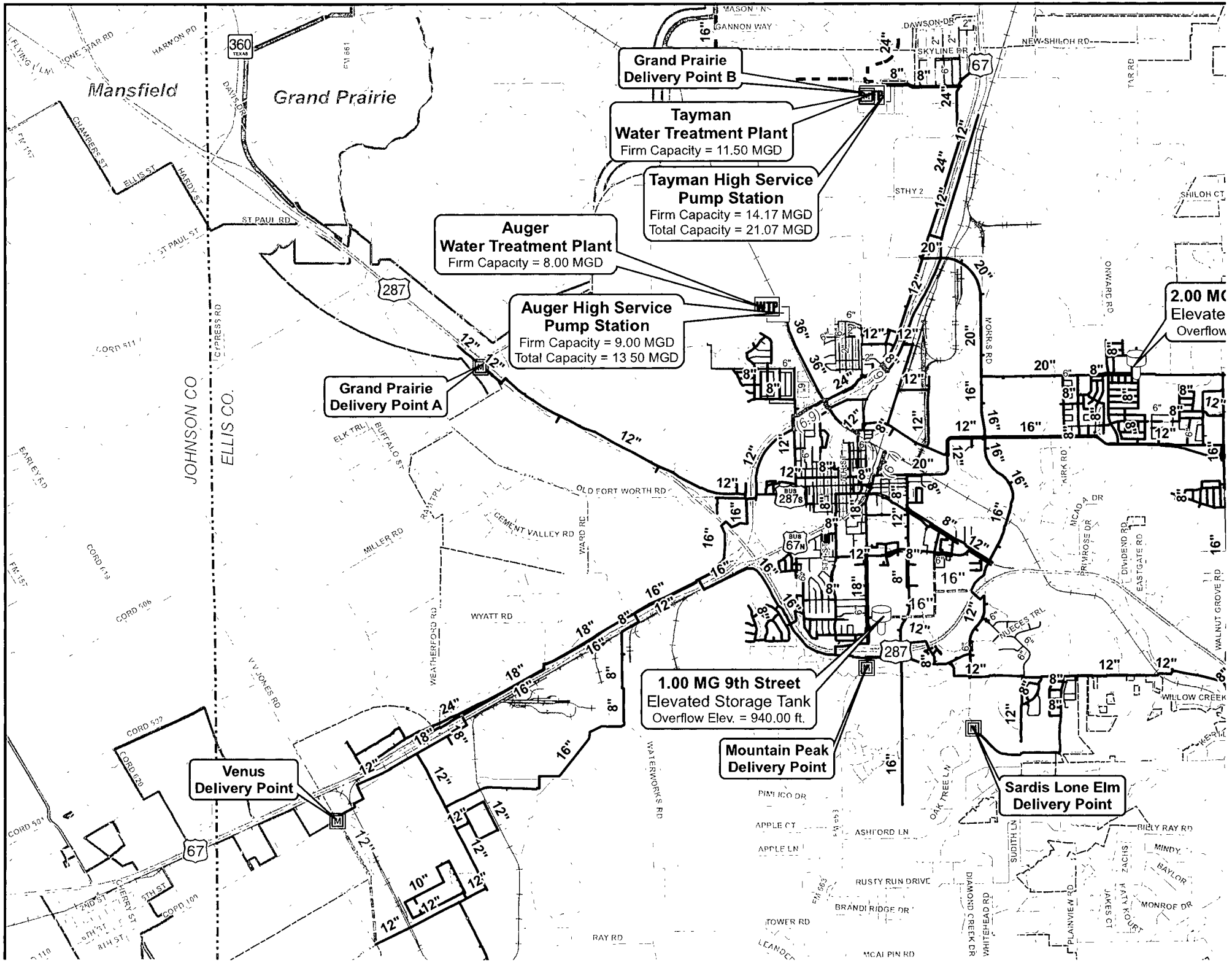
APPENDIX C
Water System Analysis Mapping



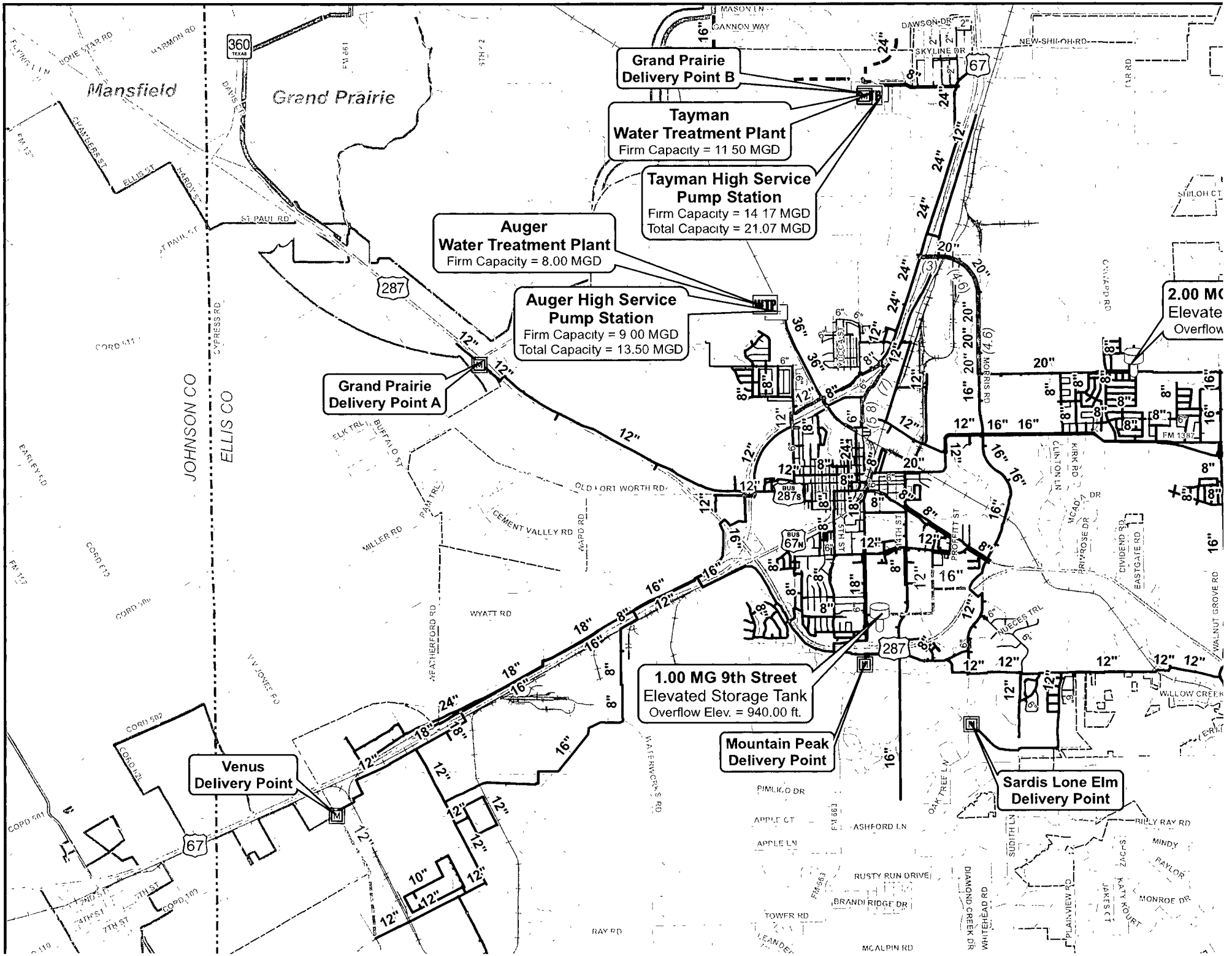
(Figure_C-1)_Existing_MD_Min_Pressure_11x17.mxd

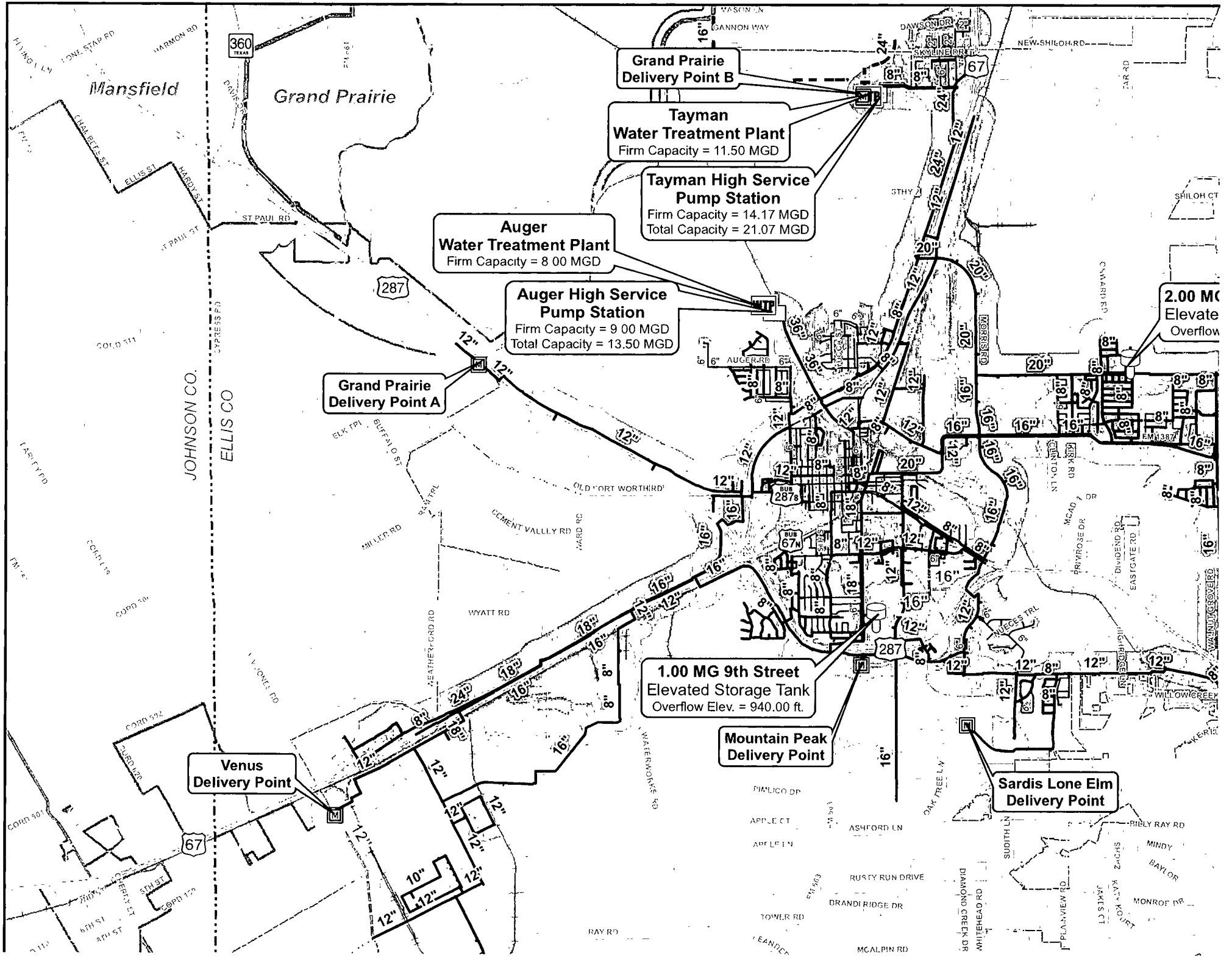


(Figure_C-2)_Existing_MD_Max_Pressure_11x17.mxd

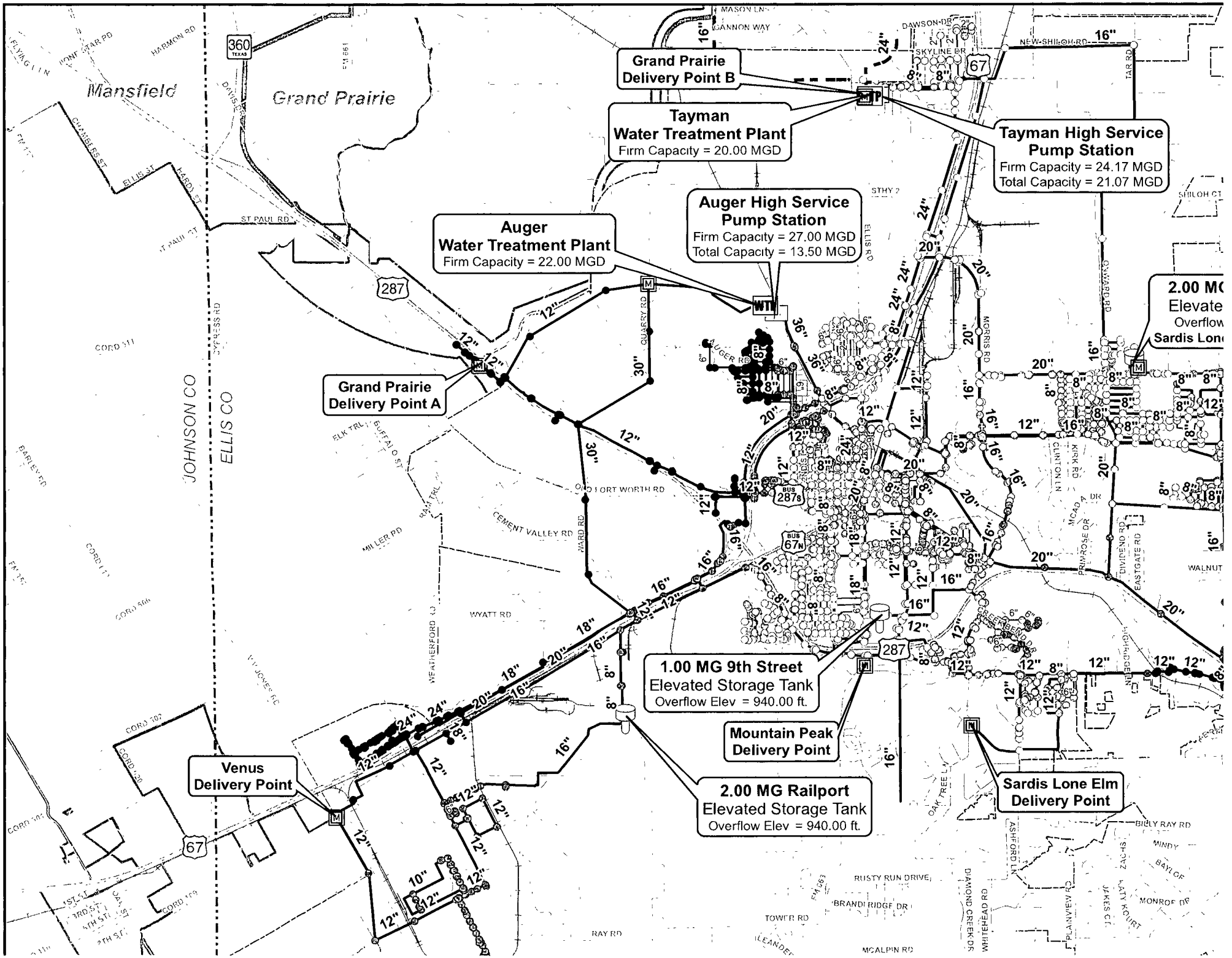


(Figure_C-3)_Existing_MD_Max_Velocity_11x17.mxd

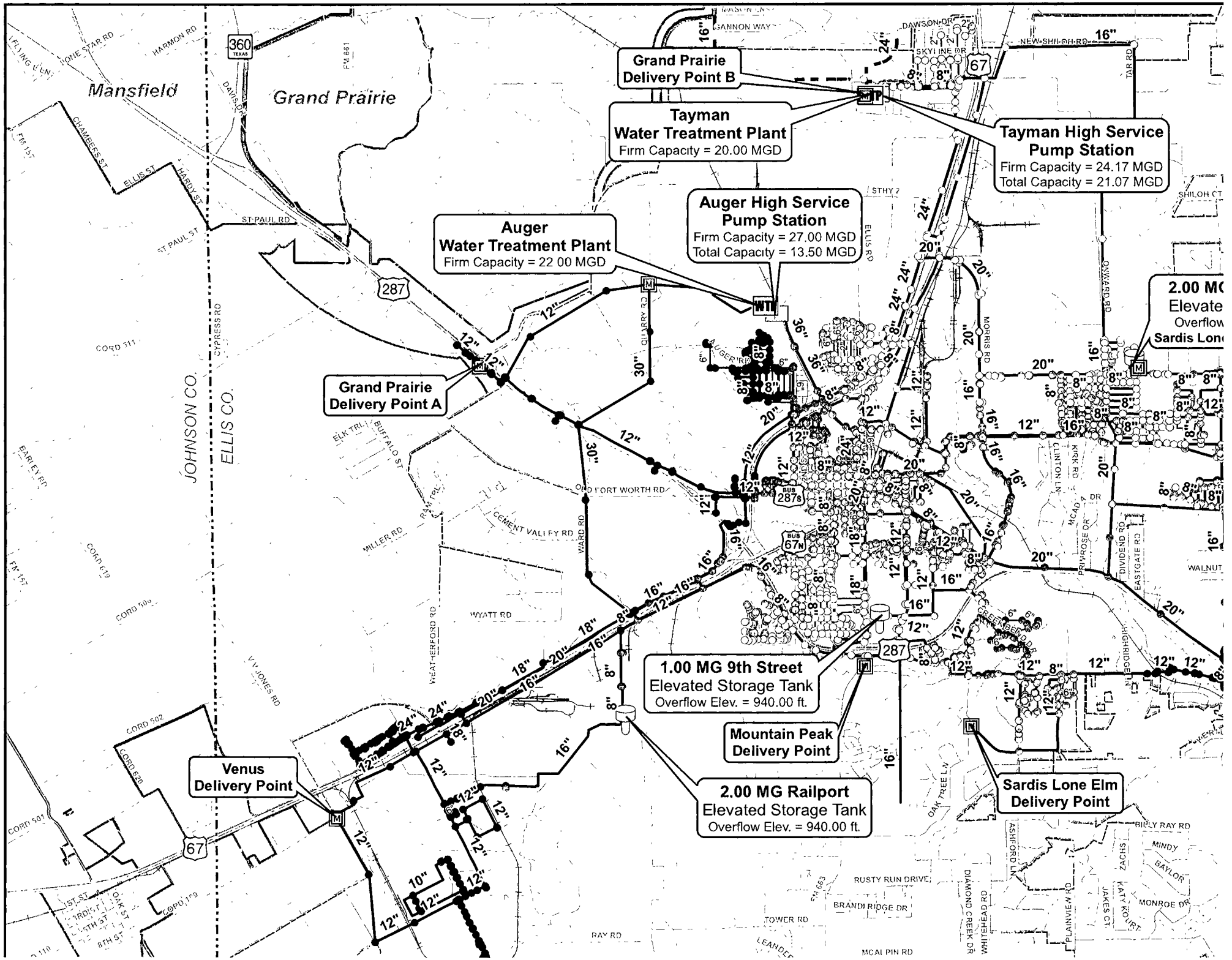

Grand Prairie Delivery Point B
Tayman Water Treatment Plant
Firm Capacity = 11 50 MGD
Tayman High Service Pump Station
Firm Capacity = 14 17 MGD
Total Capacity = 21.07 MGD
Auger Water Treatment Plant
Firm Capacity = 8.00 MGD
Auger High Service Pump Station
Firm Capacity = 9 00 MGD
Total Capacity = 13.50 MGD
Grand Prairie Delivery Point A
1.00 MG 9th Street Elevated Storage Tank
Overflow Elev. = 940.00 ft.
Mountain Peak Delivery Point
Sardis Lone Elm Delivery Point
Venus Delivery Point
2.00 MG Elevated Overflow
Mansfield
Grand Prairie
JOHNSON CO
ELLIS CO
WTP
287
67
360



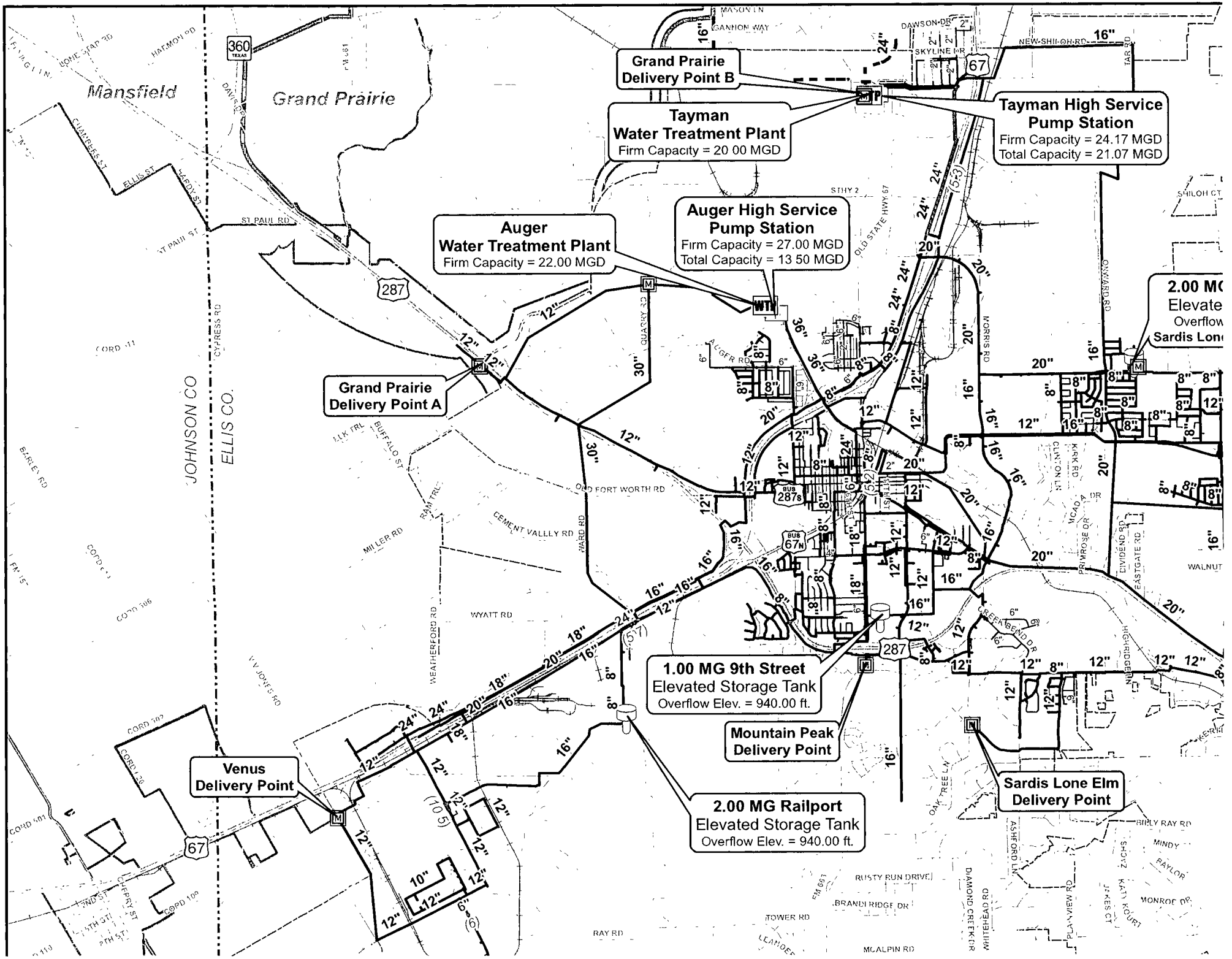
(Figure_C-5)_Existing_MD_FF_Availability_11x17.mxd

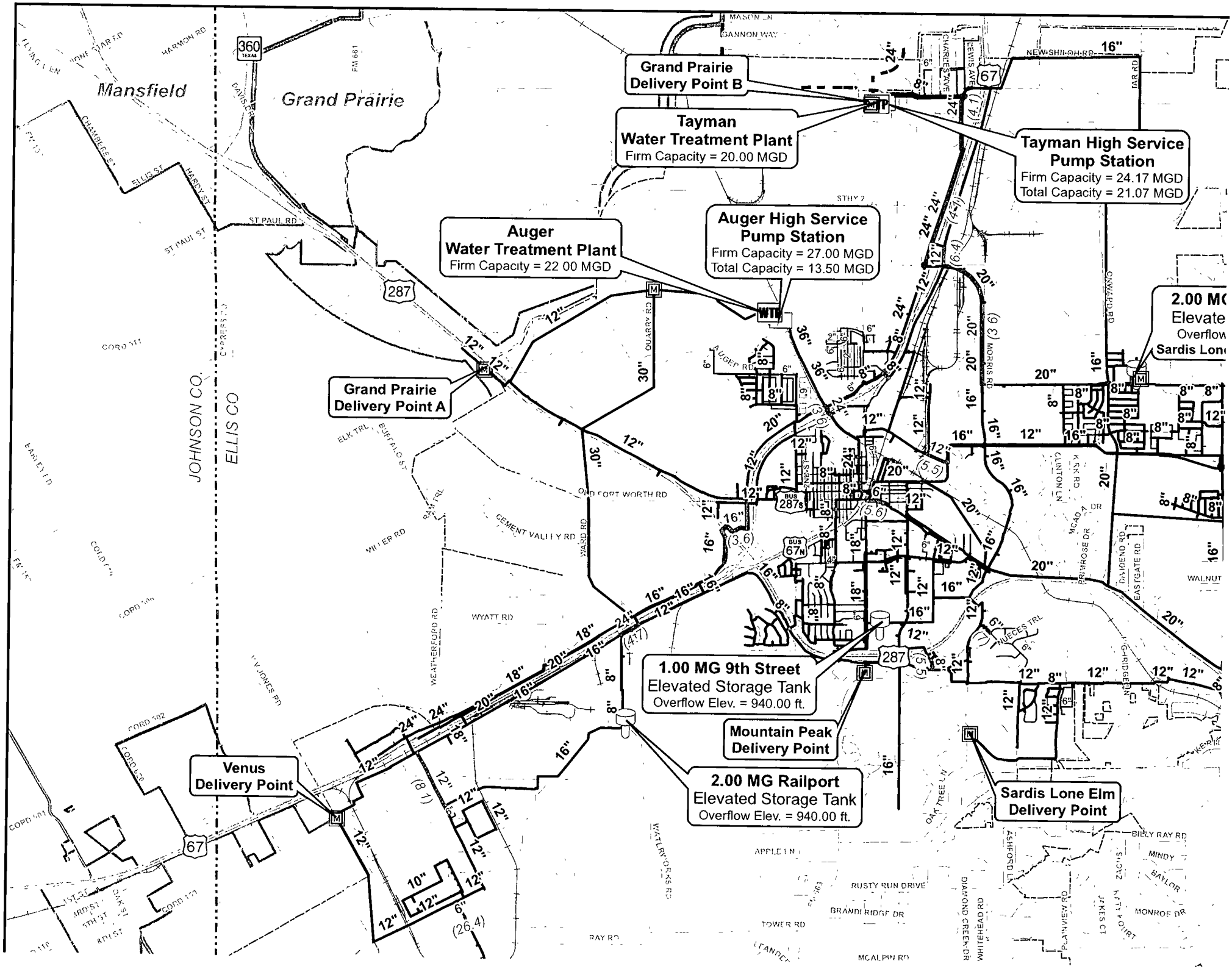


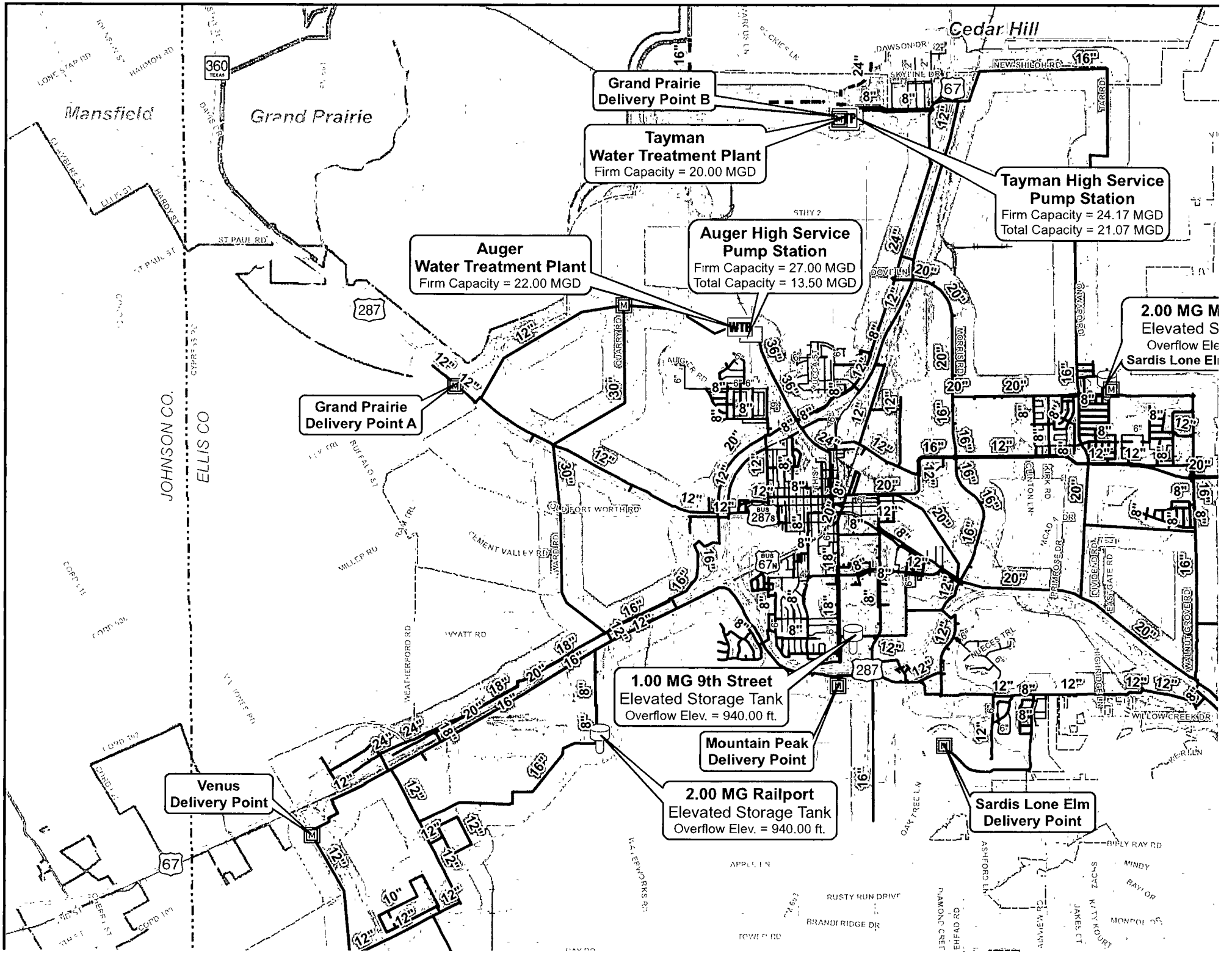
(Figure_C-6)_Future_MD_Min_Pressure_11x17.mxd



(Figure_C-7)_Future_MD_Max_Static_Pressure_11x17.mxd


Grand Prairie Delivery Point B
Tayman Water Treatment Plant
Firm Capacity = 20 00 MGD
Tayman High Service Pump Station
Firm Capacity = 24.17 MGD
Total Capacity = 21.07 MGD
Auger Water Treatment Plant
Firm Capacity = 22.00 MGD
Auger High Service Pump Station
Firm Capacity = 27.00 MGD
Total Capacity = 13 50 MGD
Grand Prairie Delivery Point A
2.00 MG
Elevate
Overflow
Sardis Lon
1.00 MG 9th Street
Elevated Storage Tank
Overflow Elev. = 940.00 ft.
Mountain Peak Delivery Point
Venus Delivery Point
2.00 MG Railport
Elevated Storage Tank
Overflow Elev. = 940.00 ft.
Sardis Lone Elm Delivery Point
Mansfield
Grand Prairie
JOHNSON CO
ELLIS CO.
360
287
67
WTP
BUS 287B
BUS 67N


Grand Prairie Delivery Point B
Tayman Water Treatment Plant
Firm Capacity = 20.00 MGD
Tayman High Service Pump Station
Firm Capacity = 24.17 MGD
Total Capacity = 21.07 MGD
Auger Water Treatment Plant
Firm Capacity = 22 00 MGD
Auger High Service Pump Station
Firm Capacity = 27.00 MGD
Total Capacity = 13.50 MGD
Grand Prairie Delivery Point A
2.00 MG Elevated Overflow Sardis Lone
1.00 MG 9th Street Elevated Storage Tank
Overflow Elev. = 940.00 ft.
Mountain Peak Delivery Point
2.00 MG Railport Elevated Storage Tank
Overflow Elev. = 940.00 ft.
Venus Delivery Point
Sardis Lone Elm Delivery Point
Mansfield
Grand Prairie
JOHNSON CO.
ELLIS CO
ST PAUL RD
OLD FORT WORTH RD
CEMENT VALLEY RD
WYATT RD
QUARRY RD
WARD RD
WEATHERFORD RD
N V JONES RD
NEW SHILOH RD
MORRIS RD
CLUNTON LN
PRIMROSE DR
DIVIDEND RD
EASTGATE RD
WALNUT
RUSTY RUN DRIVE
BRANDI RIDGE DR
TOWER RD
MCALPIN RD
BILLY RAY RD
MINDY
BAYLOR
MONROE DR
APPLE LN
OAK TREE LN
WHITEHEAD RD
DIAMOND CREEK DR
ASHFORD LN
PLAINVIEW RD
ZACHS
HATTY JAKES CT
287
67
360
(Figure_C-9)_Future_MD_Max_Headloss_11x17.mxd



(Figure_C-10)_Future_MD_FF_Availability_11x17.mxd

APPENDIX D
Capital Improvement Plan (CIP) Detailed Cost Estimates

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 1 — **Phase:** 10-Year

Project Name: Phase 1: Capacity Expansion at the Auger HSPS/Auger WTP Expansion/ Auger Clearwell Expansion

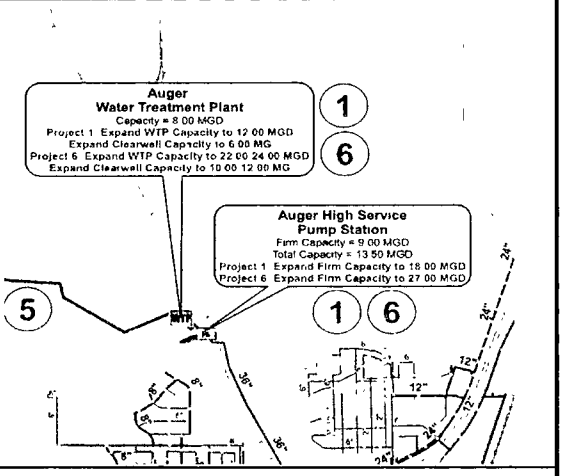
Project Description:

This project will expand capacity at the Auger WTP to 12 MGD. This project will also expand capacity of the Auger HSPS to 18 MGD. Clearwell storage at the Auger WTP will be expanded to 6 MG.

Project Drivers:

This project will add 4 MGD of treatment capacity to the Auger WTP, bringing firm treatment capacity to 12.0 MGD. This project will also add 9 MGD of pumping capacity to the Auger HSPS, bringing firm pumping capacity to 18 MGD. 3 MG of additional clearwell storage will be added to the Auger WTP, bringing total clearwell storage to 6 MG.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Auger WTP Expansion to 12 MGD	1	LS	$ 7,067,583	$ 7,067,583
2	3.0 MG Ground Storage Tank	1	LS	$ 3,000,000	$ 3,000,000
				SUBTOTAL:	**$ 10,067,600**
			CONTINGENCY	30%	$ 900,000
				SUBTOTAL:	**$ 10,967,600**
			ENG/SURVEY	20%	$ 2,193,600
				SUBTOTAL:	**$ 13,161,200**
				Estimated Project Total:	**$ 13,161,200**

Comments: Auger WTP Expansion OPCC from detailed OPCC dated 2/25/19. (Item 1 estimate includes treatment capacity expansion, HSPS improvements, strainer, hot water tank/pump and brine tank, 30% contingency, OH&P)

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

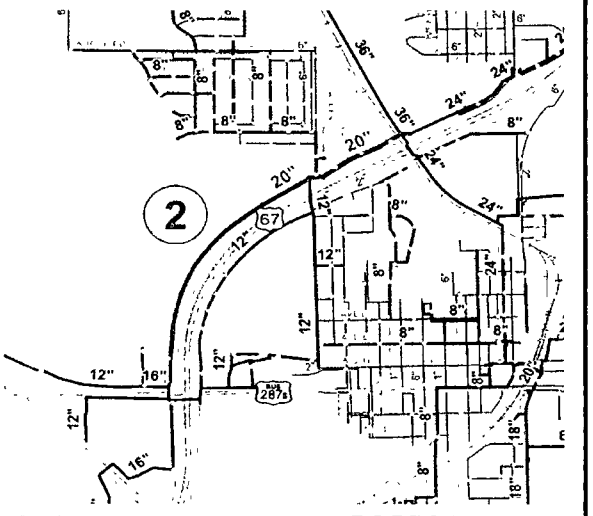
Construction Project Number: 2 — **Phase:** 10-Year

Project Name: 20-inch Capacity Expansion along Hwy 67

Project Description:

This project will upsize the existing 12-inch waterline between the railroad tracks and Overlook Drive to a 20-inch, and extend a new 20-inch section of transmission main along the northwestern side of Highway 67 between Overlook Drive and W. Avenue G.

Vicinity Map



Project Drivers:

This project will provide additional capacity to supply water from the Auger HSPS to the Grand Prairie delivery point and south to the Railport industrial area. Additionally, this project will reduce velocity and friction losses.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	20" WL & Appurtenances	5,550	LF	$ 180	$ 999,000
2	30" Boring and Casing	250	LF	$ 525	$ 131,250
3	Pavement Repair	556	SY	$ 150	$ 83,333
				SUBTOTAL:	**$ 1,213,600**
			CONTINGENCY	30%	$ 364,100
				SUBTOTAL:	**$ 1,577,700**
			ENG/SURVEY	20%	$ 315,600
				SUBTOTAL:	**$ 1,893,300**
				Estimated Project Total:	**$ 1,893,300**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 3 — **Phase:** 10-Year

Project Name: 16-inch/24-inch Railport Expansion

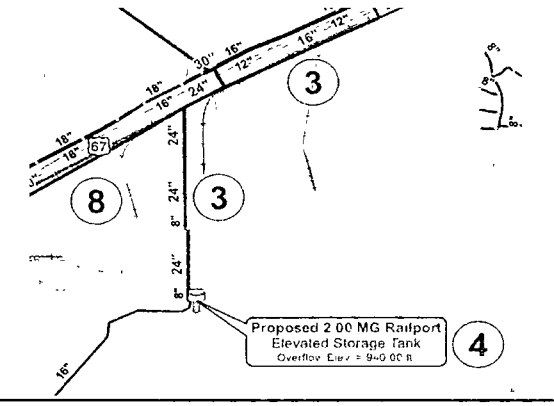
Project Description:

This project will extend a 16-inch water line along Highway 67 from an existing 16-inch to Cottonwood Creek. From there, a 24-inch line will replace an existing 8-inch water line to connect with an existing 16-inch waterline.

Project Drivers:

This project will add transmission capacity to the Railport industrial area and provide a large supply line for the future Railport EST.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	30" WL & Appurtenances	4,870	LF	$ 270	$ 1,314,900
2	16" WL & Appurtenances	3,215	LF	$ 144	$ 462,960
3	Pavement Repair	194	SY	$ 150	$ 29,167
4	48" Boring and Casing	150	LF	$ 840	$ 126,000
5	24" Boring and Casing	150	LF	$ 420	$ 63,000
				SUBTOTAL:	**$ 1,996,100**
			CONTINGENCY	30%	$ 598,900
				SUBTOTAL:	**$ 2,595,000**
			ENG/SURVEY	20%	$ 519,000
				SUBTOTAL:	**$ 3,114,000**
				Estimated Project Total:	**$ 3,114,000**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate	Costs in 2019 Dollars
Construction Project Number: 4	Phase: 10-Year
Project Name:	2.0 MG Railport Elevated Storage Tank

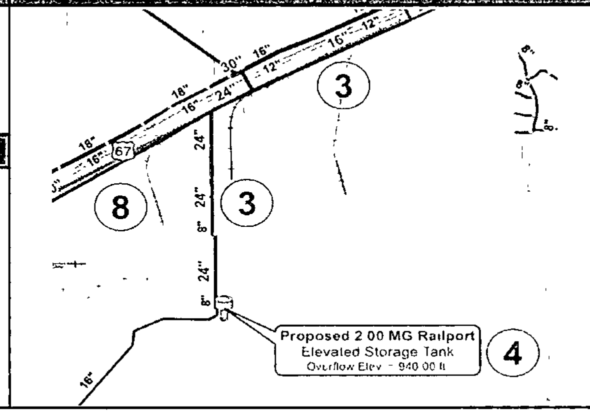
Project Description:

Proposed 2.0 MG Elevated Storage Tank located along Ward Road.

Project Drivers:

This project will add 2.0 MG of elevated storage in the Railport industrial area to supply projected increased demand.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	2.0 MG Elevated Storage Tank	1	LS	$ 5,250,000	$ 5,250,000
				SUBTOTAL:	**$ 5,250,000**
		CONTINGENCY		10%	$ 525,000
				SUBTOTAL:	**$ 5,775,000**
		ENG/SURVEY		10%	$ 577,500
				SUBTOTAL:	**$ 6,352,500**
				Estimated Project Total:	**$ 6,352,500**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 5 — **Phase:** 10-Year

Project Name: 36-inch/30-inch Western Transmission Main

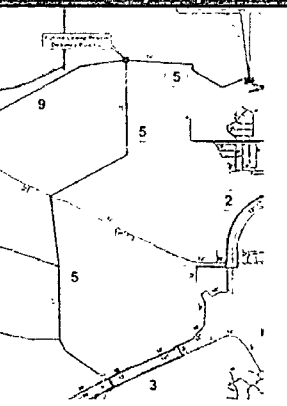
Project Description:

Proposed 36-inch and 30-inch transmission main from Auger HSPS to Highway 67 near the Railport area.

Project Drivers:

This project will add transmission capacity needed to supply demands at the Grand Prairie and Railport areas. Additionally, this project will reduce head at the Auger HSPS.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	30" WL & Appurtenances	18,016	LF	$ 270	$ 4,864,266
2	36" WL & Appurtenances	6,427	LF	$ 324	$ 2,082,348
3	Pavement Repair	110	SY	$ 150	$ 16,500
4	42" Boring and Casing	800	LF	$ 735	$ 588,000
				SUBTOTAL:	**$ 7,551,200**
			CONTINGENCY	30%	$ 2,265,400
				SUBTOTAL:	**$ 9,816,600**
			ENG/SURVEY	20%	$ 1,963,400
				SUBTOTAL:	**$ 11,780,000**
				Estimated Project Total:	**$ 11,780,000**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate	**Costs in 2019 Dollars**
Construction Project Number: 6	**Phase:** 10-Year
Project Name:	**Phase 2: Capacity Expansion at Auger HSPS/Auger WTP Expansion/Auger Clearwell Expansion**

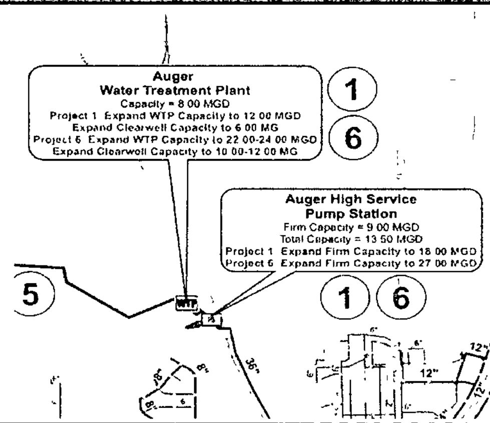
Project Description:

This project will add 9 MGD of pumping capacity at the Auger HSPS. This project will also expand the Auger WTP to 22-24 MGD and expand the Auger clearwell storage capacity to 10-12 MG.

Project Drivers:

This project will provide 9 MGD of additional pumping capacity from the Auger Water Treatment Plant, bringing firm pumping capacity at the Auger HSPS to 27 MGD. Additionally, this project will add 10-12 MGD of treatment capacity to the Auger WTP, bringing firm treatment capacity to 22-24 MGD. 4-6 MG of additional clearwell capacity at the Auger WTP will be added, bringing total clearwell storage capacity to 10-12 MG. This expansion is necessary to meet future projected demands.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Auger WTP Expansion to 22 MGD	1	LS	$ 28,128,029	$ 28,128,029
2	6.0 MG Ground Storage Tank	1	LS	$ 6,000,000	$ 6,000,000
				SUBTOTAL:	**$ 34,128,100**
		CONTINGENCY		30%	$ 1,800,000
				SUBTOTAL:	**$ 35,928,100**
		ENG/SURVEY		20%	$ 7,185,700
				SUBTOTAL:	**$ 43,113,800**
				Estimated Project Total:	**$ 43,113,800**

Comments: Auger WTP Expansion OPCC from detailed OPCC dated 6/14/19. Item 1 lump sum estimate already includes 30% contingency and OH&P. Contingency shown above is only for proposed clearwell.

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 7 — **Phase:** 10-Year

Project Name: 20-inch Upsize Railport Line and Railroad Crossing

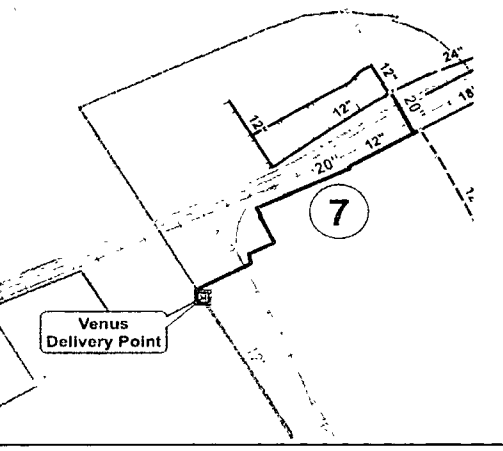
Project Description:

This project will extend a new 20-inch across Highway 67 and the railroad tracks along Miller Road/Railport Parkway. The new 20-inch crossing will connect to the existing 18-inch on the southern side of the railroad tracks. Additionally, the existing 12-inch line which runs southwest to the Venus wholesale meter will be upsized to 20-inch diameter.

Project Drivers:

The project will provide additional transmission capacity to supply increased demands at the Venus wholesale delivery point and in the Railport industrial area. Additionally, the 20-inch highway crossing along Miller Road will provide looping.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	20" WL & Appurtenances	6,092	LF	$ 180	$ 1,096,560
2	36" Boring and Casing	650	LF	$ 750	$ 487,500
3	Pavement Repair	25	SY	$ 150	$ 3,750
				SUBTOTAL:	**$ 1,587,900**
			CONTINGENCY	30%	$ 476,400
				SUBTOTAL:	**$ 2,064,300**
			ENG/SURVEY	20%	$ 412,900
				SUBTOTAL:	**$ 2,477,200**
				Estimated Project Total:	**$ 2,477,200**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 8 — **Phase:** 10-Year

Project Name: 20-inch Parallel Water Line from Railport EST

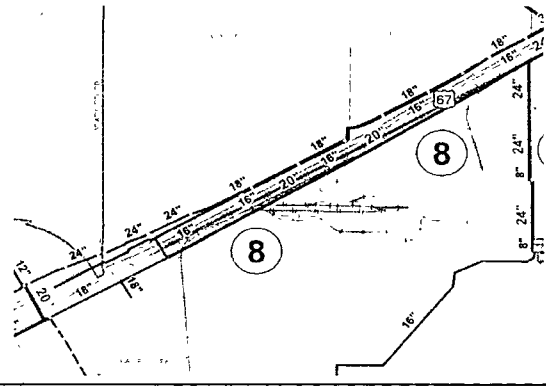
Project Description:

This project will extend a 20-inch water line parallel to Highway 67.

Project Drivers:

This project will add transmission capacity from the Railport EST to serve the industrial customers in the Railport area and Venus's wholesale demands. The parallel line will reduce friction losses and velocity in the existing 16-inch water line.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	20" WL & Appurtenances	7,950	LF	$ 180	$ 1,431,000
2	Pavement Repair	89	SY	$ 150	$ 13,333
				SUBTOTAL:	**$ 1,444,400**
			CONTINGENCY	30%	$ 433,400
				SUBTOTAL:	**$ 1,877,800**
			ENG/SURVEY	20%	$ 375,600
				SUBTOTAL:	**$ 2,253,400**
				Estimated Project Total:	**$ 2,253,400**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 9 — **Phase:** 10-Year

Project Name: 12-inch Grand Prairie Loop

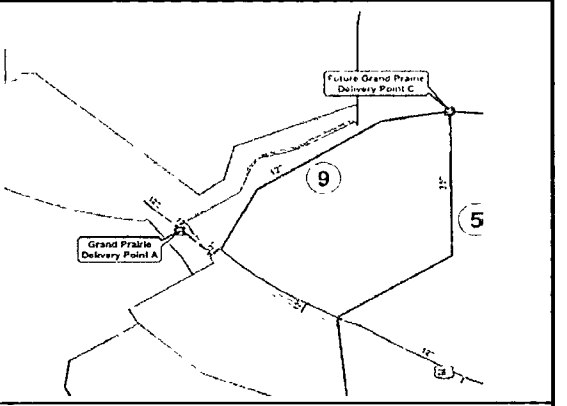
Project Description:

This project will extend a new 12-inch waterline from the proposed 30-inch Western Transmission Main at Quarry Road to the existing 12-inch waterline along Highway 287.

Project Drivers:

This project will provide looped supply to the Grand Prairie Delivery Point A.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	7,953	LF	$ 108	$ 858,924

		SUBTOTAL:	**$ 859,000**
	CONTINGENCY	30%	$ 257,700
		SUBTOTAL:	**$ 1,116,700**
	ENG/SURVEY	20%	$ 223,400
		SUBTOTAL:	**$ 1,340,100**
		Estimated Project Total:	**$ 1,340,100**

Comments:

City of Midlothian

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 10 — **Phase:** 10-Year

Project Name: 20-inch Transmission along Highway 287

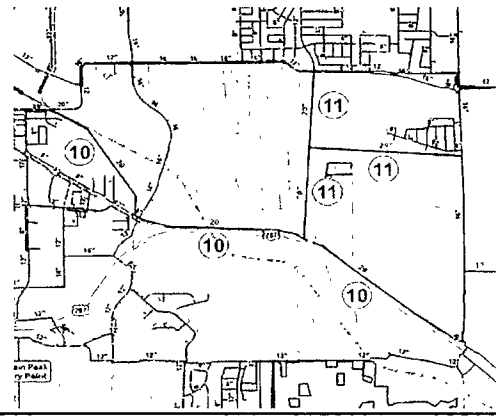
Project Description:

This project will extend a 20-inch transmission line along Highway 287 from Walnut Grove Road to Midlothian Parkway. From there, the 20-inch transmission line will extend westward to E. Avenue East (FM 1387).

Project Drivers:

This project will increase transmission capacity and provide looping to serve increased future demands in the eastern service area.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	20" WL & Appurtenances	16,941	LF	$ 180	$ 3,049,380
2	36" Boring and Casing	750	LF	$ 750	$ 562,500
3	Pavement Repair	278	SY	$ 150	$ 41,667
				SUBTOTAL:	**$ 3,653,600**
		CONTINGENCY		30%	$ 1,096,100
				SUBTOTAL:	**$ 4,749,700**
		ENG/SURVEY		20%	$ 950,000
				SUBTOTAL:	**$ 5,699,700**
				Estimated Project Total:	**$ 5,699,700**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

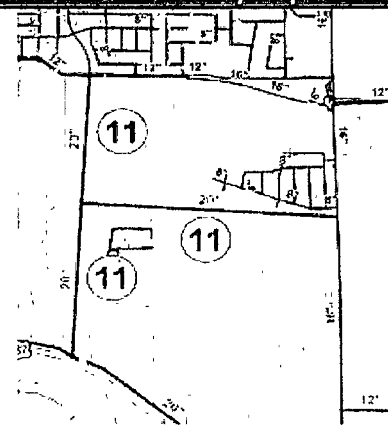
Construction Project Number: 11 — **Phase:** 10-Year

Project Name: **20-inch Water Line between Hwy 287 and FM 1387**

Project Description:

This project will extend a 20-inch water line between Highway 287 near Enterprise Drive north to connect to an existing 12-inch water line along FM 1387. A 20-inch water line will also be extended between the existing 16-inch water line along Walnut Grove Road and the new 20-inch line between Highway 287 and FM 1387.

Vicinity Map



Project Drivers:

This project will provide looping and transmission capacity to meet future demands in the eastern service area.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	20" WL & Appurtenances	10,858	LF	$ 180	$ 1,954,440
				SUBTOTAL:	**$ 1,954,500**
		CONTINGENCY		30%	$ 586,400
				SUBTOTAL:	**$ 2,540,900**
		ENG/SURVEY		20%	$ 508,200
				SUBTOTAL:	**$ 3,049,100**
				Estimated Project Total:	**$ 3,049,100**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 12 — **Phase:** 10-Year

Project Name: Diamond J Improvements

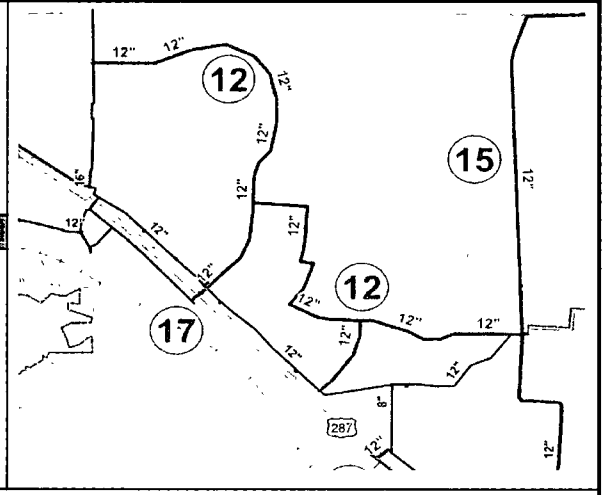
Project Description:

This project will extend a system of 12-inch water lines along the thoroughfares in the Diamond J area.

Project Drivers:

This project will add transmission capacity to supply water to future development within the Diamond J area.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	17,540	LF	$ 108	$ 1,894,320
2	Pavement Repair	89	SY	$ 150	$ 13,333
				SUBTOTAL:	$ **1,907,700**
			CONTINGENCY	30%	$ 572,400
				SUBTOTAL:	$ **2,480,100**
			ENG/SURVEY	20%	$ 496,100
				SUBTOTAL:	$ **2,976,200**
				Estimated Project Total:	$ **2,976,200**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate	**Costs in 2019 Dollars**
Construction Project Number: 13	**Phase: 10-Year**
Project Name:	**16-inch Loop along New Shiloh Road**

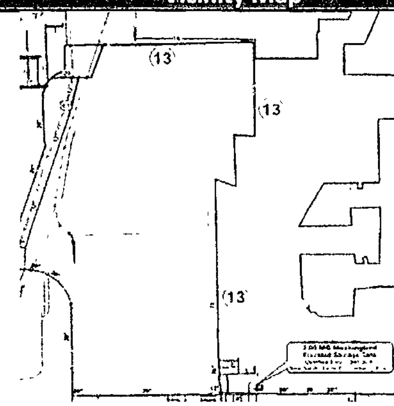
Project Description:

This project will extend a 16-inch water line east along Shiloh Road to Tar Road. At the intersection Tar Road and Shiloh Road, the line will continue southward along Tar Road and Onward Road to connect to the existing 16-inch line along Onward Road.

Project Drivers:

This project will provide redundant, looped transmission capacity from the Tayman HSPS to the Mockingbird EST to supply future projected demands.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	16" WL & Appurtenances	22,579	LF	$ 144	$ 3,251,376
2	24" Boring and Casing	350	LF	$ 420	$ 147,000
3	Pavement Repair	67	SY	$ 150	$ 10,000
				SUBTOTAL:	**$ 3,408,400**
		CONTINGENCY		30%	$ 1,022,600
				SUBTOTAL:	**$ 4,431,000**
		ENG/SURVEY		20%	$ 886,200
				SUBTOTAL:	**$ 5,317,200**
				Estimated Project Total:	**$ 5,317,200**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate | **Costs in 2019 Dollars**

Construction Project Number: 14 | **Phase:** 10-Year

Project Name: Capacity Expansion at Tayman HSPS/ Transmission Line Expansion/Capacity Expansion at the Tayman WTP/Tayman Clearwell Expansion

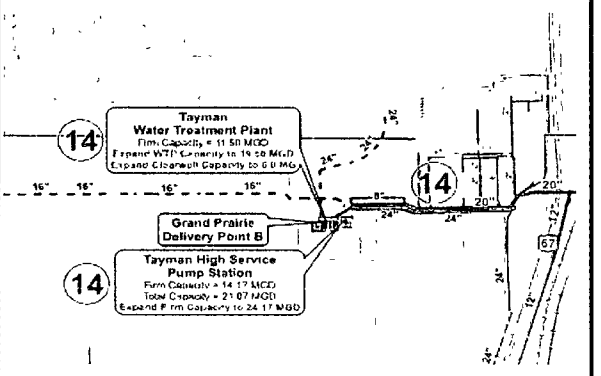
Project Description:

This project will add 10 MGD of pumping capacity at the Tayman HSPS and a parallel 20-inch transmission main. This project will also expand the capacity at the Tayman WTP to 20.00 MGD and increase clearwell storage to 6 MG.

Project Drivers:

This project will add 10 MGD pumping capacity to the Tayman HSPS, bringing firm pumping capacity to 24.17 MGD. This expansion is necessary to satisfy projected 10-year maximum day demands. The parallel 20-inch transmission main will reduce friction losses and add transmission capacity. The WTP expansion will add 8.0 MGD of additional treatment capacity, bringing the firm treatment capacity to 19.50 MGD. 2 MG of additional clearwell storage will be added to the WTP, bringing total Tayman clearwell storage to 6 MG.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Pump Station - Expans 10 MGD	1	LS	$ 3,000,000	$ 3,000,000
2	20" WL & Appurtenances	4,875	LF	$ 180	$ 877,500
3	Pavement Repair	156	SY	$ 150	$ 23,333
4	36" Boring and Casing	500	LF	$ 750	$ 375,000
5	Tayman WTP Expansion to 21.5 MGD	1	LS	$ 32,220,000	$ 32,220,000
6	2.0 MG Ground Storage Tank	1	LS	$ 2,000,000	$ 2,000,000
				SUBTOTAL:	**$ 38,495,900**
			CONTINGENCY	30%	$ 1,882,800
				SUBTOTAL:	**$ 40,378,700**
			ENG/SURVEY	20%	$ 1,255,200
				SUBTOTAL:	**$ 41,633,900**
				Estimated Project Total:	**$ 41,633,900**

Comments: Item 5 (Tayman WTP Expansion to 21.5 MGD) lump sum estimate already includes contingency, engineering, and construction administration (RPR is not included).

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 15 — **Phase:** 10-Year

Project Name: 12-inch Eastern Loop

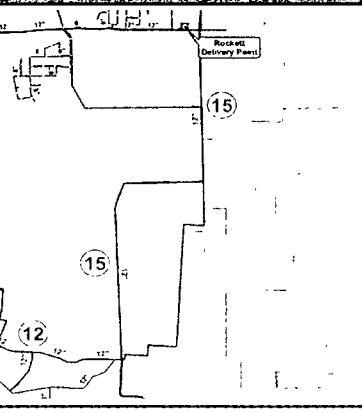
Project Description:

This project will extend a 12-inch water line between the existing 12-inch along Rex Odom Road to connect with the existing 12-inch water line along FM 1387 near the Rockett wholesale meter.

Project Drivers:

This project will add capacity for future growth and provide a redundant, looped supply to serve Rockett's wholesale demands. This project will reduce headlosses and velocities in the existing 12-inch single service line to Rockett.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	14,527	LF	$ 108	$ 1,568,916
2	Pavement Repair	550	SY	$ 150	$ 82,500
				SUBTOTAL:	**$ 1,651,500**
			CONTINGENCY	30%	$ 495,500
				SUBTOTAL:	**$ 2,147,000**
			ENG/SURVEY	20%	$ 429,400
				SUBTOTAL:	**$ 2,576,400**
				Estimated Project Total:	**$ 2,576,400**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate — **Costs in 2019 Dollars**

Construction Project Number: 16 — **Phase:** 10-Year

Project Name: 12-inch Loop to Rockett Delivery Point

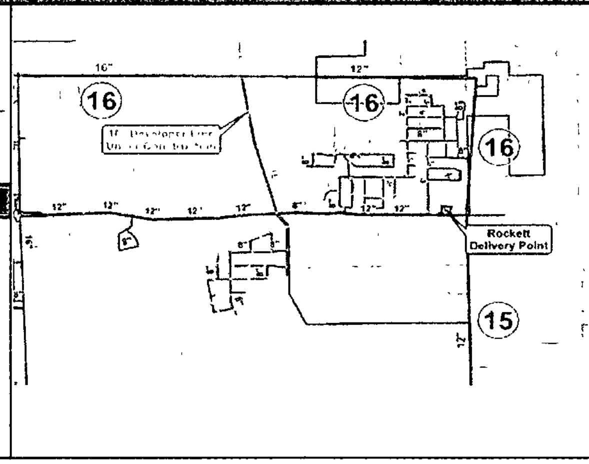
Project Description:

This project will extend a 12-inch water line north approximately 0.7 miles from the existing 12-inch line along FM 1387 which supplies Rockett's wholesale meter. From there, the line will turn west and connect with a 16-inch water line currently under construction.

Project Drivers:

This project will add looping and redundancy to supply the Rockett wholesale delivery point. This 12-inch line will also reduce friction loss and velocity.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	10,425	LF	$ 108	$ 1,125,900
2	Pavement Repair	222	SY	$ 150	$ 33,333
3	20" Boring and Casing	200	LF	$ 350	$ 70,000
			SUBTOTAL:		**$ 1,229,300**
		CONTINGENCY		30%	$ 368,800
			SUBTOTAL:		**$ 1,598,100**
		ENG/SURVEY		20%	$ 319,700
			SUBTOTAL:		**$ 1,917,800**
			Estimated Project Total:		**$ 1,917,800**

Comments:

City of Midlothian

FREESE AND NICHOLS | Midlothian DFW's Southern Star

DRAFT Capital Improvement Cost Estimate	Costs in 2019 Dollars
Construction Project Number: 17	Phase: 10-Year
Project Name:	12-Inch Connections

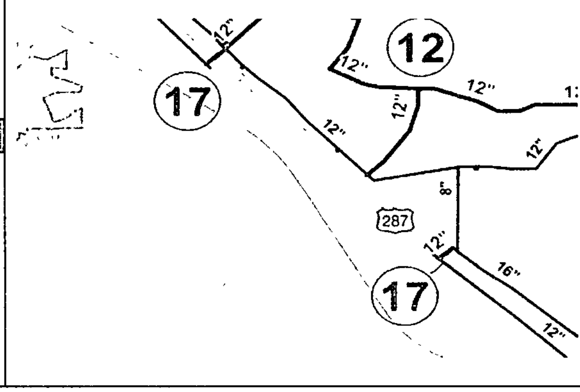
Project Description:

This project extends two 12-inch water line connections beneath Highway 287 to connect to existing water main and promote looping.

Project Drivers:

This project will add looping to the water supply system along Highway 287.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	470	LF	$ 108	$ 50,760
2	20" Boring and Casing	350	LF	$ 350	$ 122,500
			SUBTOTAL:		**$ 173,300**
		CONTINGENCY		30%	$ 52,000
			SUBTOTAL:		**$ 225,300**
		ENG/SURVEY		20%	$ 45,100
			SUBTOTAL:		**$ 270,400**
			Estimated Project Total:		**$ 270,400**

Comments:

City of Midlothian

DRAFT Capital Improvement Cost Estimate | **Costs in 2019 Dollars**

Construction Project Number: 18 | **Phase:** 10-Year

Project Name: New 1.5 MG EST

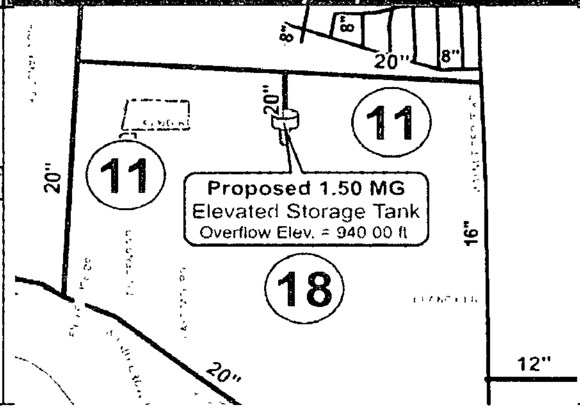
Project Description:

This project involves construction of a new 1.5 MG elevataed water storage tank along the proposed 20-inch transmission main (Project 11).

Project Drivers:

This project will add 1.5 MG of additional elevated storage to the system to serve future demands.

Vicinity Map



Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1.5 MG Elevated Storage Tank	1	LS	$ 3,937,500	$ 3,937,500
				SUBTOTAL:	**$ 3,937,500**
		CONTINGENCY	30%		$ 1,181,300
				SUBTOTAL:	**$ 5,118,800**
		ENG/SURVEY	10%		$ 511,900
				SUBTOTAL:	**$ 5,630,700**
				Estimated Project Total:	**$ 5,630,700**

Comments: