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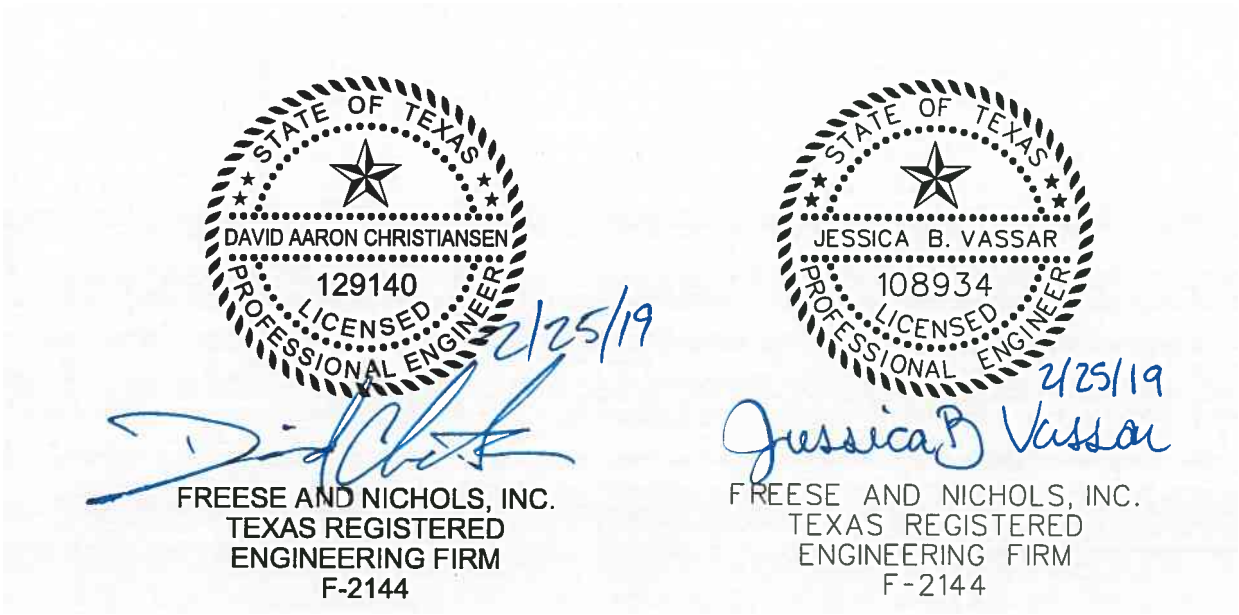
WATER, WASTEWATER, AND REUSE SYSTEM MASTER PLAN

Prepared for:

City of Fair Oaks Ranch



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EXECUTIVE SUMMARY

1.0 INTRODUCTION

The City of Fair Oaks Ranch is a community located in central Texas and straddles three counties: Bexar, Comal, and Kendall. The City currently provides water service to almost 3,000 customers and wastewater service to roughly 1,750 customers. The population within the service area is projected to grow by just over 2,000 connections in the next 20 years. Accommodating this growth in an efficient and effective manner, while also focusing on the maintenance of existing water, wastewater, and reuse system assets, is the purpose of this Water, Wastewater, and Reuse Master Plan. This report has been prepared to provide the City of Fair Oaks Ranch with a planning tool that will serve as a guide for short-term and long-term improvements to infrastructure within the water, wastewater, and reuse systems.

2.0 POPULATION AND NON-RESIDENTIAL LAND USE

Growth projections are an important component of the master planning process. The magnitude and distribution of the growth will dictate where future infrastructure is required. For this study, data on future land use and population projections were provided by Gap Strategies as part of the Comprehensive Plan for the City of Fair Oaks Ranch. **Table ES-1** presents a summary of the connection projections for the Water and Wastewater Service Areas.

Table ES-1: Water and Wastewater Connection Projections

Year	Water Connections	Wastewater Connections
2018	2,880	1,740
2023	3,728	2,455
2028	4,578	3,169
Buildout	4,914	3,502

3.0 WATER DEMAND PROJECTIONS AND SUPPLY EVALUATION

Water demands were projected for 2018, 2023, 2028, and Buildout conditions for the City of Fair Oaks Ranch. The evaluation of historical trends in the usage data provided a basis for determining the design criteria used to project average day water demands. An average day demand of 500 gallons per connection per day (gpCd) was selected, along with a 2.50 maximum day to average day peaking factor and a 2.00 peak hour to maximum day peaking factor. **Table ES-2** shows the demand projections for 2018, 2023, 2028, and Buildout in million gallons per day (MGD).

Table ES-2: Water Demand Projections

Year	Average Day Demand (MGD)	Maximum Day Demand (MGD)	Peak Hour Demand (MGD)
2018	1.44	3.60	7.20
2023	1.86	4.66	9.32
2028	2.29	5.72	11.45
Buildout	2.46	6.14	12.29

Based on growth projections, the City's water demands will eventually surpass their total current supply of 3.7 MGD from the both the Trinity Aquifer and the Guadalupe-Blanco River Authority (GBRA). To provide the City with a conservative estimate of the amount of water supply needed to serve projected growth, it was determined that the City should have adequate supply capacity to meet 100% of maximum day demands. Zone C was not included because there is very little projected growth in that part of the service area, and no additional supply is needed through Buildout. For Zones A and B, the projected maximum day demand surpasses the available supply beginning in 2026, even when assuming an increase in supply from GBRA up to the maximum allowable amount of 1,850 acre-feet per year, or 1.65 MGD, in 2022. A water supply evaluation was performed, and it was determined that obtaining additional GBRA supply was the most cost-effective solution to address the projected future supply deficit.

4.0 WATER SYSTEM ANALYSES

The City of Fair Oaks Ranch's water distribution system consists of three independent pressure zones, a network of water lines ranging in diameter from 2 inches to 12 inches, seven ground storage tanks (GST), five pump stations (PS), 30 active groundwater wells, and a wholesale supply connection to GBRA's Western Canyon transmission main.

The existing hydraulic water model was updated in the InfoWater® software by Innovyze. The model pipeline network was updated from the City's geographic information system (GIS). Demands were allocated using metered billing data provided by the City.

Hydraulic analyses were performed under existing maximum day and peak hour demand conditions to evaluate system operations, residual pressures, and available fire flow throughout the distribution system. Most of the system is able to meet the TCEQ minimum pressure requirement of 35 psi, but the areas along Meadow Creek Trail near the fire station and Enclave neighborhood show modeled pressures below 35 psi. Large portions of the system have available fire flow below 500 gpm due to small-diameter

lines. These large areas with available fire flow below 500 gpm were addressed as part of the capital improvement plan (CIP).

As a public water utility, the City of Fair Oaks Ranch must comply with the rules and regulations for public water systems set forth by the Texas Commission on Environmental Quality (TCEQ) in Chapter 290, Public Drinking Water. In a letter dated September 1, 2017, the City was cited by TCEQ for reaching 91% and 95% of its hydropneumatic tank capacity in Zones A and C, respectively. The City has responded to that citation, and the recommendations in this report address the impending shortage of hydropneumatic storage in both pressure zones. The City is currently meeting or exceeding all TCEQ minimum pumping and storage requirements.

Hydraulic model analyses were performed on the distribution system under future demand conditions. Model runs were conducted under maximum day and peak hour demand conditions for each future planning period to identify areas of concern and to develop recommended improvements.

5.0 WATER SYSTEM CAPITAL IMPROVEMENT PLAN

A CIP was developed for the City of Fair Oaks Ranch water system. Below is a summary of CIP projects and the issues that triggered them for each planning period.

- 2023:
  - Additional hydropneumatic storage at Plant #2 to remain in compliance with TCEQ minimum requirements until elevated storage can be constructed in Zone C
  - A new elevated storage tank to provide emergency and equalization storage in Zone A
  - Line improvements to serve growth in the northeastern portion of the Water Service Area
  - Additional pumping and storage capacity at Plant #5 to meet FNI recommended capacity in Zones A and B
  - Additional pumping capacity at Elmo Davis to maintain adequate pressure during periods of peak demand in Zone C
- 2028:
  - A new pressure reducing valve (PRV) along to Meadow Creek Trail to make use of existing infrastructure and provide more redundancy for Zone B
  - Line improvements to serve growth in the eastern portion of the Water Service Area
  - A new pump station (Plant #6) to provide Zones A and B with adequate pumping capacity and improved system pressure and to improve available fire flow in Zone A
  - Replace existing small diameter lines to improve fire flow and transmission capacity.

  - Added water lines in the South PP to serve development.
- Buildout:
  - Line improvements to improve transmission capacity and available fire flow in Zone C
  - A new elevated storage tank to provide emergency and equalization storage in Zone C

The recommended improvements will provide the required capacity and reliability to meet projected water demands through Buildout conditions. Locations shown for new pipeline and other recommended improvements were generalized for hydraulic analysis. Specific alignments and sites will be determined as part of the design process. It is recommended that these projects be constructed generally in the order listed. However, development patterns may make it necessary to construct some projects sooner or later than anticipated. The recommended projects are presented on **Figure ES-1**. Detailed descriptions and cost estimates for the proposed water system projects are included in **Appendix F**.

Table ES-3 summarizes the costs of the water capital improvements plan for the City of Fair Oaks Ranch. The costs are in 2018 dollars and include an allowance for engineering, surveying, and contingencies. Cost estimates do not include allowances for right-of-way acquisition.

Plant #3
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 8,000 gal Hydropneumatic Tank

Plant #3 Pump Station
Firm Capacity = 850 gpm
Total Capacity = 1,300 gpm

Plant #5
0.125 MG Ground Storage Tank
0.50 MG Ground Storage Tank

Zone A Pump Station
Firm Capacity = 575 gpm
Total Capacity = 1,150 gpm

Zone B Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,600 gpm
400 gpm Zone B PS Expansion

GBRA Delivery Point

New Pressure Reducing Valve

0.50 MG Zone A EST

Plant #6
600 gpm Zone A PS
1,600 gpm Zone B PS
1.00 MG GST

New GBRA Delivery Point

Elmo Davis Plant
(2) - 0.5 MG Ground Storage Tanks
(2) - 5,000 gal. Hydropneumatic Tanks

Zone C Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,450 gpm
650 gpm Zone C PS Expansion

Plant #2 Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,250 gpm

Plant #2
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 8,000 gal. Hydropneumatic Tank

0.50 MG Plant #2 EST

9,000 gal. Hydropneumatic Tank

FIGURE ES-1
CITY OF FAIR OAKS RANCH
WATER SYSTEM CAPITAL IMPROVEMENT PLAN
LEGEND

5-Year Improvements
- Valve
- Pump Station
- Hydropneumatic Tank
- Ground Storage Tank
- Elevated Storage Tank
- Water Line

10-Year Improvements
- Pump Station
- Ground Storage Tank
- Water Line

Buildout Improvements
- Elevated Storage Tank
- Water Line

Existing Water Systen
- Well
- Pump Station
- Hydropneumatic Tank
- Ground Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- GBRA Western Canyon Line
- Road
- Stream
- Parcel
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

PRESSURE ZONES
- Zone A (1,525 feet)
- Zone B (1,460 feet)
- Zone C (1,555 feet)

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Table ES-3: Water System Capital Improvement Plan

Project Number	Project Name	Cost
	Short Term Projects	
1	9,000-Gallon Plant #2 Hydropneumatic Tank (Zone C)	$ 246,700
2	0.5-MG Zone A Elevated Storage Tank (Zone A)	$ 3,289,000
3	12-inch West Ammann Road Water Line (Zone A)	$ 1,016,600
4	12-inch Northeast Water Lines (Zone A)	$ 1,614,600
5	400-gpm Plant #5 Zone B Pump Station Expansion and 0.5-MG GST (Zone B)	$ 2,167,800
6	650-gpm Elmo Davis Pump Station Expansion (Zone C)	$ 971,800
7	Pressure Reducing Valve at Rolling Acres Trail and Meadow Creek Trail (Zone B)	$ 149,500
	Short Term Total	**$ 9,456,000**
	Intermediate Projects	
8	8-inch Water Line at Dietz Elkhorn Road and Ralph Fair Road (Zone C)	$ 287,100
9	12-inch Southeastern Water Lines (Zone B)	$ 2,619,300
10	12/16-inch Plant #6 Discharge Water Lines (Zone A/B)	$ 2,822,600
11	Plant #6 and New GBRA Delivery Point (Zone A/B)	$ 5,905,300
12	12-inch ETJ Water Line (Zone B)	$ 2,559,500
	Intermediate Total	**$ 14,193,800**
	Long Term Projects	
13	0.5-MG Plant #2 Elevated Storage Tank (Zone C)	$ 3,289,000
14	8/12-inch Royal Ascot/Triple Crown/Equestrian Water Line Replacement (Zone C)	$ 1,085,400
15	8-inch Pimlico Lane Water Line Replacement (Zone C)	$ 758,000
16	8-inch Preakness Lane Water Line Replacement (Zone C)	$ 991,200
17	12-inch Triple Crown Road Water Line Replacement (Zone C)	$ 1,448,700
18	8-inch Rolling Acres Trail Water Line (Zone A)	$ 649,200
19	8-inch Post Oak Trail Water Line (Zone A)	$ 1,295,500
20	8-inch Silver Spur Trail Water Line (Zone A)	$ 677,500
	Long Term Total	**$ 10,194,500**
	CIP Total	**$ 33,844,300**

6.0 WASTEWATER FLOW PROJECTIONS

Future wastewater flows were developed by selecting a design criterion for average annual daily flow based on historical flows and a wet weather peaking factor. Based on this analysis, FNI utilized a value 160 gpCd for average annual daily flow, and a wet weather peaking factor of 3.5. A wet weather peaking factor of 3.5 was selected in absence of historical peak flow data based on discussions with City staff indicating that the collection system has relatively low amounts of infiltration and inflow (I/I), or water that enters the system through cracks/openings in the collection system due to rainfall or the presence of groundwater. **Table ES-4** summarizes the total projected average daily and peak wet weather wastewater flows by planning period.

Table ES-4: Projected Wastewater Flows

Year	Wastewater Connections	Gallons per Connection per Day	Average Annual Daily Flow (MGD)	Wet Weather Peaking Factor	Peak Wet Weather Flow (MGD)
2018	1,740	160	0.28	3.50	0.97
2023	2,455	160	0.39	3.50	1.37
2028	3,169	160	0.51	3.50	1.77
Buildout	3,502	160	0.56	3.50	1.96

7.0 WASTEWATER SYSTEM ANALYSES

The City of Fair Oaks Ranch's wastewater collection system consists of seven lift stations (LS) and associated force mains, a wastewater treatment plant, and a network of gravity mains ranging from 4 inches to 16 inches in diameter. The City of Fair Oaks Ranch owns and operates one wastewater treatment plant (WWTP) with a current permitted capacity of 0.5 MGD annual average day flow (AADF).

The existing hydraulic model was converted to Innovyze's InfoSewer® software and updated based on the City's most recent GIS data of their collection system. Pipelines that have been constructed since the last study were added to the model.

Hydraulic modeling analyses were conducted to identify deficiencies in the City of Fair Oaks Ranch's existing wastewater collection system and to establish a capital improvement plan to improve the existing system and accommodate the projected wastewater flows through Buildout. Various combinations of improvements and modifications were investigated to determine the most appropriate approach for conveying projected flows. Parameters used in developing the improvement plan included simplifying system operations, conveying peak wet weather flows in areas of projected growth, and increasing treatment capacity.

8.0 WASTEWATER SYSTEM CAPITAL IMPROVEMENTS PLAN

A wastewater system CIP was developed for the City of Fair Oaks Ranch based on hydraulic modeling results. The recommended improvements will provide the required capacity and reliability to meet projected wastewater flows through Buildout conditions. To serve future growth, the City of Fair Oaks Ranch must upsize existing infrastructure and provide additional service to areas of growth. The following key observations and recommendations resulted from modeling and evaluating the collection system.

A. Simplify Operations and Energy Savings

Based on existing topography and the configuration of the collection system, the Falls LS is capable of being bypassed using a new gravity main conveying flow north to existing mains. Once the new WWTP is constructed, the Setterfeld LS is also able to be bypassed, with its flow being conveyed instead through a gravity main to the new WWTP site. Eliminating these LSs reduces the cost of operating and maintaining the collection system and simplifies system operations.

B. Growth

New collection mains and lift stations are required to provide service to new developments in the wastewater service area. Lines were sized based on the flows of each specific area served with a minimum diameter of 8-inches.

C. Increase Treatment Capacity

The existing WWTP has a permitted capacity of 0.5 MGD. TCEQ §305.126, commonly referred to as the 75/90 rule, requires a WWTP permit holder to begin planning for expansion of the treatment facility when the average daily or average annual flow reaches 75% of the permitted capacity. When the average daily or average annual flow reaches 90% of the permitted capacity, the permit holder shall obtain necessary authorization from the commission to commence construction of the necessary additional treatment facilities. For the sake of projecting trends, Buildout was estimated to occur in 2033. The average annual daily flows are projected to exceed 75% of the WWTP capacity by 2023, 90% of capacity by 2026, and 100% of capacity by 2028, indicating that the City must begin planning the construction of either an expansion to the existing plant or a new plant by 2023, be under construction by 2026, and be finished and operational by 2028.

It is recommended that the City move forward with designing and constructing a new 0.6-MGD WWTP rather than expanding the existing facility. It should be noted that, although the recommended capacity is only 100,000 gallons per day higher than the existing permitted capacity, many improvements would be required at the existing facility to enable it to treat even the permitted 0.5 MGD, let alone 0.6 MGD. The limited space available at the existing site, existing issues with the required buffer zone between the treatment facility and surrounding buildings, and a historically contentious relationship with the facility's neighbors all factor in to the recommendation to build a new facility in a different location.

Recommended projects are presented on **Figure ES-2**. Locations shown for new sewer pipelines and other recommended improvements were generalized for hydraulic analysis. Specific alignments and sites will be determined as part of the design process. It is recommended that these projects be constructed generally in the order listed. However, development patterns may make it necessary to construct some projects sooner or later than anticipated. Detailed descriptions and cost estimates for the proposed water system projects are included in **Appendix G**.

Table ES-5 summarizes the cost estimates of the wastewater capital improvements plan for the City of Fair Oaks Ranch. The cost estimates are in 2018 dollars and include an allowance for engineering, surveying, and contingencies. Cost estimates do not include allowances for right-of-way or land acquisition.

FIGURE ES-2
CITY OF FAIR OAKS RANCH
WASTEWATER SYSTEM CAPITAL IMPROVEMENT PLAN

LEGEND

5-Year Improvements

- Lift Station
- Wastewater Treatment Plant
- Wastewater Line
- Force Main

10-Year Improvements

- Wastewater Line

Buildout Improvements

- Lift Station
- Wastewater Line

Existing Wastewater System

- Lift Station
- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- Force Main
- Road
- Stream
- Index Contour (50-ft)
- Intermediate Contour (10-ft)
- Fair Oaks Ranch City Limit
- Other City Limit
- County Boundary

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Table ES-5: Wastewater System Capital Improvement Plan

Project Number	Project Name	Cost
Short Term Projects		
1	8-inch Gravity Line and Decommission Falls Lift Station	$ 550,900
2	New Wastewater Treatment Plant	$ 21,427,100
3	New Gravity Line from Old WWTP to New WWTP	$ 1,830,300
4	Decommission Existing WWTP	$ 1,495,000
Short Term Total		**$ 25,303,300**
Intermediate Projects		
5	12/15-inch Gravity Line in the ETJ	$ 878,500
6	12-inch Gravity Line in the ETJ	$ 728,900
7	12-inch Gravity Line in the ETJ	$ 511,300
8	10-inch Gravity Line north of Ralph Fair Road	$ 699,700
9	8/10-inch Gravity Line north of Ralph Fair Road	$ 929,600
10	8-inch Gravity Line north of Dietz Elkhorn Road	$ 483,300
11	8-inch Gravity Line east of Ralph Fair Road	$ 358,000
12	10-inch Gravity Line crossing Cibolo Creek	$ 498,700
13	12-inch Gravity Line to the new WWTP	$ 381,300
Intermediate Total		**$ 5,469,300**
Long Term Projects		
14	10-inch Gravity Line and Decommission Setterfeld Lift Station	$ 738,600
Long Term Total		**$ 738,600**
CIP Total		**$ 31,511,200**

9.0 NON-POTABLE REUSE SYSTEM EVALUATION

The City of Fair Oaks Ranch currently has a successful water reuse program which provides non-potable reuse water from its WWTP to the golf course for irrigation purposes. The City is contractually obligated to provide all the effluent from the WWTP to the golf course. A copy of the effluent disposal agreement is provided in **Appendix I.** The existing reuse system consists of a network of lines ranging from 6 inches to 8 inches, two chlorine stations, and three effluent storage ponds.

In the future, the City has plans to build a new WWTP. This plant will allow the City to treat additional wastewater flows and provide additional effluent for reuse. Under the current contract with the golf course, the City is obligated to provide all the WWTP effluent to the golf course. FNI evaluated the capacity of the golf course to handle the Buildout average annual daily flow of 0.56 MGD. Utilizing 30 Tex. Admin. Code §285.90 (1) Figure 1, FNI determined that the maximum application rate for the Fair Oaks Ranch golf course is 0.064 gallons per square foot per day. According to the effluent disposal agreement between the City and golf course, the golf course has approximately 280 acres for application of reuse

water. Using the maximum application rate, this allows for up to 0.78 MGD of effluent to be used for the golf course. By these calculations, the City can continue to send all the effluent through Buildout to the golf course. To pump reuse water from the proposed wastewater treatment plant back to the golf course, FNI recommends a new pump station and pipeline to connect to the existing reuse infrastructure. Capital costs were calculated for the recommended improvements and are summarized in **Table ES-6**. The costs are provided as estimates based on previous similar engineering experience in 2018 dollars and include an allowance for engineering, surveying, and contingencies. Recommended projects are presented on **Figure ES-3**. Locations of projects have been generalized during the hydraulic analysis. Specific locations of project alignment and location will be determined as a part of the design process. If the City can renegotiate their contact with the golf course when the new WWTP is built, the City should consider the option of extending purple pipe to the neighborhoods north of the WWTP to utilize effluent.

Table ES-6: Reuse System Improvements Opinion of Probable Construction Cost

Item	Description	Quantity	Unit	Unit Price	Total
1	Pump Station - New 2.0 MGD	1	LS	$1,338,000	$1,338,000
2	12" Reuse Line	5,070	LF	$120	$608,400
3	8" Reuse Line	1,020	LF	$80	$81,600
4	20" Boring and Casing	200	LF	$400	$80,000
				Subtotal:	**$2,108,000**
			Contingency	30%	$632,400
				Subtotal:	**$2,740,400**
			Eng./Survey	15%	$411,060
				Subtotal:	**$3,151,460**
				Estimated Project Total:	**$3,151,460**

FIGURE ES-3
CITY OF FAIR OAKS RANCH
REUSE SYSTEM CAPITAL IMPROVEMENTS PLAN

LEGEND

Proposed Reuse Improvements

- Pump Station (PS)
- Wastewater Treatment Plant (WWTP)
- Reuse Line

Existing Reuse System

- Chlorine Station (C)
- Ground Storage Tank
- Pump Station (PS)
- Wastewater Treatment Plant (WWTP)

- Effluent Main
- Effluent Storage Pond
- Road
- Index Contour (50-ft)
- Intermediate Contour (10-ft)
- Stream
- Pond
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

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10.0 RISK-BASED ASSESSMENT

A risk-based assessment of the water, wastewater, and reuse facilities was conducted to assist in the prioritization of recommended operations and maintenance improvements. The assessment was based on the condition and criticality of existing facilities. Site visits were performed by FNI and City staff in August 2017 to evaluate the condition of the facilities, and redundancy, distance from sensitive features, and population served were used to measure criticality. A scoring system was developed to provide an analytical and quantitative method to evaluate the condition and criticality of each facility. The results of both the criticality and condition analysis were utilized to develop a rehabilitation CIP, which is summarized in **Table ES-7**. Recommended rehabilitation projects are presented on **Figure ES-4**. A report containing the details of the existing WWTP assessment and proposed improvements can be found in **Appendix H**.

Table ES-7: Rehabilitation Capital Improvement Plan

Project Number	Project Title	Project Cost
1 & 2	Elmo Davis GST #1 & GST #2 – Mechanical/Structural	$313,270
3	Elmo Davis Pump Station – Electrical	$256,930
4	Wastewater Treatment Plant	$4,087,530
5	Plant #3 Pump Station – Electrical/Instrumentation	$255,290
6	Creek Crossing Repair West	$34,130
7	Creek Crossing Repair Central	$34,130
8	School Lift Station – Mechanical	$196,630
9	Deer Meadows Lift Station #2 – Instrumentation	$111,320
10	Deer Meadows Lift Station #1 – Instrumentation	$111,320
11	Well K6 – Electrical	$39,230
12	Well JW1 – Structural	$18,980
13	Well 9 – Electrical	$46,760
14	Well 5 – Electrical	$4,710
15	Well 27 – Electrical	$36,360
16	Well CR1 – Electrical	$37,970
17	Well 25 – Electrical/Mechanical/Structural	$51,720
18	Well 26 – Electrical/Mechanical/Structural	$53,090
19	Well 31 – Mechanical/Structural	$18,430
20	Well 32 – Electrical/Mechanical/Structural	$21,920
21	Well 28 – Electrical	$36,360
22	Well 12 – Mechanical/Structural	$18,430
23	Well K7 – Mechanical/Structural	$18,980
24	Well 14 – Electrical/Mechanical/Structural	$65,190
25	Well 1 – Electrical	$18,630
26	Well 19 – Electrical	$40,520
27	Effluent Pump Station Expansion	$162,500
28	Rolling Acres Trail Water Line	$291,720
29	Willow Wind Drive/Red Bud Hill Water Line	$308,880
30	Fair Oaks Parkway Water Line Reroute	$214,370
31	Keeneland Drive Water Line Creek Crossing	$51,870
32	Plant #5 GST - THM Removal System	$384,000
33	Plant #2 VFD	$164,810
34	Blackjack Chlorine Station SCADA	$146,250
35	Live Oak Chlorine Station SCADA	$146,250
	TOTAL:	**$5,927,830**

Note: Project costs include 25% for engineering/survey and 30% for contingency.

FIGURE ES-4
CITY OF FAIR OAKS RANCH
PROPOSED REHABILITATION PROJECTS

LEGEND

- Well
- Chlorine Station
- Pump
- Hydropneumatic Tank
- Ground Storage Tank
- Water Treatment Plant
- Irrigation Well
- Lift Station
- Wastewater Treatment Plant
- County Boundary

Proposed Rehabilitation Project

- Well
- Ground Storage Tank
- Lift Station
- Pump Station
- Wastewater Treatment Plant
- Line Repair
- Road
- Stream
- Parcel
- Fair Oaks Ranch City Limit
- ETJ Boundary

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Well K1
Well K5
Plant #3 Pump Station
Firm Capacity = 850 gpm
Total Capacity = 1,300 gpm
Plant #3
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 2,500 gal Hydropneumatic Tank
(1) - 8,000 gal Hydropneumatic Tank
Well CR1
Well K2
Well K8
Well K6
Plant #5
(1) - 0.125 MG Ground Storage Tank
Zone A Pump Station
Firm Capacity = 575 gpm
Total Capacity = 1,150 gpm
Zone B Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,600 gpm
Well K7
Deer Meadows LS #1
Deer Meadows LS #2
Well K3
Blackjack Chlorine Station
Well 36
Well 34
Well 35
The Falls LS
Well 16
Well 1
Well 19
Well 10
Setterfeld LS
Well 30
Well 31
Wastewater Treatment Plant
0.5 MGD
WWTP LS
Well 18
Well 12
Well 14
Effluent PS Expansion
Live Oak Chlorine Station
Well 9
Elmo Davis Plant Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,450 gpm
Elmo Davis GST #1
Elmo Davis GST #2
Well 32
Well 23
Well 3
Well 2
Well 4
Elmo Davis Plant
(2) - 0.5 MG Ground Storage Tanks
(2) - 5,000 gal. Hydropneumatic Tanks
Well 21
School LS
Well 7
Well 6
Well 5
Well 8
Plant #2
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 5,000 gal. Hydropneumatic Tank
(1) - 8,000 gal. Hydropneumatic Tank
Well 15
Plant #2 Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,250 gpm
Well 16
Well 13
Well 22
Well 27
Well 26
Well 25
Well 28
Well 17
Plant #4
2 - Pumps
1 - 22,500 gal. Ground Storage Tank
Well JW1

RANCH RUN, RANCH PASS, RANCH FALLS, RANCH VALLEY, STONE TERRACE, SENDERO WOODS, WOODLAND VIEW, RANCH TERRACE, AMMANN RD, W AMMANN RD, KENDALL CO, COMAL CO, WOOD TRL, SANDY OAKS DR, OAKWOOD LN, KIRCHSKE RANCH RD, CIBOLO RIDGE TRL, CIBOLO HOLW N, ROCK FRST, FLAGSTONE HILL DR, SUNLAND, WILD OAK HILL, WINDMILL CIR, SKY BLUE RDG, WEMBLEY, SCARTEEN, ROLLING ACRES TRAIL, Cibolo Creek, POST OAK TRL, MEADOW CREEK TRAIL, HIGH ANTLER, STEPHANIE WAY, HONEY OAK CIRCLE, ANTLER OAK, OAK BEND ESTATES, AXIS PASS, ANTLER MEADOW, FM 3351, KNOTTY GROVE, CAVALRY DRIVE, DELTA DAWN LANE, AXIS RUN, WOODBINE WAY, JODHPUR DRIVE, MAN O WAR DRIVE, HIGH CLIFF DRIVE, ROCK OAK CIR, FIREBIRD DRIVE, SILVER SPUR TRL, FARM-TO-MARKET ROAD 3351, SCHEELE RD, KENDALL PKWY, KENDALL POINTE DR, CANYON CIR, KENDALL LN, KENDALL RDG, INTREPID DR, ROBIN DALE DR, VENTURER, ROYAL VALANCE, SWEETRIDGE CIR, KEENELAND DR, SETTERFELD CIRCLE, WILD COYOTE LANE, SARATOGA DR, CIBOLO OAKS, VALLEY CREST, CIBOLO VIEW, CIBOLO VALLEY, CIBOLO RUN, CIBOLO COURT, CIBOLO TRACE, CIBOLO GAP, FAIRWAY GREEN DR, FAIRVIEW PL, FAIRWAY VISTA DR, WILLOW WIND DR, RED BUD PL, DEW RDG, FAIRWAY TRAIL DR, FAIRWAY BLUFF DR, FAIRWAY VLY, SADDLE INTENSE, HIGH ESCHELON, HANSEL DRIVE, RAINTREE WOODS DRIVE, SUMMER SONG CIRCLE, TERRA BELLA, TERRA VISTA, SCINTILLA LANE, RALPH FAIR ROAD, NO LE HACE DR, DUBERRY RIDGE, WHIMSEY RIDGE, KEARNEY RIDGE, ELKHORN RIDGE, AVIATOR CIR, CONNEMARA DR, DEER LEAP, ENCHANTED ELM, ENCHANTED PARK, SEABISCUIT DRIVE, TESSARA CIR, BOLD FORBES CIR, ALYDAR CIRCLE, OAKVIEW PASS, NORTHVIEW PASS, FALLS TERRACE, DRIVEWAY, DIETZ ELKHORN RD, OLD DIETZ ELKHORN RD, STEVENSON GATE, FAIRS GATE, NOLL RD, ROYAL MUSTANG CIRCLE, TIVOLI WAY, NOBLE LARK DR, KAI KALLO DR, WHISPER GATE, PFEIFFERS GATE, IRVING HILL, HIDDEN GATE, FRONT GATE, GATE FOREST, HERITAGE TRAIL, FAIR OAKS PARKWAY, WHIRLAWAY CIR, SEATTLE SLEW, WINDERMERE DRIVE, RIVA RIDGE DRIVE, TURF PARADISE LANE, DAPPER DAN DRIVE, SECRETARIAT LANE, PREAKNESS LN, CHARTWELL LN, OLD FREDERICKSBURG RD, EXIT 546, I 10, IH 10 W, WATERVIEW DR, REDFISH, POMPANO DR, TARPON DR, SAILFISH DR, MARLIN DR, AQUA DR, LESLIE PFEIFFER DR, COPPER LEAF, WOODLAND PARKWAY, TIMBERLAND TRAIL, MONUMENT OAK, TURNING LEAF, TRIPLE CROWN, DAMASCUS DRIVE, CLYDESDALE CIRCLE, EQUESTRIAN, STEEPLECHASE LANE, AQUEDUCT LANE, RUFFIAN DRIVE, PIMLICO LANE, COLONIAL OAK, SETTLERS PEAK, TRADITION TRL, COLONIAL WOODS, LEGACY WOODS, OAK BROOK WAY, LIBERTY PARK, JAMESTOWN SQ, BOWMANS LN, WOODLAND GRN, MOUNTAIN TRL, FAWN MTN, SMOKEY VW, COVEY ROOST, INDIAN HILLS LN, FLINT ROCK DR, REYGLEN DR, JASON AVE, HAZY HOLW, TRACINEY BLVD, CLASSIC OAKS LN, ROBIN TRL, WESTOUTER DR, E OUTER DR, 4WD ROAD, MOYER RD, Salado Creek, CENTRAL RD, TENBERG DR, FINCKE DR, PLANT RD, BARNARD RD, TOMPKINS RD, ROBERTS DR, MCELROY DR, BOYD LN, H-22, H-21, H-20, H-19, H-18, D-24, U-26, U-29, U-28, U-27, F-13, F-11, F-10, B-7, C-9, S-1

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1.0 INTRODUCTION

The City of Fair Oaks Ranch is a community located in central Texas that straddles three counties: Bexar, Comal, and Kendall. The City currently provides water service to almost 3,000 customers and wastewater service to roughly 1,750 customers. The population within the service area is projected to grow by just over 2,000 connections in the next 20 years. Accommodating this growth in an efficient and effective manner, while also focusing on the maintenance of existing water, wastewater, and reuse system assets, is the purpose of this Water and Wastewater, and Reuse Master Plan. This report has been prepared to provide to the City of Fair Oaks Ranch with a planning tool that will serve as a guide for short-term and long-term improvements to infrastructure within the water, wastewater, and reuse systems.

1.1 SCOPE OF WORK

Freese and Nichols, Inc. (FNI) was retained in 2017 by the City of Fair Oaks Ranch to prepare a Water, Wastewater, and Reuse Master Plan. The goals of the Water, Wastewater, and Reuse Master Plan were to evaluate the integrity of the existing water, wastewater, and reuse systems and to recommend a phased capital improvement plan (CIP) through Buildout of the service areas. The recommended improvements will serve as a basis for the design, construction and financing of facilities required to meet the City's water, wastewater, and reuse capacity and system renewal needs. The major elements of the scope of this project included:

- Water Demand Projections and Water Supply Evaluation
- Water Model Update and Calibration
- Water System Analyses
- Wastewater Load Projections
- Wastewater Model Update and Validation
- Wastewater System Analyses
- Risk-Based Assessment of the Water, Wastewater, and Reuse Systems
- Reuse System Evaluation
- Water, Wastewater, and Reuse Capital Improvement Plans
- Water, Wastewater, and Reuse Master Plan Report
- Stakeholder Workshop Presentations

1.2 LIST OF ABBREVIATIONS

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

Table 1-1: List of Abbreviations

Abbreviation	Full Nomenclature
AADF	Average Annual Daily Flow
AD	Average Day
CIP	Capital Improvement Plan
EPS	Extended Period Simulation
EST	Elevated Storage Tank
FNI	Freese and Nichols, Inc.
GIS	Geographic Information System
gpCd	gallons per connection per day
gpm	gallons per minute
GBRA	Guadalupe-Blanco River Authority
GST	Ground Storage Tank
I/I	Infiltration and Inflow
LS	Lift Station
MD	Maximum Day
MG	Million Gallons
MGD	Million Gallons per Day
PF	Peaking Factor
PH	Peak Hour
PRV	Pressure Reducing Valve
PS	Pump Station
psi	pounds per square inch
PZ	Pressure Zone
SAWS	San Antonio Water System
TCEQ	Texas Commission on Environmental Quality
WWTP	Wastewater Treatment Plant

2.0 LAND USE ASSUMPTIONS

Growth projections are an important component of the master planning process. The magnitude and distribution of the growth in population and non-residential development will dictate where future infrastructure is required. For this study, data on future land use and population projections were provided by Gap Strategies as part of the Comprehensive Plan for the City of Fair Oaks Ranch.

2.1 SERVICE AREA

The City of Fair Oaks Ranch's water and wastewater service areas are defined separately. The difference between the water and wastewater service areas is due to some portions of the City being served by septic systems. The water service area includes most of the city limits and ETJ with exclusions for areas served by SAWS or for Camp Bullis. The wastewater service area includes the central part of the area within the city limits, as well as city limits and ETJ on the east side of the City. Some of the areas within the service areas are not currently in the City's Certificates of Convenience and Necessity. **Figures 2-1** and **2-2** illustrate water and wastewater service areas, respectively.

2.2 HISTORICAL POPULATION

The City of Fair Oaks Ranch provided yearly water and wastewater connection data from 2008 through 2017. The City provides water and wastewater service to some areas and water only to areas with private septic systems. **Table 2-1** presents the historical water and wastewater connections and annual growth rates. The data indicated average growth rates of 2.08% and 2.77% in water and wastewater connections, respectively.

Table 2-1: Historical Water and Wastewater Connections

Year	Water Connections	Water Connection Growth Rate	Wastewater Connections	Wastewater Connection Growth Rate
2008	2,390	-	1,345	-
2009	2,399	0.38%	1,358	0.97%
2010	2,442	1.79%	1,391	2.43%
2011	2,481	1.60%	1,418	1.94%
2012	2,507	1.05%	1,447	2.05%
2013	2,570	2.51%	1,489	2.90%
2014	2,662	3.58%	1,552	4.23%
2015	2,768	3.98%	1,635	5.35%
2016	2,838	2.53%	1,696	3.73%
2017	2,874	1.27%	1,718	1.30%
Average	**-**	**2.08%**	**-**	**2.77%**

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FIGURE 2-1
CITY OF FAIR OAKS RANCH
WATER SERVICE AREA

LEGEND

- Road
- Stream
- Water Service Area
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

CITY OF FAIR OAKS RANCH • TEXAS

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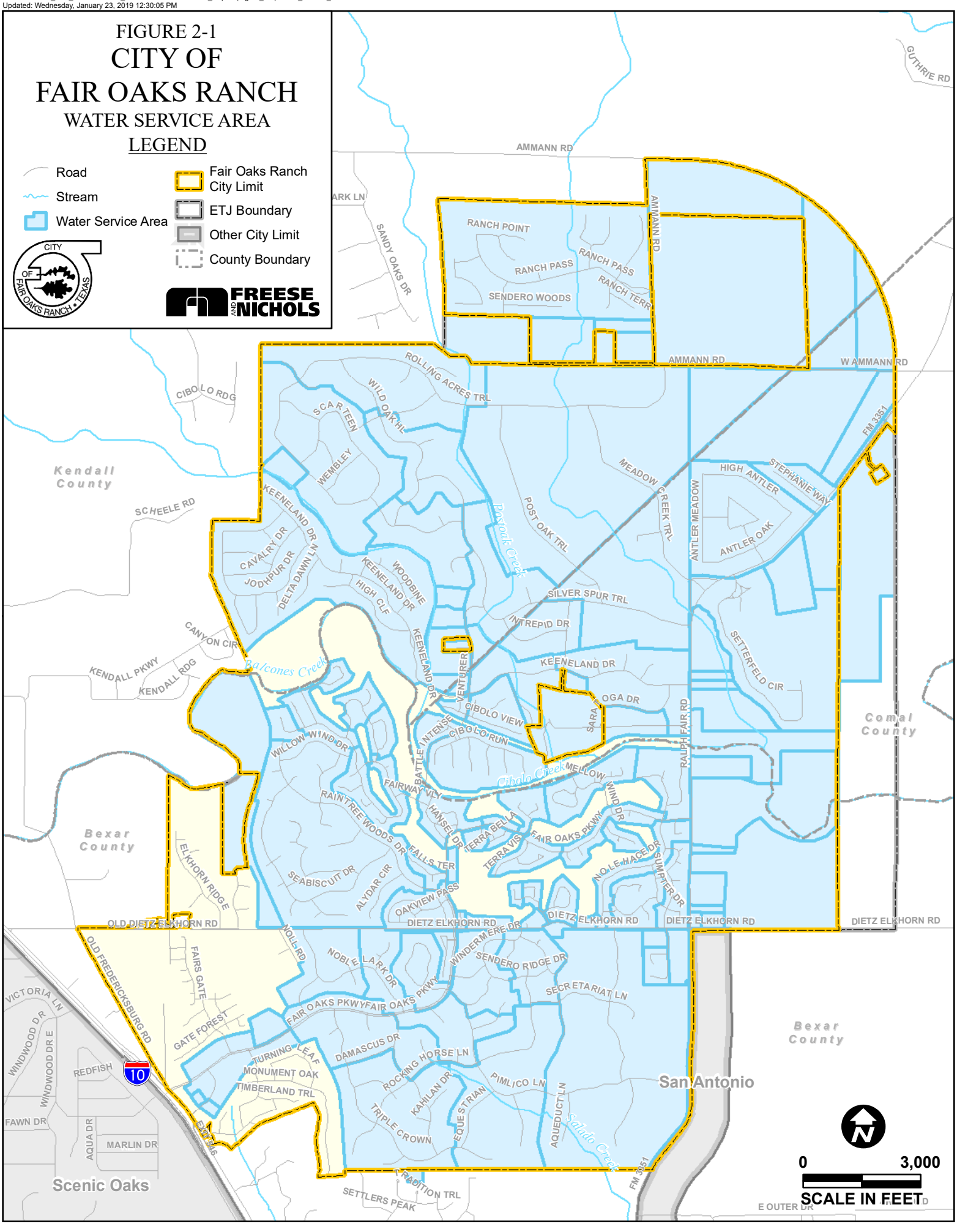

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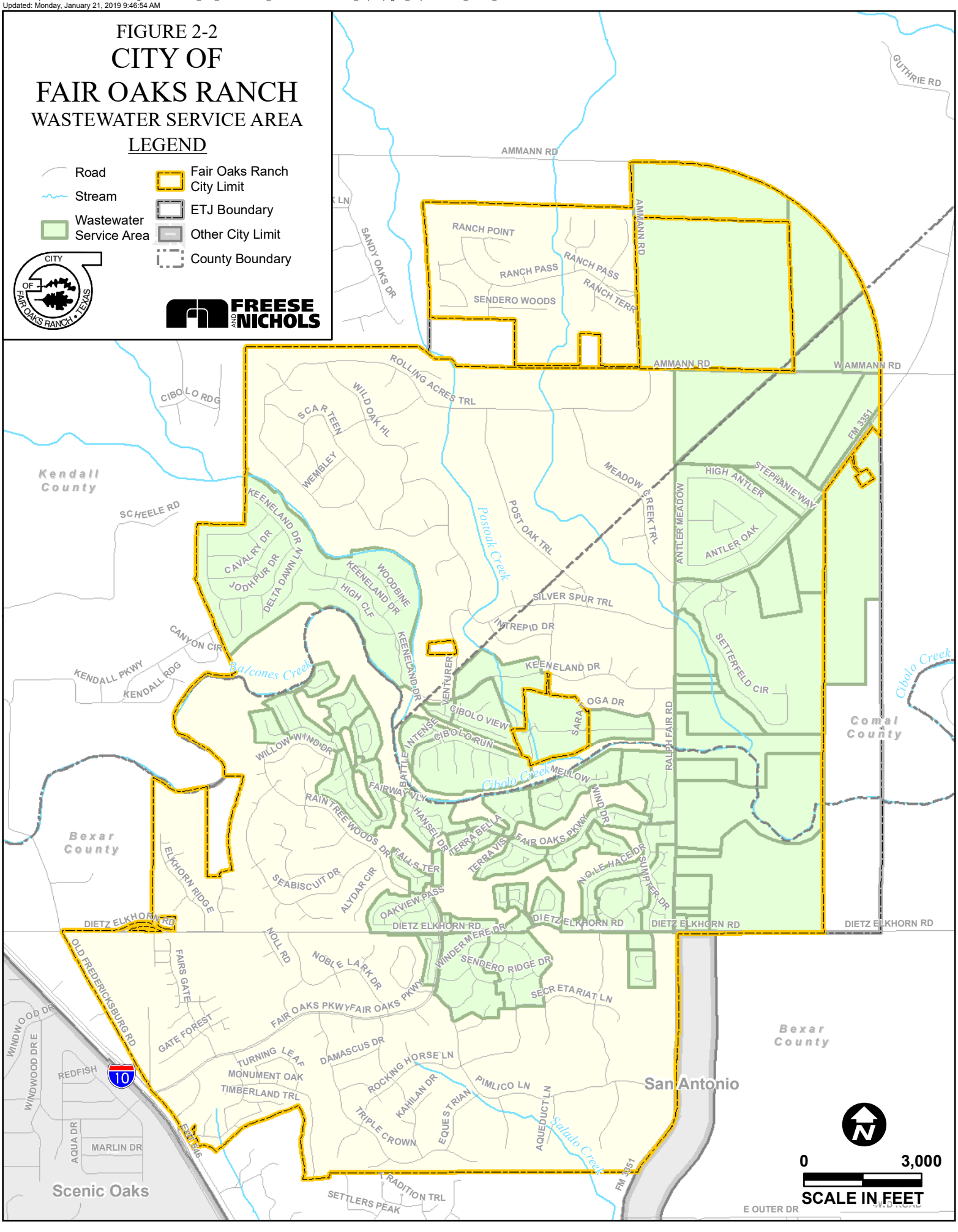
FIGURE 2-2
CITY OF FAIR OAKS RANCH
WASTEWATER SERVICE AREA

LEGEND

- Road
- Stream
- Wastewater Service Area
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

CITY OF FAIR OAKS RANCH • TEXAS

FREESE AND NICHOLS



2.3 POPULATION PROJECTIONS

Land use assumption and population projections were developed by Gap Strategies for "The Future of Fair Oaks Ranch, A Comprehensive Plan for the City of Fair Oaks Ranch." Shapefiles of future land use, timing of development, and overall population projections were provided by Gap Strategies. The information on the timing of development is provided in **Appendix A**. The future land use plan is presented on **Figure 2-3**. The comprehensive plan calls for the City to have a population of 10,200 by 2023, 12,700 by 2028, and 13,900 by Buildout. FNI used this information along with the water and wastewater service area boundaries to determine the growth in water and wastewater connections. The water and wastewater connections by planning year are presented in **Table 2-2**.

Table 2-2: Water and Wastewater Growth Projections

Year	Water Connections	Wastewater Connections
2018	2,880	1,740
2023	3,728	2,455
2028	4,578	3,169
Buildout	4,924	3,512

In addition to the total number of connections, it is important to know where the connections will be located to determine the timing and sizing of infrastructure. Planning areas corresponding to subdivision units were provided by the City and used to distribute the future connections. The number of connections for each planning area was based on data provided by the City for existing developments or by data provided by Gap Strategies for future developments. Figures and a table summarizing the growth in water and wastewater connections by planning area is provided in **Appendix B**.

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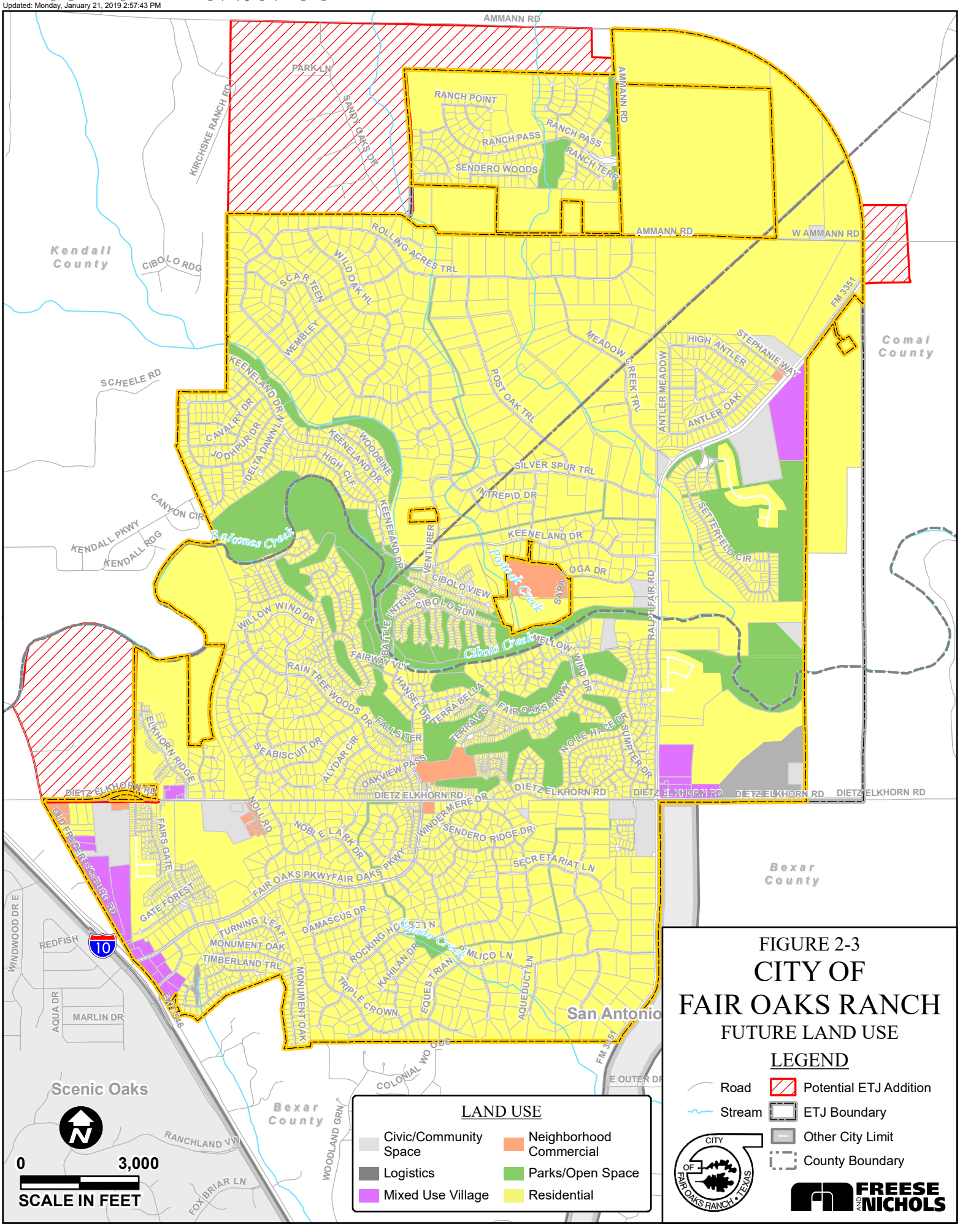


3.0 WATER DEMAND PROJECTIONS

3.1 HISTORICAL WATER DEMANDS

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 typically occurring 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 late afternoon. 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.

Reviewing historical water demands provides insight into selecting design criteria used to project future water demands. For this study, historical consumption data was provided by the City for 2010 through 2017. Consumption data comes from metered billing data, which provides a record of the amount of water used by each household or business. Historical AD demand was calculated for each year from 2010 to 2017 by dividing the annual usage in gallons by days in the year. Historical usage rates in gallons per connection per day (gpCd) were calculated by dividing the historical AD demand in gallons per day by the number of water connections for each year from 2010 through 2017. **Table 3-1** shows the historical AD demand in million gallons per day (MGD) and historical per connections usage.

To calculate historical maximum day to average day peaking factors (PF), maximum day demand data from the City for the years of 2010 through 2017 were divided by the calculated average day demand for the corresponding year. A summary of historical maximum day demand and peaking factors is shown in **Table 3-1**.

Table 3-1: Historical Water Consumption

Year	Water Connections	Average Day Demand (MGD)	Average Day Per Connection Usage (gpCd)	Maximum Day Demand (MGD)	Maximum Day to Average Day Peaking Factor
2010	2,442	1.23	505	3.11	2.52
2011	2,481	1.52	614	2.91	1.91
2012	2,507	1.28	511	2.96	2.31
2013	2,570	1.30	505	2.93	2.26
2014	2,662	1.28	480	2.98	2.33
2015	2,768	1.25	450	3.08	2.47
2016	2,838	1.23	433	3.01	2.45
2017	2,874	1.50	521	3.62	2.42
Average	-	-	**502**	-	**2.33**
Maximum	-	-	**614**	-	**2.52**

3.2 WATER DEMAND PROJECTIONS

Water demands were projected for 2018, 2023, 2028, and Buildout conditions for the City of Fair Oaks Ranch. The evaluation of historical trends in the per capita data provided a basis for determining the design criteria used to project average day water demands. Based on the review of this data and the need to plan for low rainfall (dry) years with minimal water restrictions, FNI recommended a design residential per connection usage of 500. A design maximum day to average day peaking factor of 2.50 was selected based on the peaking factors calculated for 2010 through 2017. A design peak hour to maximum day peaking factor of 2.00 was selected based on input from the City. **Table 3-2** summarizes the design criteria used to calculate the water demand projections, and **Table 3-3** shows the demand projections for 2018, 2023, 2028, and Buildout for each pressure zone. **Figure 3-1** provides a graphical illustration of the historical and projected water demands through Buildout.

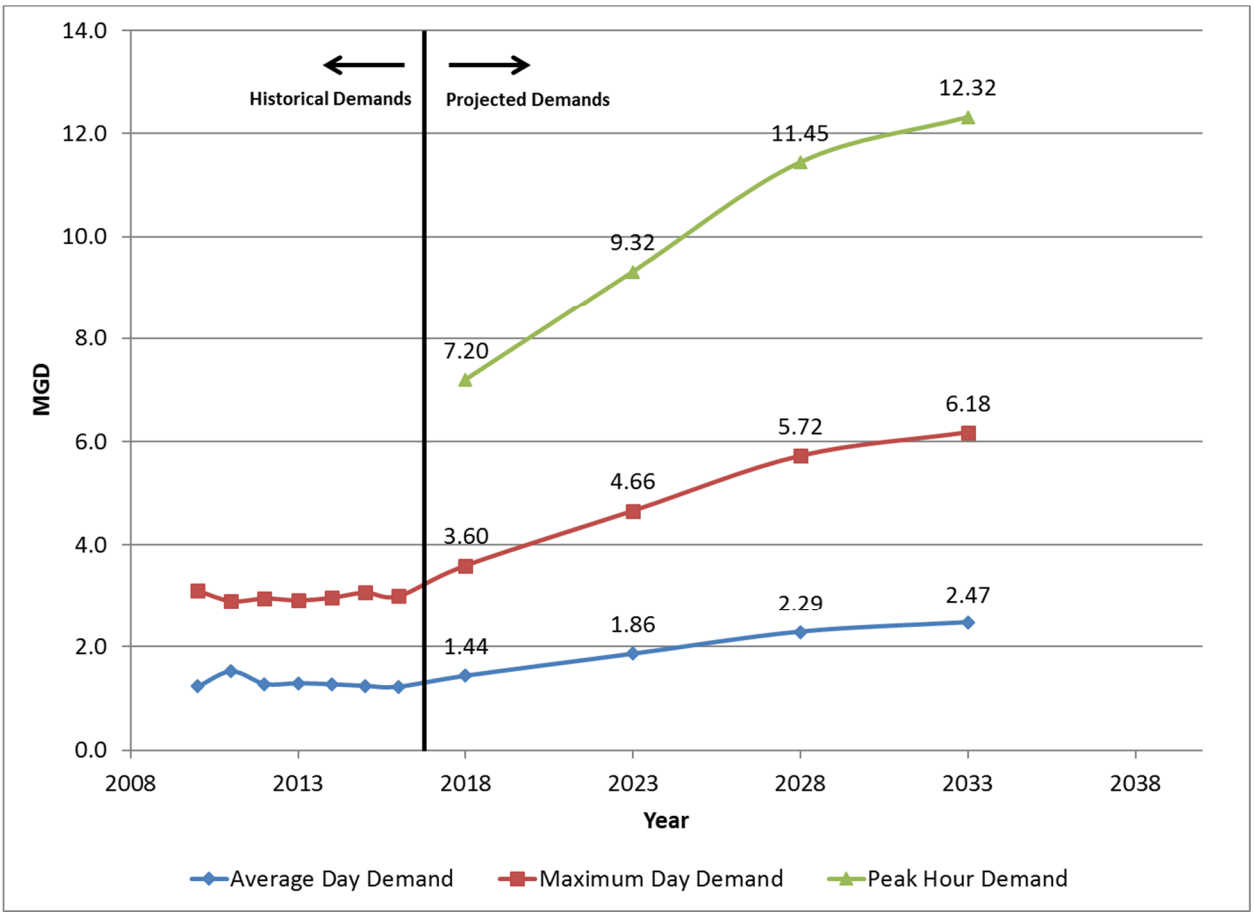
Table 3-2: Water Demands Design Criteria

Average Day Demand (gpCd)	Maximum Day to Average Day Peaking Factor	Peak Hour to Maximum Day Peaking Factor
500	2.50	2.00

Table 3-3: Projected Water Demands

Year	Pressure Zone	Water Connections	Average Day Demand (gpCd)	Average Day Demand (MGD)	Maximum Day to Average Day Peaking Factor	Maximum Day Demand (MGD)	Peak Hour to Maximum Day Peaking Factor	Peak Hour Demand (MGD)
2018	Zone A	360	500	0.18	2.50	0.45	2.00	0.90
	Zone B	1,482	500	0.74	2.50	1.85	2.00	3.71
	Zone C	1,038	500	0.52	2.50	1.30	2.00	2.60
	Total	**2,880**	**500**	**1.44**	**2.50**	**3.60**	**2.00**	**7.20**
2023	Zone A	781	500	0.39	2.50	0.98	2.00	1.95
	Zone B	1,808	500	0.90	2.50	2.26	2.00	4.52
	Zone C	1,139	500	0.57	2.50	1.42	2.00	2.85
	Total	**3,728**	**500**	**1.86**	**2.50**	**4.66**	**2.00**	**9.32**
2028	Zone A	1,199	500	0.60	2.50	1.50	2.00	3.00
	Zone B	2,140	500	1.07	2.50	2.68	2.00	5.35
	Zone C	1,239	500	0.62	2.50	1.55	2.00	3.10
	Total	**4,578**	**500**	**2.29**	**2.50**	**5.72**	**2.00**	**11.45**
Buildout	Zone A	1,376	500	0.69	2.50	1.72	2.00	3.44
	Zone B	2,270	500	1.14	2.50	2.84	2.00	5.68
	Zone C	1,278	500	0.64	2.50	1.60	2.00	3.20
	Total	**4,924**	**500**	**2.47**	**2.50**	**6.16**	**2.00**	**12.32**

Figure 3-1: Historical and Projected Water Demands



3.3 WATER SUPPLY EVALUATION

The City of Fair Oaks Ranch currently owns and operates 30 ground water wells located throughout the City and surrounding area. The estimated capacity of the in-service wells is 2.90 MGD as shown in **Table 3-4**. These wells pump water from the Trinity Aquifer. The City also purchases wholesale treated water from the Guadalupe-Blanco River Authority (GBRA), which consists of treated surface water from GBRA's Western Canyon Reservoir. The City's contract currently provides them with 942 acre-feet per year at a rate of 0.795 MGD, which can increase up to 1,850 acre-feet per year if the City desires.

Table 3-4: Existing Well Capacity

Plant	Pressure Zone Served	Well Capacity (MGD)
Elmo Davis	Zone B/C	1.26
Plant #2	Zone C	0.76
Plant #3	Zone A	0.88
System-Wide Total		**2.90**

3.3.1 Evaluation of Future Water Supply Sources

Based on the growth projections detailed in **Section 2.3**, the City's water demands will eventually surpass their current supply from the Trinity Aquifer and GBRA. To provide the City with a conservative estimate of the amount of water supply needed to serve projected growth, it was determined that the City should have adequate supply capacity to meet 100% of maximum day demands. **Table 3-5** shows a comparison of the projected maximum day demand and available supply for Zones A and B. Zone C was not included because there is very little projected growth in that part of the service area, and no additional supply is needed through Buildout. For Zones A and B, the projected maximum day demand surpasses the available supply beginning in 2026, even when assuming an increase in supply from GBRA up to the maximum allowable amount of 1,850 acre-feet per year, or 1.65 MGD in 2022. **Table 3-5** also provides a cost comparison between obtaining the necessary additional supply from San Antonio Water System (SAWS) and GBRA. Costs for SAWS wholesale water were taken from their website, the details of which can be found in **Appendix C**, and an overall estimated cost of $1,700 per acre-foot was provided by SAWS staff. To estimate GBRA wholesale costs, an assumption of $1,500 per acre-foot was used based on information provided to the City by GBRA for additional Western Canyon supply. These costs are only for the water supply, and do not include any provisions for infrastructure required to deliver the water. Due to current regulations restricting the use of Edwards Aquifer water in Kendall County, any supply from SAWS that contained Edwards Aquifer water could only be utilized in Zone C. Because additional supply is needed in Zones A and B, new infrastructure would be required to convey the current Zone C supply to Zones A and B, while utilizing the new SAWS supply exclusively in Zone C. Also, the City has both an existing agreement and existing infrastructure in place to receive additional water from GBRA with some small improvements. Based on the cost estimates below and the reasons listed above, it is recommended that the City pursue obtaining additional supply from GBRA.

Table 3-5: Projected Supply vs. Demand and Supply Costs for Zones A and B

Year	Zones A & B							
					SAWS Wholesale Rates[1]		GBRA Wholesale Rates[1]	
	Maximum Day Demand (MGD)	Current GBRA Supply (MGD)	Current Trinity Supply (MGD)	Supply Deficit (MGD)	Annual Cost of Additional Supply from SAWS ($)	Annual Cost of Additional Supply from SAWS[2] ($ per Acre-Foot)	Annual Cost of Additional GBRA Western Canyon Supply ($)	Annual Cost of Additional GBRA Western Canyon Supply[3] ($ per Acre-Foot)
2018	2.30	0.80	2.13	-	-	-	-	-
2019	2.50	0.80	2.13	-	-	-	-	-
2020	2.70	0.80	2.13	-	-	-	-	-
2021	2.90	0.80	2.13	-	-	-	-	-
2022	3.10	1.65	2.13	-	-	-	-	-
2023	3.30	1.65	2.13	-	-	-	-	-
2024	3.50	1.65	2.13	-	-	-	-	-
2025	3.70	1.65	2.13	-	-	-	-	-
2026	3.90	1.65	2.13	0.12	$220,701	$1,700	$194,737	$1,500
2027	4.10	1.65	2.13	0.32	$601,549	$1,700	$530,780	$1,500
2028	4.30	1.65	2.13	0.52	$982,396	$1,700	$866,824	$1,500
2029	4.35	1.65	2.13	0.57	$1,081,417	$1,700	$954,195	$1,500
2030	4.40	1.65	2.13	0.62	$1,180,437	$1,700	$1,041,566	$1,500
2031	4.46	1.65	2.13	0.67	$1,279,458	$1,700	$1,128,938	$1,500
2032	4.51	1.65	2.13	0.72	$1,378,478	$1,700	$1,216,309	$1,500
2033	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2034	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2035	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2036	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2037	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2038	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2039	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2040	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2041	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2042	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2043	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2044	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2045	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2046	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2047	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2048	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2049	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2050	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2051	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2052	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2053	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2054	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2055	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2056	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2057	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2058	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2059	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2060	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2061	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2062	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2063	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2064	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2065	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2066	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2067	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500
2068	4.56	1.65	2.13	0.78	$1,477,498	$1,700	$1,303,680	$1,500

(1) Rates are in 2018 dollars. Rates may increase in the future.
(2) $1,700 per acre-foot for SAWS wholesale supply from SAWS, 2019.
(3) $1,500 per acre-foot for GBRA Western Canyon supply from GBRA, 2017.

4.0 WATER SYSTEM ANALYSES

4.1 EXISTING WATER SYSTEM

The City of Fair Oaks Ranch's water distribution system consists of three independent pressure zones, a network of water lines ranging in diameter from 2 inches to 12 inches, seven ground storage tanks (GST), five pump stations (PS), 30 active groundwater wells, and a wholesale supply connection to GBRA's Western Canyon transmission main. Zone A includes the northern third of the area encompassed by the city limits, from Ammann Road in the north to Cibolo Creek and Silver Spur Trail to the south and is served by Plant #3 and Plant #5. Zone B is located in the central portion of the City on either side of Cibolo Creek, including both golf courses, and is served by Plant #5 and Elmo Davis. Zone C includes the southernmost part of the City, roughly bounded by the golf courses to the north and the city limits to the south and is served by Elmo Davis and Plant #2, which receives supply from an untreated water pump station, Plant #4, as well as directly from groundwater wells. Production capacities by pump station are shown in **Table 4-1**. Summaries of the storage and pumping facilities are presented in **Tables 4-2** and **4-3**, respectively. Storage volume is shown in million gallons (MG) and pumping capacity is shown in gallons per minute (gpm). **Figure 4-1** displays the existing water distribution system in schematic form. The existing distribution system and pressure plane boundaries are shown on **Figure 4-2**.

Table 4-1: Production Facility Summary

Pump Station	Supply Source	Production Capacity (MGD)	Production Capacity (gpm)
Plant #1	Trinity Aquifer	1.256	872
Plant #2	Trinity Aquifer	0.756	525
Plant #3	Trinity Aquifer	0.878	610
Plant #5	GBRA Western Canyon	0.795(1)	552(1)
TOTAL		**3.685**	**2,559**

(1) The City's current contract with GBRA allows them to increase their allocation up to 1,850 acre-feet in the future.

Table 4-2: Storage Facilities Summary

Pressure Zone	Facility	Type	Volume (MG)
Zone A	Plant #3	Ground Storage Tank	0.350
		Ground Storage Tank	0.150
		Hydropneumatic Tank	0.008
	Plant #5	Ground Storage Tank	0.125[1]
Zone B	Plant #5	Ground Storage Tank	0.125[1]
	Elmo Davis	Elevated Storage Tank	0.500[2]
		Elevated Storage Tank	0.500[2]
Zone C	Elmo Davis	Ground Storage Tank	0.500[2]
		Ground Storage Tank	0.500[2]
		Hydropneumatic Tank	0.005
		Hydropneumatic Tank	0.005
	Plant #2	Ground Storage Tank	0.350
		Ground Storage Tank	0.150
		Hydropneumatic Tank	0.008
		Hydropneumatic Tank	0.005
		TOTAL	**3.250**

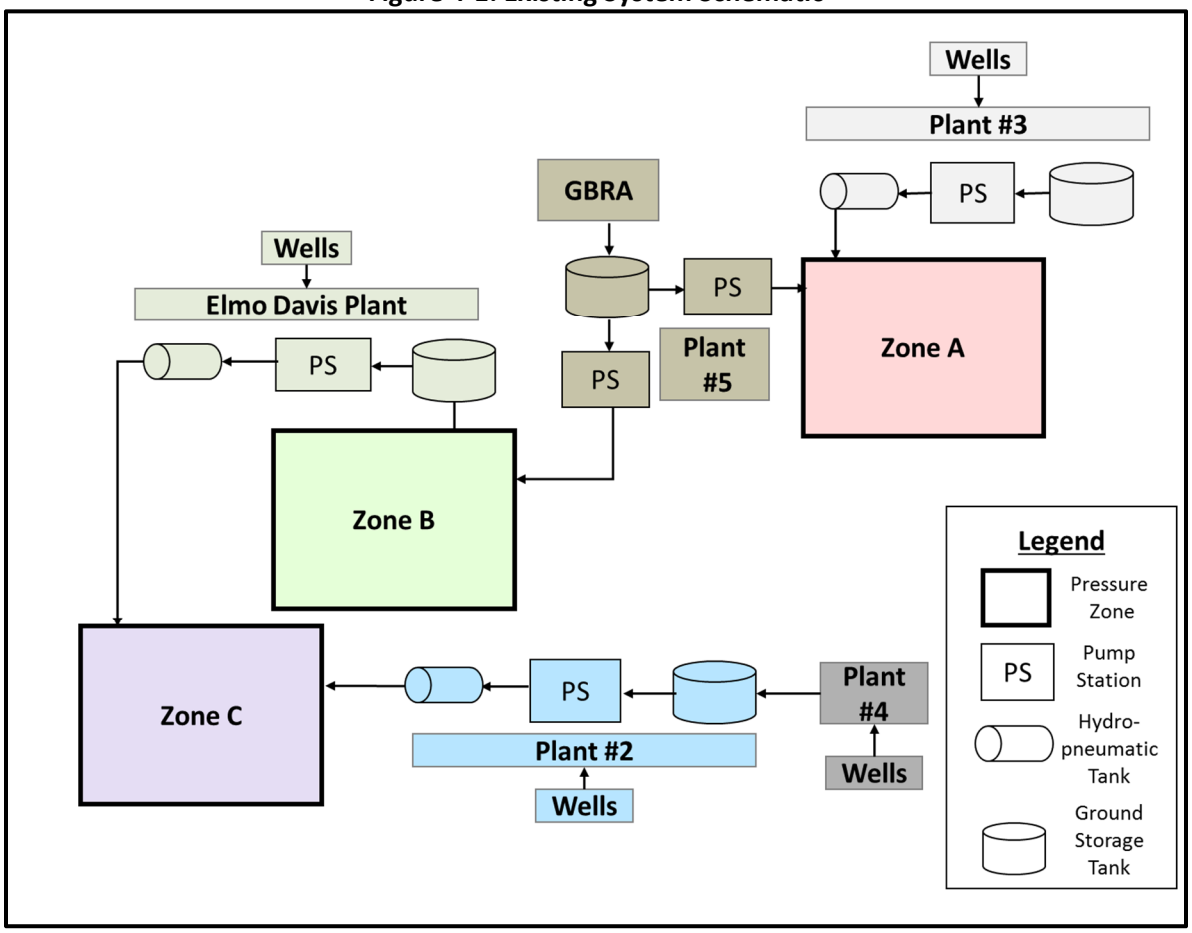
(1) The Plant #5 GST serves as ground storage for both Zones A and B.

(2) The Elmo Davis GSTs serve as elevated storage for Zone B and as ground storage for Zone C.

Table 4-3: Pumping Facilities Summary

Pressure Zone	Facility	Number of Pumps	Firm Capacity (gpm)	Total Capacity (gpm)
Zone A	Plant #3	3	850	1,300
	Plant #5	2	575	1,150
Zone B	Plant #5	2	800	1,600
Zone C	Elmo Davis	3	800	1,450
	Plant #2	3	800	1,250
		TOTAL	**3,825**	**6,750**

Figure 4-1: Existing System Schematic



Plant #3
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 8,000 gal Hydropneumatic Tank

Plant #3 Pump Station
Firm Capacity = 850 gpm
Total Capacity = 1,300 gpm

Plant #5
(1) - 0.125 MG Ground Storage Tank

GBRA Delivery Point

Zone A Pump Station
Firm Capacity = 575 gpm
Total Capacity = 1,150 gpm

Zone B Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,600 gpm

Elmo Davis Plant
(2) - 0.5 MG Ground Storage Tanks
(2) - 5,000 gal. Hydropneumatic Tanks

Elmo Davis Plant Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,450 gpm

Plant #2 Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,250 gpm

Plant #2
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 5,000 gal. Hydropneumatic Tank
(1) - 8,000 gal. Hydropneumatic Tank

FIGURE 4-2
CITY OF FAIR OAKS RANCH
EXISTING WATER SYSTEM
LEGEND

- Well
- Water Pump
- Hydropneumatic Tank
- Ground Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Stream
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

PRESSURE ZONES
- Zone A
- Zone B
- Zone C

FREESE AND NICHOLS

CITY OF FAIR OAKS RANCH • TEXAS

0 1,100 2,200
SCALE IN FEET

Created By Freese and Nichols, Inc.
Job No.: FAO17329
Location: H:\W_WW_PLANNING\01_DELIVERABLES\11-Final_Report\(Figure_4-2)-Existing_Water_System.mxd
Updated: Wednesday, January 23, 2019 1:23:57 PM
User Name: 02818

4.2 PRESSURE TESTING

Temporary field pressure testing was conducted June 22 – July 6, 2017. Twelve Telog® brand pressure recorders were installed throughout the distribution system. Locations of the pressure recorders are illustrated on a map in **Appendix D**. **Appendix D** also contains graphs of the pressure recording data.

4.3 WATER MODEL UPDATE AND CALIBRATION

As part of the Water and Wastewater Impact Fee Update completed in January 2015, a hydraulic model of the water distribution system was built using the H2OMAP Water® hydraulic modeling software by Innovyze, which makes use of engineering equations and mathematical algorithms to determine the flows and pressures that would occur in a distribution system under a specified set of conditions. As part of the current study, because H2OMAP Water® is soon to be discontinued, the hydraulic model was converted to Innovyze's InfoWater® software, a similar software package that uses the same hydraulic calculations and algorithms. In general, the flow and gradient patterns depend upon the magnitude and location of system supplies and demands and on the characteristics of the water mains and other facilities in the distribution network. The headloss through each main is a function of the flow rate and the pipe diameter, length, and interior roughness.

4.3.1 Pipeline Network Update

The hydraulic model was updated based on the City's most recent geographic information system (GIS) data of their pipelines. Pipes that have been constructed since the last study were added to the model.

4.3.2 Demand Allocation

The distribution, or allocation, of water demands is a crucial step in developing a hydraulic model. The spatial location and relative magnitude of demands significantly impact the hydraulics of a water distribution system. In master planning, an accurate distribution of demands facilitates the development of sound capital improvements. This distribution was achieved using metered billing data provided by the City. The metered billing data included the total consumption in gallons for every customer as well as the address and size of each meter. The active meters were geocoded using parcel and street centerline data. Geocoding is a GIS technique used to generate a geographic location (x-y coordinates) from an address. During the geocoding process 2,874 meters out of 2,916 meters were matched to an address, accounting for 99% of the metered water usage. July 2017 water demands were allocated to the model by spatially

joining the meters to the nearest model node in InfoWater® using the Demand Allocator module. The demands were then scaled to match the demand experienced during the calibration day and are discussed further in **Section 4.3.3**.

4.3.3 Extended Period Simulation Model Calibration

To verify that the hydraulic model accurately represented the actual distribution system, an extended period simulation (EPS) model calibration analysis was performed. The calibration process involved adjusting system operation, C-values, demand allocation, and peaking factors to match a known condition. July 2, 2017 was selected for calibration because it was a week day with the most complete data.

Demands were allocated to the model from metered billing data provided by the City for July 2017. The demands were then scaled to match the system-wide demand for July 2, 2017 for calibration, which was 2.3 MGD. Since a diurnal pattern, which imitates how demands fluctuate over the course of a 24-hour period, could not be developed with the available SCADA data, the diurnal pattern from a similar hill country community was utilized. This diurnal pattern is presented in **Appendix E.**

The results of the EPS calibration are summarized on the graphs included in **Appendix E**. The graphs show modeled pressures and tank levels versus recorded data at pressure recorder locations and facilities throughout the system. The results suggest a good correlation between recorded and modeled values. This degree of calibration provides confidence in the accuracy of the model. Therefore, the model is considered suitable for master planning purposes.

4.4 TCEQ REQUIREMENTS

As a public water utility, the City of Fair Oaks Ranch must comply with the rules and regulations for public water systems set forth by the Texas Commission on Environmental Quality (TCEQ) in Chapter 290, Public Drinking Water. The City is required to meet the TCEQ elevated storage capacity requirement of 100 gallons per connection in pressure zones with elevated storage, the hydropneumatic storage requirement of 20 gallons per connection in pressure zones with hydropneumatic storage, and the total storage capacity requirement of 200 gallons per connection system-wide. In addition to storage requirements, the City is also required to meet the TCEQ pumping capacity requirements. System-wide the City is required to provide a production capacity of at least 0.6 gpm per connection. For distribution pumping, in pressure zones where the City is providing at least 200 gallons per connection of elevated storage (i.e.

Zone B), the minimum requirement is 0.6 gpm per connection. In pressure zones served by hydropneumatic storage (i.e. Zone A and Zone C), the minimum requirement is 2.0 gpm per connection or the ability to meet peak hour demands with the largest pump in the zone out of service. In a letter dated September 1, 2017, the City was cited by TCEQ for reaching 91% and 95% of its hydropneumatic tank capacity in Zones A and C, respectively. The City has responded to that citation, and the recommendations in this report address the impending shortage of hydropneumatic storage in both pressure zones. Existing storage and pumping capacities were evaluated and are summarized in **Tables 4-4** through **4-8**. The City is currently meeting or exceeding all TCEQ minimum pumping and storage requirements.

Table 4-4: TCEQ Requirement vs. City Production Capacity

Pressure Zone	TCEQ Requirement	Number of Connections	Required Capacity (gpm)	Available Capacity (gpm)	TCEQ Requirement Met?
All	0.6 gpm per connection	2,880	1,728	2,559	Yes

Table 4-5: TCEQ Requirement vs. City Total Storage Capacity

Pressure Zone	TCEQ Requirement	Number of Connections	Required Total Storage (gallons)	Available Total Storage (gallons)	TCEQ Requirement Met?
All	200 gallons per connection	2,880	576,000	2,130,000	Yes

Table 4-6: TCEQ Requirement vs. City Distribution Pumping Capacity

Pressure Zone	TCEQ Requirement	Number of Connections	Required Pumping Capacity (gpm)	Available Pumping Capacity (gpm)	TCEQ Requirement Met?
A	2.0 gpm per connection	360	720	2,450	Yes
B	0.6 gpm per connection	1,483	890	1,600	Yes
C	2.0 gpm per connection	1,037	2,074	2,700	Yes

Table 4-7: TCEQ Requirement vs. City Hydropneumatic Storage Capacity

Pressure Zone	TCEQ Requirement	Number of Connections	Required Pressure Tank Volume (gallons)	Available Pressure Tank Volume (gallons)	TCEQ Requirement Met?
A	20 gallons per connection	360	7,200	8,000	Yes
B	20 gallons per connection	1,483	N/A	N/A	N/A
C	20 gallons per connection	1,037	20,740	23,000	Yes

Table 4-8: TCEQ Requirement vs. City Elevated Storage Capacity

Pressure Zone	TCEQ Requirement	Number of Connections	Required Elevated Storage Volume (gallons)	Available Elevated Storage Volume (gallons)	TCEQ Requirement Met?
A	100 gallons per connection	360	N/A	N/A	N/A
B	100 gallons per connection	1,483	148,300	1,000,000	Yes
C	100 gallons per connection	1,037	N/A	N/A	N/A

4.5 STORAGE AND PUMPING RECOMMENDATIONS

This section summarizes an evaluation of the storage and pumping capacity for the City based on criteria developed by FNI. These criteria are typically more stringent than the TCEQ requirements and take into consideration additional factors including operational flexibility, fire suppression, system redundancy, and energy efficiency. The design criteria used to analyze elevated storage tank (EST) 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). This evaluation assumes that pumping will meet 60% of peak hour demands and elevated storage will meet the remaining 40% of peak hour demands. **Table 4-9** shows the recommended elevated storage by pressure zone. FNI recommends that the City constructs ESTs in Zones A and C to provide operational flexibility and emergency storage to serve projected growth.

Table 4-9: Recommended Elevated Storage

Year	Pressure Zone	Peak Demand (MGD)[1]	Peak Volume (MG)[2]	Fire Volume (MG)[3]	Total (MG)[4]	Available Elevated Storage (MG)
2018	Zone A	0.36	0.05	0.27	0.32	0.00
	Zone B	1.48	0.19	0.27	0.46	1.00
	Zone C	1.04	0.13	0.27	0.40	0.00
2023	Zone A	0.78	0.10	0.27	0.37	0.00
	Zone B	1.81	0.23	0.27	0.50	1.00
	Zone C	1.14	0.14	0.27	0.41	0.00
2028	Zone A	1.20	0.15	0.27	0.42	0.00
	Zone B	2.14	0.27	0.27	0.54	1.00
	Zone C	1.24	0.15	0.27	0.42	0.00
Buildout	Zone A	1.38	0.17	0.27	0.44	0.00
	Zone B	2.27	0.28	0.27	0.57	1.00
	Zone C	1.28	0.16	0.27	0.43	0.00

(1) Equals 40% of peak hour demand
(2) Required volume to supply the peak demand for a duration of 3 hours
(3) Assuming highest fire flow required is 1,500 gpm for a duration of 3 hours
(4) The greater of twice the peaking volume or the peaking volume plus fire volume

The recommended firm pumping capacity was calculated based on meeting 60% of the peak hour demands. Firm pumping capacity is defined as the total available pumping capacity with the largest pump out of service. **Table 4-10** presents the recommended firm pumping capacity. The recommended firm pumping capacity exceeds the existing available firm pumping capacity for Zone B; therefore, additional pumping capacity is required. This deficiency was addressed as part of the Master Plan.

Table 4-10: Recommended Firm Pumping Capacity

Year	Pressure Zone	Peak Hour Demand (MGD)	Recommended Pumping (1) (MGD)	Available Total Pumping (MGD)	Available Firm Pumping (MGD)
2018	Zone A	0.90	0.54	3.53	2.05
	Zone B	3.71	2.22	2.30	1.15
	Zone C	2.60	1.56	3.89	2.30
2023	Zone A	1.95	1.17	3.53	2.05
	Zone B	4.52	2.71	2.30	1.15
	Zone C	2.85	1.71	3.89	2.30
2028	Zone A	3.00	1.80	3.53	2.05
	Zone B	5.35	3.21	2.30	1.15
	Zone C	3.10	1.86	3.89	2.30
Buildout	Zone A	3.44	2.06	3.53	2.05
	Zone B	5.68	3.41	2.30	1.15
	Zone C	3.20	1.92	3.89	2.30

(1) Recommended Pumping is 60% of the peak hour demand in each pressure zone.
(2) Available firm pumping capacity is the largest pump out of service at each pump station.

Recommended ground storage capacity was calculated based on providing storage equivalent to 8-12 hours of maximum day demand. Storage volumes equivalent to 8, 10, and 12 hours of MD demand were calculated, and range from least conservative to most conservative, respectively. Based on feedback from City staff, it was determined to use a recommendation of 8 hours of MD demand for Zone C, and 12 hours of MD demand for Zones A and B. **Table 4-11** presents the recommended ground storage capacity by pressure zone. Additional ground storage is recommended for Zones A and B as part of the Master Plan. Although Zone C also shows a deficit in ground storage for the 2028 and Buildout planning periods, no additional ground storage is recommended because of the 1.00 MG of storage capacity at Elmo Davis being counted as elevated storage for Zone B, but which can also be utilized as ground storage for Zone C.

Table 4-11: Recommended Ground Storage

Year	Pressure Zone	Maximum Day Demand (MGD)	8 Hours of Ground Storage (MG)	10 Hours of Ground Storage (MG)	12 Hours of Ground Storage (MG)	Available Ground Storage (MG)
2018	Zone A	0.45	0.15	0.19	**0.23**	0.50
	Zone B	1.85	0.62	0.77	**0.93**	0.13
	Zone C	1.30	**0.43**	0.54	0.65	0.50(1)
2023	Zone A	0.98	0.33	0.41	**0.49**	0.50
	Zone B	2.26	0.75	0.94	**1.13**	0.13
	Zone C	1.42	**0.47**	0.59	0.71	0.50(1)
2028	Zone A	1.50	0.50	0.62	**0.75**	0.50
	Zone B	2.68	0.89	1.11	**1.34**	0.13
	Zone C	1.55	**0.52**	0.65	0.77	0.50(1)
Buildout	Zone A	1.72	0.57	0.72	**0.86**	0.50
	Zone B	2.84	0.95	1.18	**1.42**	0.13
	Zone C	1.60	**0.53**	0.67	0.80	0.50(1)

(1) Zone C available ground storage does not include the 1.00 MG of the Elmo Davis GSTs because they are counted as elevated storage for Zone B.

4.6 HYDRAULIC MODELING ANALYSIS

4.6.1 Existing System Analysis

A hydraulic analysis was performed under existing peak hour demand conditions to evaluate system operations and residual pressures throughout the distribution system. 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 residual pressures because the highest demand period typically induces the lowest pressure due to increased headloss throughout the system. **Figure 4-3** shows the minimum pressure observed in the model under existing peak hour demand conditions. This map helped identify potential problem areas in the system and was used as a tool to assure that reasonable pressure ranges were maintained throughout the system. The TCEQ minimum required pressure within a distribution system is 35 pounds per square inch (psi) under non-emergency demand conditions. As seen on **Figure 4-3**, most of the system is able to meet that minimum requirement, but the areas along Meadow Creek Trail near the fire station and Enclave neighborhood show modeled pressures below 35 psi.

To evaluate the fire suppression capabilities of the existing system, a fire flow analysis was conducted under existing maximum day demand conditions. TCEQ requires a minimum residual pressure of 20 psi be maintained while delivering the fire flow demand. For this analysis, the available fire flow was

calculated at each node in the system while maintaining a residual pressure of 20 psi. **Figure 4-4** shows the results of the fire flow simulation. Large portions of the system have available fire flow below 500 gpm due to small-diameter lines. Upsizing of smaller lines and looping are two methods to improve low fire flow. Available fire flow for commercial, multi-family, and industrial land uses should be evaluated on a case by case basis. These large areas with available fire flow below 500 gpm were addressed as part of the Master Plan.

FIGURE 4-3

CITY OF FAIR OAKS RANCH

EXISTING WATER SYSTEM PEAK HOUR PRESSURES

LEGEND

- Well
- Water Pump
- Hydropneumatic Tank
- Ground Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Stream
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

CITY OF FAIR OAKS RANCH • TEXAS

FREESE AND NICHOLS

PRESSURES

- Less than 35 psi
- 35 - 50 psi
- 50 - 80 psi
- 80 - 100 psi
- Greater than 100 psi

PRESSURE ZONES

- Zone A
- Zone B
- Zone C

Plant #3 Pump Station
Firm Capacity = 850 gpm
Total Capacity = 1,300 gpm

Plant #3
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 8,000 gal Pressure Tank

Plant #5
(1) - 0.125 MG Ground Storage Tank

Zone A Pump Station
Firm Capacity = 575 gpm
Total Capacity = 1,150 gpm

Zone B Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,600 gpm

GBRA Delivery Point

Elmo Davis Plant
(2) - 0.5 MG Ground Storage Tanks
(2) - 5,000 gal. Pressure Tanks

Elmo Davis Plant Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,450 gpm

Plant #2
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 5,000 gal. Pressure Tank
(1) - 8,000 gal. Pressure Tank

Plant #2 Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,250 gpm

Kendall County

Comal County

Bexar County

San Antonio

Scenic Oaks

Cibolo Creek

Balcones Creek

Postoak Creek

Salado Creek

AMMANN RD

RANCH POINT

SENDERO POINT

RANCH PASS

RANCH BROOK

SENDERO WOODS

WOOD TRL

OAKWOOD LN

SANDY OAKS DR

ROLLING ACRES TRL

SUNLAND

SCARTEEN

WEMBLEY

WILD OAK HL

ROCK OAK DR

POST OAK TRL

FIREBIRD DR

SILVER SPUR TRL

MEADOW CREEK TRL

HIGH ANTLER

STEPHANIE WAY

HONEY OAK CIR

AXIS PASS

ANTLER OAK

ANTLER MEADOW

WILD COYOTE LN

SETTERFIELD CIR

RALPH FAIR RD

FM 3351

SCHEELE RD

CASCADE CAVERNS RD

KENDALL PKWY

KENDALL PKWY CANYON CIR

KENDALL LN

KENDALL RDG

OLD FREDERICKSBURG RD

KEARNEY RIDGE

ELKHORN RIDGE

DIETZ ELKHORN RD

OLD DIETZ ELKHORN RD

GATE RUN

NOLL RD

FAIRS GATE

WHISPER GATE

PFEIFFERS GATE

IRVING HILL

GATE FOREST

PARKING LOT

VICTORIA LN

STRAWBERRY

BLUEBERRY DR

SAXET DR

WINDWOOD DR

DEER RIDGE DR

REDFISH

POMPANO DR

WATERVIEW DR

TARPON DR

FAWN DR

SAILFISH DR

MARLIN DR

AQUA DR

AUTUMN GLN

RANCH CRK

RANCH LN

EXIT 546

RAMP

I-10

FAIR OAKS PKWY

WHITLAWAY CIR

SR LITTLE SLEW

TURNING LEAF

HERITAGE TRL

MONUMENT OAK

TIMBERLAND TRL

WOODLAND PKWY

LESLIE PFEIFFER DR

COPPERLEAF

TRADITION TRL

ARBOR VLG

COLONIAL WOODS

LIBERTY PARK

TRADITION OAK

WOODLAND GRN

WILLOW WIND DR

DEW RDG

FAIRWAY RUN

RAINTREE HL

RED BUD HL

RAINTREE WOODS DR

FAIRWAY BLUFF DR

SUMMER SONG

AVALOR CIR

CONNEMARA DR

SEABISCUIT DR

GOLD FORBES CIR

TESSARA DR

FALLS TER

OAKVIEW PASS

NORTHVIEW PASS

ALVARADO CIR

DELTA DAWN LN

WOODBINE

VENTURER

VALLEY CREST

CIBOLO VIEW

CIBOLO MEADOW

BATTLE INTENSE

CIBOLO RUN

CIBOLO PATH

CIBOLO OAK

CIBOLO LCT

GREENLAND DR

ROYAL VALENCE

SWEETRIDGE CIR

WILD FIRE DR

SARATOGA DR

SARATOGA LN

TWIN OAK LN

WINDERMERE DR

SENDERO RIDGE DR

RIVA RIDGE DR

TURF PARADISE LN

JIM DANDY CIR

ROCKING HORSE LN

PIMLICO LN

SECRETARIAT LN

PREAKNESS LN

2" AQUEDUCT LN

RUFFIAN DR

KALKALLOR

DAMASCUS DR

QUADRILLE LN

TRIPLE CROWN

SCINTILLA LN

NO LE HACE DR

GRAND COTEAU DR

SUMTER DR

TERRA VIS

OUTER DR

4WD ROAD

0 1,500 3,000

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FIGURE 4-4

CITY OF FAIR OAKS RANCH

EXISTING WATER SYSTEM AVAILABLE FIRE FLOW

LEGEND

- Well
- Pump Station
- Hydropneumatic Tank
- Ground Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Stream
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

CITY OF FAIR OAKS RANCH • TEXAS

FREESE AND NICHOLS

AVAILABLE FIRE FLOW

- Less than 500 gpm
- 500 - 1,000 gpm
- 1,000 - 2,000 gpm
- 2,000 - 3,000 gpm
- Greater than 3,000 gpm

Pleasant Valley Creek
Cibolo Creek
Postoak Creek
Balcones Creek
Scatano Creek
San Antonio
Scenic Oaks

AMMANN RD
GUTHRIE RD
FM 3351
SCHEELE RD
KENDALL PKWY
KENDALL LN
KENDALL RDG
CANYON CIR
OLD FREDERICKSBURG RD
DIETZ ELKHORN RD
OLD DIETZ ELKHORN RD
GATE RUN
NOLL RD
FAIRS GATE
PFEIFFERS GATE
IRVING HILL
GATE FOREST
BLUEBERRY DR
PARKING LOT
VICTORIA LN
WINDWOOD DR
WATERVIEW DR
REDFISH
DEER RIDGE DR
POMPANO DR
FAWN DR
SAILFISH DR
MARLIN DR
AQUA DR
RANCH CRK
RANCH LN
EXIT 546
PARK LN
SANDY OAKS DR
ROBINS WAY
WOOD TRL
OAKWOOD LN
CIBOLO HOLW
CIBOLO PASS
RANCH POINT
RANCH BROOK
RANCH PASS
SENDERO WOODS
ROLLING ACRES TRL
DEER SMT
SUNLAND
SCARTEEN
WEMBLEY
WILD OAK HL
POST OAK TRL
ANTLER MEADOW
MEADOW CREEK TRL
HIGH ANTLER
HONEY OAK CIR
SYCAMORE WAY
ANTLER OAK
ROCK OAK CIR
FIREBIRD DR
SILVER SPUR TRL
ROBIN DALE DR
VENTURER
ROYAL VALANCE
SWEETRIDGE CIR
WILD FIRE DR
KEENELAND DR
SETTERFIELD CIR
WILD COYOTE LN
SARATOGA DR
SARATOGA LN
RALPH FAIR RD
WOODBINE
DELTA DAWN LN
FAIRWAY RUN
VALLEY CREST
RIBOLO VIEW
BATTLE INTENSE
CIBOLO RUN
CIBOLO CT
CIBOLO GAP
WILLOW WIND DR
DEW RDG
RAINTREE HL
FAIRWAY BLUFF DR
RAINTREE WOODS DR
RED BUD HL
SUMMER SONG CIR
AVIATOR CIR
BONNEMARA DR
FALLS TER
SEA BISCUIT DR
BOLD FORBES CIR
TESSARA CIR
ALYDAR CIR
NORTHVIEW PASS
OAKVIEW PASS
TIMBER TOP DR
TERRA VIS
NO LE HACE DR
MANDETTA DR
PROXIMITY DR
SUMMER DR
CROWNTER
ANGEL FIRE DR
WINDERMERE DR
SENDERO RIDGE DR
RIVA RIDGE DR
NOBLE LARK DR
KALKALLO DR
DYALLWAY
WHITEWAY CIR
SEATTLE GLEN
FAIR OAKS PKWY
SECRETARIAT LN
PREAKNESS LN
CHARTWELL LN
TURF PARADISE LN
DAMASCUS DR
ROCKING HORSE LN
JIM DANDY CIR
QUADRILLE LN
TRIPLE CROWN
EQUESTRIAN
PIMLICO LN
AQUEDUCT LN
RUFFIAN DR
HERITAGE TRL
TURNING LEAF
MONUMENT OAK
TIMBERLAND TRL
WOODLAND PKWY
LESLIE PFEFFER DR
COLONIAL OAK
ARBOR VLG
OUTER DR
BOERNE STAGE RD

0 1,500 3,000

SCALE IN FEET

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4.6.2 Future System Analysis

Using the recommended criteria outlined in **Section 4.5**, water system improvements were developed to accommodate the anticipated growth through Buildout of the water service area. Challenges facing the water system include improving areas of low pressure and available fire flow, providing additional pumping and/or ground storage to Zones A and B, and providing service to areas of future growth where little or no infrastructure currently exists. The following key observations and recommendations resulted from modeling and evaluating the distribution system.

A. Improve System Pressures

The existing distribution system has low pressure in the northeastern portion of Zone B along Meadow Creek Trail near the fire station and Enclave neighborhood due to large amounts of headloss between that area and Plant #5 and Elmo Davis. FNI recommends constructing a second pump station, Plant #6, in Zone B on the eastern side of the pressure zone that not only improves system pressures, but also provides additional water supply to serve future growth.

B. Improve Available Fire Flow

Large portions of Zone A and Zone C currently have less than 500 gpm in available fire flow capacity. FNI recommends that the City serve these pressure zones with ESTs instead of hydropneumatic tanks to improve fire flow. FNI also recommends constructing a new Zone A pump station on the eastern side of the pressure zone, Plant #6, and upsizing small-diameter lines within Zone C. These additional projects will further improve available fire flow in Zones A and C.

C. Pumping and Storage

Zone B requires more pumping and ground storage capacity to serve existing customers and to allow for future growth. Zone A also requires more ground storage capacity; therefore, FNI recommends increasing the ground storage capacity at Plant #5 and constructing a new pump station on the eastern side of the pressure zone, Plant #6, both of which serve both Zone A and Zone B.

D. Growth

New distribution mains are required to provide service to new developments in the water service area. Lines were sized based on the demands of each specific area served and a minimum diameter of 6-inches.

Once these improvements were added to the existing water system, hydraulic analyses were performed under Buildout maximum day and peak hour demand conditions. Any areas of high headloss, high velocity, or low pressure were adjusted accordingly to verify sizing of system improvements. The improvements were phased by planning year depending on when the areas being served were projected to develop and the needed capacity recommendations by pressure zone. To verify the improvements would operate correctly as phased, a model run was performed under maximum day and peak hour demand conditions for each future planning period.

Figure 4-5 shows minimum pressures during Buildout peak hour demand conditions. No pressures below 35 psi were observed in the modeling results. **Figure 4-6** shows available fire flows during Buildout maximum day demand conditions.

Plant #3
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 8,000 gal Hydropneumatic Tank

Plant #3 Pump Station
Firm Capacity = 850 gpm
Total Capacity = 1,300 gpm

Plant #5
0.125 MG Ground Storage Tank
0.50 MG Ground Storage Tank

GBRA Delivery Point

Zone A Pump Station
Firm Capacity = 575 gpm
Total Capacity = 1,150 gpm

Zone B Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,600 gpm
400 gpm Zone B PS Expansion

New Pressure Reducing Valve

0.50 MG Zone A EST

Plant #6
600 gpm Zone A PS
1,600 gpm Zone B PS
1.00 MG GST

New GBRA Delivery Point

Elmo Davis Plant
(2) - 0.5 MG Ground Storage Tanks
(2) - 5,000 gal. Hydropneumatic Tanks

Zone C Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,450 gpm
650 gpm Zone C PS Expansion

Plant #2 Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,250 gpm

0.50 MG Plant #2 EST

Plant #2
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 5,000 gal. Hydropneumatic Tank
(1) - 8,000 gal. Hydropneumatic Tank

9,000 gal. Hydropneumatic Tank

FIGURE 4-5
CITY OF FAIR OAKS RANCH
BUILDOUT WATER SYSTEM PEAK HOUR PRESSURES

LEGEND

Buildout Improvements
- Valve
- Pump Station
- Hydropneumatic Tank
- Ground Storage Tank
- Elevated Storage Tank
- Water Line

Existing Water System
- Pump Station
- Hydropneumatic Tank
- Ground Storage Tank

- 8" and Smaller Water Line
- 10" and Larger Water Line
- GBRA Western Canyon Line
- Road
- Stream
- Parcel
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

PRESSURES
- Less than 35 psi
- 35 - 50 psi
- 50 - 80 psi
- 80 - 100 psi
- Greater than 100 psi

PRESSURE ZONES
- Zone A (1,525 feet)
- Zone B (1,460 feet)
- Zone C (1,555 feet)

FREESE AND NICHOLS

0 1,100 2,200
SCALE IN FEET

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Plant #3
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 8,000 gal Hydropneumatic Tank

Plant #3 Pump Station
Firm Capacity = 850 gpm
Total Capacity = 1,300 gpm

Plant #5
0.125 MG Ground Storage Tank
0.50 MG Ground Storage Tank

Zone A Pump Station
Firm Capacity = 575 gpm
Total Capacity = 1,150 gpm

Zone B Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,600 gpm
400 gpm Zone B PS Expansion

GBRA Delivery Point

New Pressure Reducing Valve

0.50 MG Zone A EST

Plant #6
600 gpm Zone A PS
1,600 gpm Zone B PS
1.00 MG GST

New GBRA Delivery Point

Zone C Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,450 gpm
650 gpm Zone C PS Expansion

Elmo Davis Plant
(2) - 0.5 MG Ground Storage Tanks
(2) - 5,000 gal. Hydropneumatic Tanks

Plant #2 Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,250 gpm

0.50 MG Plant #2 EST

Plant #2
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 5,000 gal. Hydropneumatic Tank
(1) - 8,000 gal. Hydropneumatic Tank

9,000 gal. Hydropneumatic Tank

FIGURE 4-6
CITY OF FAIR OAKS RANCH
BUILDOUT WATER SYSTEM AVAILABLE FIRE FLOW

LEGEND

Buildout Improvements
- Valve
- Pump Station
- Hydropneumatic Tank
- Ground Storage Tank
- Elevated Storage Tank
- Water Line

Existing Water System
- Pump Station
- Hydropneumatic Tank
- Ground Storage Tank

- 8" and Smaller Water Line
- 10" and Larger Water Line
- GBRA Western Canyon Line
- Road
- Stream
- Parcel
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

AVAILABLE FIRE FLOW
- Less than 500 gpm
- 500 - 1,000 gpm
- 1,000 - 2,000 gpm
- 2,000 - 3,000 gpm
- Greater than 3,000 gpm

0 1,100 2,200
SCALE IN FEET

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CIP projects were identified for each planning period based on modeling results and FNI capacity recommendations. Below is a summary of CIP projects and the issues that triggered them for each planning period.

- 2023:
  - Additional hydropneumatic storage at Plant #2 to remain in compliance with TCEQ minimum requirements until elevated storage can be constructed in Zone C
  - A new elevated storage tank to provide emergency and equalization storage in Zone A
  - Line improvements to serve growth in the northeastern portion of the Water Service Area
  - Additional pumping and storage capacity at Plant #5 to meet FNI recommended capacity in Zones A and B
  - Additional pumping capacity at Elmo Davis to maintain adequate pressure during periods of peak demand in Zone C
- 2028:
  - A new pressure reducing valve (PRV) along to Meadow Creek Trail to make use of existing infrastructure and provide more redundancy for Zone B
  - Line improvements to serve growth in the eastern portion of the Water Service Area
  - A new pump station (Plant #6) to provide Zones A and B with adequate pumping capacity and improved system pressure and to improve available fire flow in Zone A
  - Replace existing small diameter lines to improve fire flow and transmission capacity.
  - Added water lines in the South PP to serve development.
- Buildout:
  - Line improvements to improve transmission capacity and available fire flow in Zone C
  - A new elevated storage tank to provide emergency and equalization storage in Zone C

5.0 WATER SYSTEM CAPITAL IMPROVEMENT PLAN

A water system CIP was developed for the City of Fair Oaks Ranch. The recommended improvements will provide the required capacity and reliability to meet projected water demands through Buildout conditions. The recommended projects are presented on **Figure 5-1**. Locations shown for new line and other recommended improvements were generalized for hydraulic analysis. Specific alignments and sites will be determined as part of the design process. Projects 18, 19, and 20 were identified by City staff. It is recommended that these projects be constructed generally in the order listed. However, development patterns may make it necessary to construct some projects sooner or later than anticipated. Detailed descriptions and cost estimates for the proposed water system projects are included in **Appendix F**.

Table 5-1 summarizes the costs of the water capital improvement plan for the City of Fair Oaks Ranch. The costs are in 2018 dollars and include an allowance for engineering, surveying, and contingencies. Cost estimates do not include allowances for right-of-way acquisition.

Table 5-1: Water System Capital Improvement Plan

Project Number	Project Name	Cost
Short Term Projects		
1	9,000-Gallon Plant #2 Hydropneumatic Tank (Zone C)	$ 246,700
2	0.5-MG Zone A Elevated Storage Tank (Zone A)	$ 3,289,000
3	12-inch West Ammann Road Water Line (Zone A)	$ 1,016,600
4	12-inch Northeast Water Lines (Zone A)	$ 1,614,600
5	400-gpm Plant #5 Zone B Pump Station Expansion and 0.5-MG GST (Zone B)	$ 2,167,800
6	650-gpm Elmo Davis Pump Station Expansion (Zone C)	$ 971,800
7	Pressure Reducing Valve at Rolling Acres Trail and Meadow Creek Trail (Zone B)	$ 149,500
	Short Term Total	**$ 9,456,000**
Intermediate Projects		
8	8-inch Water Line at Dietz Elkhorn Road and Ralph Fair Road (Zone C)	$ 287,100
9	12-inch Southeastern Water Lines (Zone B)	$ 2,619,300
10	12/16-inch Plant #6 Discharge Water Lines (Zone A/B)	$ 2,822,600
11	Plant #6 and New GBRA Delivery Point (Zone A/B)	$ 5,905,300
12	12-inch ETJ Water Line (Zone B)	$ 2,559,500
	Intermediate Total	**$ 14,193,800**
Long Term Projects		
13	0.5-MG Plant #2 Elevated Storage Tank (Zone C)	$ 3,289,000
14	8/12-inch Royal Ascot/Triple Crown/Equestrian Water Line Replacement (Zone C)	$ 1,085,400
15	8-inch Pimlico Lane Water Line Replacement (Zone C)	$ 758,000
16	8-inch Preakness Lane Water Line Replacement (Zone C)	$ 991,200
17	12-inch Triple Crown Road Water Line Replacement (Zone C)	$ 1,448,700
18	8-inch Rolling Acres Trail Water Line (Zone A)	$ 649,200
19	8-inch Post Oak Trail Water Line (Zone A)	$ 1,295,500
20	8-inch Silver Spur Trail Water Line (Zone A)	$ 677,500
	Long Term Total	**$ 10,194,500**
	CIP Total	**$ 33,844,300**

Plant #3
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 8,000 gal Hydropneumatic Tank

Plant #3 Pump Station
Firm Capacity = 850 gpm
Total Capacity = 1,300 gpm

Plant #5
0.125 MG Ground Storage Tank
0.50 MG Ground Storage Tank

GBRA Delivery Point

Zone A Pump Station
Firm Capacity = 575 gpm
Total Capacity = 1,150 gpm

Zone B Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,600 gpm
400 gpm Zone B PS Expansion

0.50 MG Zone A EST

Plant #6
600 gpm Zone A PS
1,600 gpm Zone B PS
1.00 MG GST

New GBRA Delivery Point

New Pressure Reducing Valve

Elmo Davis Plant
(2) - 0.5 MG Ground Storage Tanks
(2) - 5,000 gal. Hydropneumatic Tanks

Zone C Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,450 gpm
650 gpm Zone C PS Expansion

Plant #2 Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,250 gpm

Plant #2
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 8,000 gal. Hydropneumatic Tank

0.50 MG Plant #2 EST

9,000 gal. Hydropneumatic Tank

FIGURE 5-1
CITY OF FAIR OAKS RANCH
WATER SYSTEM CAPITAL IMPROVEMENT PLAN
LEGEND

5-Year Improvements
- Valve
- Pump Station
- Hydropneumatic Tank
- Ground Storage Tank
- Elevated Storage Tank
- Water Line

10-Year Improvements
- Pump Station
- Ground Storage Tank
- Water Line

Buildout Improvements
- Elevated Storage Tank
- Water Line

Existing Water Systen
- Well
- Pump Station
- Hydropneumatic Tank
- Ground Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- GBRA Western Canyon Line
- Road
- Stream
- Parcel
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

PRESSURE ZONES
- Zone A (1,525 feet)
- Zone B (1,460 feet)
- Zone C (1,555 feet)

FREESE AND NICHOLS

0 1,100 2,200
SCALE IN FEET

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6.0 WASTEWATER FLOWS

The performance of a wastewater collection system is dependent on the amount of water being conveyed through the system. To determine locations where future capacity improvements are necessary, existing and future wastewater flow projections must be developed. Future wastewater flow projections are critical to the development of short- and long-term capital improvements. FNI developed projected wastewater flows for the 5-year, 10-year, and Buildout planning periods for the Wastewater Master Plan. These flows were utilized in the wastewater hydraulic model to plan future wastewater system improvements. Wastewater collection system infrastructure, including lift stations, is sized to convey peak wastewater flows.

6.1 HISTORICAL WASTEWATER FLOWS

Historical wastewater treatment plant (WWTP) effluent flows were provided by the City. The average day flows to the WWTP for the past seven years are summarized in **Table 6-1**.

Table 6-1: Historical WWTP Flows

Year	Wastewater Connections	Average Annual Daily Flow (gallons per day)	Average Annual Daily Flow (MGD)	Average Annual Daily Flow (gpCd)
2010	1,391	223,772	0.22	161
2011	1,418	195,970	0.20	138
2012	1,447	204,573	0.20	141
2013	1,489	218,143	0.22	147
2014	1,552	224,129	0.22	144
2015	1,635	251,682	0.25	154
2016	1,696	235,597	0.24	139
2017	1,718	222,916	0.22	130
Average	-	-	-	**144**
Maximum	-	-	-	**161**

6.2 PROJECTED WASTEWATER FLOWS

Future wastewater flows were developed by selecting a design criterion for average annual daily flow based on historical flows and a wet weather peaking factor. Based on this analysis, FNI recommends a value 160 gpCd for average annual daily flow, and a wet weather peaking factor of 3.5. A wet weather peaking factor of 3.5 was selected in absence of historical peak flow data based on discussions with City

staff indicating that the collection system has relatively low amounts of infiltration and inflow (I/I), or water that enters the system through cracks/openings in the collection system due to rainfall or the presence of groundwater. **Table 6-2** summarizes the total projected average daily and peak wet weather wastewater flows by planning period.

Table 6-2: Projected Wastewater Flows

Year	Wastewater Connections	Gallons per Connection per Day	Average Annual Daily Flow (MGD)	Wet Weather Peaking Factor	Peak Wet Weather Flow (MGD)
2018	1,740	160	0.28	3.50	0.97
2023	2,455	160	0.39	3.50	1.37
2028	3,169	160	0.51	3.50	1.77
Buildout	3,512	160	0.56	3.50	1.97

7.0 WASTEWATER SYSTEM ANALYSES

7.1 EXISTING WASTEWATER SYSTEM

The City of Fair Oaks Ranch's wastewater collection system consists of seven lift stations (LS) and associated force mains, a wastewater treatment plant, and a network of gravity mains 4 inches to 16 inches. The City of Fair Oaks Ranch owns and operates one wastewater treatment plant (WWTP) with a current permitted capacity of 0.5 MGD annual average day flow (AADF). **Figure 7-1** shows the current collection system for the City of Fair Oaks Ranch.

7.2 WASTEWATER MODEL UPDATE

As part of the Water and Wastewater Impact Fee Update completed in January 2015, a hydraulic model of the wastewater collection system was built using the H2OMAP Sewer® hydraulic modeling software by Innovyze. As part of the current study, because H2OMAP Sewer® is soon to be discontinued, the hydraulic model was converted to Innovyze's InfoSewer® software, a similar software package that uses the same hydraulic calculations and algorithms. The hydraulic model was updated based on the City's most recent GIS data of their collection system. Pipelines that have been constructed since the last study were added to the model. Geocoded water meter billing data collected during winter months was used for existing wastewater flow allocation to minimize the impact of irrigation on usage rates. Using winter water billing data provides the most accurate data for actual wastewater flows, as very little water used for irrigation makes its way into the wastewater collection system. These wastewater loads were distributed and allocated to the nearest manhole included in the model.

FIGURE 7-1
CITY OF
FAIR OAKS RANCH
EXISTING WASTEWATER SYSTEM

LEGEND

- Lift Station
- Wastewater Treatment Plant
- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- Force Main
- Road
- Stream
- Index Contour (50-ft)
- Intermediate Contour (10-ft)
- Fair Oaks Ranch City Limit
- Other City Limit

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Deer Meadows LS #1

Deer Meadows LS #2

Falls LS

Setterfeld LS

Bottom of the Hill LS

Wastewater Treatment Plant 0.5 MGD

School LS

0 1,000 2,000

SCALE IN FEET

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Location: H:\W_WW_PLANNING\01_DELIVERABLES\11-Final_Report\(Figure_7-1)-Existing_Wastewater_System.mxd
Updated: Thursday, January 24, 2019 11:18:10 AM

7.3 HYDRAULIC MODELING ANALYSIS

7.3.1 Existing System Analysis

Hydraulic modeling analyses were conducted to identify deficiencies in the City of Fair Oaks Ranch's existing wastewater collection system and to establish a capital improvement plan to improve the existing system and accommodate the projected wastewater flows through Buildout. Various combinations of improvements and modifications were investigated to determine the most appropriate approach for conveying projected flows. Parameters used in developing the improvement plan included simplifying system operations, conveying peak wet weather flows in areas of projected growth, and increasing treatment capacity.

The critical flow condition for analyzing a wastewater collection system is peak wet weather. Flow, depth, and velocity are important factors when analyzing the peak wet weather simulations. When the peak wet weather flows are applied to the model, the effects of I/I in the system can be seen. No existing system issues were observed during peak wet weather flows.

7.3.2 Future System Analysis

Wastewater system improvement alternatives were developed to accommodate the anticipated residential and non-residential growth through Buildout. To serve future growth, the City of Fair Oaks Ranch must upsize existing infrastructure and provide additional service to areas of growth. The following key observations and recommendations resulted from modeling and evaluating the collection system.

A. Simplify Operations and Energy Savings

   Based on existing topography and the configuration of the collection system, the Falls LS is capable of being bypassed using a new gravity main conveying flow north to existing mains. Once the new WWTP is constructed, the Setterfeld LS is also able to be bypassed, with its flow being conveyed instead through a gravity main to the new WWTP site. Eliminating these LSs reduces the cost of operating and maintaining the collection system and simplifies system operations.

B. Growth

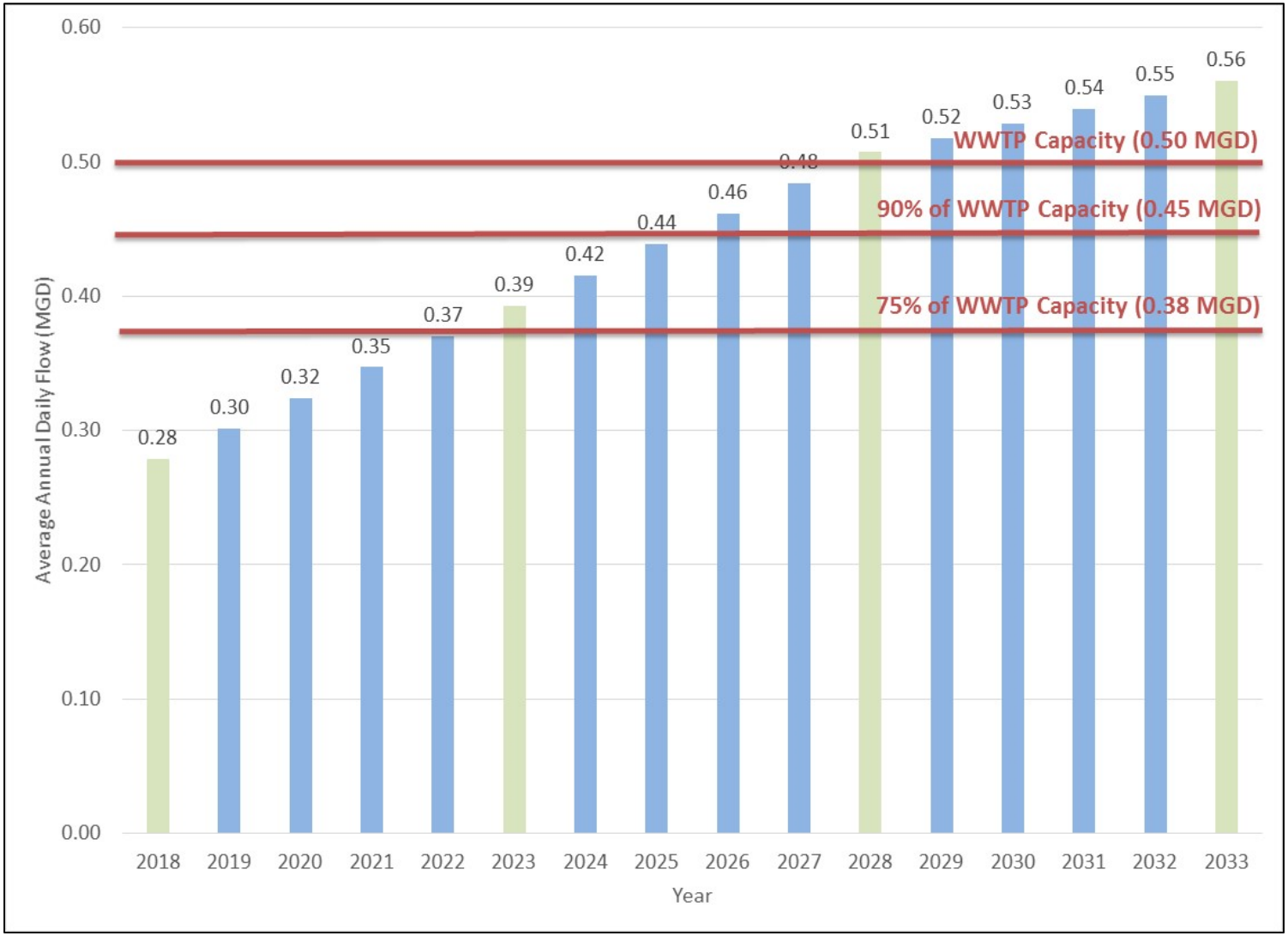
New collection mains and lift stations are required to provide service to new developments in the wastewater service area. Lines were sized based on the flows of each specific area served with a minimum diameter of 8-inches.

C. Increase Treatment Capacity

The existing WWTP has a permitted capacity of 0.5 MGD. TCEQ §305.126, commonly referred to as the 75/90 rule, requires a WWTP permit holder to begin planning for expansion of the treatment facility when the average daily or average annual flow reaches 75% of the permitted capacity. When the average daily or average annual flow reaches 90% of the permitted capacity, the permit holder shall obtain necessary authorization from the commission to commence construction of the necessary additional treatment facilities. Total historical and projected average daily flows for the WWTP are graphed against the current TCEQ permitted capacities of the WWTP on **Figure 7-2**. For the sake of projecting trends, Buildout was estimated to occur in 2033. The average annual daily flows are projected to exceed 75% of the WWTP capacity by 2023, 90% of capacity by 2026, and 100% of capacity by 2028, indicating that the City must begin planning the construction of either an expansion to the existing plant or a new plant by 2023, be under construction by 2026, and be finished and operational by 2028.

It is recommended that the City move forward with designing and constructing a new 0.6-MGD WWTP rather than expanding the existing facility. It should be noted that, although the recommended capacity is only 100,000 gallons per day higher than the existing permitted capacity, many improvements would be required at the existing facility to enable it to treat even the permitted 0.5 MGD, let alone 0.6 MGD. The limited space available at the existing site, existing issues with the required buffer zone between the treatment facility and surrounding buildings, and a historically contentious relationship with the facility's neighbors all factor in to the recommendation to build a new facility in a different location.

Figure 7-2: Historical and Projected Average Daily Flows



8.0 WASTEWATER SYSTEM CAPITAL IMPROVEMENT PLAN

FNI developed a CIP for the City's wastewater collection system based on hydraulic modeling results. Capital costs were calculated for all recommended improvements and do not include individual service connections or internal subdivision infrastructure and are summarized in **Table 8-1**. The costs are provided as estimates based on previous similar engineering experience in 2018 dollars and include an allowance for engineering, surveying, and contingencies. Recommended projects are presented on **Figure 8-1**. Locations of projects have been generalized during the hydraulic analysis. Specific locations of project alignment and location will be determined as a part of the design process. It is suggested that projects be constructed in the order indicated. In the case of development occurring earlier or later, projects may be delayed or expedited as needed. Detailed description of projects and cost estimates can be found in **Appendix G**. A report containing the details of the proposed WWTP can be found in **Appendix H**.

Table 8-1: Wastewater Capital Improvement Plan

Project Number	Project Name	Cost
Short Term Projects		
1	8-inch Gravity Line and Decommission Falls Lift Station	$ 550,900
2	New 0.60-MGD Wastewater Treatment Plant	$ 21,427,100
3	New Gravity Line from Old WWTP to New WWTP	$ 1,830,300
4	Decommission Existing WWTP	$ 1,495,000
Short Term Total		**$ 25,303,300**
Intermediate Projects		
5	12/15-inch Gravity Line in the ETJ	$ 878,500
6	12-inch Gravity Line in the ETJ	$ 728,900
7	12-inch Gravity Line in the ETJ	$ 511,300
8	10-inch Gravity Line north of Ralph Fair Road	$ 699,700
9	8/10-inch Gravity Line north of Ralph Fair Road	$ 929,600
10	8-inch Gravity Line north of Dietz Elkhorn Road	$ 483,300
11	8-inch Gravity Line east of Ralph Fair Road	$ 358,000
12	10-inch Gravity Line crossing Cibolo Creek	$ 498,700
13	12-inch Gravity Line to the new WWTP	$ 381,300
Intermediate Total		**$ 5,469,300**
Long Term Projects		
14	10-inch Gravity Line and Decommission Setterfeld Lift Station	$ 738,600
Long Term Total		**$ 738,600**
CIP Total		**$ 31,511,200**

FIGURE 8-1

CITY OF FAIR OAKS RANCH

WASTEWATER SYSTEM CAPITAL IMPROVEMENT PLAN

LEGEND

5-Year Improvements

- Lift Station
- Wastewater Treatment Plant
- Wastewater Line
- Force Main

10-Year Improvements

- Wastewater Line

Buildout Improvements

- Lift Station
- Wastewater Line

Existing Wastewater System

- Lift Station
- 8" and Smaller Wastewater Line
- 10" and Larger Wastewater Line
- Force Main
- Road
- Stream
- Index Contour (50-ft)
- Intermediate Contour (10-ft)
- Fair Oaks Ranch City Limit
- Other City Limit
- County Boundary

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0 1,000 2,000

SCALE IN FEET

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User Name: GO326

9.0 NON-POTABLE REUSE SYSTEM EVALUATION

9.1 EXISTING REUSE SYSTEM

The City of Fair Oaks Ranch currently has a successful water reuse program which provides non-potable reuse water from its WWTP to the golf course for irrigation purposes. The City is contractually obligated to provide all the effluent from the WWTP to the golf course. A copy of the effluent disposal agreement is provided in **Appendix I.** The existing reuse system consists of a network of lines ranging from 6-inches to 8-inches, two chlorine stations, and three effluent storage ponds. **Figure 9-1** shows the City's existing non-potable reuse system.

9.2 FUTURE SYSTEM ANALYSIS

In the future, the City has plans to build a new WWTP. This plant will allow the City to treat additional wastewater flows and provide additional effluent for reuse. Under the current contract with the golf course, the City is obligated to provide all the WWTP effluent to the golf course. FNI evaluated the capacity of the golf course to handle the Buildout average annual daily flow of 0.56 MGD. Utilizing 30 TAC §285.90 (1) Figure 1, FNI determined that the maximum application rate for the Fair Oaks Ranch golf course is 0.064 gallons per square foot per day. According to the effluent disposal agreement between the City and golf course, the golf course has approximately 280 acres for application of reuse water. Using the maximum application rate, this allows for up to 0.78 MGD of effluent to be used for the golf course. By these calculations, the City can continue to send all the effluent through Buildout to the golf course, although additional pond storage may be required to store the effluent during low demand periods.

9.3 REUSE SYSTEM CAPITAL IMPROVEMENT PLAN

To pump reuse water from the proposed wastewater treatment plant back to the golf course, FNI recommends a new pump station and line to connect to the existing reuse infrastructure. Capital costs were calculated for the recommended improvements and are summarized in **Table 9-1**. The costs are provided as estimates based on previous similar engineering experience in 2018 dollars and include an allowance for engineering, surveying, and contingencies. Recommended projects are presented on **Figure 9-2**. Locations of projects have been generalized during the hydraulic analysis. Specific locations of project alignment and location will be determined as a part of the design process. If the City can renegotiate their contact with the golf course when the new WWTP is built, the City should consider the option of extending purple pipe to the neighborhoods north of the WWTP to utilize effluent.

FIGURE 9-1
CITY OF FAIR OAKS RANCH
EXISTING REUSE SYSTEM

LEGEND

- Chlorine Station
- Ground Storage Tank
- Pump Station
- Wastewater Treatment Plant
- Effluent Main
- Effluent Storage Pond
- Road
- Index Contour (50-ft)
- Intermediate Contour (10-ft)
- Stream
- Pond
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

FREESE AND NICHOLS

0 1,000 2,000
SCALE IN FEET

Blackjack Chlorine Station
Live Oak Chlorine Station
0.5 MGD Wastewater Treatment Plant
Effluent Storage Pond
8"
6"

KENDALL CO
COMAL CO
BEXAR CO

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FIGURE 9-2
CITY OF FAIR OAKS RANCH
REUSE SYSTEM
CAPITAL IMPROVEMENTS PLAN

LEGEND

Proposed Reuse Improvements

- Pump Station (PS)
- Wastewater Treatment Plant (WWTP)
- Reuse Line

Existing Reuse System

- Chlorine Station (C)
- Ground Storage Tank
- Pump Station (PS)
- Wastewater Treatment Plant (WWTP)
- Effluent Main
- Effluent Storage Pond
- Road
- Index Contour (50-ft)
- Intermediate Contour (10-ft)
- Stream
- Pond
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

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0 1,000 2,000
SCALE IN FEET

Table 9-1: Reuse System Improvements Opinion of Probable Construction Cost

Item	Description	Quantity	Unit	Unit Price	Total
1	Pump Station - New 2.0 MGD	1	LS	$1,338,000	$1,338,000
2	12" Reuse Line	5,070	LF	$120	$608,400
3	8" Reuse Line	1,020	LF	$80	$81,600
4	20" Boring and Casing	200	LF	$400	$80,000
				Subtotal:	**$2,108,000**
			Contingency	30%	$632,400
				Subtotal:	**$2,740,400**
			Eng./Survey	15%	$411,060
				Subtotal:	**$3,151,460**
				Estimated Project Total:	**$3,151,460**

10.0 RISK-BASED ASSESSMENT

10.1 WATER SYSTEM RISK-BASED ASSESSMENT

A risk-based assessment of facilities was conducted to assist in the prioritization of recommended operations and maintenance improvements. The assessment was based on the condition and criticality of existing water system facilities. Site visits were performed by FNI and City staff in August 2017 to evaluate the condition of the facilities, and redundancy and population served were used to measure criticality. A scoring system was developed to provide an analytical and quantitative method to evaluate the condition and criticality of each pump station and tank. The results of both the criticality and condition analysis were input to a matrix to provide an overall ranking of facilities.

10.1.1 Water Facilities Condition Scoring

Table 10-1 displays the condition rating system utilized to score each component of a facility. A condition rating of 1 signified that the component was new and met or exceeded all the current standards that applied. A rating of 5 indicated that the component was in very poor shape and required immediate rehabilitation or replacement. Each component of all evaluated facilities received a score between 1 and 5. Components were assigned a weighted percentage, and a total score was calculated for each facility. **Table 10-2** summarizes numeric ranges of the total score to determine whether the overall facility is in very good, good, fair, poor, or very poor condition.

Table 10-1: Facility Condition Scoring

Description	Condition Rating
New, perfect condition	1
Good condition, no improvements recommended to maintain function	2
Fair condition, improvements recommended to improve performance or efficiency	3
Poor condition, improvements recommended to maintain reliability	4
Eminent failure, rehabilitation or replacement required	5

Table 10-2: Facility Condition Assessment Scoring Definition

Score	Condition Assessment Scoring Definition
Very Good	Sound physical condition Total Score ≤ 1.25
Good	Acceptable physical condition 1.25 < Total Score ≤ 2
Fair	Normal wear and tear 2 < Total Score ≤ 3
Poor	Failure likely in short to medium term 3 < Total Score ≤ 4
Very Poor	Failed or near failure Major work or replacement required urgently Total Score > 4

A. Pump Station Condition

All the pump stations in the distribution system were evaluated. **Table 10-3** shows the weightings for each component of the pump stations, and **Tables 10-4 and 10-5** display the weighted score for each pump station and well, respectively, from worst to best. Detailed summary sheets for pump stations from the site visits can be found in **Appendix J**.

Table 10-3: Pump Station Condition Scoring

Component Group	Weight Factor
Electrical – MCC, Switch Gear, Alternate Power	25%
Pumps and Motors	30%
Instrumentation - SCADA, alarms	10%
Structure - Walls, Roof, Foundation	20%
Mechanical - HVAC, Piping, Valves, Meters	15%
Total Inspection Score	100%

Table 10-4: Pump Station Condition Rating Summary

Pump Station	Weighted Score	Overall Condition
Elmo Davis Pump Station	2.46	Fair
Plant #2 Pump Station	2.28	Fair
Plant #3 Pump Station	2.31	Fair
Plant #4 Pump Station	1.95	Good
Plant #5 Zone A Pump Station	1.52	Good
Plant #5 Zone B Pump Station	1.52	Good

Table 10-5: Well Condition Rating Summary

Well	Weighted Score	Overall Condition
Well 25	3.15	Poor
Well 26	3.15	Poor
Well 32	2.90	Fair
Well 9	2.75	Fair
Well 5	2.63	Fair
Well 27	2.55	Fair
Well 13	2.50	Fair
Well K6	2.50	Fair
Well 28	2.43	Fair
Well CR1	2.40	Fair
Well 4	2.25	Fair
Well K3	2.25	Fair
Well 12	2.15	Fair
Well 31	2.15	Fair
Well K5	2.15	Fair
Well 16	2.13	Fair
Well K7	2.05	Fair
Well 7	2.00	Good
Well 8	2.00	Good
Well K1	2.00	Good
Well K8	2.00	Good
Well JW1	1.95	Good
Well K2	1.90	Good
Well 17	1.80	Good
Well 2	1.75	Good
Well 6	1.75	Good
Well 10	1.75	Good
Well 22	1.75	Good
Well 21	1.65	Good
Well 15	0.00	Very Good

B. Storage Facilities Condition

The City's ground storage tanks were evaluated as part of the condition assessment. **Table 10-6** shows the weightings for each component of the ground storage tanks and **Table 10-7**

displays the weighted score for each ground storage tank. Detailed summary sheets for ground storage tanks from the site visits can be found in **Appendix J**.

Table 10-6: Ground Storage Condition Scoring

Component Group	Weight Factor
Mechanical-Piping, Hatches, Valves, Vents	20%
Tank Structure and Roof Slope	50%
Instrumentation and SCADA	10%
Tank Overflow	10%
Site - Drainage, Access Drive, Security, Fencing	10%
Total	100%

Table 10-7: Ground Storage Condition Rating Summary

Storage Facility	Weighted Score	Overall Condition
Elmo Davis GST #1	2.60	Fair
Elmo Davis GST #2	2.40	Fair
Plant #2 GST #2	2.10	Fair
Plant #2 GST #1	2.00	Good
Plant #3 GST #1	1.75	Good
Plant #4 GST	1.65	Good
Plant #3 GST #2	1.55	Good
Plant #5 GST	0.90	Very Good

10.1.2 Water Facilities Criticality Scoring

The criticality of a facility can also be defined as the consequence of a failure. Factors to consider include:

- Number of customers affected
- Redundancy within the system
- Repair and response time

Since repair time for facilities is based on many factors and cannot be easily estimated, and the water system is equally redundant in terms of pumping facilities in each pressure zone, only population served was considered for criticality evaluation of facilities. For groundwater wells, the population served by each well could not be easily calculated, so production capacity was considered instead. **Table 10-8** presents the scoring parameters used and the weighting factors assigned to each water facility. **Table 10-9** shows the scores associated with the rating categories of the criticality assessment. The final criticality scores are shown in **Table 10-10**.

Table 10-8: Criticality Scoring Categories and Weighting

Pump Stations - Connections Served (100%)	Wells – Production Capacity (100%)
> 1,600 = 5 1,201 – 1,600 = 4 801 – 1,200 = 3 401 – 800 = 2 ≤ 400 = 1	101 – 150 gpm = 5 81 – 100 gpm = 4 61 – 80 gpm = 3 ≤ 60 gpm = 2

Table 10-9: Criticality Score Ranges

Score	Criticality Scoring Range
Very Low Impact	Total Score ≤ 1.25
Low Impact	1.25 < Total Score ≤ 2
Moderate Impact	2 < Total Score ≤ 3
High Impact	3 < Total Score ≤ 4
Very High Impact	Total Score > 4

Table 10-10: Facility Criticality Scoring Results

Facility	Weighted Score	Overall Criticality
Elmo Davis GST #1	5.00	Very High
Elmo Davis GST #2	5.00	Very High
Plant #5 GST	5.00	Very High
Well K6	5.00	Very High
Well K5	5.00	Very High
Well 7	5.00	Very High
Well 17	5.00	Very High
Plant #5 Zone B Pump Station	4.00	High
Well K3	4.00	High
Well 16	4.00	High
Well 8	4.00	High
Well K8	4.00	High
Well JW1	4.00	High
Well 22	4.00	High
Well 21	4.00	High
Elmo Davis Pump Station	3.00	Moderate
Plant #2 Pump Station	3.00	Moderate
Plant #4 Pump Station	3.00	Moderate
Plant #2 GST #1	3.00	Moderate
Plant #2 GST #2	3.00	Moderate
Plant #4 GST	3.00	Moderate
Well 9	3.00	Moderate
Well 5	3.00	Moderate
Well 27	3.00	Moderate
Well CR1	3.00	Moderate
Well 4	3.00	Moderate
Well 31	3.00	Moderate
Well K2	3.00	Moderate
Well 25	2.00	Low
Well 26	2.00	Low
Well 32	2.00	Low
Well 13	2.00	Low
Well 28	2.00	Low
Well 12	2.00	Low
Well K7	2.00	Low
Well K1	2.00	Low
Well 2	2.00	Low
Well 6	2.00	Low
Well 10	2.00	Low
Well 15	2.00	Low
Plant #3 Pump Station	1.00	Very Low
Plant #5 Zone A Pump Station	1.00	Very Low
Plant #3 GST #1	1.00	Very Low
Plant #3 GST #2	1.00	Very Low

10.1.3 Water Facilities Analysis Summary

The results of both the criticality and condition analysis were input to a matrix to give facilities an overall combined ranking. A summary of the risk assessment scores can be seen in **Table 10-11**. The facility matrix and well matrix are shown on **Figure 10-1** and **Figure 10-2**. The boxes in red and orange represent relatively short-term critical needs. Any facilities or wells that had components earning a condition rating of Poor or Very Poor were included as projects on the rehabilitation CIP and prioritized by criticality score.

Table 10-11: Summary of Water Facility Risk Assessment

Facility Name	Condition Score	Criticality Score	Overall Score	Risk Category
Elmo Davis GST #1	2.60	5.00	7.60	High Risk
Well K6	2.50	5.00	7.50	High Risk
Elmo Davis GST #2	2.40	5.00	7.40	High Risk
Well K5	2.15	5.00	7.15	High Risk
Well 7	2.00	5.00	7.00	High Risk
Well 17	1.80	5.00	6.80	High Risk
Well K3	2.25	4.00	6.25	High Risk
Well 16	2.13	4.00	6.13	High Risk
Well 8	2.00	4.00	6.00	Moderate Risk
Well K8	2.00	4.00	6.00	Moderate Risk
Well JW1	1.95	4.00	5.95	Moderate Risk
Plant #5 GST	0.90	5.00	5.90	Moderate Risk
Well 22	1.75	4.00	5.75	Moderate Risk
Well 9	2.75	3.00	5.75	Moderate Risk
Well 21	1.65	4.00	5.65	Moderate Risk
Well 5	2.63	3.00	5.63	Moderate Risk
Well 27	2.55	3.00	5.55	Moderate Risk
Plant #5 Zone B Pump Station	1.52	4.00	5.52	Moderate Risk
Elmo Davis Pump Station	2.46	3.00	5.46	Moderate Risk
Well CR1	2.40	3.00	5.40	Moderate Risk
Plant #2 Pump Station	2.28	3.00	5.28	Moderate Risk
Well 4	2.25	3.00	5.25	Moderate Risk
Well 31	2.15	3.00	5.15	Moderate Risk
Well 25	3.15	2.00	5.15	Moderate Risk
Well 26	3.15	2.00	5.15	Moderate Risk
Plant #2 GST #2	2.10	3.00	5.10	Moderate Risk
Plant #2 GST #1	2.00	3.00	5.00	Moderate Risk
Plant #4 Pump Station	1.95	3.00	4.95	Moderate Risk
Well K2	1.90	3.00	4.90	Moderate Risk
Well 32	2.90	2.00	4.90	Moderate Risk
Plant #4 GST	1.65	3.00	4.65	Moderate Risk
Well 13	2.50	2.00	4.50	Moderate Risk
Well 28	2.43	2.00	4.43	Moderate Risk
Well 12	2.15	2.00	4.15	Moderate Risk
Well K7	2.05	2.00	4.05	Moderate Risk
Well K1	2.00	2.00	4.00	Low Risk
Well 2	1.75	2.00	3.75	Low Risk
Well 6	1.75	2.00	3.75	Low Risk
Well 10	1.75	2.00	3.75	Low Risk
Plant #3 Pump Station	2.31	1.00	3.31	Low Risk
Plant #3 GST #1	1.75	1.00	2.75	Low Risk
Plant #3 GST #2	1.55	1.00	2.55	Low Risk
Plant #5 Zone A Pump Station	1.52	1.00	2.52	Low Risk
Well 15	0.00	2.00	2.00	Low Risk

Figure 10-1: Water Facility Condition and Criticality Matrix

Risk Rating = Condition + Criticality	Condition Ranking: Very Good	Good	Fair	Poor	Very Poor
Criticality Ranking: Very Low Impact		Plant #5 Zone A PS Plant #3 GST #1 Plant #3 GST #2	Plant #3 PS		
Low Impact					
Moderate Impact		Plant #4 PS Plant #2 GST #1 Plant #4 GST	Elmo Davis PS Plant #2 PS Plant #2 GST #2		
High Impact		Plant #5 Zone B PS			
Very High Impact	Plant #5 GST		Elmo Davis GST #1 Elmo Davis GST #2		

Figure 10-2: Well Condition and Criticality Matrix

Risk Rating = Condition + Criticality	Condition Ranking: Very Good	Good	Fair	Poor	Very Poor
Criticality Ranking: Very Low Impact					
Low Impact	Well 15	Well 2 Well K1 Well 6 Well 10	Well 12 Well 13 Well 28 Well 32 Well K7	Well 25 Well 26	
Moderate Impact		Well K2	Well 4 Well 5 Well 9 Well 27 Well 31 Well CR1		
High Impact		Well 8 Well 21 Well 22 Well JW1 Well K8	Well 16 Well K3		
Very High Impact		Well 7 Well 17	Well K5 Well K6		

10.2 WASTEWATER AND REUSE SYSTEM RISK BASED ASSESSMENT

FNI performed a risk-based assessment on the City's seven lift stations and two reuse chlorine stations. The risk-based assessment considered condition and criticality components to evaluate the risk of failure of each facility inspected. The condition assessment included a visual inspection of each facility and its components. The criticality assessment included an analysis of the proximity of the facility to critical or environmentally sensitive areas, as well as the population served. Facilities were assigned an overall condition and criticality scores based on the results of the assessments. These scores were used to assign a risk category (extreme, high, moderate, or low) to each asset. The results of both the criticality and condition analysis were input to a matrix to provide an overall ranking of facilities.

A separate assessment was conducted of the existing WWTP by design engineers from a subconsultant, Ardurra Group. The general findings of this assessment are included in **Section 10.3**. A detailed report of the WWTP assessment can be found in **Appendix H**.

10.2.1 Lift Station and Chlorine Station Condition Scoring

FNI developed a list of electrical, structural, mechanical, and site components to be inspected at each facility site. A condition weighting factor was assigned to each component group based on the relative importance of the component to the overall function of the facility. Major components in each of these categories were evaluated separately. **Table 10-12** illustrates the condition component groups, parameters, and weighting for the lift station and chlorine station facilities.

Table 10-12: Condition Assessment Component Groups and Weighting

Component Group	Weight Factor
Pumps and Motors	20%
Electrical – MCC, Back-up Power, Cables	20%
Instrumentation –SCADA, alarms	15%
Structure – Wet Well, Hatches, Corrosion, Cracks, Leaking	20%
Piping and Valves	15%
Site - Drainage, Access Drive, Security, Fencing	10%
Total	100%

Site visits for the lift stations and chlorine stations were performed in August 2017. The condition inspections were conducted by a team of design, electrical and modeling engineers from FNI, as well as

operations staff from the City. FNI assigned numerical scores ranging from 1 to 5 to each component group based on the physical condition as seen during the inspection and information provided by the City staff relating to its operational performance. **Table 10-13** shows the guidelines used during assignment of numerical scores for component groups.

Table 10-13: Facility Condition Scoring

Description	Condition Rating
New, perfect condition	1
Good condition, no improvements recommended to maintain function	2
Fair condition, improvements recommended to improve performance or efficiency	3
Poor condition, improvements recommended to maintain reliability	4
Eminent failure, rehabilitation or replacement required	5

Once the visual site inspections were completed, ranges were assigned for the condition scores, and categories were designated from very good to very poor as shown in **Table 10-14**. Final condition scores for each facility are shown in **Table 10-15**. Detailed risk-based assessment sheets including facility information, individual component group scores for condition and criticality, and additional comments for each facility are included in **Appendix J**.

Table 10-14: Facility Condition Assessment Scoring Definition

Score	Condition Assessment Scoring Definition
Very Good	Sound physical condition Total Score ≤ 1.25
Good	Acceptable physical condition 1.25 < Total Score ≤ 2
Fair	Normal wear and tear 2 < Total Score ≤ 3
Poor	Failure likely in short to medium term 3 < Total Score ≤ 4
Very Poor	Failed or near failure Major work or replacement required urgently Total Score > 4

Table 10-15: Condition Assessment Component Groups and Weighting

Facility Name	Weighted Score	Overall Condition
The Falls Lift Station	2.50	Fair
WWTP Lift Station	2.05	Fair
School Lift Station	1.90	Good
Deer Meadows Lift Station #1	1.85	Good
Deer Meadows Lift Station #2	1.75	Good
Bottom of the Hill Lift Station	1.60	Good
Blackjack Chlorine Station	1.25	Very Good
Live Oak Chlorine Station	1.25	Very Good
Setterfeld Lift Station	1.00	Very Good

10.2.2 Lift Station and Chlorine Station Criticality Scoring

FNI performed a criticality assessment for each facility based on three categories:

- Proximity to High Impact Areas
- Population Served
- Proximity to Environmentally Sensitive Areas

Table 10-16 shows the scoring parameters used and the weighting factors assigned to each facility criticality category. Densely populated areas were considered to be more critical than areas with fewer connections. If a facility fell into multiple categories, the higher score was used.

Table 10-16: Criticality Assessment Component Groups and Weightings

Proximity to High Impact Areas (25%)	Population Served (50%)
≤ 2000 feet from hospital or school = 5	> 6,000 = 5
≤ 2000 feet from golf course = 4	3,001 – 6,000 = 4
≤ 500 feet from residential or commercial structure = 3	1,501 – 3,000 = 3
501 – 1,000 feet from residential or commercial structure = 2	501 – 1,500 = 2
None of the above = 0	≤ 500 = 1
Proximity to Environmentally Sensitive Areas (25%)	
≤ 250 feet from any water body or park = 5	
251 – 500 feet from any water body or park = 4	
501 – 750 feet from any water body or park = 3	
751 – 1,000 feet from any water body or park = 2	
> 1,000 feet from any water body or park = 1	

GIS tools were utilized to determine the distance from each facility to the high impact areas and environmentally sensitive areas. Geocoded water meters were used to determine the existing population within each facility service area.

Once the proximity and population analyses were completed, ranges were assigned for the criticality scores, and categories were designated from very low impact to very high impact. **Table 10-17** shows the scores associated with the rating categories of the criticality assessment. Final criticality scores for each lift station and chlorine station are shown in **Table 10-18**.

Table 10-17: Criticality Score Ranges

Score	Criticality Scoring Range
Very Low Impact	Total Score ≤ 1.25
Low Impact	1.25 < Total Score <≤ 2
Moderate Impact	2 < Total Score <≤ 3
High Impact	3 < Total Score ≤ 4
Very High Impact	Total Score > 4

Table 10-18: Lift Station and Chlorine Station Criticality Score Summary

Facility Name	Criticality Score	Overall Criticality
Bottom of the Hill Lift Station	4.50	Very High
WWTP Lift Station	3.75	High
School Lift Station	3.00	Moderate
The Falls Lift Station	2.50	Moderate
Deer Meadows Lift Station #1	2.50	Moderate
Deer Meadows Lift Station #2	2.50	Moderate
Setterfeld Lift Station	2.50	Moderate
Blackjack Chlorine Station	0.50	Very Low
Live Oak Chlorine Station	0.50	Very Low

10.2.3 Lift Station and Chlorine Station Analysis Summary

FNI utilized the results of the condition and criticality assessments to develop a risk-based assessment of the City's lift stations and chlorine stations. Risk scores were calculated by the summation of the condition and criticality scores for each facility. These risk scores were divided into four ranges (extreme, high, moderate, and low) to assign a risk of failure to each facility. The results of both the criticality and condition analysis were input to a matrix to give the lift stations and chlorine stations an overall combined ranking. This matrix is shown on **Figure 10-3**.

Two of the lift stations, Bottom of the Hill and WWTP, received a good or fair condition score, respectively, but received a high risk rating due to their high criticality. These lift stations should continue to be well maintained to minimize lift station downtime given the high consequence of failure of these facilities. A summary of the risk assessment scores can be seen in **Table 10-19**.

Table 10-19: Summery of Lift Station Risk Assessment

Lift Station	Condition Rating	Criticality Rating	Overall Score	Risk Category
Bottom of the Hill Lift Station	1.60	4.50	6.10	High Risk
WWTP Lift Station	2.05	3.75	5.80	High Risk
The Falls Lift Station	2.50	2.50	5.00	Moderate Risk
School Lift Station	1.90	3.00	4.90	Moderate Risk
Deer Meadows Lift Station #1	1.85	2.50	4.35	Moderate Risk
Deer Meadows Lift Station #2	1.75	2.50	4.25	Moderate Risk
Setterfeld Lift Station	1.00	2.50	3.50	Low Risk
Blackjack Chlorine Station	1.25	0.50	0.00	Low Risk
Live Oak Chlorine Station	1.25	0.50	0.00	Low Risk

Figure 10-3: Lift Station and Chlorine Station Facility Condition and Criticality Matrix

Risk Rating = Condition + Criticality		Condition Ranking				
		Very Good	Good	Fair	Poor	Very Poor
Criticality Ranking	Very Low Impact	Blackjack Chlorine Station Live Oak Chlorine Station				
	Low Impact					
	Moderate Impact	Setterfeld LS	Deer Meadows LS #1 Deer Meadows LS #2 School LS	Falls LS		
	High Impact			WWTP LS		
	Very High Impact		Bottom of the Hill LS			

10.3 REHABILITATION CAPITAL IMPROVEMENT PLAN

The findings from the risk-based assessments of the water, wastewater, and reuse systems were utilized to develop a rehabilitation capital improvement plan. This plan includes projects designed to prolong the useful life and improve reliability of existing infrastructure. Projects 27 through 35 were identified by City staff. As mentioned in **Section 10.2**, a separate assessment of the existing WWTP was conducted by design engineers from Ardurra Group. The general findings of that assessment include:

- City would like finer influent screening. Existing screen lacks screenings wash press.
- There is no grit removal at existing WWTP, which results in grit buildup at the In-Yard Lift Station and Oxidation Ditch.
- Lack of concrete deck at mixing ends of Oxidation Ditch creates unsightly and inconvenient overspray.
- Oxidation Ditch aerators, motors and gearboxes are approaching the end of their useful life and may fail within the next 5 to 10 years.
- There are no digesters or aerated sludge holding tanks at the existing WWTP, which makes plant operations (wasting sludge) difficult.
- Issues with wasting sludge leads to sludge bulking and/or denitrification in the clarifier resulting in floating solids being carried over the weir with the effluent.
- The sludge drying beds are limited in capacity, which exacerbates the lack of digesters or sludge storage, and causes the City to wet haul sludge. At the time of the site visit, the cost of wet hauling was approximately $20,000/month in the winter.
- The WWTP has received odor complaints related to the screening structure and sludge drying beds. Some WWTP process units likely fall within TCEQ's required 150 ft buffer zone to the nearest property line (30 TAC 309).

Based on these observations, the recommended rehabilitation projects at the existing WWTP are as follows:

- Installation of new mechanical fine screen and screening wash press

- Installation of new Oxidation Ditch aerators, motors and gearboxes
- Construction of concrete deck at mixing ends of the Oxidation Ditch
- Sludge wasting and dewatering improvements
- Electrical improvements required to support process upgrades

Cost estimates for each project and estimated year of completion are summarized in **Table 10-20**. Recommended rehabilitation projects are presented on **Figure 10-4**. A report containing the details of the existing WWTP assessment and proposed improvements can be found in **Appendix H**.

Table 10-20: Rehabilitation Capital Improvement Plan

Project Number	Project Title	Project Cost
1 & 2	Elmo Davis GST #1 & GST #2 – Mechanical/Structural	$313,270
3	Elmo Davis Pump Station – Electrical	$256,930
4	Wastewater Treatment Plant	$4,087,530
5	Plant #3 Pump Station – Electrical/Instrumentation	$255,290
6	Creek Crossing Repair West	$34,130
7	Creek Crossing Repair Central	$34,130
8	School Lift Station – Mechanical	$196,630
9	Deer Meadows Lift Station #2 – Instrumentation	$111,320
10	Deer Meadows Lift Station #1 – Instrumentation	$111,320
11	Well K6 – Electrical	$39,230
12	Well JW1 – Structural	$18,980
13	Well 9 – Electrical	$46,760
14	Well 5 – Electrical	$4,710
15	Well 27 – Electrical	$36,360
16	Well CR1 – Electrical	$37,970
17	Well 25 – Electrical/Mechanical/Structural	$51,720
18	Well 26 – Electrical/Mechanical/Structural	$53,090
19	Well 31 – Mechanical/Structural	$18,430
20	Well 32 – Electrical/Mechanical/Structural	$21,920
21	Well 28 – Electrical	$36,360
22	Well 12 – Mechanical/Structural	$18,430
23	Well K7 – Mechanical/Structural	$18,980
24	Well 14 – Electrical/Mechanical/Structural	$65,190
25	Well 1 – Electrical	$18,630
26	Well 19 – Electrical	$40,520
27	Effluent Pump Station Expansion	$162,500
28	Rolling Acres Trail Water Line	$291,720
29	Willow Wind Drive/Red Bud Hill Water Line	$308,880
30	Fair Oaks Parkway Water Line Reroute	$214,370
31	Keeneland Drive Water Line Creek Crossing	$51,870
32	Plant #5 GST - THM Removal System	$384,000
33	Plant #2 VFD	$164,810
34	Blackjack Chlorine Station SCADA	$146,250
35	Live Oak Chlorine Station SCADA	$146,250
	TOTAL:	**$5,927,830**

Note: Project costs include 25% for engineering/survey and 30% for contingency.

FIGURE 10-4
CITY OF FAIR OAKS RANCH
PROPOSED REHABILITATION PROJECTS

LEGEND

- Well
- Chlorine Station
- Pump
- Hydropneumatic Tank
- Ground Storage Tank
- Water Treatment Plant
- Irrigation Well
- Lift Station
- Wastewater Treatment Plant
- County Boundary

Proposed Rehabilitation Project

- Well
- Ground Storage Tank
- Lift Station
- Pump Station
- Wastewater Treatment Plant
- Line Repair
- Road
- Stream
- Parcel
- Fair Oaks Ranch City Limit
- ETJ Boundary

CITY OF FAIR OAKS RANCH • TEXAS

FREESE AND NICHOLS

Well K1
Well K5
Plant #3 Pump Station
Firm Capacity = 850 gpm
Total Capacity = 1,300 gpm
Plant #3
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 2,500 gal Hydropneumatic Tank
(1) - 8,000 gal Hydropneumatic Tank
Well CR1
Well K2
Well K8
Well K6
Plant #5
(1) - 0.125 MG Ground Storage Tank
Zone A Pump Station
Firm Capacity = 575 gpm
Total Capacity = 1,150 gpm
Zone B Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,600 gpm
Well K7
Deer Meadows LS #1
Deer Meadows LS #2
Well K3
Blackjack Chlorine Station
Well 36
Well 34
Well 35
The Falls LS
Well 16
Plant #2
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 5,000 gal. Hydropneumatic Tank
(1) - 8,000 gal. Hydropneumatic Tank
Well 15
Plant #2 Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,250 gpm
Well 13
Well 27
Well 26
Well 25
Well 28
Well 17
Plant #4
2 - Pumps
1 - 22,500 gal. Ground Storage Tank
Well JW1
Live Oak Chlorine Station
Wastewater Treatment Plant
0.5 MGD
Effluent PS Expansion
WWTP LS
Well 18
Well 1
Well 19
Well 10
Well 30
Well 31
Setterfeld LS
Well 12
Well 14
Elmo Davis GST #1
Elmo Davis GST #2
Well 32
Well 23
Well 4
Elmo Davis Plant Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,450 gpm
Elmo Davis Plant
(2) - 0.5 MG Ground Storage Tanks
(2) - 5,000 gal. Hydropneumatic Tanks
Well 3
Well 2
Well 21
School LS
Well 7
Well 6
Well 5
Well 8
Well 22
Well 9

RANCH RUN, RANCH FALLS, RANCH VALLEY, RANCH PASS, WOODLAND VIEW, RANCH TERRACE, STONE TERRACE, SENDERO WOODS, AMMANN RD, W AMMANN RD, KIRCHSKE RANCH RD, WOOD TRL, SANDY OAKS DR, OAKWOOD LN, CIBOLO RIDGE TRL, CIBOLO HOLW N, ROCK FRST, SUNLAND, FLAGSTONE HILL DR, WILD OAK HILL, WINDMILL CIR, SKY BLUE RDG, WEMBLEY, SCARTEEN, ROLLING ACRES TRAIL, Cibolo Creek, KENDALL CO, COMAL CO, BEXAR CO, FM 3351, MEADOW CREEK TRAIL, POST OAK TRL, HIGH ANTLER, STEPHANIE WAY, HONEY OAK CIRCLE, ANTLER MEADOW, AXIS PASS, ANTLER OAK, OAK BEND ESTATES, Posnak Creek, KNOTTY GROVE, CAVALRY DRIVE, DELTA DAWN LANE, AXIS RUN, WOODBINE WAY, ROCK OAK CIR, FARM-TO-MARKET ROAD 3351, JODHPUR DRIVE, MAN O WAR DRIVE, HIGH CLIFF DRIVE, FIREBIRD DRIVE, SILVER SPUR TRL, SCHEELE RD, KENDALL PKWY, KENDALL POINTE DR, CANYON CIR, KENDALL LN, KENDALL RDG, Cibolo Creek, VENTURER, ROBIN DALE DR, ROYAL VALANCE, SWEETRIDGE CIR, INTREPID DR, KEENELAND DR, SETTERFELD CIRCLE, WILD COYOTE LANE, SARATOGA DR, CIBOLO OAKS, CIBOLO VALLEY, CIBOLO VIEW, VALLEY CREST, CIBOLO RUN, CIBOLO COURT, CIBOLO TRACE, CIBOLO GAP, FAIRWAY GREEN DR, FAIRVIEW PL, FAIRWAY VISTA DR, WILLOW WIND DR, RED BUD PL, DEW RDG, FAIRWAY TRAIL DR, FAIRWAY BLUFF DR, FAIRWAY VLY, SEATTLE INTENSE, HIGH ESCHELON, HANSEL DRIVE, RAINTREE WOODS DRIVE, SUMMER SONG CIRCLE, TERRA BELLA, TERRA VISTA, SCINTILLA LANE, RALPH FAIR ROAD, NO LE HACE DR, DUBERRY RIDGE, WHIMSEY RIDGE, KEARNEY RIDGE, ELKHORN RIDGE, AVIATOR CIR, CONNEMARA DR, DEER LEAP, ENCHANTED ELM, ENCHANTED PARK, SEABISCUIT DRIVE, TESSARA CIR, BOLD FORBES CIR, ALYDAR CIRCLE, OAKVIEW PASS, NORTHVIEW PASS, FALLS TERRACE, DRIVEWAY, DIETZ ELKHORN RD, OLD DIETZ ELKHORN RD, STEVENSON GATE, FAIRS GATE, WHISPER GATE, NOLL RD, ROYAL MUSTANG CIRCLE, TIVOLI WAY, NOBLE LARK DR, KAI KALLO DR, WINDERMERE DRIVE, RIVA RIDGE DRIVE, TURF PARADISE LANE, DAPPER DAN DRIVE, SECRETARIAT LANE, PREAKNESS LN, CHARTWELL LN, OLD FREDERICKSBURG RD, IRVING HILL, HIDDEN GATE, PFEIFFERS GATE, FRONT GATE, GATE FOREST, HERITAGE TRAIL, WHIRLAWAY CIR, SEATTLE SLEW, FAIR OAKS PARKWAY, TURNING LEAF, TRIPLE CROWN, DAMASCUS DRIVE, CLYDESDALE CIRCLE, MONUMENT OAK, TIMBERLAND TRAIL, LESLIE PFEIFFER DR, COPPER LEAF, WOODLAND PARKWAY, EXIT 546, I 10, IH 10 W, WATERVIEW DR, REDFISH, POMPANO DR, TARPON DR, SAILFISH DR, MARLIN DR, AQUA DR, NCH LN, ROCKING HORSE LANE, COLONIAL OAK, SETTLERS PEAK, TRADITION TRL, COLONIAL WOODS, LEGACY WOODS, OAK BROOK WAY, LIBERTY PARK, JAMESTOWN SQ, BOWMANS LN, EQUESTRIAN, STEEPLECHASE LANE, AQUEDUCT LANE, RUFFIAN DRIVE, PIMLICO LANE, WOODLAND GRN, MOUNTAIN TRL, FAWN MTN, SMOKEY VW, COVEY ROOST, INDIAN HILLS LN, FLINT ROCK DR, REYGLEN DR, TRACINEY BLVD, JASON AVE, HAZY HOLW, CLASSIC OAKS LN, E OUTER DR, 4WD ROAD, WESTOUTER DR, MOYER RD, Salado Creek, CENTRAL RD, TENBERG DR, FINCKE DR, PLANT RD, BARNARD RD, TOMPKINS RD, ROBERTS DR, MCELROY DR, ROAD NO F-10, BOYD LN, H-22, H-21, H-20, H-19, H-18, D-24, U-26, U-29, U-28, U-27, F-13, F-11, F-10, S-1, B-7, C-9

0 1,000 2,000
SCALE IN FEET

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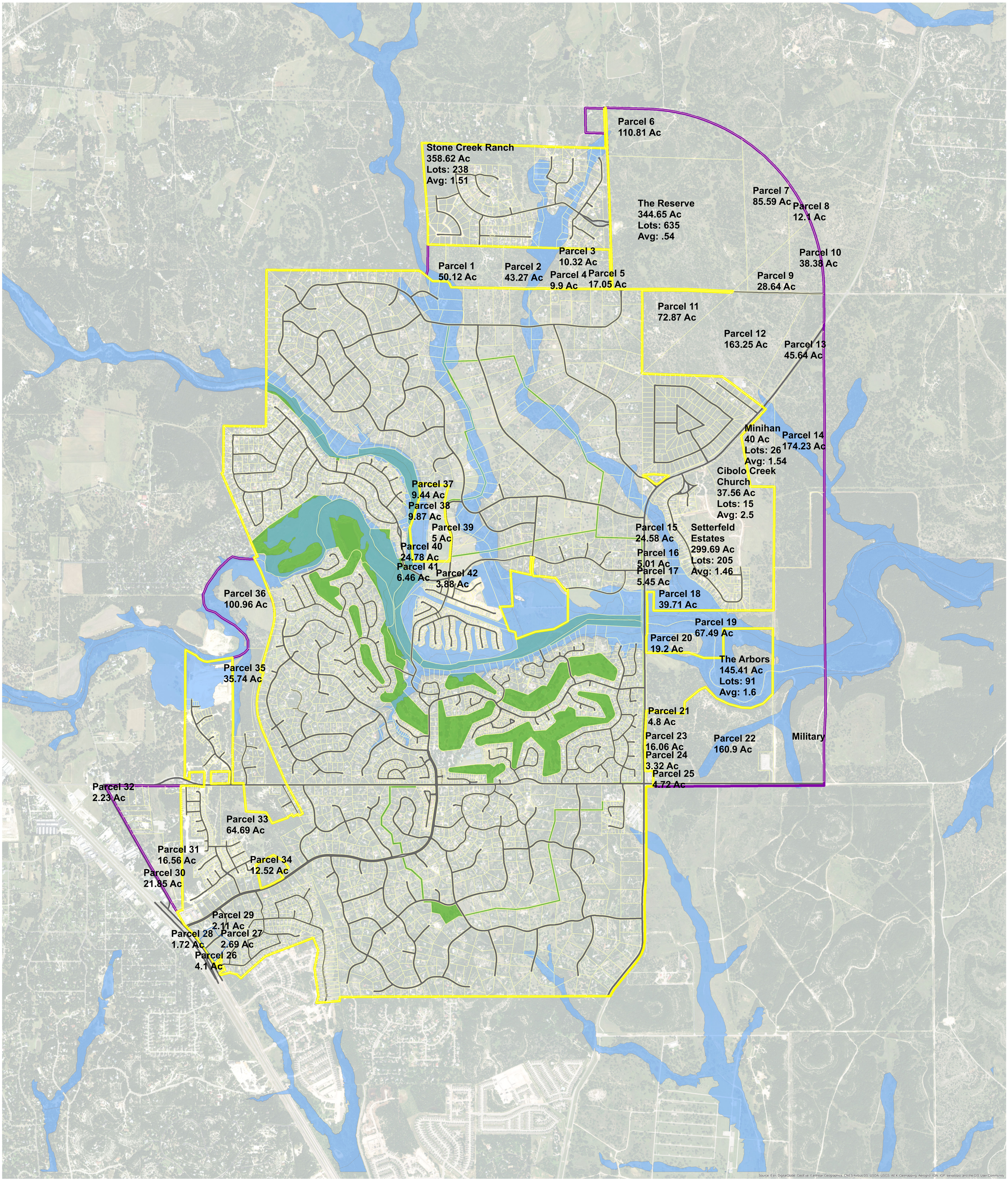
APPENDIX A
FUTURE DEVELOPMENT INFORMATION

City of Fair Oaks Ranch
Table A-1: Projected Development

Proposed Zoning Build Out Projections							
Develpoment Name	Acerage	Rural Residential Lot #	Neighborhood Residential Lot #	Commercial Sqft	MF Units	Units per Acre	Lot Count
Minihan	40	8.89				4.50	
Oak Bend Estates	149	33.11				4.50	
The Reserve	345	76.59				4.50	
Cibolo Creek Church	38		50.08			0.75	
Hill Country Church	10		13.33			0.75	
TOTAL	**581**	**118.59**	**63.41**	**0.00**	**0.00**	-	

Development ID	Description	Acreage	Rural Residential Lot #	Neighborhood Residential Lot #	Commercial Sqft	MF Units	Units per Acre	Avg Size - Lot Count
1	Rural Residential	50	11.14				4.50	31.08
2	Rural Residential	43	9.62				4.50	26.83
3	Rural Residential	10	2.29				4.50	6.40
4	Rural Residential	10	2.20				4.50	6.14
5	Rural Residential	17	3.79				4.50	10.57
6	Rural Residential	111	24.62				4.50	68.72
7	Rural Residential	86	19.02				4.50	53.08
8	Rural Residential	12	2.69				4.50	7.50
9	Rural Residential	29	6.36				4.50	17.76
10	Rural Residential	38	8.53				4.50	23.80
11	Rural Residential	73	16.19				4.50	45.19
12	Rural Residential	163	36.28				4.50	101.24
13	Rural Residential	46	10.14				4.50	28.30
14	Rural Residential	174	38.72				4.50	108.05
15	Neighborhood Residential	25		32.77			0.75	15.24
16	Neighborhood Residential	5		6.68			0.75	3.11
17	Neighborhood Residential	5		7.27			0.75	3.38
18	Rural Residential	40	8.82				4.50	24.63
19	Rural Residential	67	15.00				4.50	41.85
20	Rural Residential	19	4.27				4.50	11.91
21	Neighborhood Residential	5		6.40			0.75	2.98
22	Neighborhood Residential	161		214.53			0.75	99.78
23	Ralph Fair MU	16			100,000	115		
24	Ralph Fair MU	3						
25	Ralph Fair MU	5						
26	Old Fredricksburg MU	4			20,000			
27	Old Fredricksburg MU	3			10,000			
28	Old Fredricksburg MU	2			5,000			
29	Old Fredricksburg MU	2			5,000			
30	Old Fredricksburg MU	22			235,000	250		
31	Old Fredricksburg MU	17						
32	Dietz Elkhorn Commerical Corner	2			5,000			
33	Neighborhood Residential	65		86.25			0.75	40.12
34	Neighborhood Residential	13		16.69			0.75	7.76
35	Rural Residential	36	7.94				4.50	22.16
36	Rural Residential	101	22.44				4.50	62.61
37	Rural Residential	9	2.10				4.50	5.85
38	Rural Residential	10	2.19				4.50	6.12
39	Rural Residential	5	1.11				4.50	3.10
40	Rural Residential	25	5.51				4.50	15.37
TOTAL			**260.97**	**370.60**	**380,000**	**365**	-	**900.62**

Assumptions	
Rural Residential Lot Avg	4.50
Neighborhood Residential Lot Avg.	0.75
Existing Commercial FAR	0.03
Average Lot Size of Dev. Agreement	1.61


Parcel 6
110.81 Ac
Stone Creek Ranch
358.62 Ac
Lots: 238
Avg: 1.51
The Reserve
344.65 Ac
Lots: 635
Avg: .54
Parcel 7
85.59 Ac
Parcel 8
12.1 Ac
Parcel 10
38.38 Ac
Parcel 3
10.32 Ac
Parcel 1
50.12 Ac
Parcel 2
43.27 Ac
Parcel 4
9.9 Ac
Parcel 5
17.05 Ac
Parcel 9
28.64 Ac
Parcel 11
72.87 Ac
Parcel 12
163.25 Ac
Parcel 13
45.64 Ac
Minihan
40 Ac
Lots: 26
Avg: 1.54
Parcel 14
174.23 Ac
Cibolo Creek
Church
37.56 Ac
Lots: 15
Avg: 2.5
Parcel 37
9.44 Ac
Parcel 38
9.87 Ac
Parcel 39
5 Ac
Parcel 40
24.78 Ac
Parcel 41
6.46 Ac
Parcel 42
3.88 Ac
Parcel 15
24.58 Ac
Setterfeld
Estates
299.69 Ac
Lots: 205
Avg: 1.46
Parcel 16
5.01 Ac
Parcel 17
5.45 Ac
Parcel 18
39.71 Ac
Parcel 36
100.96 Ac
Parcel 19
67.49 Ac
Parcel 20
19.2 Ac
The Arbors
145.41 Ac
Lots: 91
Avg: 1.6
Parcel 35
35.74 Ac
Parcel 21
4.8 Ac
Parcel 23
16.06 Ac
Parcel 22
160.9 Ac
Military
Parcel 24
3.32 Ac
Parcel 25
4.72 Ac
Parcel 32
2.23 Ac
Parcel 33
64.69 Ac
Parcel 31
16.56 Ac
Parcel 34
12.52 Ac
Parcel 30
21.85 Ac
Parcel 29
2.11 Ac
Parcel 28
1.72 Ac
Parcel 27
2.69 Ac
Parcel 26
4.1 Ac
Source: Esri, DigitalGlobe, GeoEye, Earthstar Geographics, CNES/Airbus DS, USDA, USGS, AEX, Getmapping, Aerogrid, IGN, IGP, swisstopo, and the GIS User Community

APPENDIX B
WATER AND WASTEWATER CONNECTIONS BY PLANNING AREA

FIGURE B-1
CITY OF FAIR OAKS RANCH
WATER CONNECTIONS BY PLANNING AREA

LEGEND

- Planning Area
- Road
- Stream
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

SUBDIVISION UNIT ID
2018 Connections (2,880)
2023 Connections (3,728)
2028 Connections (4,578)
Buildout Connections (4,914)

SU1 0 0 0 0
SU2 0 10 21 25
SU3 118 168 218 238
SU4 0 8 16 19
SU5 0 1 2 3
SU6 0 265 529 645
SU7 0 1 2 2
SU8 0 4 7 9
SU9 0 5 9 11
SU10 0 4 8 10
SU11 0 3 5 6
SU12 0 1 2 2
SU13 0 2 3 4
SU14 51 54 57 58
SU15 0 7 13 16
SU16 0 0 1 1
SU17 0 15 30 36
SU18 0 4 8 10
SU19 3 4 5 5
SU20 87 90 93 94
SU21 30 32 33 34
SU22 4 4 4 4
SU23 0 1 3 3
SU24 8 10 12 13
SU25 1 55 109 130
SU26 32 34 35 36
SU27 0 11 22 26
SU28 0 16 32 39
SU29 7 7 8 8
SU30 289 298 307 310
SU31 0 6 13 15
SU32 20 23 27 28
SU33 0 1 2 2
SU34 0 1 2 2
SU35 15 15 16 16
SU36 2 2 3 3
SU37 0 14 28 33
SU38 0 0 1 1
SU39 122 157 191 205
SU40 0 2 5 6
SU41 0 3 6 7
SU42 17 17 17 17
SU43 101 104 107 108
SU44 40 41 43 43
SU45 0 1 1 1
SU46 10 11 13 13
SU47 0 3 6 7
SU48 0 0 1 1
SU49 31 31 31 31
SU50 17 18 20 20
SU51 0 4 7 9
SU52 45 55 64 68
SU53 54 54 54 54
SU54 0 0 1 1
SU55 0 5 8 12
SU56 11 11 12 12
SU57 32 32 32 32
SU58 34 34 34 34
SU59 0 6 12 15
SU60 0 9 19 22
SU61 37 37 38 38
SU62 0 2 4 4
SU63 39 39 39 39
SU64 47 49 50 51
SU65 112 112 112 112
SU66 0 38 76 91
SU67 22 22 22 22
SU68 29 29 29 29
SU69 0 3 7 8
SU70 7 7 7 7
SU71 55 55 55 55
SU72 25 25 25 25
SU73 20 20 20 20
SU74 7 7 8 8
SU75 228 231 234 235
SU76 0 3 5 6
SU77 67 67 67 67
SU79 66 67 68 68
SU80 6 6 6 6
SU81 0 0 0 0
SU82 30 31 32 32
SU83 0 89 179 215
SU84 3 3 3 3
SU85 0 25 50 61
SU86 43 43 43 43
SU87 21 23 24 25
SU88 30 30 30 30
SU89 51 53 55 56
SU90 30 31 32 32
SU91 0 25 50 61
SU92 88 89 90 90
SU93 1 1 1 1
SU94 0 25 50 61
SU95 17 17 17 17
SU96 8 8 8 8
SU97 5 5 5 5
SU98 28 28 28 28
SU99 27 30 32 33
SU100 37 39 40 41
SU101 42 44 45 46
SU102 32 32 33 33
SU103 33 33 33 33
SU104 55 57 59 60
SU105 50 53 55 56
SU106 0 8 15 18
SU107 62 62 62 62
SU108 70 71 72 72
SU109 22 24 26 27
SU110 0 0 0 0
SU111 56 57 59 59
SU112 0 1 3 3
SU113 0 0 0 0
SU114 0 3 6 7
SU115 91 95 99 100
SU116 0 0 0 0

Kendall County
Comal County
Bexar County
San Antonio
Scenic Oaks

Cibolo Creek
Postoak Creek
Balcones Creek
Salado Creek

AMMANN RD
GUTHRIE RD
PARK LN
ROBINS WAY
SANDY OAKS DR
SANDY OAKS DR
WOOD TRL
OAKWOOD LN DR
RANCH POINT
SENDERO POINT
RANCH PASS
STONE TER
SENDERO WOODS
RANCH BROOK
WOODLAND VIEW VIEW
RANCH TERR
BURNT CEDAR
ROCK FRST
SUNLAND
FLAGSTONE HILL DR
WILD OAK HL
WINDMILL CIR
SCARTEEN
ROLLING ACRES TRL
KEENELAND DR
JODHPUR DR
KNOTTY GROVE
CAVALRY DR
DELTA DAWN LN
AXIS RUN
FALLOW PL
ROSEBEN
WOODBINE
AXTON
HIGH CLF
MAN O WAR DR
OVARO CIR
SCHEELE RD
CANYON CIR
KENDALL PKWY
KENDALL LN
KENDALL RDG
OLD FREDERICKSBURG RD
FAIRWAY ASH
DEW RDG
RED BUD HL
RAINTREE WOODS DR
SUMMER SONG CIR
AVIATOR CIR
CONNEMARA DR
SEA BISCUIT DR
BOLD FORBES CIR
ALYDAR CIR
TESSARA CIR
GRAFORD RIDGE
DIETZ ELKHORN RD
STEVENSON GATE
NOLL RD
FAIRS GATE
WHISPER GATE
PFEIFFERS GATE
IRVING HILL
GATE FOREST
KALKALLO DR
CANTOR CIR
NOBLE LARK DR
CROWN TER
ANGEL FIRE DR
FAIR OAKS PKWY
WHIRLAWAY CIR
DAMASCUS DR
TURNING LEAF
MONUMENT OAK
TIMBERLAND TRL
WOODLAND PKWY
QUADRILLE LN
ROCKING HORSE LN
ROYAL ASCOT DR
EQUESTRIAN
STEEPLECHASE LN
AQUEDUCT LN
RUFFIAN DR
PIMLICO LN
SECRETARIAT LN
PREAKNESS LN
SETTERFELD CIR
SARATOGA DR
SARATOGA LN
PADDOCK LN
TRIPLE CROWN
COLONIAL OAK
TRADITION TRL
ARBOR VLG
COLONIAL WOODS
WOODLAND GRN
LIBERTY PARK
TRADITION OAK
MELLOW RDG
CIBOLO GAP
SILVER SPUR TRL
INTREPID DR
POST OAK TRL
MEADOW CREEK TRL
HIGH ANTLER
ANTLER MEADOW
AXIS PASS
HONEY OAK CIR
ANTLER OAK
RALPH FAIR RD
FM 3351
OUTER DR
4WD ROAD
MOYER RD
CENTRAL RD
WEST OUTER DR
PARKING LOT
VICTORIA LN
WINDWOOD DR
WATERVIEW DR
REDFISH
DEER RIDGE DR
POMPANO DR
TARPON DR
FAWN DR
MARLIN DR
AQUA DR
RANCH CRK
RANCH LN
EXIT 546
I-10

0 1,500 3,000
SCALE IN FEET

Created By Freese and Nichols, Inc.
Job No.: FAO17329
Location: H:\W_WW_PLANNING\01_DELIVERABLES\11-Final_Report\(Figure_B-1)-Water_Connections_by_Planning_Area.mxd
Updated: Friday, February 15, 2019 4:47:18 PM

FIGURE B-2
CITY OF FAIR OAKS RANCH
WASTEWATER CONNECTIONS BY PLANNING AREA

SUBDIVISION UNIT ID
2018 Connections (1,740)
2023 Connections (2,455)
2028 Connections (3,169)
Buildout Connections (3,502)

LEGEND

- Planning Area
- Road
- Stream
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

CITY OF FAIR OAKS RANCH • TEXAS

FREESE AND NICHOLS

Kendall County

Comal County

Bexar County

Scenic Oaks

San Antonio

Cibolo Creek

Balcones Creek

Postoak Creek

Salado Creek

AMMANN RD

SCHEELE RD

DIETZ ELKHORN RD

KENDALL PKWY

FAIR OAKS PKWY

WOODLAND PKWY

OUTER DR

4WD ROAD

0 1,500 3,000

SCALE IN FEET

Created By Freese and Nichols, Inc.
Job No.: FAO17329
Location: H:\W_WW_PLANNING\01_DELIVERABLES\11-Final_Report\(Figure_B-2)-Wastewater_Connections_by_Planning_Area.mxd
Updated: Friday, February 15, 2019 4:49:03 PM

City of Fair Oaks Ranch
Table B-1: Water Connections by Planning Area

Subdivision ID	Name	2018 Water Connections	2023 Water Connections[1]	2028 Water Connections[1]	Buildout Water Connections[1]
1	City Limits	0	0	0	0
2	Parcel 6	0	10	21	25
3	Stone Creek Ranch	118	168	218	238
4	Parcel 7	0	8	16	19
5	Parcel 8	0	1	2	3
6	The Reserve	0	265	529	645
7	Parcel 3	0	1	2	2
8	Parcel 10	0	4	7	9
9	Parcel 1	0	5	9	11
10	Parcel 2	0	4	8	10
11	Parcel 9	0	3	5	6
12	Parcel 4	0	1	2	2
13	Parcel 5	0	2	3	4
14	Unit K2	51	54	57	58
15	Parcel 11	0	7	13	16
16	Comal County	0	0	1	1
17	Parcel 12	0	15	30	36
18	Parcel 13	0	4	8	10
19	Unit K1	3	4	5	5
20	Unit K6	87	90	93	94
21	Unit K3	30	32	33	34
22	Unit K7	4	4	4	4
23	First Baptist (FM3351)	0	1	3	3
24	The Enclave	8	10	12	13
25	Oak Bend Estates	1	55	109	130
26	Unit K5	32	34	35	36
27	Minahan	0	11	22	26
28	Parcel 14	0	16	32	39
29	Unit C1	7	7	8	8
30	Deer Meadow Estates	289	298	307	310
31	Cibolo Creek Church	0	6	13	15
32	Unit K4	20	23	27	28
33	Parcel 37	0	1	2	2
34	Parcel 38	0	1	2	2
35	Unit C2	15	15	16	16
36	Unit K8	2	2	3	3
37	Parcel 15	0	14	28	33
38	Parcel 39	0	0	1	1
39	Setterfeld Estates	122	157	191	205
40	Parcel 40	0	2	5	6
41	Parcel 16	0	3	6	7
42	Blackjack Oaks Unit B	17	17	17	17

City of Fair Oaks Ranch
Table B-1: Water Connections by Planning Area

Subdivision ID	Name	2018 Water Connections	2023 Water Connections[1]	2028 Water Connections[1]	Buildout Water Connections[1]
43	Unit C7 and C8	101	104	107	108
44	Unit C3 and C4	40	41	43	43
45	Parcel 41	0	1	1	1
46	Unit C5	10	11	13	13
47	Parcel 17	0	3	6	7
48	Parcel 42	0	0	1	1
49	Blackjack Estates Unit 2	31	31	31	31
50	Unit C13	17	18	20	20
51	Parcel 18	0	4	7	9
52	Unit C14	45	55	64	68
53	Blackjack Oaks Unit A	54	54	54	54
54	Unit C11	0	0	1	1
55	Fair Co.	0	5	8	12
56	Blackjack Oaks Unit C	11	11	12	12
57	Unit C12	32	32	32	32
58	Blackjack Estates Unit 1	34	34	34	34
59	Parcel 19	0	6	12	15
60	Parcel 36	0	9	19	22
61	Unit C9	37	37	38	38
62	Parcel 20	0	2	4	4
63	Unit O and O2	39	39	39	39
64	Unit R and S	47	49	50	51
65	Blackjack Oaks Subdivision	112	112	112	112
66	The Arbors	0	38	76	91
67	Unit Q	22	22	22	22
68	Unit W	29	29	29	29
69	Parcel 35	0	3	7	8
70	Unit T	7	7	7	7
71	Unit D4 and E	55	55	55	55
72	Unit P	25	25	25	25
73	Unit L	20	20	20	20
74	Unit P2	7	7	8	8
75	Raintree Woods Subdivision	228	231	234	235
76	Parcel 21	0	3	5	6
77	Unit D1, D2, and D3	67	67	67	67
78	Military	0	0	0	0
79	Unit B	66	67	68	68
80	Unit I	6	6	6	6
81	8710 Dietz Elkhorn	0	0	0	0
82	The Falls	30	31	32	32
83	Parcel 22	0	89	179	215
84	Fire Station	3	3	3	3

City of Fair Oaks Ranch
Table B-1: Water Connections by Planning Area

Subdivision ID	Name	2018 Water Connections	2023 Water Connections[(1)]	2028 Water Connections[(1)]	Buildout Water Connections[(1)]
85	Parcel 23	0	25	50	61
86	Unit N	43	43	43	43
87	Unit F2	21	23	24	25
88	Unit F1	30	30	30	30
89	Unit C	51	53	55	56
90	Unit J	30	31	32	32
91	Parcel 24	0	25	50	61
92	Oakwood Heights Subdivision	88	89	90	90
93	Fair Oaks Retail	1	1	1	1
94	Parcel 25	0	25	50	61
95	The Crossing	17	17	17	17
96	Unit V	8	8	8	8
97	Unit H	5	5	5	5
98	Unit M	28	28	28	28
99	The Fountains	27	30	32	33
100	Unit B5	37	39	40	41
101	Windemere Subdivision Unit 1	42	44	45	46
102	Unit B7, B8, and B13	32	32	33	33
103	Chartwell Subdivision	33	33	33	33
104	Windemere Subdivision Unit 2	55	57	59	60
105	Unit B6	50	53	55	56
106	Parcel 34	0	8	15	18
107	Unit B4	62	62	62	62
108	Unit B1	70	71	72	72
109	Unit PFE	22	24	26	27
110	Frost Bank	0	0	0	0
111	Unit B2	56	57	59	59
112	Parcel 29	0	1	3	3
113	Parcel 28	0	0	0	0
114	Parcel 27	0	3	6	7
115	Unit B3	91	95	99	100
116	Parcel 26	0	0	0	0
117	Offices	0	0	0	0
118	Homeowners/Police	0	0	0	0
Total	-	**2,880**	**3,728**	**4,578**	**4,924**

City of Fair Oaks Ranch
Table B-2: Wastewater Connections by Planning Area

Subdivision ID	Name	2018 Wastewater Connections	2023 Wastewater Connections[1]	2028 Wastewater Connections[1]	Buildout Wastewater Connections[1]
1	City Limits	0	0	0	0
2	Parcel 6	0	10	21	25
3	Stone Creek Ranch	0	0	0	0
4	Parcel 7	0	8	16	19
5	Parcel 8	0	1	2	1
6	The Reserve	0	265	529	645
7	Parcel 3	0	0	0	0
8	Parcel 10	0	4	7	9
9	Parcel 1	0	0	0	0
10	Parcel 2	0	0	0	0
11	Parcel 9	0	3	5	6
12	Parcel 4	0	0	0	0
13	Parcel 5	0	0	0	0
14	Unit K2	0	0	0	0
15	Parcel 11	0	7	13	16
16	Comal County	0	0	1	1
17	Parcel 12	0	15	30	36
18	Parcel 13	0	4	8	10
19	Unit K1	0	0	0	0
20	Unit K6	0	0	0	0
21	Unit K3	0	0	0	0
22	Unit K7	0	0	0	0
23	First Baptist (FM3351)	0	1	3	3
24	The Enclave	0	2	4	51
25	Oak Bend Estates	0	54	108	129
26	Unit K5	0	0	0	0
27	Minahan	0	11	22	26
28	Parcel 14	0	16	32	39
29	Unit C1	0	0	0	0
30	Deer Meadow Estates	285	294	303	306
31	Cibolo Creek Church	0	6	13	15
32	Unit K4	0	0	0	0
33	Parcel 37	0	0	0	0
34	Parcel 38	0	0	0	0
35	Unit C2	0	0	0	0
36	Unit K8	0	0	0	0
37	Parcel 15	0	14	28	33
38	Parcel 39	0	0	0	0
39	Setterfeld Estates	117	146	175	187
40	Parcel 40	0	0	0	0
41	Parcel 16	0	3	6	7
42	Blackjack Oaks Unit B	17	17	17	17

City of Fair Oaks Ranch
Table B-2: Wastewater Connections by Planning Area

Subdivision ID	Name	2018 Wastewater Connections	2023 Wastewater Connections[(1)]	2028 Wastewater Connections[(1)]	Buildout Wastewater Connections[(1)]
43	Unit C7 and C8	97	100	104	105
44	Unit C3 and C4	0	0	0	0
45	Parcel 41	0	0	0	0
46	Unit C5	0	0	0	0
47	Parcel 17	0	3	6	7
48	Parcel 42	0	0	0	0
49	Blackjack Estates Unit 2	31	31	31	31
50	Unit C13	17	18	20	20
51	Parcel 18	0	4	7	9
52	Unit C14	45	55	64	68
53	Blackjack Oaks Unit A	54	54	54	54
54	Unit C11	0	0	1	1
55	Fair Co.	0	5	8	12
56	Blackjack Oaks Unit C	11	11	12	12
57	Unit C12	31	31	31	31
58	Blackjack Estates Unit 1	34	34	34	34
59	Parcel 19	0	6	12	15
60	Parcel 36	0	0	0	0
61	Unit C9	37	37	38	38
62	Parcel 20	0	2	4	4
63	Unit O and O2	39	39	39	39
64	Unit R and S	47	49	50	51
65	Blackjack Oaks Subdivision	112	112	112	112
66	The Arbors	0	38	76	91
67	Unit Q	22	22	22	22
68	Unit W	29	29	29	29
69	Parcel 35	0	0	0	0
70	Unit T	7	7	7	7
71	Unit D4 and E	55	55	55	55
72	Unit P	25	25	25	25
73	Unit L	20	20	20	20
74	Unit P2	7	7	8	8
75	Raintree Woods Subdivision	0	0	0	0
76	Parcel 21	0	3	5	6
77	Unit D1, D2, and D3	67	67	67	67
78	Military	0	0	0	0
79	Unit B	66	67	68	68
80	Unit I	6	6	6	6
81	8710 Dietz Elkhorn	0	0	0	0
82	The Falls	30	31	32	32
83	Parcel 22	0	89	179	215
84	Fire Station	0	0	0	0

City of Fair Oaks Ranch
Table B-2: Wastewater Connections by Planning Area

Subdivision ID	Name	2018 Wastewater Connections	2023 Wastewater Connections[(1)]	2028 Wastewater Connections[(1)]	Buildout Wastewater Connections[(1)]
85	Parcel 23	0	25	50	61
86	Unit N	43	43	43	43
87	Unit F2	21	23	24	25
88	Unit F1	30	30	30	30
89	Unit C	51	53	55	56
90	Unit J	30	31	32	32
91	Parcel 24	0	25	50	61
92	Oakwood Heights Subdivision	86	86	86	86
93	Fair Oaks Retail	1	1	1	1
94	Parcel 25	0	25	50	61
95	The Crossing	17	17	17	17
96	Unit V	8	8	8	8
97	Unit H	5	5	5	5
98	Unit M	29	29	29	29
99	The Fountains	27	30	32	33
100	Unit B5	0	0	0	0
101	Windemere Subdivision Unit 1	2	2	2	2
102	Unit B7, B8, and B13	0	0	0	0
103	Chartwell Subdivision	33	33	33	33
104	Windemere Subdivision Unit 2	49	51	53	54
105	Unit B6	0	0	0	0
106	Parcel 34	0	0	0	0
107	Unit B4	0	0	0	0
108	Unit B1	0	0	0	0
109	Unit PFE	0	0	0	0
110	Frost Bank	0	0	0	0
111	Unit B2	0	0	0	0
112	Parcel 29	0	0	0	0
113	Parcel 28	0	0	0	0
114	Parcel 27	0	0	0	0
115	Unit B3	0	0	0	0
116	Parcel 26	0	0	0	0
117	Offices	0	0	0	0
118	Homeowners/Police	0	0	0	0
Total	-	**1,740**	**2,455**	**3,169**	**3,512**

APPENDIX C
SAWS WHOLESALE RATES

Appendix C: SAWS Wholesale Rates

Monthly Service Availability Fee	
Meter Size (in)	Approved 2019
6	$ 538.85
8	$ 860.58
10	$ 1,235.91
12	$ 2,308.35

Monthly Volume Charge per 100 Gallons	
Usage Blocks	Approved 2019
Base*	$ 0.2099
Over Base	$ 0.6299

*Base is 100% of Average Annual Consumption.

Water Supply Fee per 100 Gallons	
Usage Blocks	Approved 2019
Base*	$ 0.2554
Over Base	$ 0.7665

*Base is 100% of Average Annual Consumption or as agreed by wholesale customer and SAWS Board of Trustees.

Edwards Aquifer Authority Permit Fee per 100 Gallons	
2018	$ 0.03533

TCEQ Pass-Through Fee Monthly Rate	
Water	$ 0.20

Account Deposit Fee
$ 87.00

APPENDIX D
PRESSURE RECORDER DATA

DRAFT FIGURE D-1

CITY OF FAIR OAKS RANCH

WATER SYSTEM PRESSURE RECORDER LOCATIONS

Plant #3
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 2,500 gal Hydropneumatic Tank
(1) - 8,000 gal Hydropneumatic Tank

Plant #3 Pump Station
Firm Capacity = 850 gpm
Total Capacity = 1,300 gpm

PR #10
8345 Rolling Acres Trl
Lot 87

PR #11
8 Ranch Terrace Lot 1

Plant #5
(1) - 0.125 MG Ground Storage Tank

Zone A Pump Station
Firm Capacity = 575 gpm
Total Capacity = 1,150 gpm

Zone B Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,600 gpm

GBRA Delivery Point

PR #9
9110 Jodhpur Dr
Lot 663

PR #8
7840 Venturer Ln
Lot 173

PR #12
30950 Meadow Creek Trl

PR #7
30050 Cibolo Run
Lot 1983

PR #6
55 Falls Terrace
Lot 996

PR #1
29331 Grand Coteau Dr
Lot 222

Elmo Davis Plant
(2) - 0.5 MG Ground Storage Tanks
(2) - 5,000 gal. Hydropneumatic Tanks

Elmo Davis Plant Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,450 gpm

PR #2
29006 Angel Fire Dr
Lot 464

PR #3
28485 Preakness Ln
Lot 53

PR #5
9064 Fair Oaks Pkwy
Lot 25

Plant #2 Pump Station
Firm Capacity = 800 gpm
Total Capacity = 1,250 gpm

Plant #2
(1) - 0.35 MG Ground Storage Tank
(1) - 0.15 MG Ground Storage Tank
(1) - 5,000 gal. Hydropneumatic Tank
(1) - 8,000 gal. Hydropneumatic Tank

PR #4
8125 Royal Ascot
Lot 152

KENDALL CO
BEXAR CO

KENDALL CO
COMAL CO

COMAL CO
BEXAR CO

Cibolo Creek
Balcones Creek
Scenic Oaks
San Antonio
Salado Creek

AMMANN RD
W AMMANN RD
DIETZ ELKHORN RD
OLD DIETZ ELKHORN RD
DRIVEWAY
WOODLAND RANCH RD
KIRCHSKE RANCH RD
SCHEELE RD
PARK LN
ROBINS WAY
SANDY OAKS DR
WOOD TRL
OAKWOOD LN
CIBOLO RIDGE TRL
CIBOLO HOLW N
CIBOLO LO RDG
RANCH POINT
SENDERO POINT
RANCH RUN
RANCH FALLS
RANCH VALLEY
SENDERO WOODS
RANCH PASS
BROOK RIDGE
RANCH BROOK
WOODLAND VIEW
DEER SUMMIT
WILD OAK WAY
FLAGSTONE WILL DR
SUNLAND
SKY BLUE RDG
WEMBLEY
SCARTEEN
ROLLING ACRES TRAIL
REKONE CIRCLE
ROCK OAK CIR
POST OAK TRL
MEADOW CREEK TRAIL
HIGH ANTLER
STEPHANIE WAY
ANTLER MEADOW
AXIS PASS
HONEY OAK CIRCLE
OAK BEND ESTATES
ANTLER OAK
KNOTTY GROVE
JODHPUR DRIVE
DELTA DAWN LANE
WOODBINE WAY
KENDALL PKWY
CANYON CIR
KENDALL LN
KENDALL RDG
FAIRWAY RUN
VENTURER
KEENELAND DR
ROYAL VALIANCE
SWEETRIDGE CIR
WILD FIRE DR
SARATOGA DR
SARATOGA LN
VALLEY CREST
CIBOLO VIEW
CIBOLO VALLEY
CIBOLO RUN
CIBOLO PATH
CIBOLO GAP
SILVER SPUR TRL
INTREPID DR
ROBIN HALE DR
SETTERFIELD CIRCLE
WILD COYOTE LANE
FAIR VIEW PL
WILLOW WIND DR
DEW RDG
RED BUD
FAIRWAY BLUFF DR
RAINTREE WOODS DRIVE
SUMMER SONG CIRCLE
BATTLE INTENSE
YELLOW RIDGE
COJAK CIRCLE
RALPH FAIR ROAD
SCINTILLA LANE
MANDETTA DRIVE
NO LE HACE DR
TERRA VISTA
RIVER RY RIDGE
AVIATOR CIR
CONNEMARA DR
DEER LEAP
SEABISCUIT DRIVE
BOLD FORBES CIR
TESSARA CIR
ALYDAR CIRCLE
OAKVIEW PASS
NORTHVIEW PASS
FALLS TERRACE
KEARNEY RIDGE
ELKHORN RIDGE
ENCHANTED ELM
ENCHANTED PARK
GATE RUN
CRAIGS GATE
FAIRS GATE
WHISPER GATE
IRVING HILL
FRONT GATE
PFEIFFERS GATE
GATE FOREST
NOLL RD
STAHMANN WAY
OLD FREDERICKSBURG RD
VICTORIA LN
WINDWOOD DR
WINDWOOD DR E
WATERVIEW DR
REDFISH
POMPANO DR
TARPON DR
DEER RIDGE DR
FAWN DR
SAILFISH DR
AQUA DR
MARLIN DR
RANCH LN
TURNING LEAF
MONUMENT OAK
TIMBERLAND TRAIL
HERITAGE TRAIL
LESLIE PFEIFFER DR
COPPER LEAF
GLENWAY
WOODLAND PARK PFEIFFER
FM 3351 CONNECTOR
FM 3351 BYPASS
I-10 W
I-10
TRIPLE CROWN
QUADRILLE LANE
DAMASCUS DRIVE
ROCKING HORSE LANE
ROYAL ASCOT DRIVE
EQUESTRIAN
PIMLICO LANE
AQUEDUCT LANE
PADDOCK LANE
COLONIAL OAK
SETTLERS PEAK
TRADITION TRL
ARBOR VLG
COLONIAL WOODS
LIBERTY PARK
LEGACY WOODS
OAK BROOK WAY
JAMESTOWN SQ
BOWMANS LN
NOBLE LARK DR
WHIRLAWAY CIR
CROWN TER
TURF PARADISE LANE
SECRETARIAT LANE
SEABISCUIT LN
WHISPER WIND
MOUNTAIN TRL
FAWN MTN
SMOKEY VW
COVEY ROOST
WESTOUTER DR
CIRCLE D DR
E OUTER DR
4WD ROAD
MOYER RD
CENTRAL RD
TENBERG DR
H-22
H-21
H-20
H-19
H-18
D-24
U-26
U-29
U-28
FINCKE DR
PLANT RD
TOMPKINS RD
ROBERTS DR
MCELROY DR
BARNARD RD
F-13
F-11
F-14
MISTY GRV
WOODLAND GRN
SKIN DR

PRESSURE ZONES

- Zone A
- Zone B
- Zone C

LEGEND

- PR — Proposed Pressure Recorder
- PS — Water Pump
- Hydropneumatic Tank
- Ground Storage Tank
- 8" and Smaller Water Line
- 10" and Larger Water Line
- Road
- Stream
- Fair Oaks Ranch City Limit
- ETJ Boundary
- Other City Limit
- County Boundary

FREESE AND NICHOLS

CITY OF FAIR OAKS RANCH • TEXAS

0 1,100 2,200
SCALE IN FEET

Created By Freese and Nichols, Inc.
Job No.: FAO17210
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Updated: Tuesday, September 25, 2018 1:23:28 PM
User Name: 02499

Figure D-2
City of Fair Oaks Ranch
Combined Pressure Recorder Data

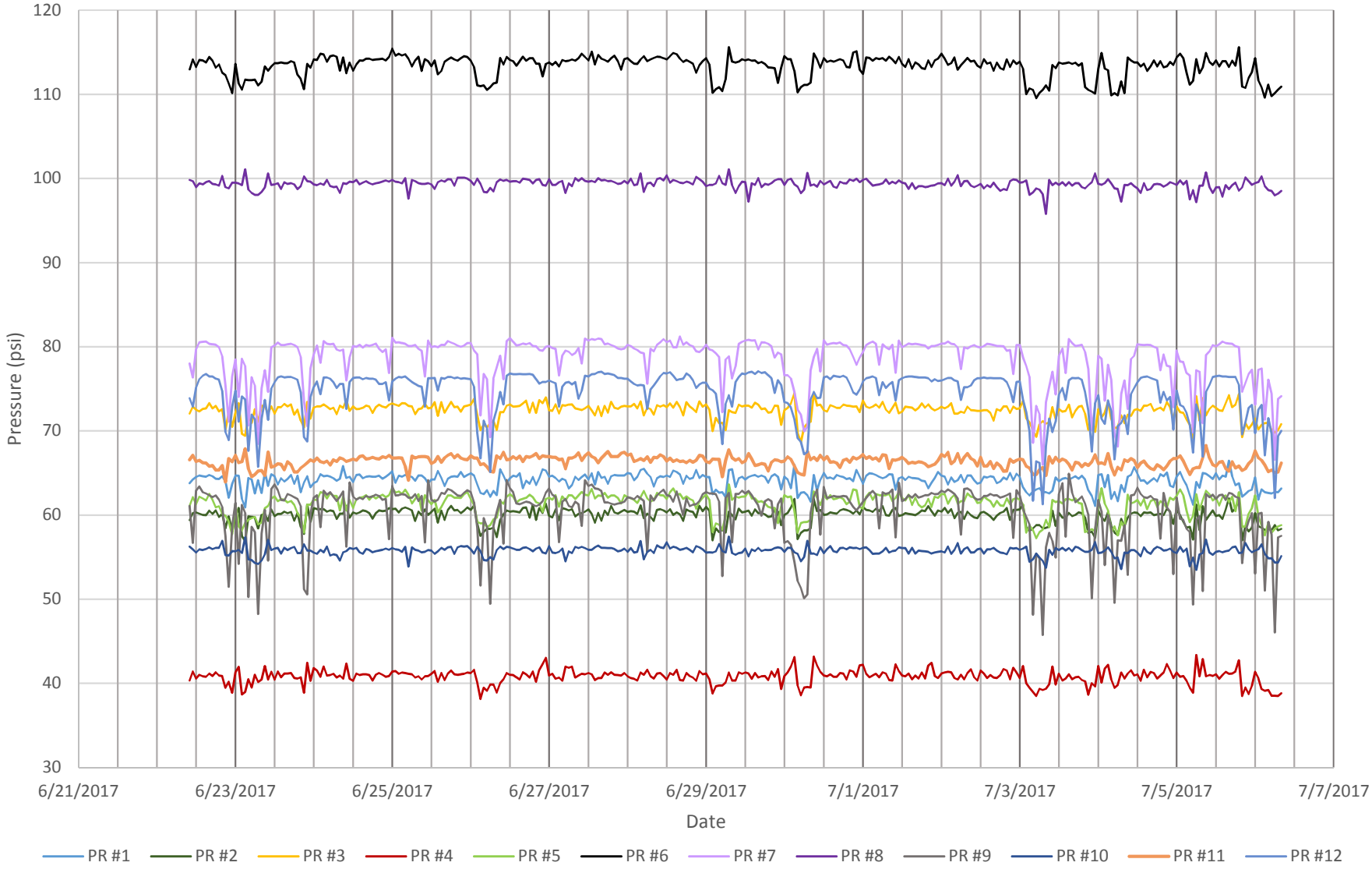


Figure D-3
City of Fair Oaks Ranch
Pressure Recorder #1
29331 Grand Coteau Dr. Lot 222

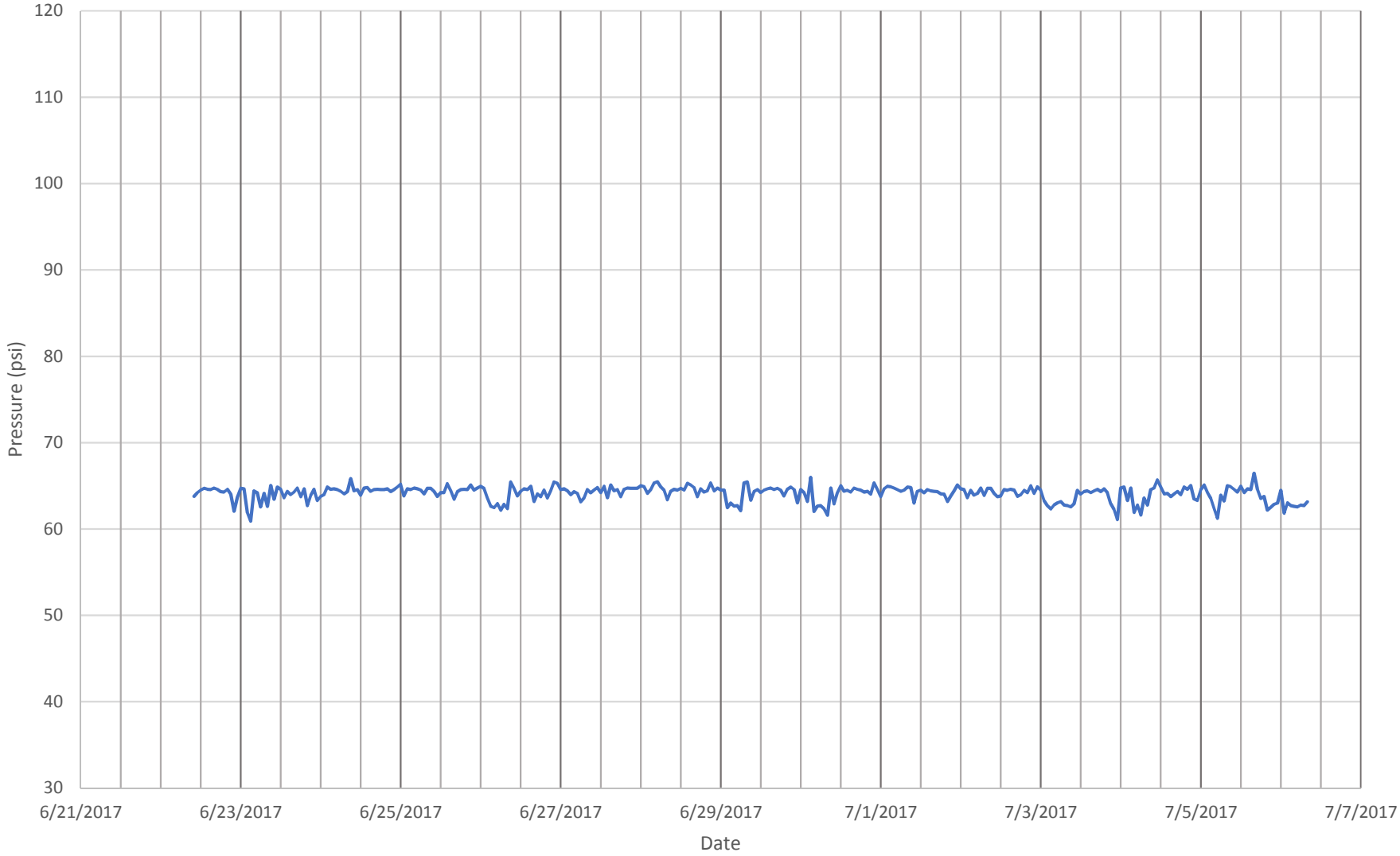


Figure D-4
City of Fair Oaks Ranch
Pressure Recorder #2
29006 Angel Fire Dr. Lot 464

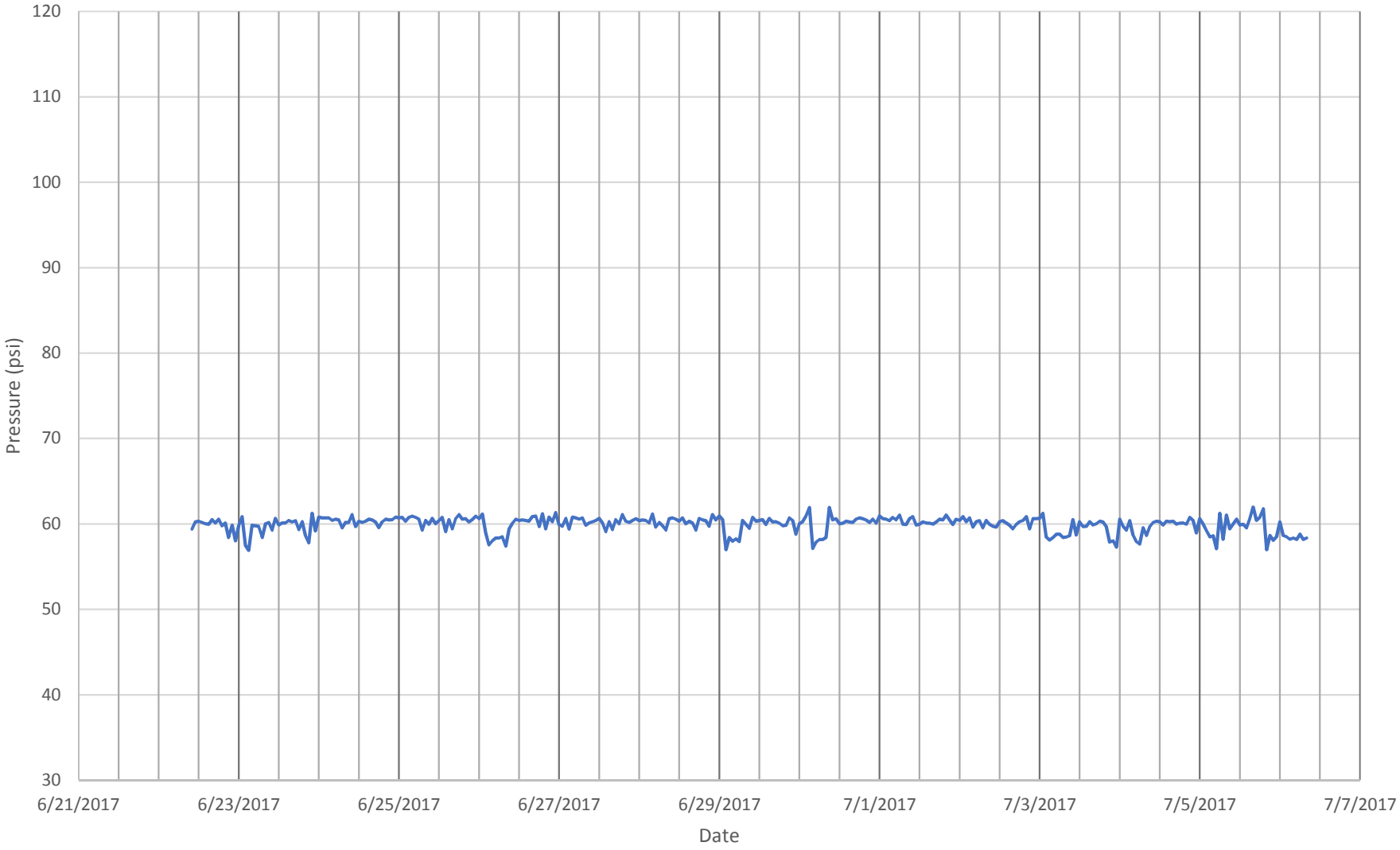


Figure D-5
City of Fair Oaks Ranch
Pressure Recorder #3
28485 Preakness Ln. Lot 53

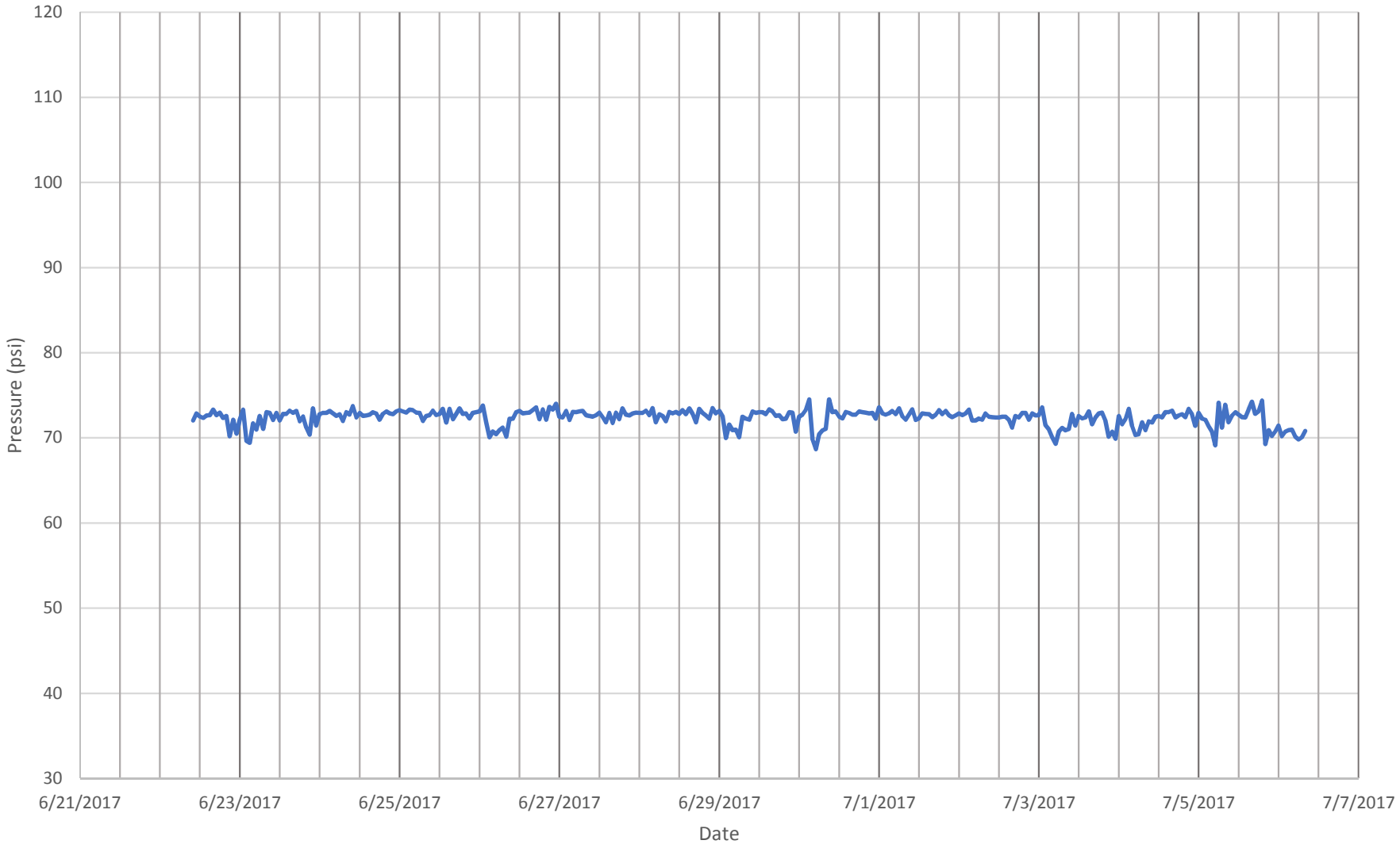


Figure D-6
City of Fair Oaks Ranch
Pressure Recorder #4
8125 Royal Ascot Dr. Lot 152

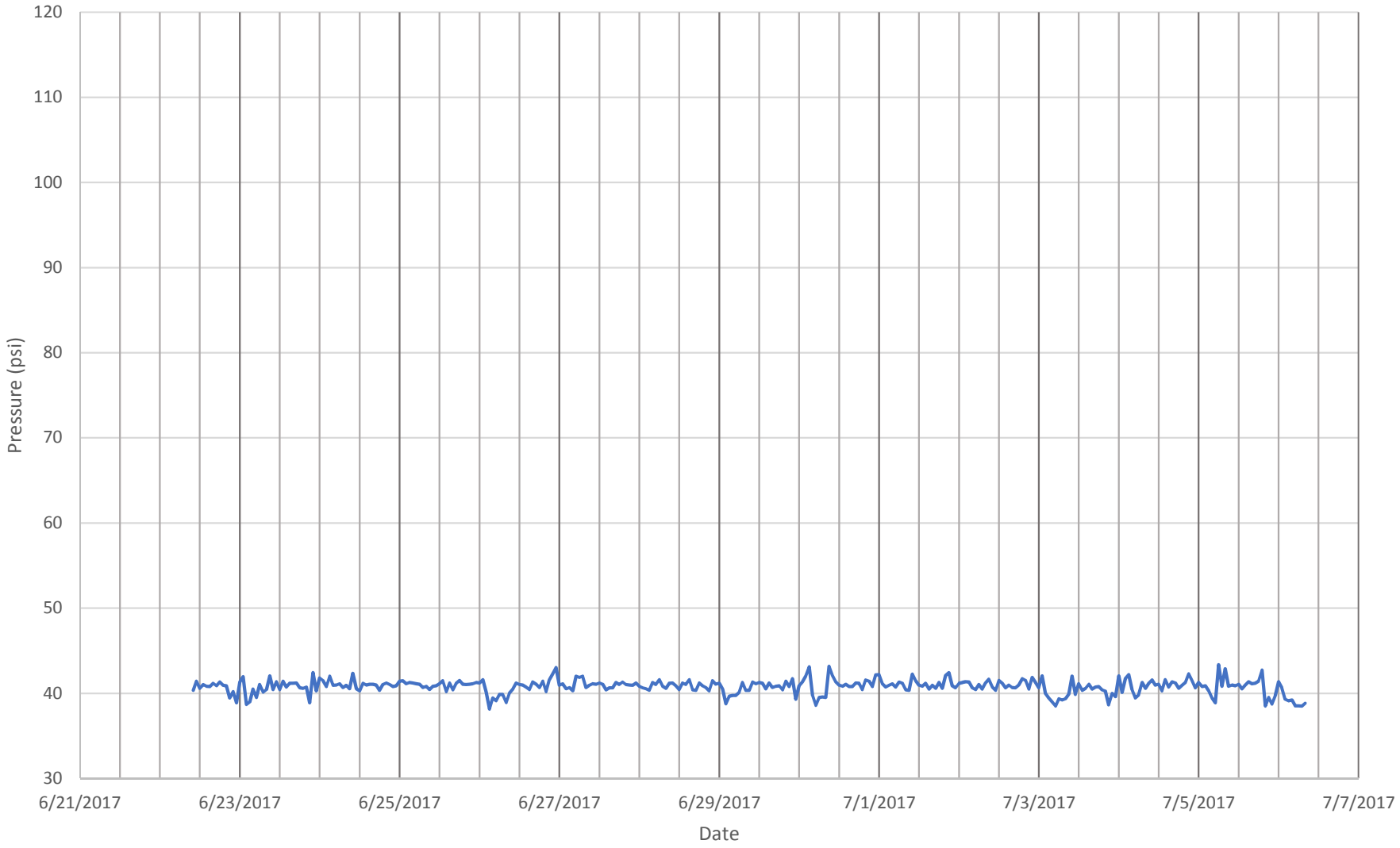


Figure D-7
City of Fair Oaks Ranch
Pressure Recorder #5
9064 Fair Oaks Parkway Lot 25

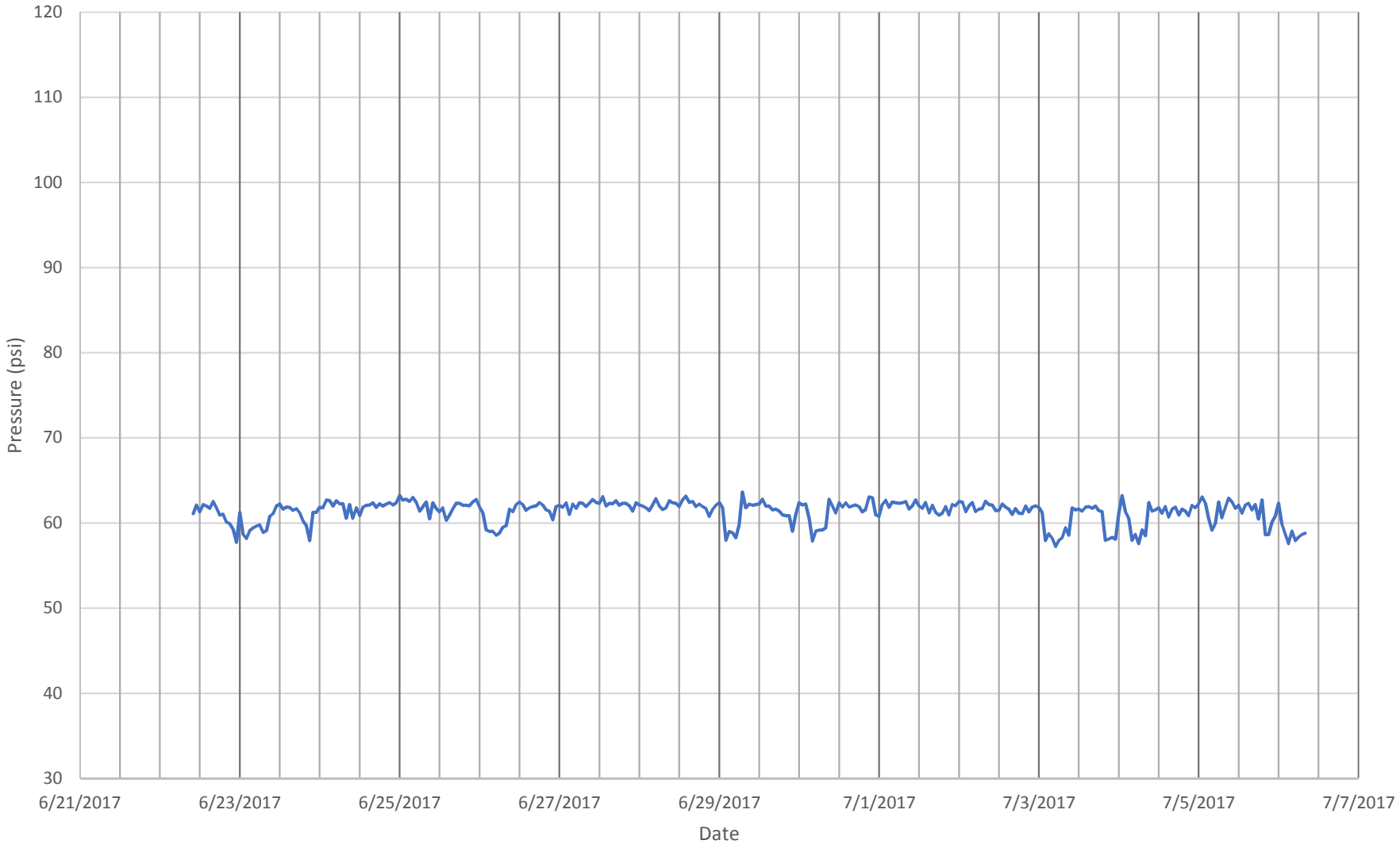


Figure D-8
City of Fair Oaks Ranch
Pressure Recorder #6
55 Falls Terrace Lot 996

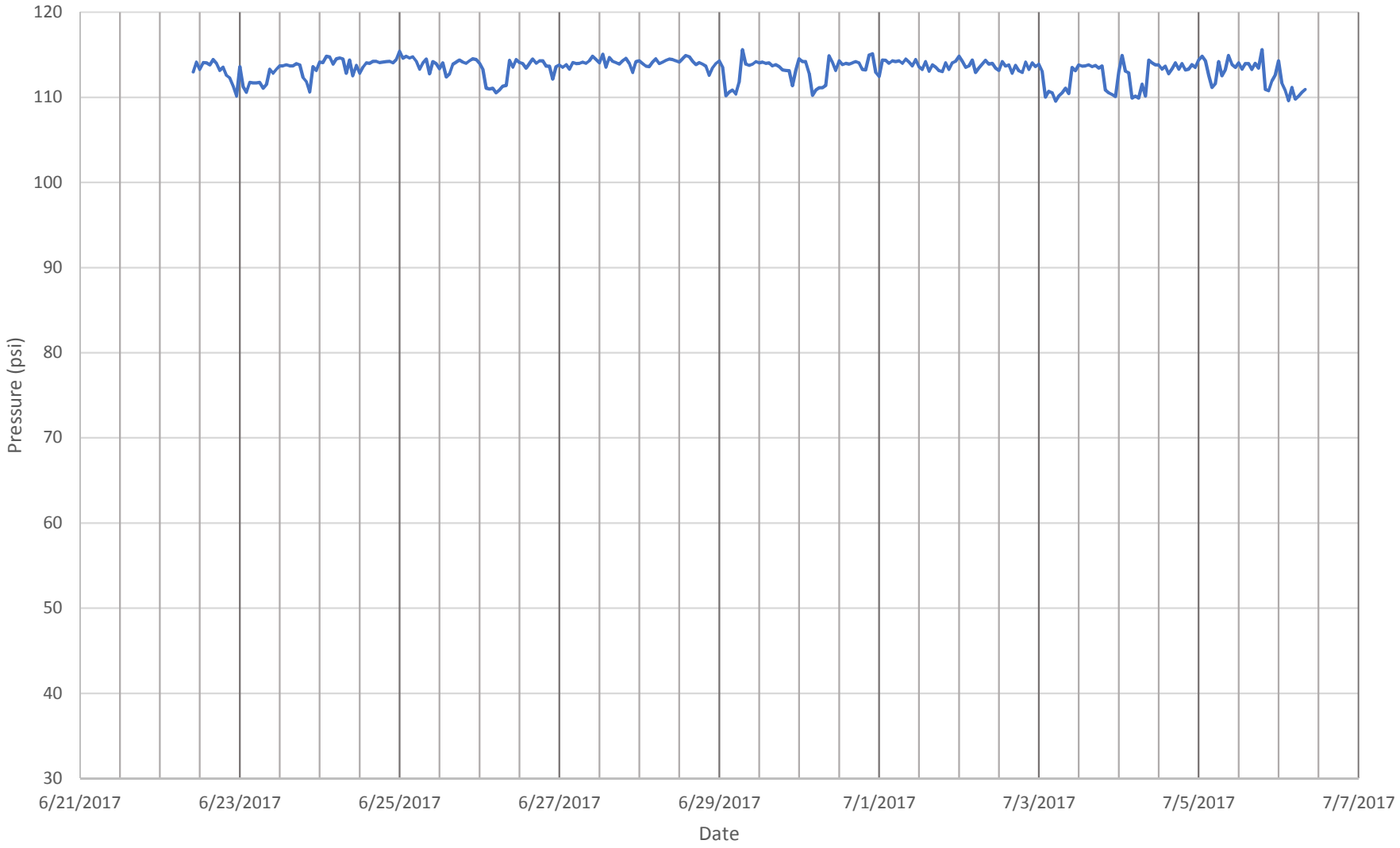


Figure D-9
City of Fair Oaks Ranch
Pressure Recorder #7
30050 Cibolo Run Lot 1983

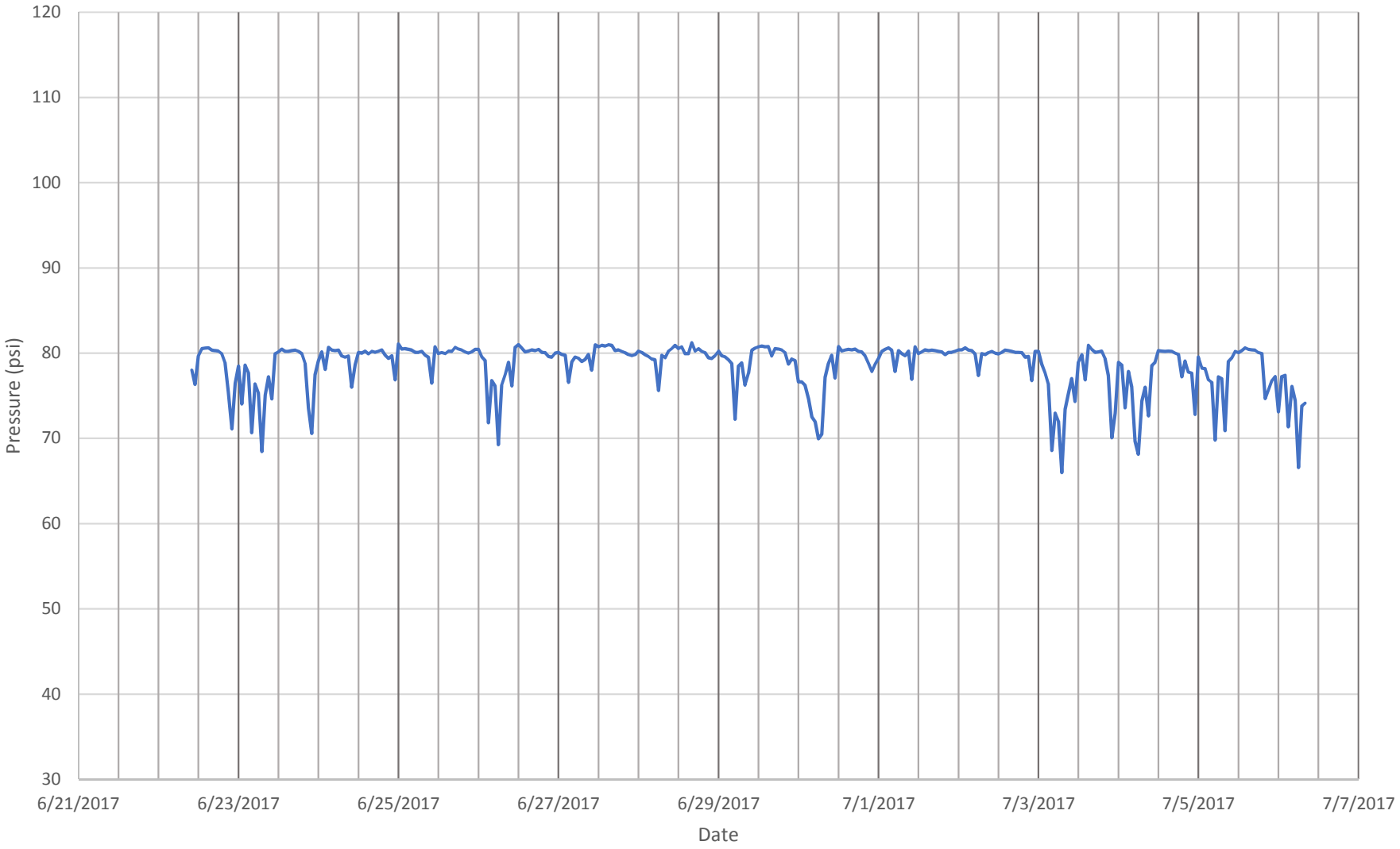


Figure D-10
City of Fair Oaks Ranch
Pressure Recorder #8
7840 Venturer Ln. Lot 173

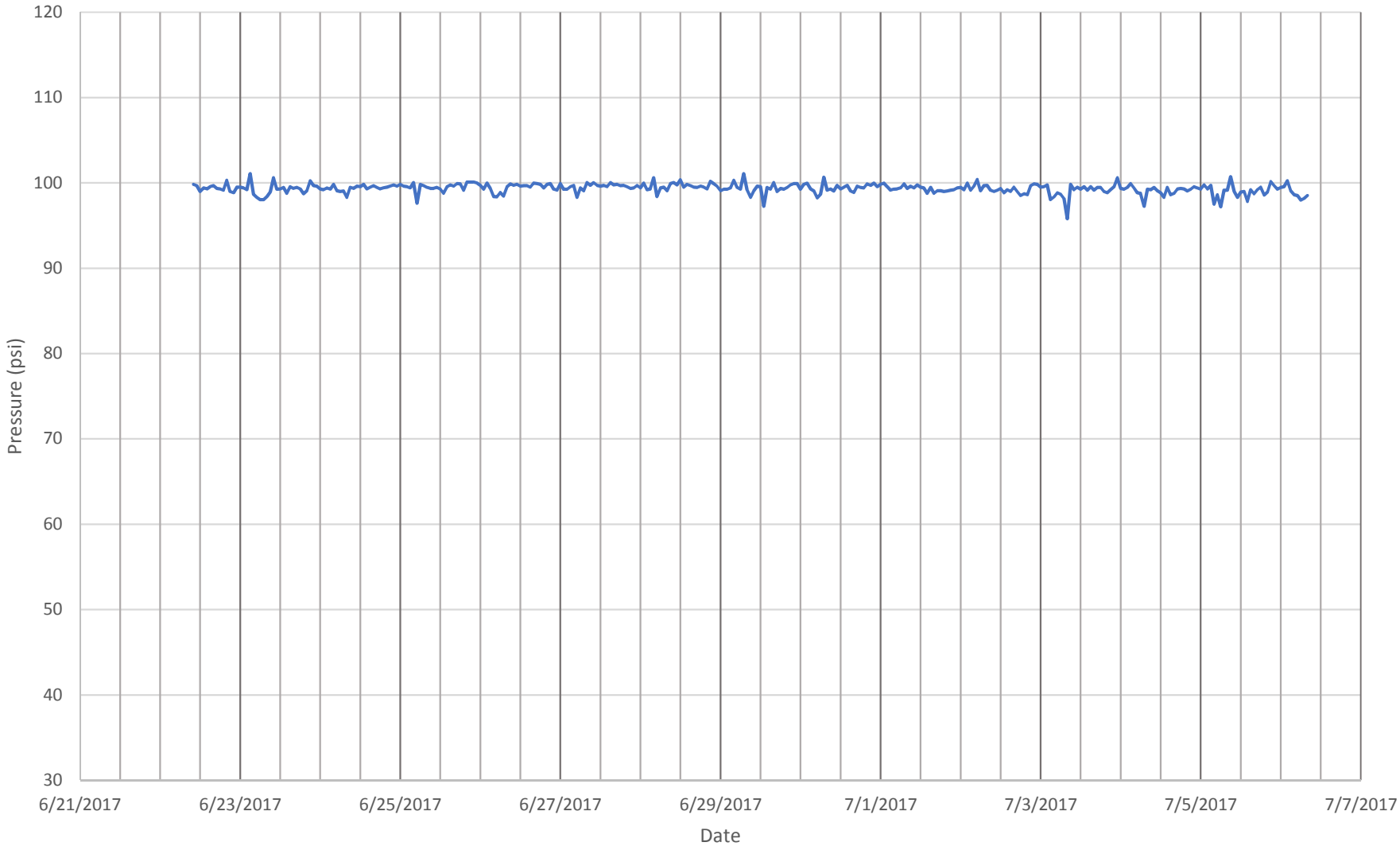


Figure D-11
City of Fair Oaks Ranch
Pressure Recorder #9
9110 Jodhpur Dr. Lot 663

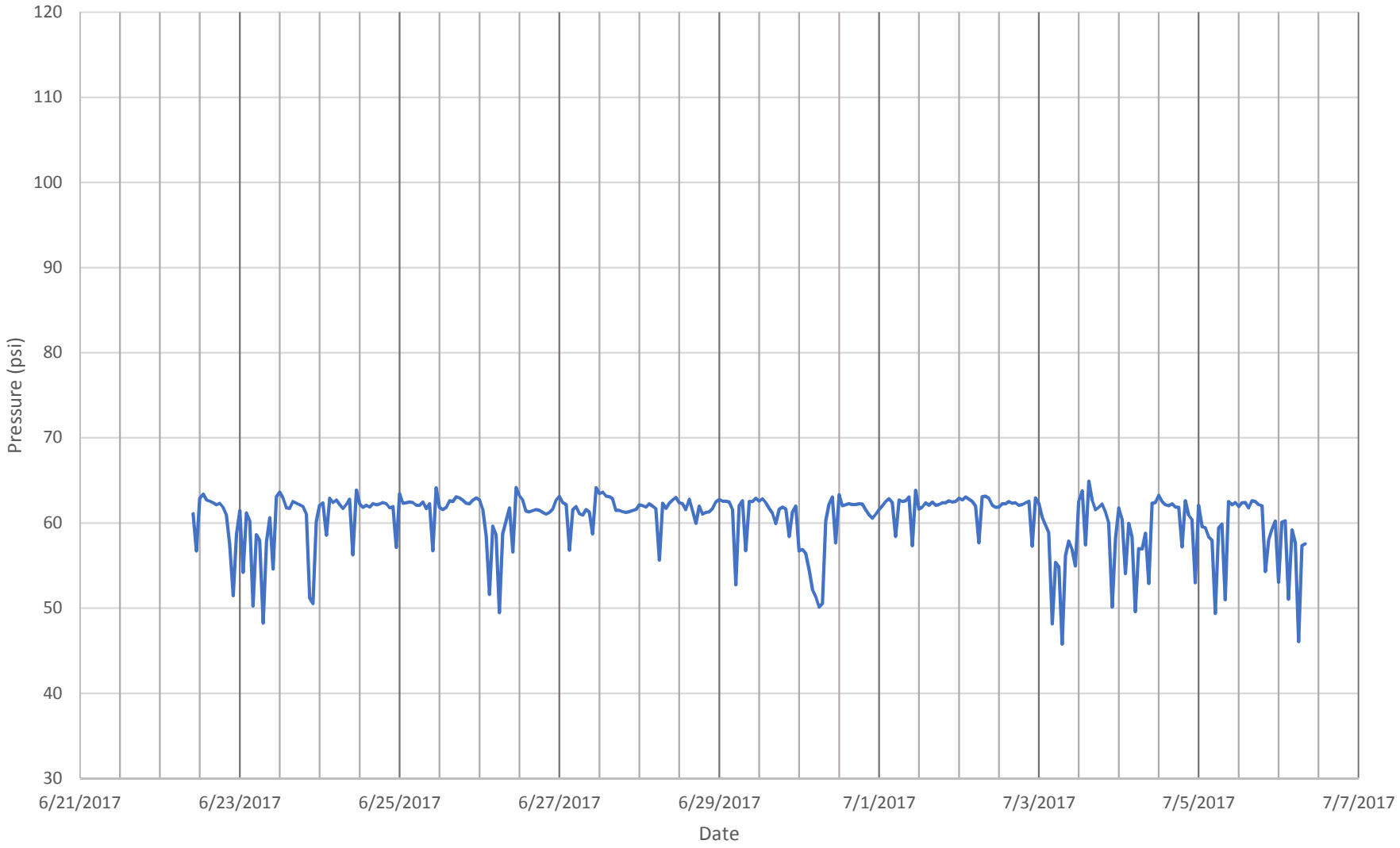


Figure D-12
City of Fair Oaks Ranch
Pressure Recorder #10
8345 Rolling Acres Trail Lot 87

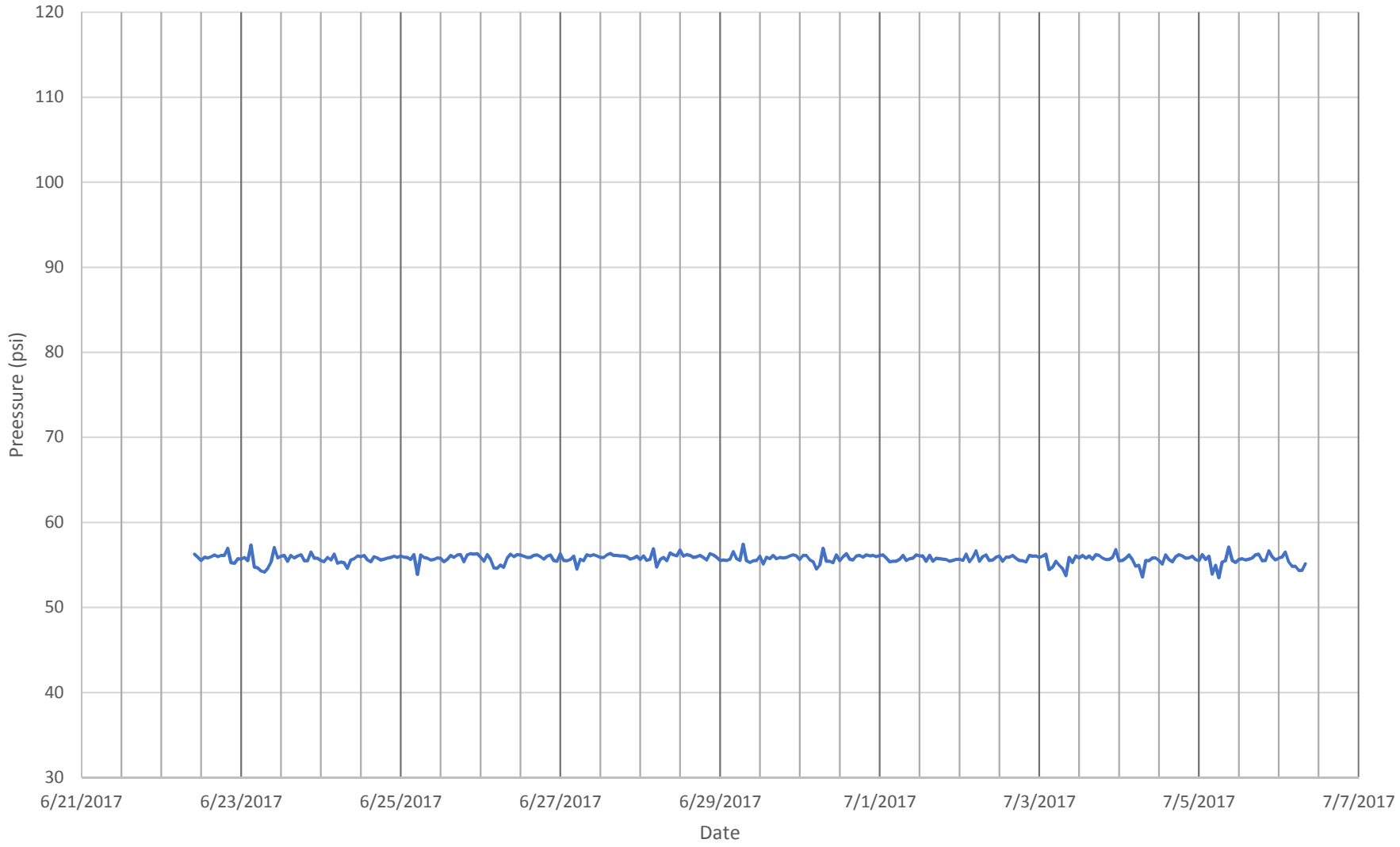


Figure D-13
City of Fair Oaks Ranch
Pressure Recorder #11
8 Ranch Terrace Lot 1

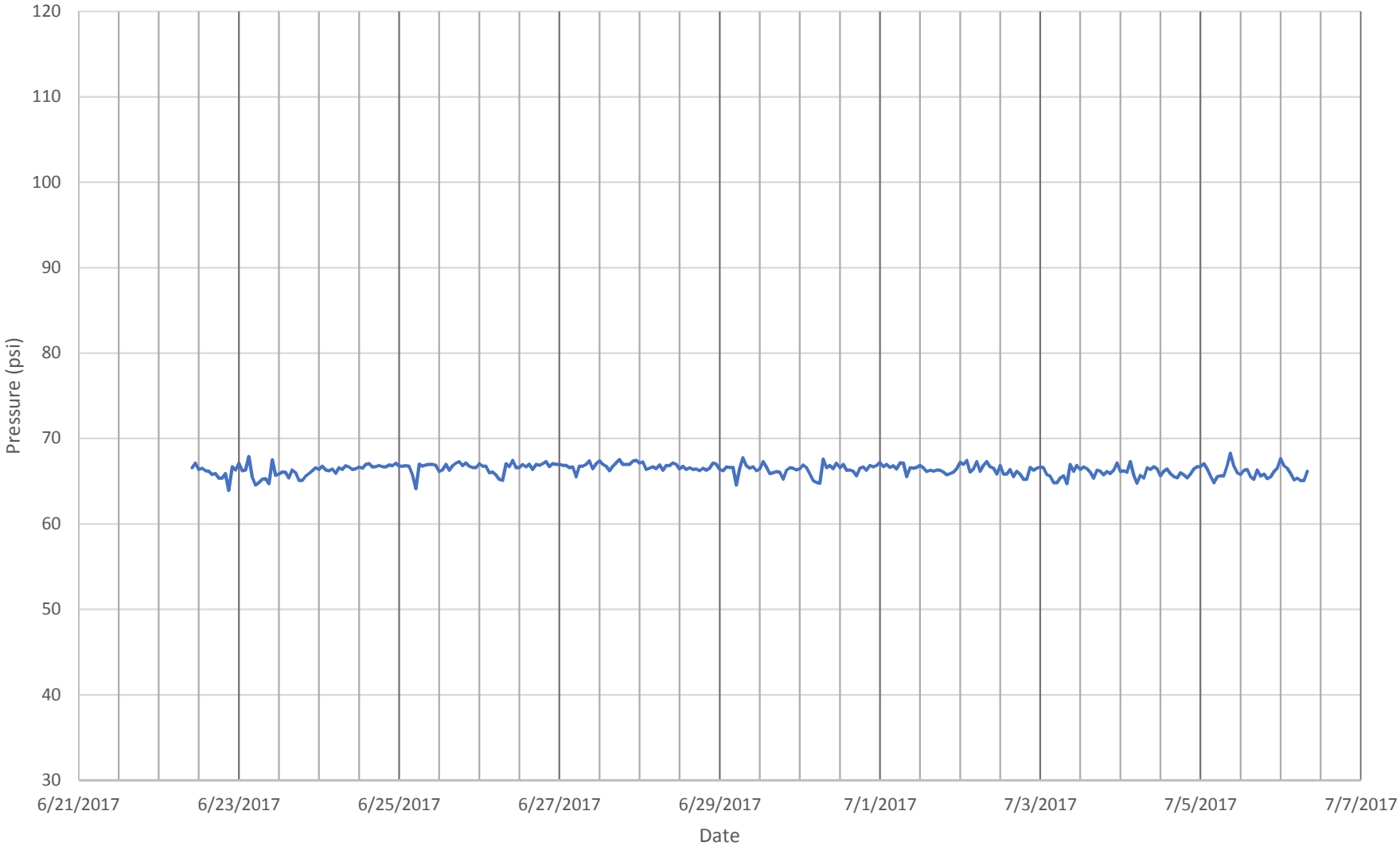
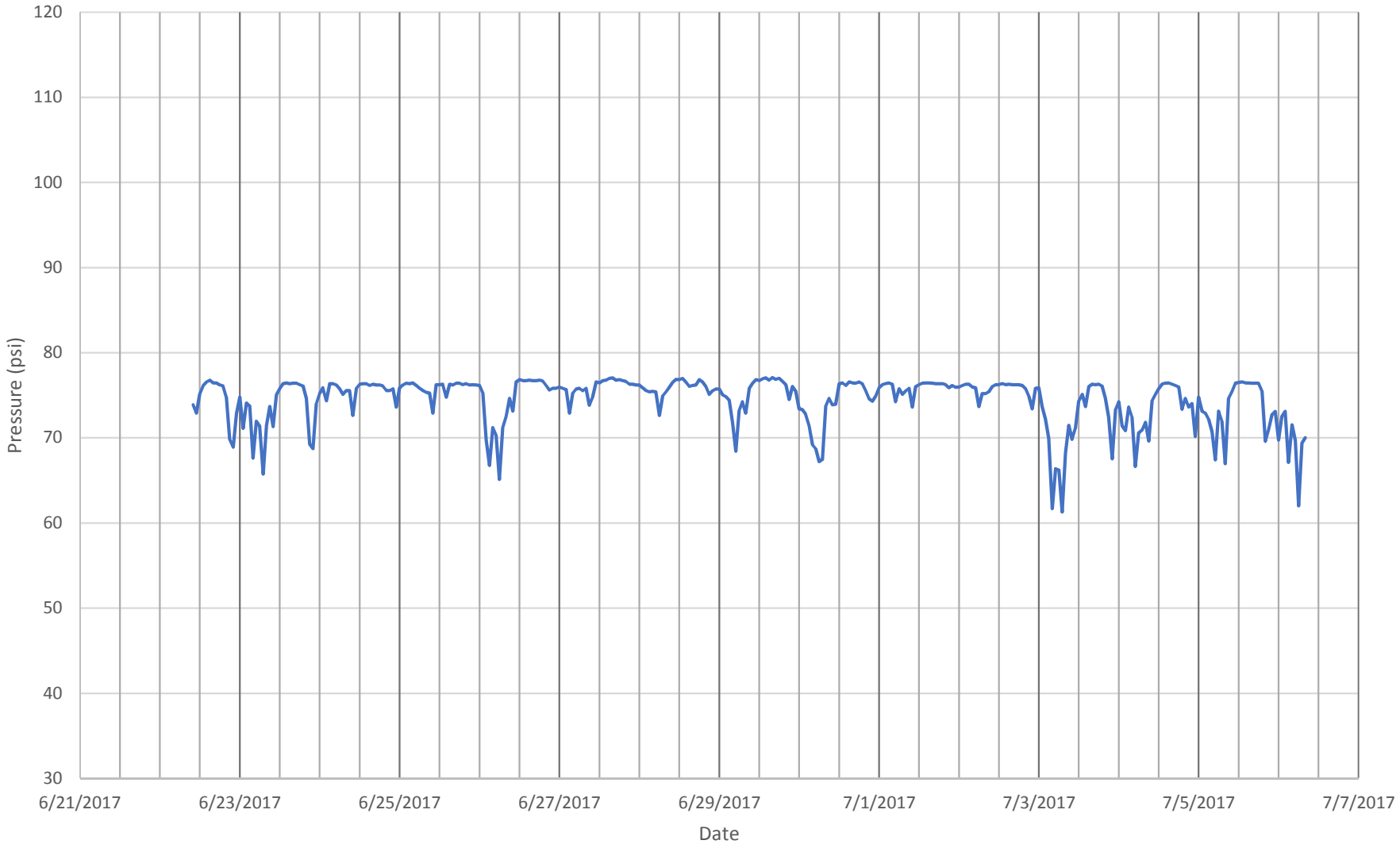


Figure D-14
City of Fair Oaks Ranch
Pressure Recorder #12
30950 Meadow Creek Trail



APPENDIX E
DIURNAL PATTERN AND MODEL CALIBRATION RESULTS

Figure E-1
City of Fair Oaks Ranch
Water Demand Diurnal Pattern

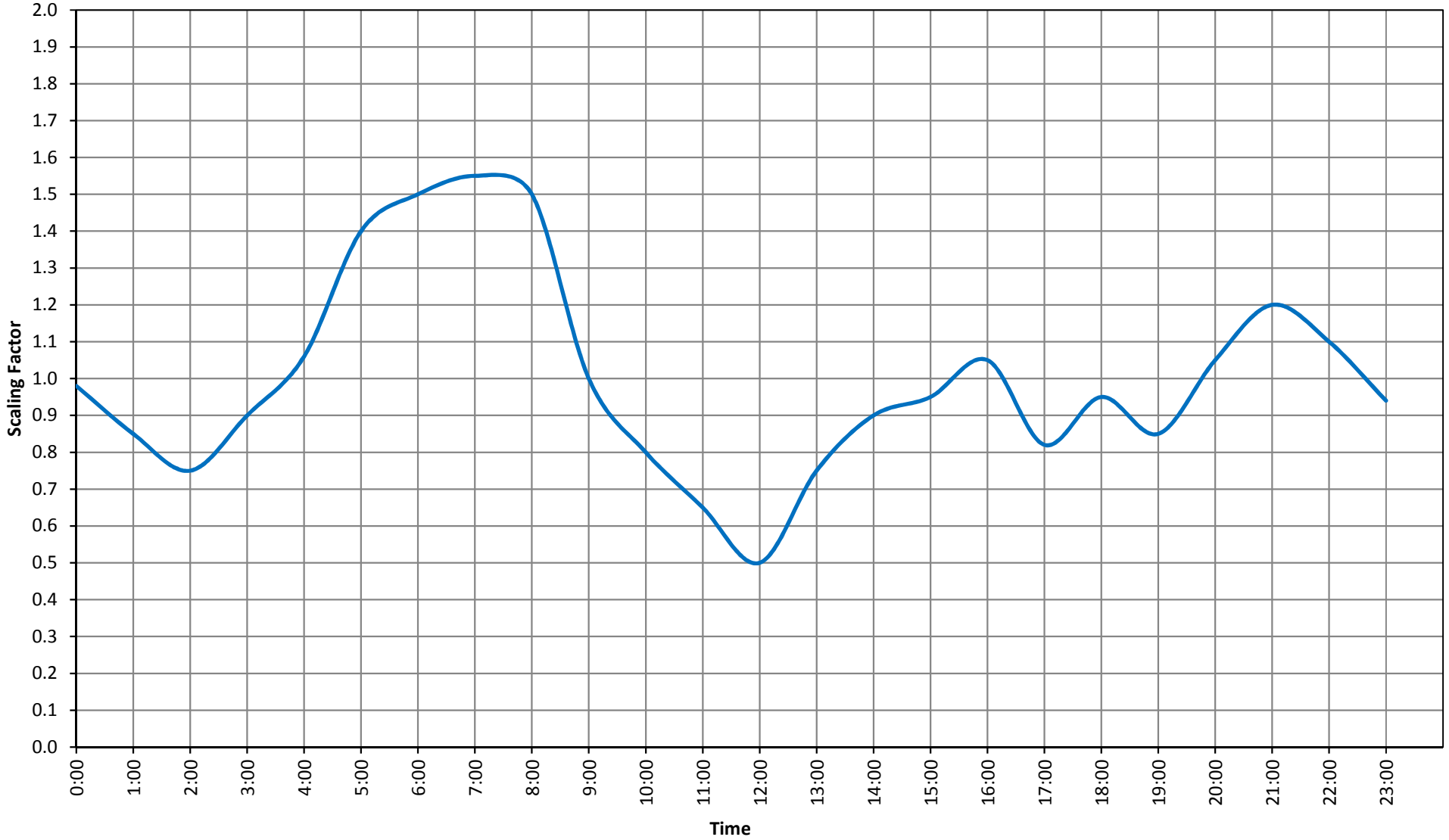


Figure E-2
City of Fair Oaks Ranch
Pressure Recorder Location #1: 29331 Grand Coteau Drive Lot 222
July 2, 2017

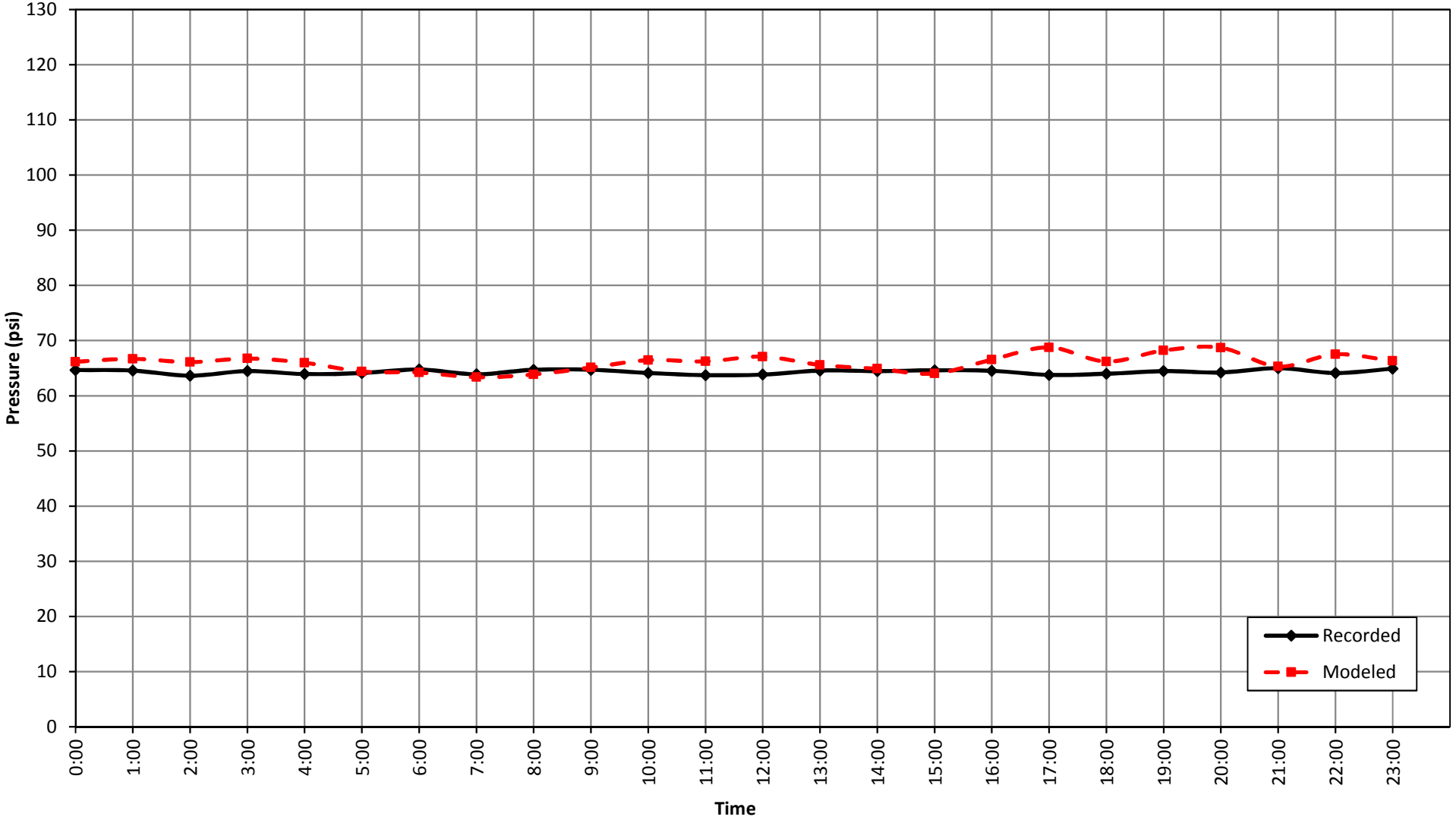


Figure E-3
City of Fair Oaks Ranch
Pressure Recorder Location #2: 29006 Angel Fire Drive Lot 464
July 2, 2017

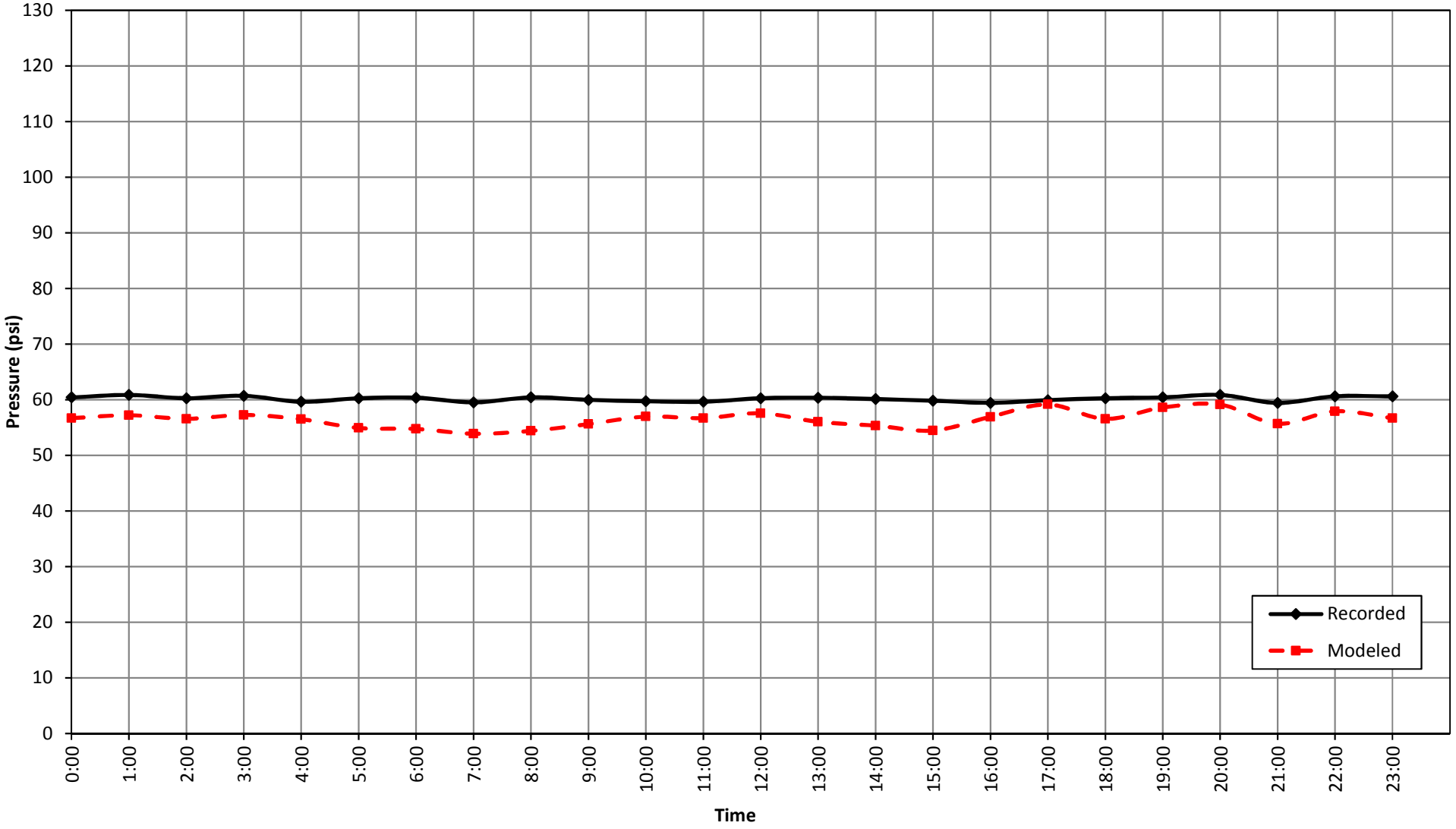


Figure E-4
City of Fair Oaks Ranch
Pressure Recorder Location #3: 28485 Preakness Lane Lot 53
July 2, 2017

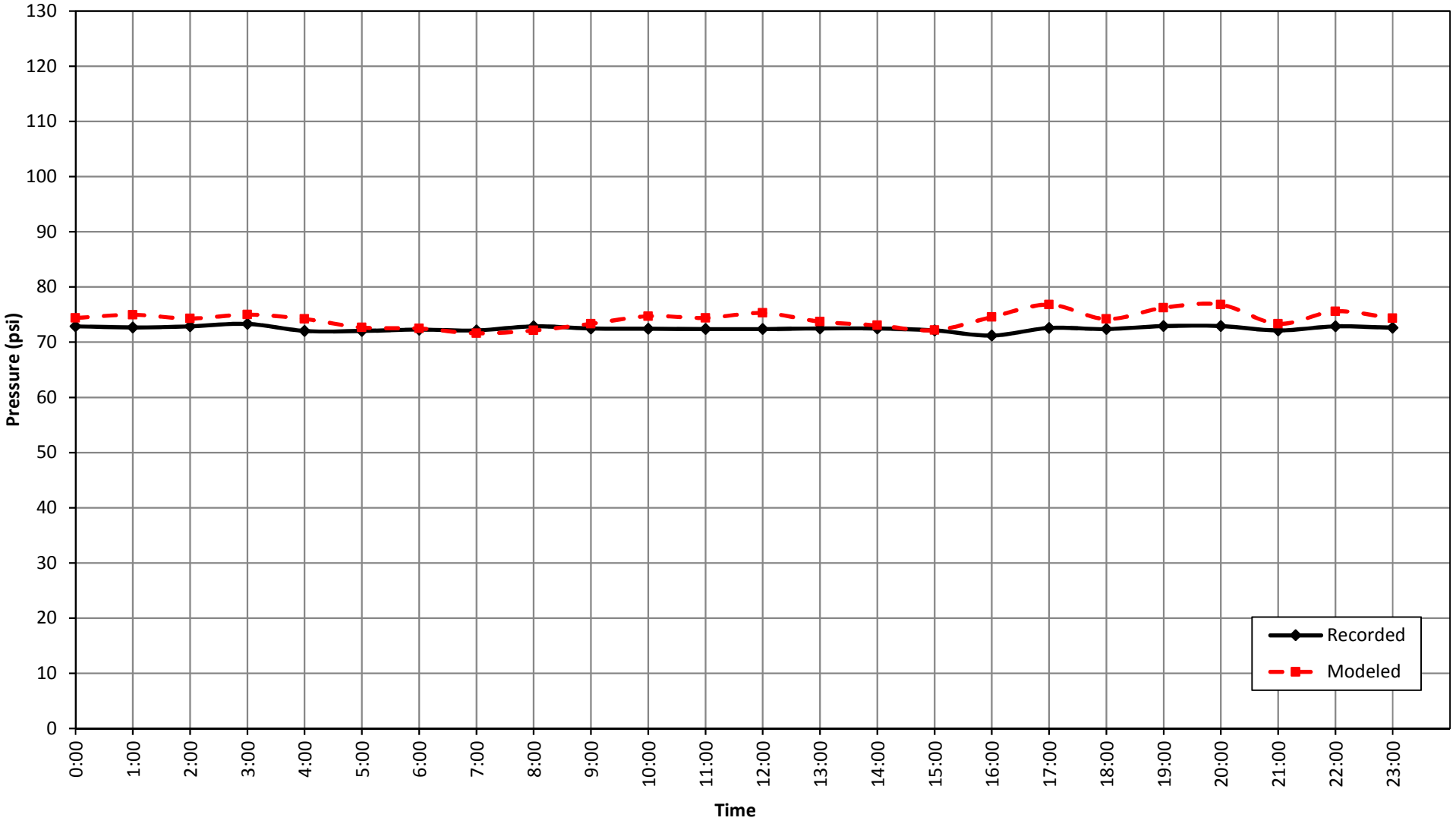


Figure E-5
City of Fair Oaks Ranch
Pressure Recorder Location #4: 8125 Royal Ascot Drive Lot 152
July 2, 2017

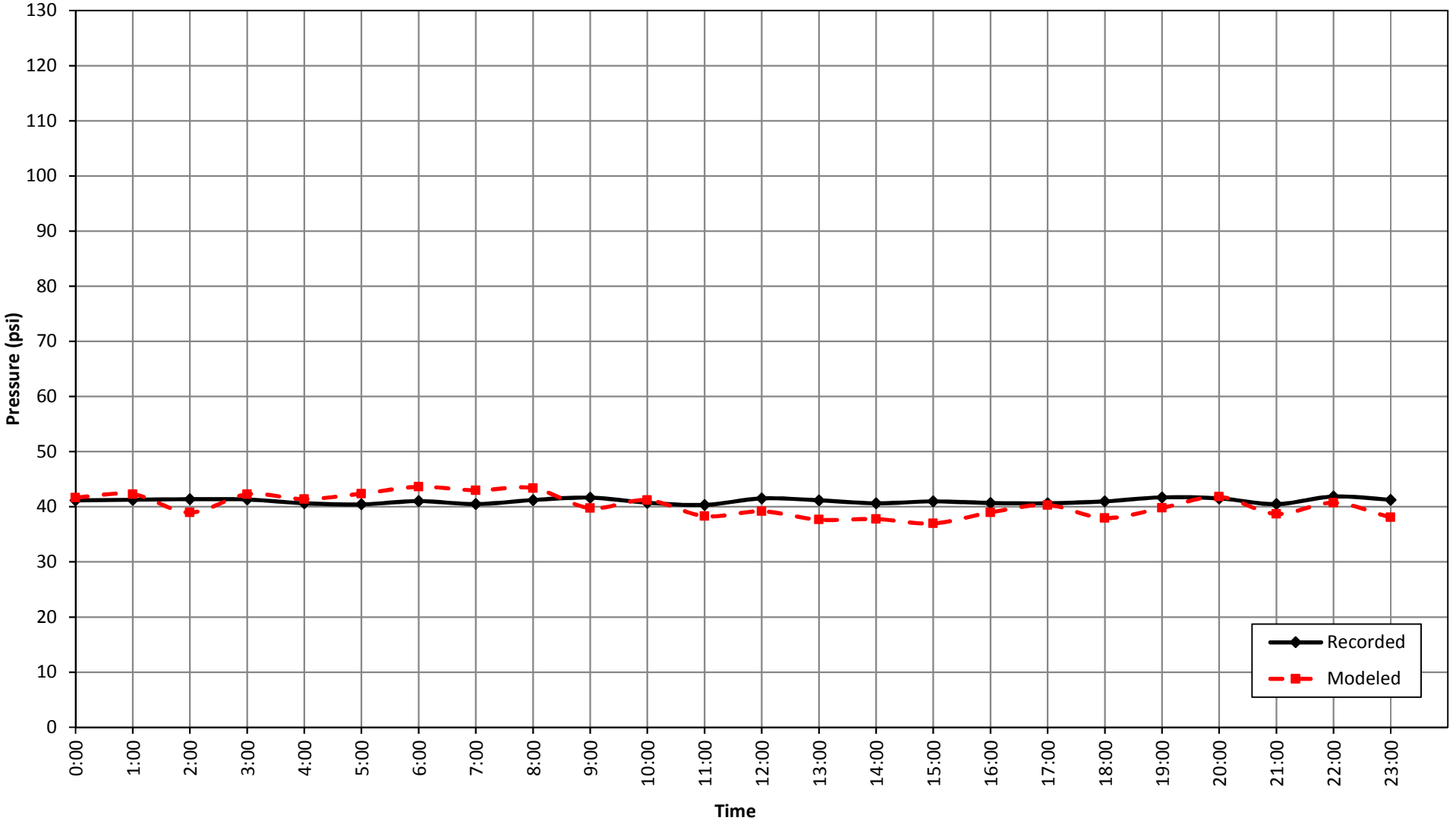


Figure E-6
City of Fair Oaks Ranch
Pressure Recorder Location #5: 9064 Fair Oaks Parkway Lot 25
July 2, 2017

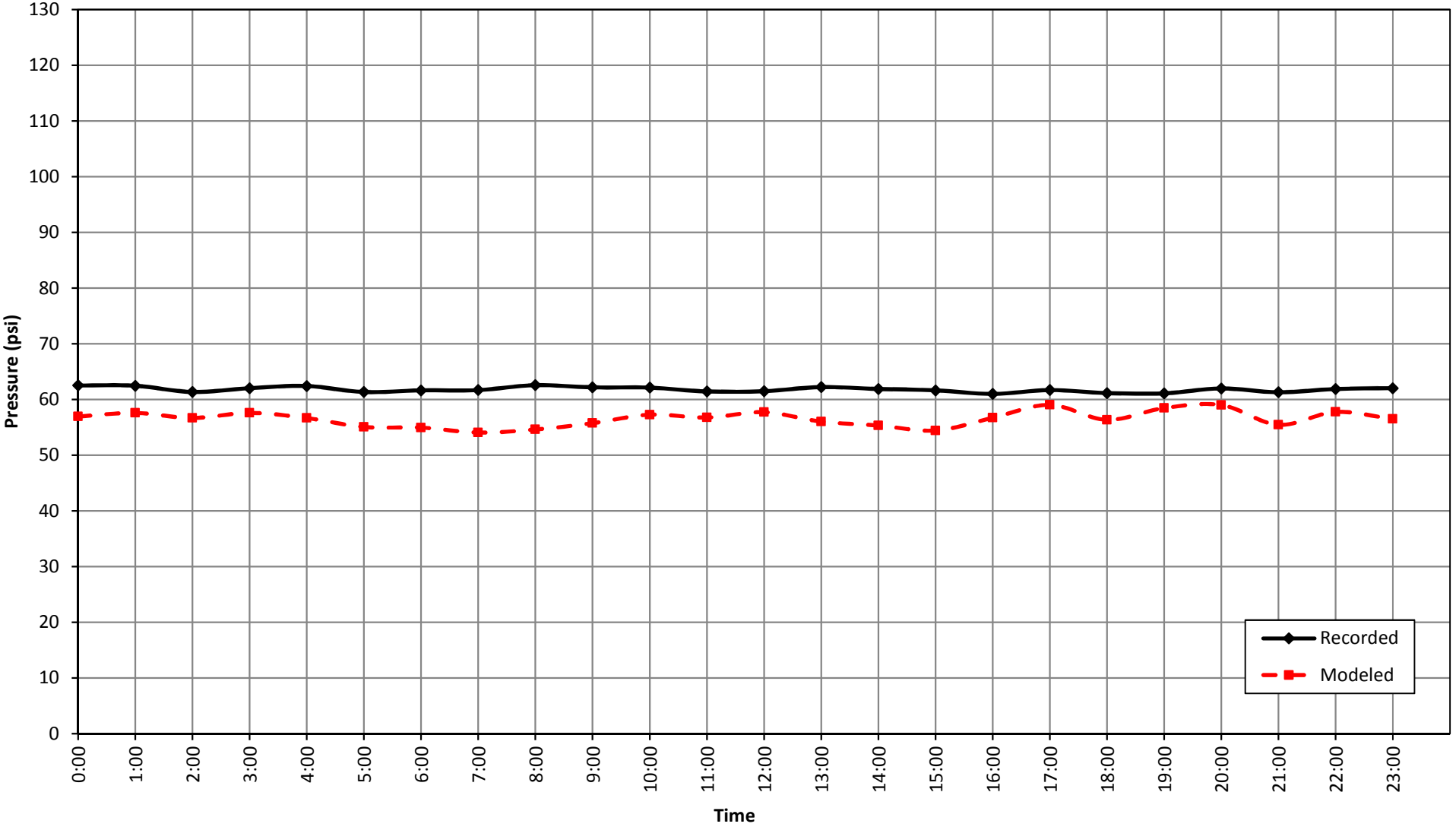


Figure E-7
City of Fair Oaks Ranch
Pressure Recorder Location #6: 55 Falls Terrace Lot 996
July 2, 2017

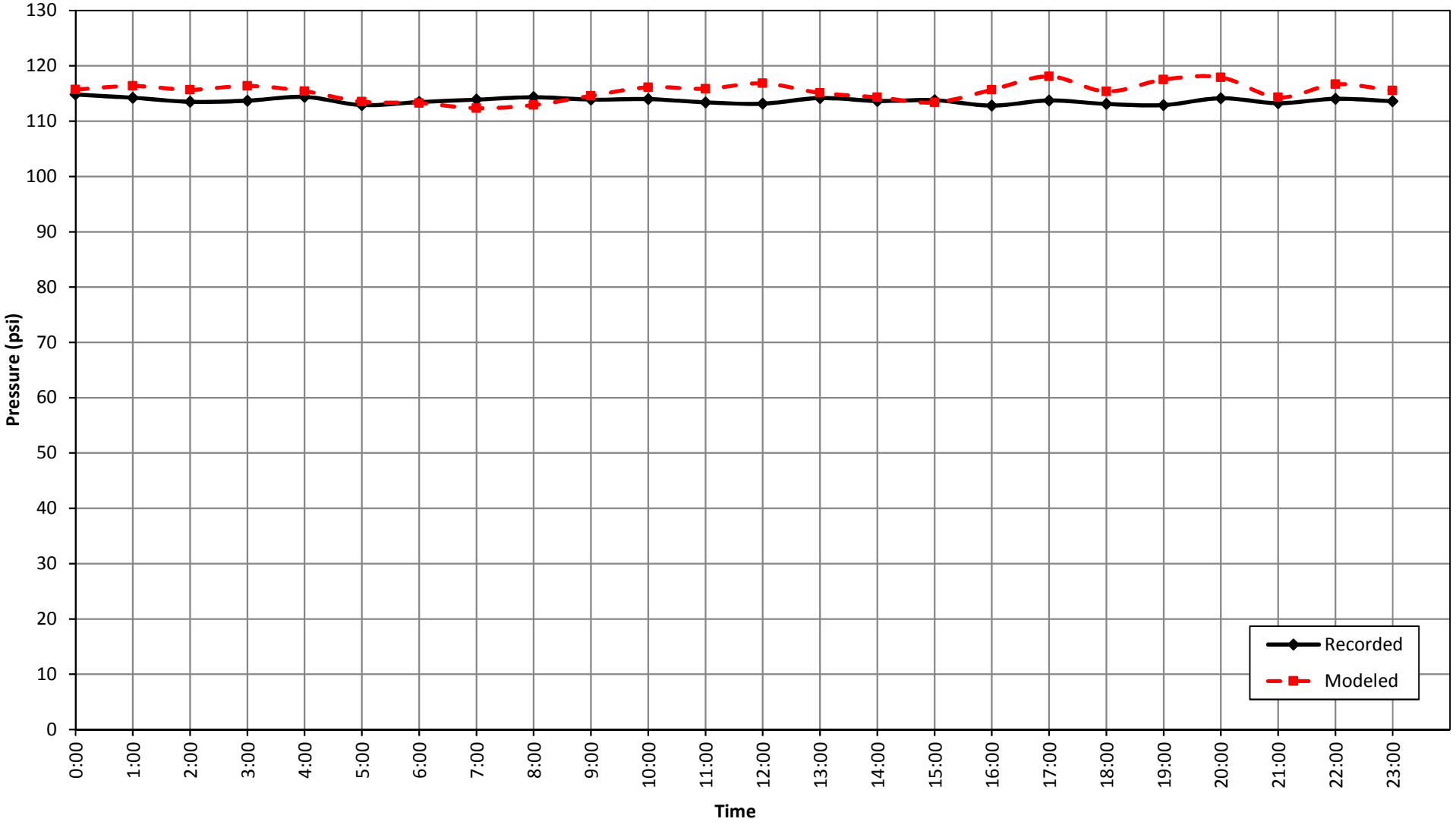


Figure E-8
City of Fair Oaks Ranch
Pressure Recorder Location #7: 30050 Cibolo Run Lot 1983
July 2, 2017

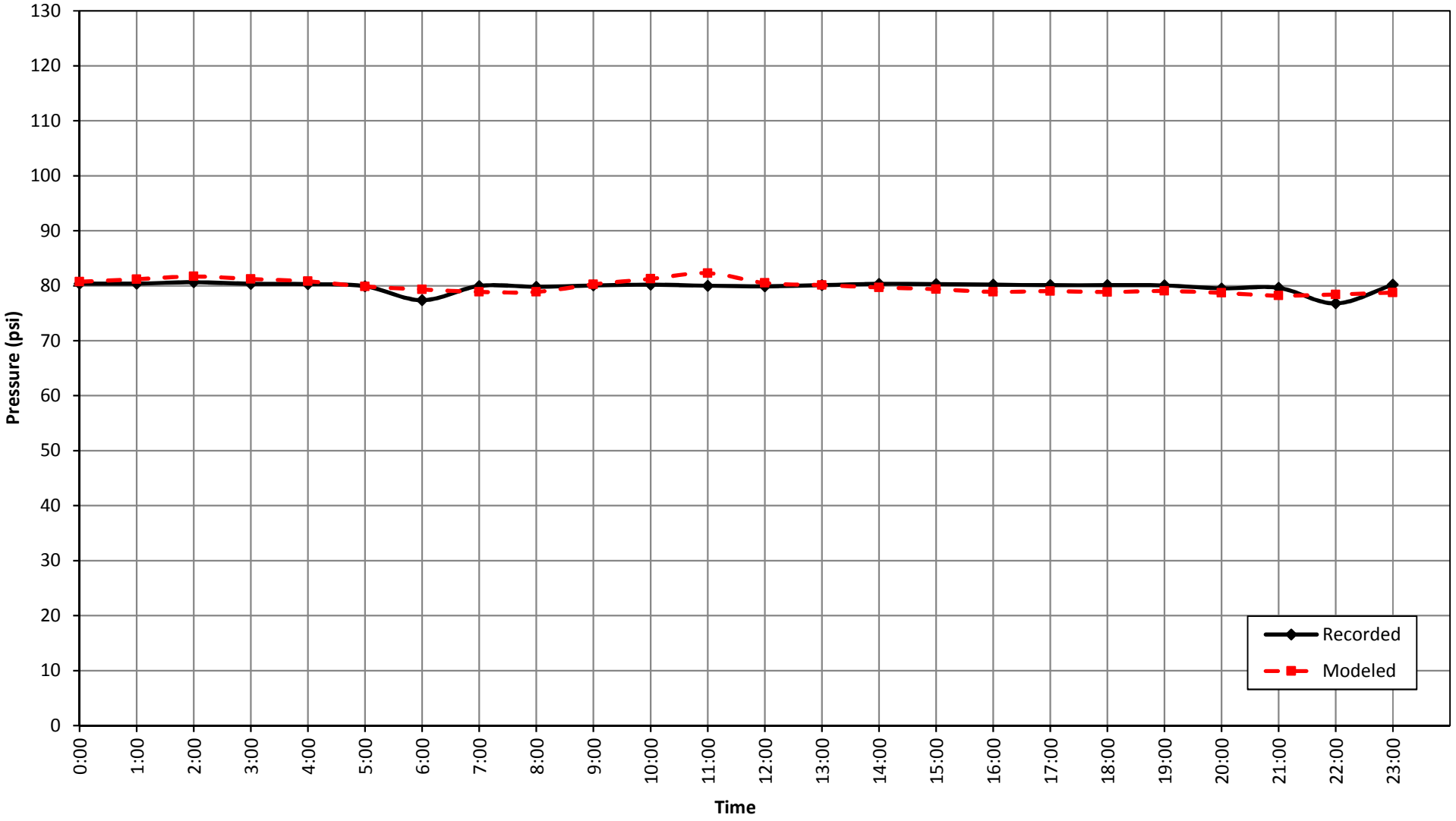


Figure E-9
City of Fair Oaks Ranch
Pressure Recorder Location #8: 7840 Venturer Lane Lot 173
July 2, 2017

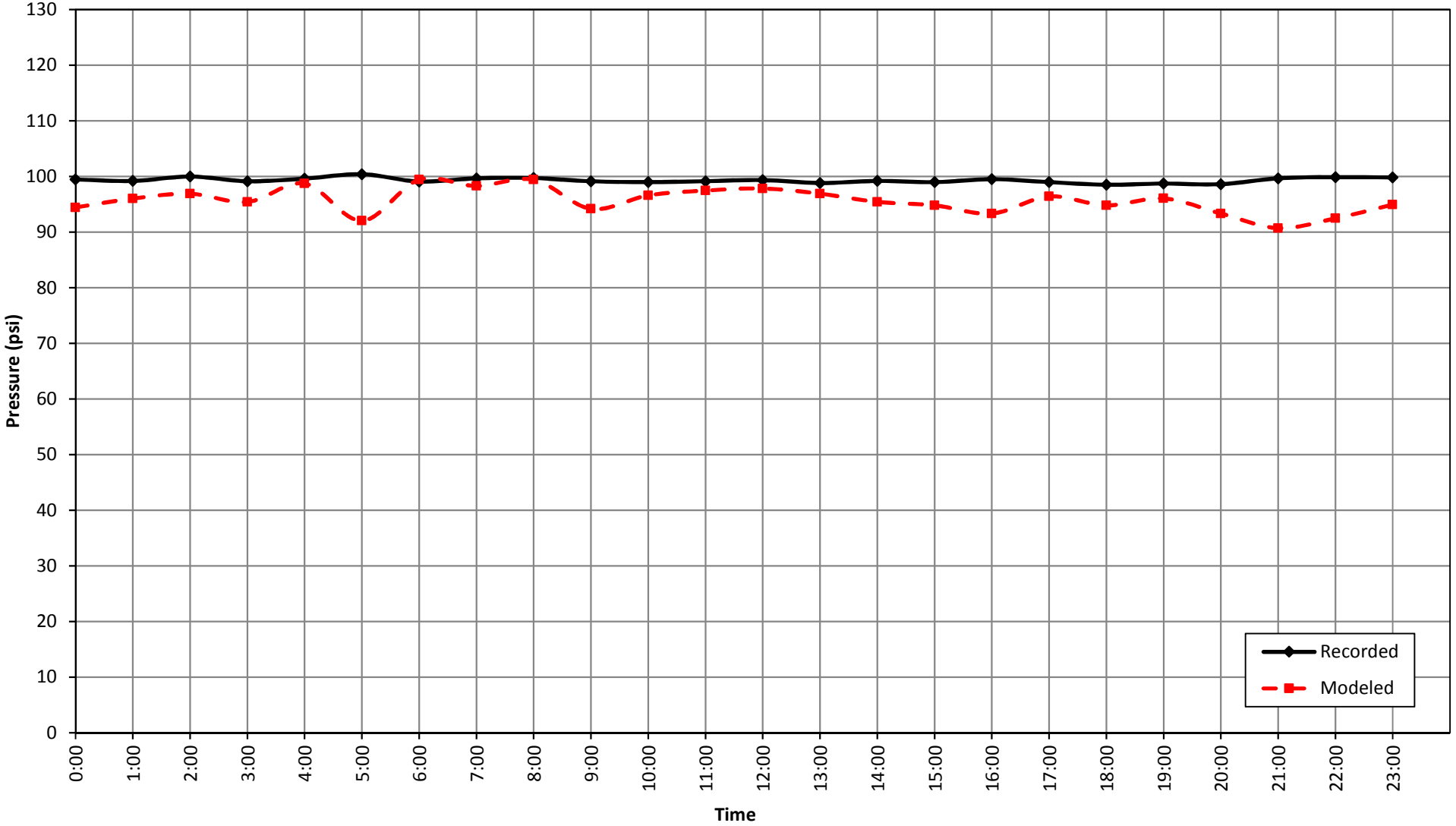


Figure E-10
City of Fair Oaks Ranch
Pressure Recorder Location #9: 9110 Jodhpur Drive Lot 663
July 2, 2017

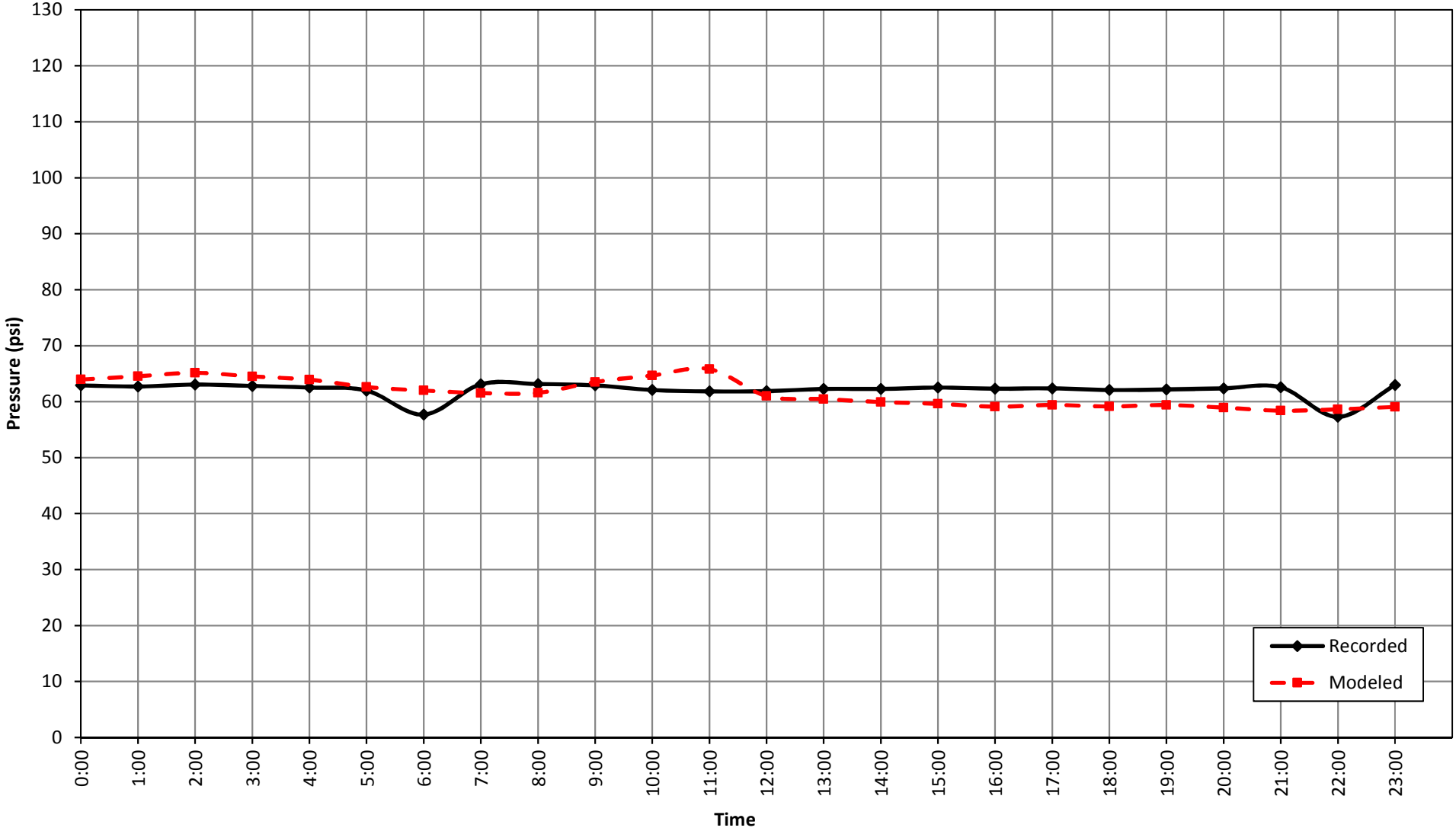


Figure E-11
City of Fair Oaks Ranch
Pressure Recorder Location #10: 8345 Rolling Acres Trail Lot 87
July 2, 2017

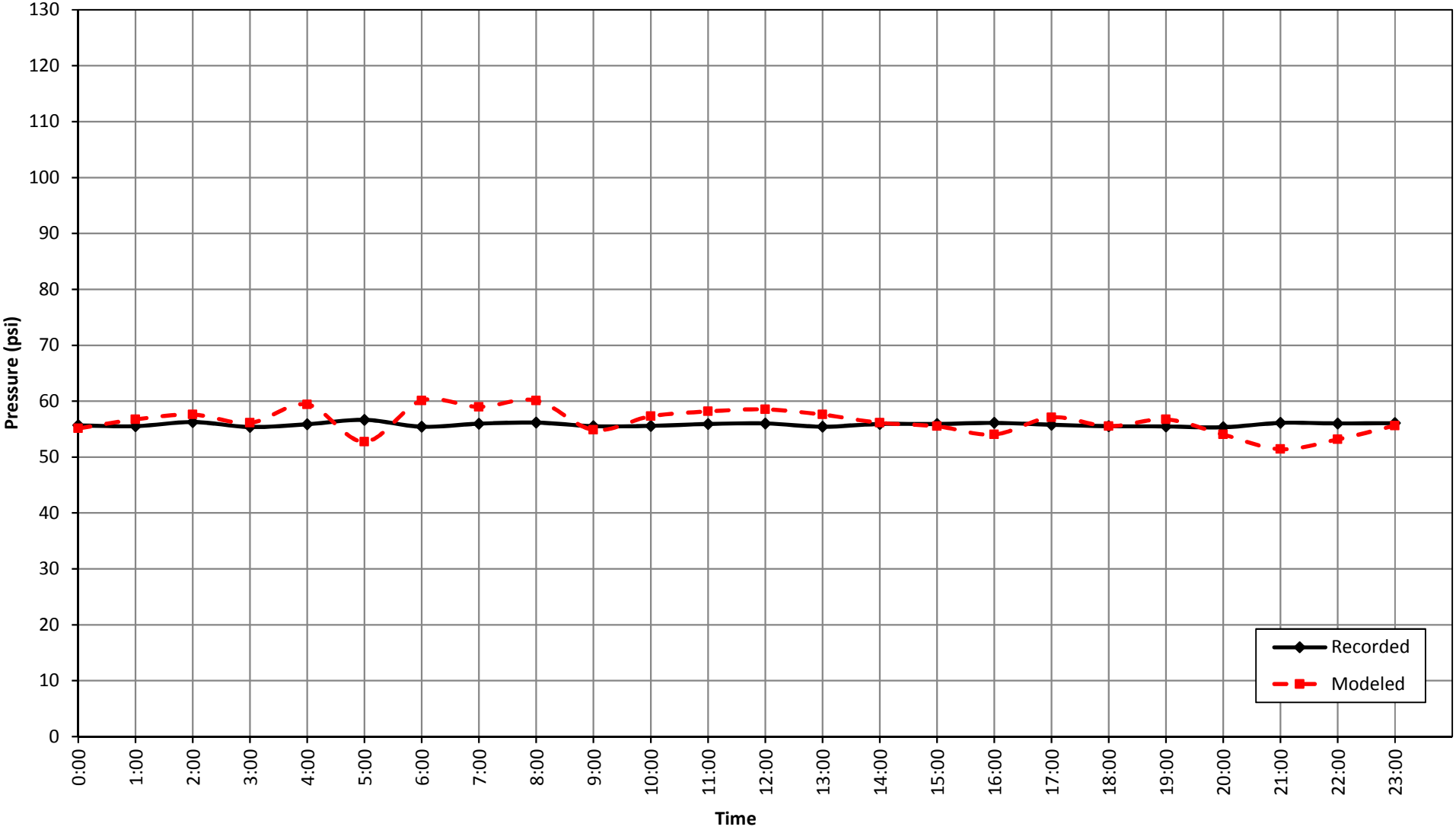


Figure E-12
City of Fair Oaks Ranch
Pressure Recorder Location #11: 8 Ranch Terrace Lot 1
July 2, 2017

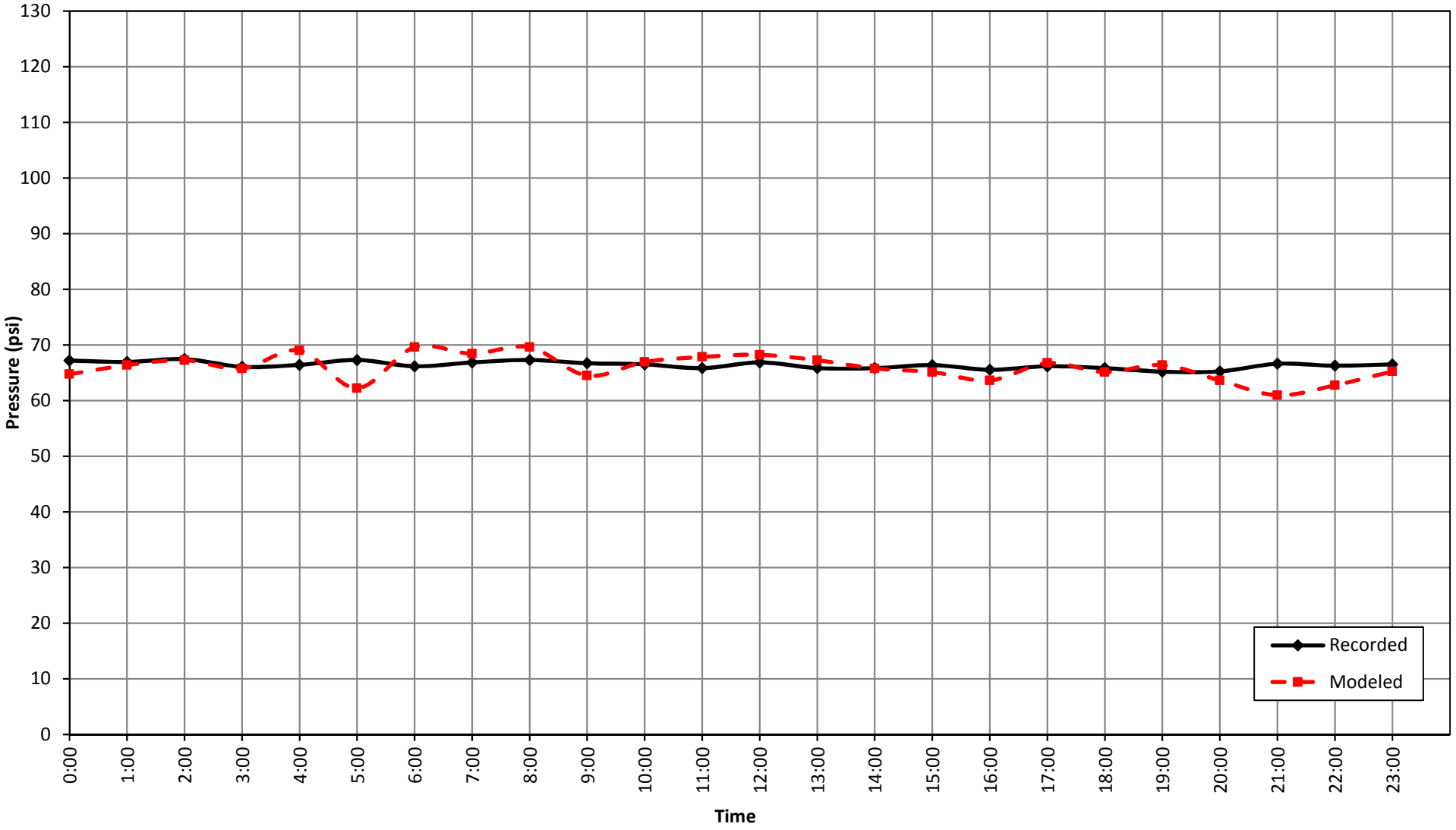


Figure E-13
City of Fair Oaks Ranch
Pressure Recorder Location #12: 30950 Meadow Creek Trail
July 2, 2017

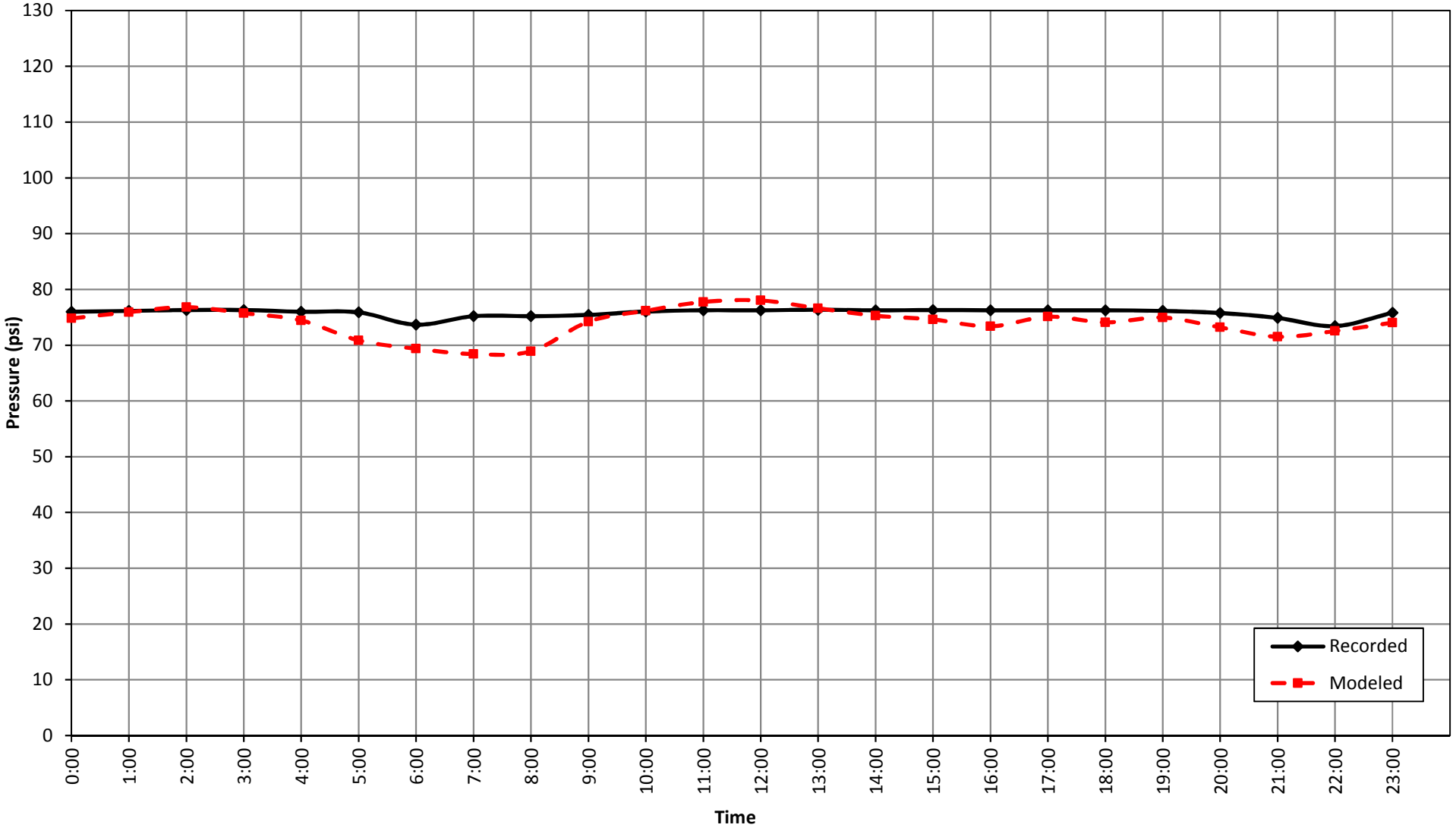


Figure E-14
City of Fair Oaks Ranch
Elmo Davis Distribution Pressure
July 2, 2017

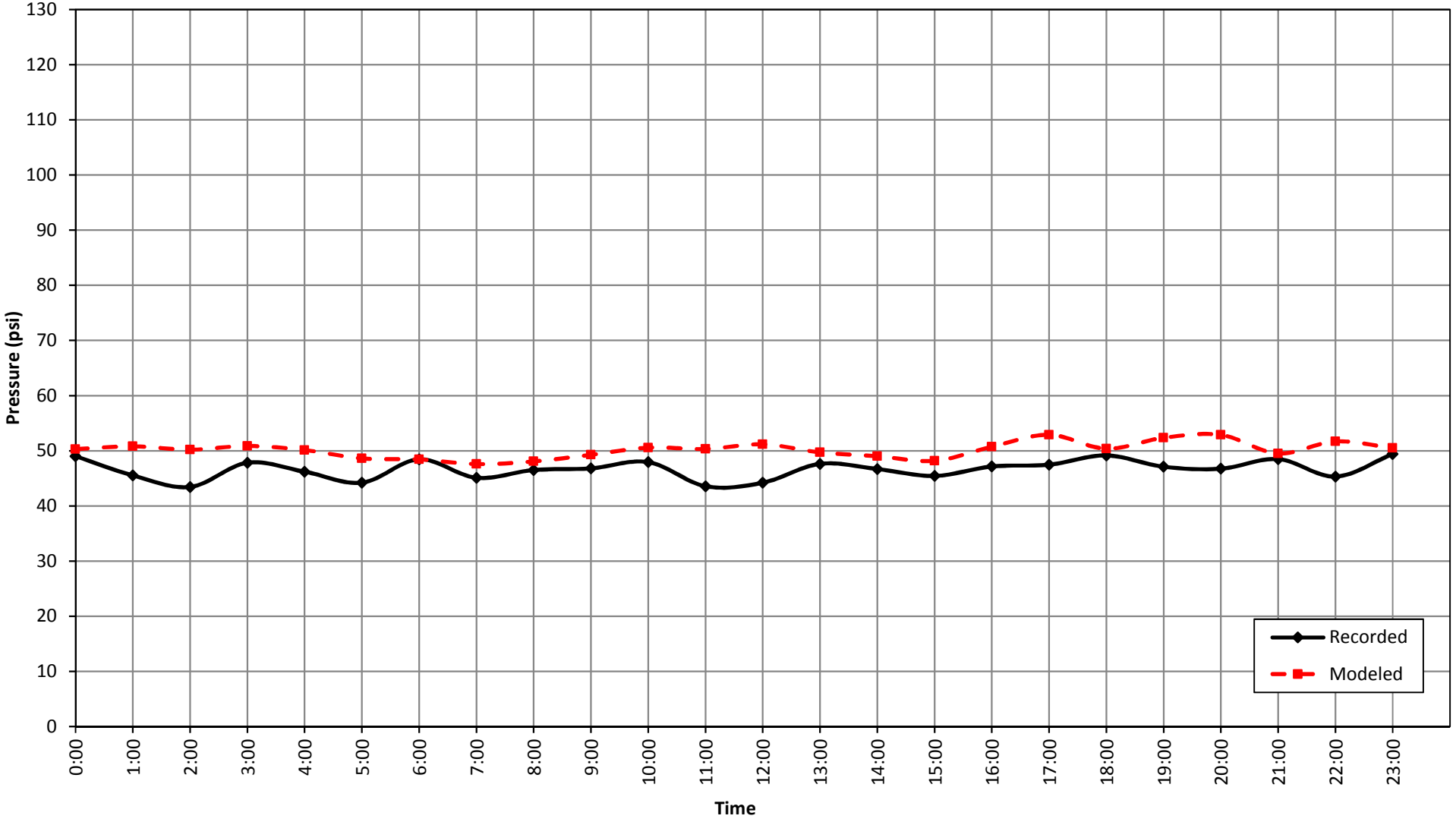


Figure E-15
City of Fair Oaks Ranch
Plant #2 Distribution Pressure
July 2, 2017

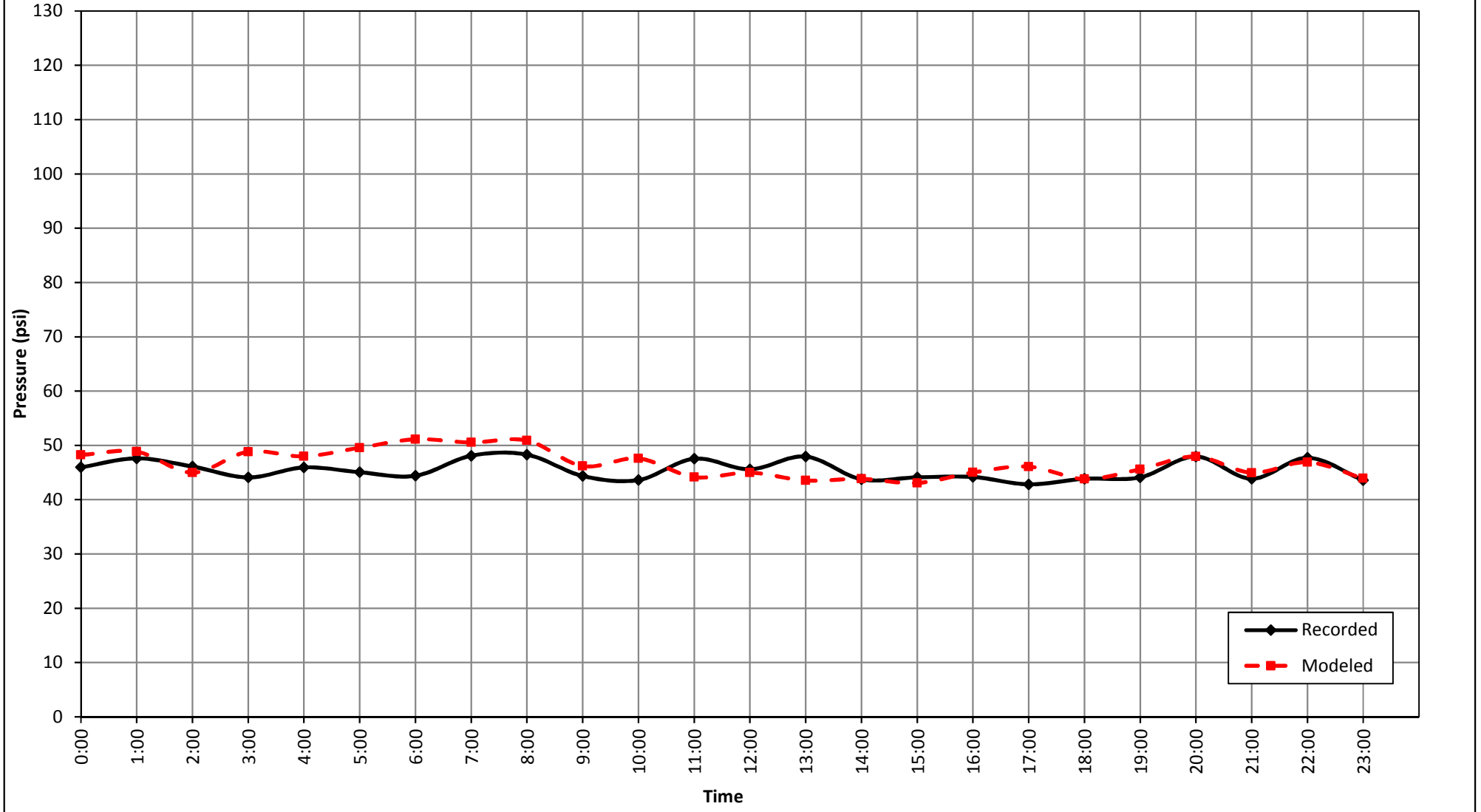


Figure E-16
City of Fair Oaks Ranch
Plant #3 Distribution Pressure
July 2, 2017

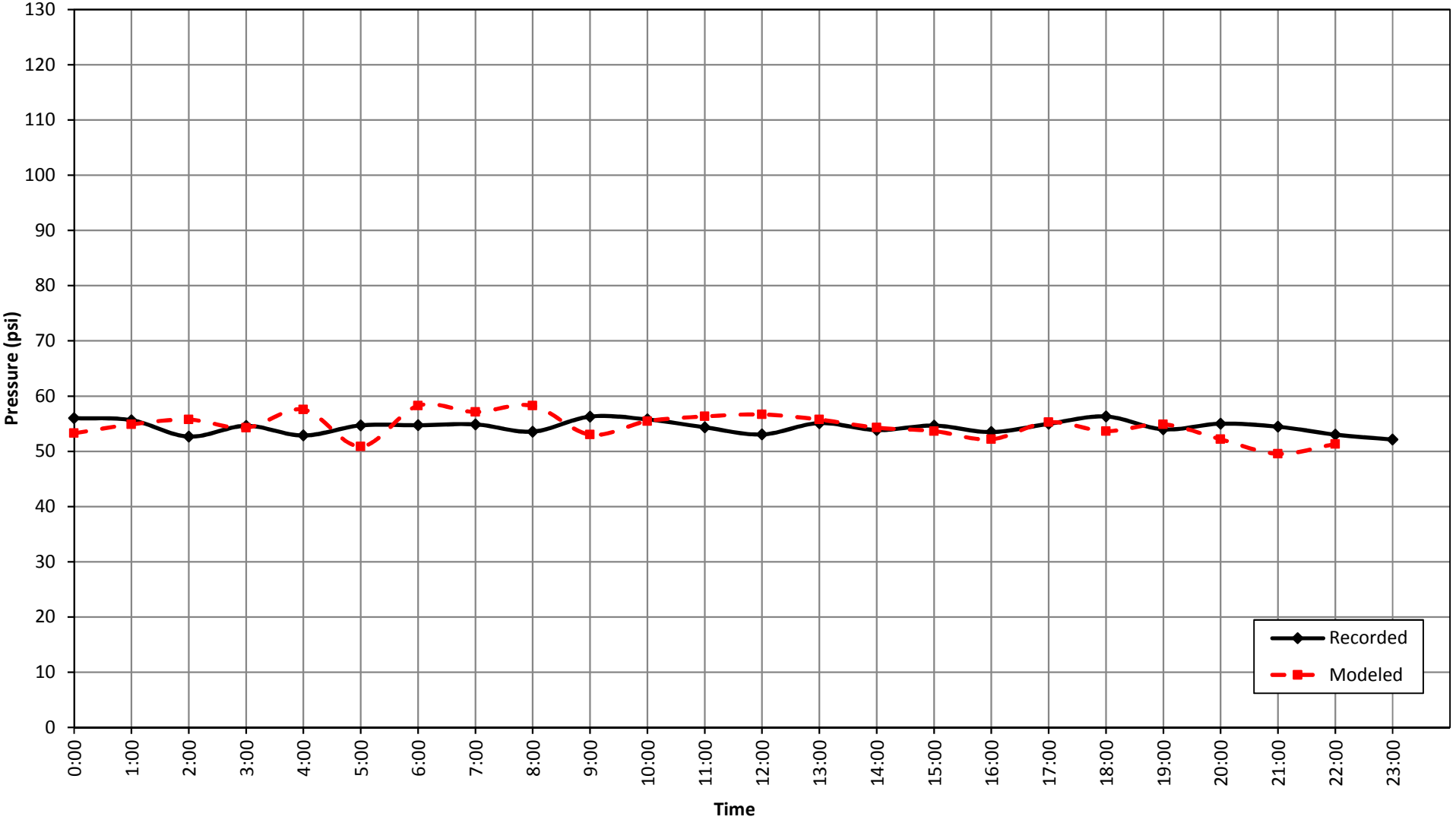


Figure E-17
City of Fair Oaks Ranch
Plant #5 Distribution Pressure - Zone A
July 2, 2017

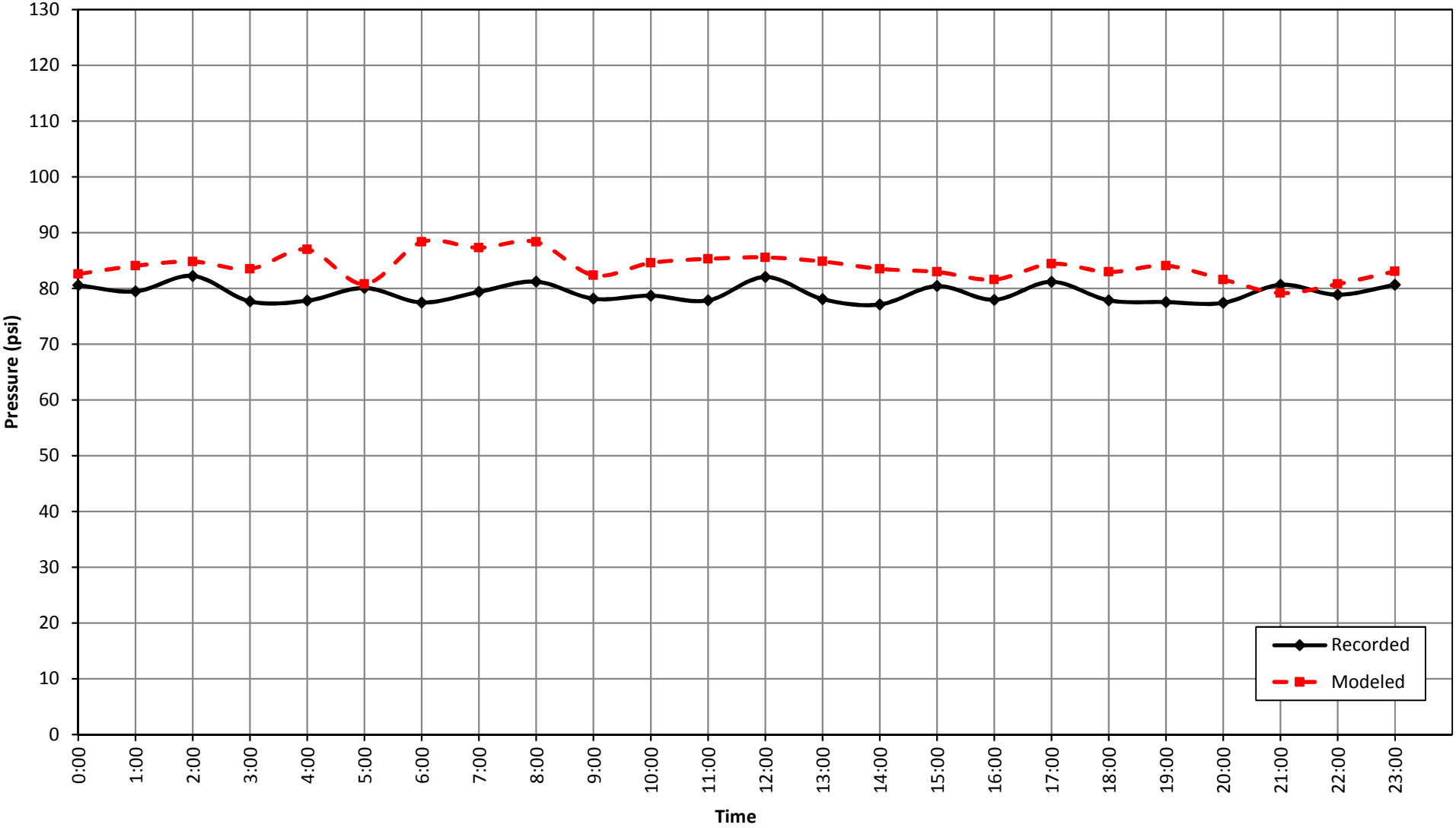
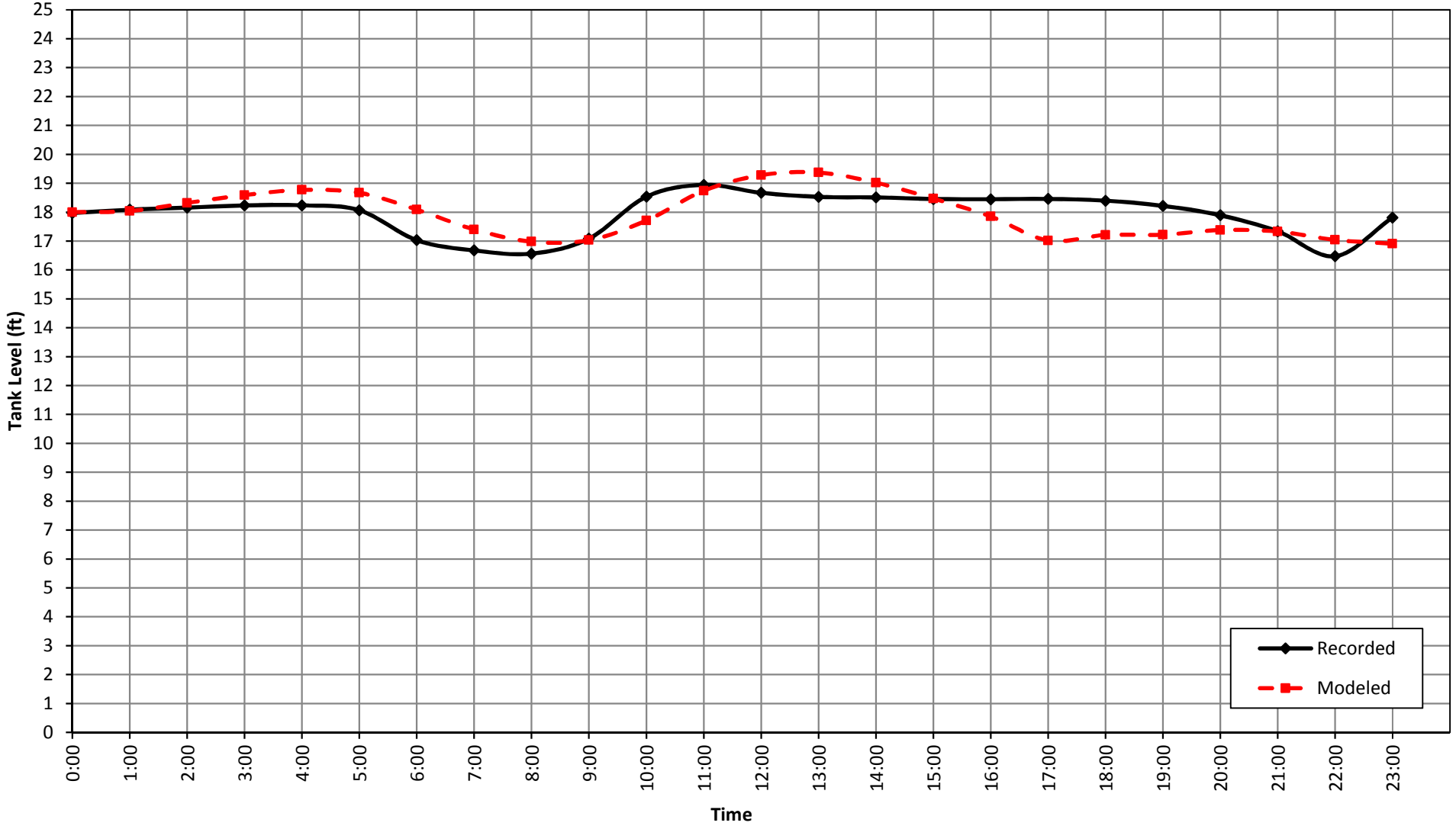


Figure E-18
City of Fair Oaks Ranch
Tank: Elmo Davis GSTs, Overflow Elevation: 1,459 ft
July 2, 2017



APPENDIX F
WATER CAPITAL IMPROVEMENT PLAN
COST ESTIMATES

City of Fair Oaks Ranch

Capital Improvement Cost Estimate	**January 2019**
Construction Project Number: 1	**Phase: 2023**
Project Name:	**9,000-Gallon Plant #2 Hydropneumatic Tank (Zone C)**

Project Description:

This project consists of a new 9,000 gallon hydropneumatic tank at Plant #2.

Project Drivers:

This project will allow the City to meet the TCEQ minimum requirements for hydropneumatic storage in Zone C.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	9,000-gallon Hydropneumatic Tank	1	LS	$ 150,000	$ 150,000
2	Remove Existing Hydropneumatic Tank	1	LS	$ 15,000	$ 15,000
				SUBTOTAL:	**$ 165,000**
			CONTINGENCY	30%	$ 49,500
				SUBTOTAL:	**$ 214,500**
			ENG/SURVEY	15%	$ 32,200
				SUBTOTAL:	**$ 246,700**
				Estimated Project Total:	**$ 246,700**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 2 — **Phase:** 2023

Project Name: 0.5-MG Zone A Elevated Storage Tank (Zone A)

Project Description:

This project consists of a new 0.5 MG Zone A elevated storage tank at the intersection of West Ammann Road and the Comal County Line.

Project Drivers:

This project will provide elevated storage capacity in Zone A.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	0.5 MG Elevated Storage Tank	1	LS	$ 2,200,000	$ 2,200,000

SUBTOTAL:		**$ 2,200,000**
CONTINGENCY	30%	$ 660,000
SUBTOTAL:		**$ 2,860,000**
ENG/SURVEY	15%	$ 429,000
SUBTOTAL:		**$ 3,289,000**
Estimated Project Total:		**$ 3,289,000**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 3 — **Phase:** 2023

Project Name: 12-inch West Ammann Road Water Line (Zone A)

Project Description:

This project consists of a new 12-inch water line that flows between the Zone A elevated storage tank described in Project 2 and Rolling Acres Trail, along West Ammann Road.

Project Drivers:

This project will serve growth in Zone A.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	4,000	LF	$ 120	$ 480,000
2	Water Pavement Repair	4,000	LF	$ 50	$ 200,000

SUBTOTAL:		**$ 680,000**
CONTINGENCY	30%	$ 204,000
SUBTOTAL:		**$ 884,000**
ENG/SURVEY	15%	$ 132,600
SUBTOTAL:		**$ 1,016,600**
Estimated Project Total:		**$ 1,016,600**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate		**January 2019**
Construction Project Number:	**4**	**Phase: 2023**
Project Name:	**12-inch Northeast Water Lines (Zone A)**	

Project Description:

This project consists of a new 12-inch water line that flows between the Zone A Elevated Storage Tank mentioned in Project 2 and the Ranch Pass subdivision.

Project Drivers:

This project will serve growth in Zone A.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	9,000	LF	$ 120	$ 1,080,000

SUBTOTAL:		**$ 1,080,000**
CONTINGENCY	30%	$ 324,000
SUBTOTAL:		**$ 1,404,000**
ENG/SURVEY	15%	$ 210,600
SUBTOTAL:		**$ 1,614,600**
Estimated Project Total:		**$ 1,614,600**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 5 — **Phase:** 2023

Project Name: 400-gpm Plant #5 Zone B Pump Station Expansion and 0.5-MG GST (Zone B)

Project Description:

This project consists of a 400 gpm expansion at the Plant #5 Zone B Pump Station. This project will increase the firm capacity from 800 gpm to 1,200 gpm. This project also includes a new 0.50-MG ground storage tank.

Project Drivers:

This project will provide additional distribution pumping capacity in Zone B.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Pump Station - Expansion 400 gpm	1	LS	$ 450,000	$ 450,000
2	0.5 MG Ground Storage Tank	1	LS	$ 1,000,000	$ 1,000,000
				SUBTOTAL:	**$ 1,450,000**
			CONTINGENCY	30%	$ 435,000
				SUBTOTAL:	**$ 1,885,000**
			ENG/SURVEY	15%	$ 282,800
				SUBTOTAL:	**$ 2,167,800**
				Estimated Project Total:	**$ 2,167,800**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 6 — **Phase:** 2023

Project Name: 650-gpm Elmo Davis Pump Station Expansion (Zone C)

Project Description:

This project consists of a 650 gpm expansion at the Elmo Davis Pump Station. This project will increase the firm capacity from 800 gpm to 1,450 gpm.

Project Drivers:

This project will provide additional distribution pumping capacity in Zone C.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Pump Station - Expansion 650 gpm	1	LS	$ 650,000	$ 650,000

SUBTOTAL:		**$ 650,000**
CONTINGENCY	30%	$ 195,000
SUBTOTAL:		**$ 845,000**
ENG/SURVEY	15%	$ 126,800
SUBTOTAL:		**$ 971,800**
Estimated Project Total:		**$ 971,800**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate	**January 2019**
Construction Project Number: 7	**Phase: 2023**
Project Name:	**Pressure Reducing Valve at Rolling Acres Trail and Meadow Creek Trail (Zone B)**

Project Description:

This project consists of a new pressure reducing valve at the intersection of Rolling Acres Trail and Meadow Creek Trail.

Project Drivers:

This project will provide increased redundancy in Zone B.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Pressure Reducing Valve Station	1	LS	$ 100,000	$ 100,000

SUBTOTAL:		**$ 100,000**
CONTINGENCY	30%	$ 30,000
SUBTOTAL:		**$ 130,000**
ENG/SURVEY	15%	$ 19,500
SUBTOTAL:		**$ 149,500**
Estimated Project Total:		**$ 149,500**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 8 — **Phase:** 2028

Project Name: 8-inch Water Line at Dietz Elkhorn Road and Ralph Fair Road (Zone C)

Project Description:

This project consists of a new 8-inch looped water line northeast of the intersection of Dietz Elkhorn Road and Ralph Fair Road.

Project Drivers:

This project will serve growth in Zone C.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" WL & Appurtenances	2,400	LF	$ 80	$ 192,000
			SUBTOTAL:		**$ 192,000**
		CONTINGENCY		30%	$ 57,600
			SUBTOTAL:		**$ 249,600**
		ENG/SURVEY		15%	$ 37,440
			SUBTOTAL:		**$ 287,040**
				Estimated Project Total:	**$ 287,040**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 9 — **Phase:** 2028

Project Name: 12-inch Southeastern Water Lines (Zone B)

Project Description:

This project consists of a new 12-inch looped water line northeast of the intersection of Dietz Elkhorn Road and Ralph Fair Road.

Project Drivers:

This project will serve growth in Zone B.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	14,600	LF	$ 120	$ 1,752,000
			SUBTOTAL:		**$ 1,752,000**
		CONTINGENCY		30%	$ 525,600
			SUBTOTAL:		**$ 2,277,600**
		ENG/SURVEY		15%	$ 341,700
			SUBTOTAL:		**$ 2,619,300**
				Estimated Project Total:	**$ 2,619,300**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 10 — **Phase:** 2028

Project Name: 12/16-inch Plant #6 Discharge Water Lines (Zone A/B)

Project Description:

This project consists of a new 12-inch water line loop south of Plant #6 that serves Zone A and new 16-inch water lines that serve Zone B.

Project Drivers:

This project will serve growth in Zone B.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	10,800	LF	$ 120	$ 1,296,000
2	16" WL & Appurtenances	3,700	LF	$ 160	$ 592,000
			SUBTOTAL:		**$ 1,888,000**
		CONTINGENCY		30%	$ 566,400
			SUBTOTAL:		**$ 2,454,400**
		ENG/SURVEY		15%	$ 368,200
			SUBTOTAL:		**$ 2,822,600**
				Estimated Project Total:	**$ 2,822,600**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 11 — **Phase:** 2028

Project Name: Plant #6 and New GBRA Delivery Point (Zone A/B)

Project Description:

This project consists of a new Plant #6 at the intersection of West Ammann Road and the Comal County Line. It will include a 600 gpm Zone A Pump Station, a 1,600 gpm Zone B Pump Station, and a 1.75 MG Ground Storage Tank. This project will create a new delivery point from GBRA.

Project Drivers:

This project will provide additional production and distribution capacity in Zones A and B.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	PS - New 600 gpm and 1,600 gpm	1	LS	$ 2,500,000	$ 2,500,000
2	1.0 MG Ground Storage Tank	1	LS	$ 1,250,000	$ 1,250,000
3	Meter Vault for GBRA Delivery Point	1	LS	$ 200,000	$ 200,000
				SUBTOTAL:	**$ 3,950,000**
			CONTINGENCY	30%	$ 1,185,000
				SUBTOTAL:	**$ 5,135,000**
			ENG/SURVEY	15%	$ 770,300
				SUBTOTAL:	**$ 5,905,300**
				Estimated Project Total:	**$ 5,905,300**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 12 — **Phase:** 2028

Project Name: 12-inch ETJ Water Line (Zone B)

Project Description:

This project consists of a new 12-inch water line that serves the area east of the city limits in Zone B.

Project Drivers:

This project will serve growth in Zone B.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	12,600	LF	$ 120	$ 1,512,000
2	20" Boring and Casing	500	LF	$ 400	$ 200,000
				SUBTOTAL:	**$ 1,712,000**
		CONTINGENCY		30%	$ 513,600
				SUBTOTAL:	**$ 2,225,600**
		ENG/SURVEY		15%	$ 333,900
				SUBTOTAL:	**$ 2,559,500**
				Estimated Project Total:	**$ 2,559,500**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate	**January 2019**
Construction Project Number: 13	**Phase: Buildout**
Project Name:	**0.5-MG Plant #2 Elevated Storage Tank (Zone C)**

Project Description:

This project consists of a new 0.5 MG elevated storage tank at Plant #2.

Project Drivers:

This project will provide elevated storage capacity in Zone C.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	0.5 MG Elevated Storage Tank	1	LS	$ 2,200,000	$ 2,200,000
			SUBTOTAL:		**$ 2,200,000**
		CONTINGENCY		30%	$ 660,000
			SUBTOTAL:		**$ 2,860,000**
		ENG/SURVEY		15%	$ 429,000
			SUBTOTAL:		**$ 3,289,000**
				Estimated Project Total:	**$ 3,289,000**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 14 — **Phase:** Buildout

Project Name: 8/12-inch Royal Ascot/Triple Crown/Equestrian Water Line Replacement (Zone C)

Project Description:

This project replaces the existing 4 and 6-inch water lines along Royal Ascot Drive, Triple Crown Road, and Equestrian Road with 8 and 12-inch water lines.

Project Drivers:

This project will provide increased fire flow capacity in Zone C.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" WL & Appurtenances	2,800	LF	$ 80	$ 224,000
2	12" WL & Appurtenances	1,100	LF	$ 120	$ 132,000
3	16" Boring and Casing	500	LF	$ 350	$ 175,000
4	Water Pavement Repair	3,900	LF	$ 50	$ 195,000
			SUBTOTAL:		**$ 726,000**
		CONTINGENCY		30%	$ 217,800
			SUBTOTAL:		**$ 943,800**
		ENG/SURVEY		15%	$ 141,600
			SUBTOTAL:		**$ 1,085,400**
				Estimated Project Total:	**$ 1,085,400**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 15 — **Phase:** Buildout

Project Name: 8-inch Pimlico Lane Water Line Replacement (Zone C)

Project Description:

This project replaces the existing 4 and 6-inch water lines along Pimlico Lane with 8-inch water lines.

Project Drivers:

This project will provide increased fire flow capacity in Zone C.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" WL & Appurtenances	3,900	LF	$ 80	$ 312,000
2	Water Pavement Repair	3,900	LF	$ 50	$ 195,000
			SUBTOTAL:		**$ 507,000**
		CONTINGENCY		30%	$ 152,100
			SUBTOTAL:		**$ 659,100**
		ENG/SURVEY		15%	$ 98,900
			SUBTOTAL:		**$ 758,000**
				Estimated Project Total:	**$ 758,000**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 16 — **Phase:** Buildout

Project Name: 8-inch Preakness Lane Water Line Replacement (Zone C)

Project Description:

This project replaces the existing 4 and 6-inch water lines along Preakness Lane and Dietz Elkhorn Road with 8-inch water lines.

Project Drivers:

This project will provide increased fire flow capacity in Zone C.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" WL & Appurtenances	5,100	LF	$ 80	$ 408,000
2	Water Pavement Repair	5,100	LF	$ 50	$ 255,000
			SUBTOTAL:		**$ 663,000**
		CONTINGENCY		30%	$ 198,900
			SUBTOTAL:		**$ 861,900**
		ENG/SURVEY		15%	$ 129,300
			SUBTOTAL:		**$ 991,200**
				Estimated Project Total:	**$ 991,200**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 17 — **Phase:** Buildout

Project Name: 12-inch Triple Crown Road Water Line Replacement (Zone C)

Project Description:

This project replaces the existing 4-inch water lines along Triple Crown Road with 12-inch water lines.

Project Drivers:

This project will provide increased fire flow capacity in Zone C.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" WL & Appurtenances	5,700	LF	$ 120	$ 684,000
2	Water Pavement Repair	5,700	LF	$ 50	$ 285,000
			SUBTOTAL:		**$ 969,000**
		CONTINGENCY		30%	$ 290,700
			SUBTOTAL:		**$ 1,259,700**
		ENG/SURVEY		15%	$ 189,000
			SUBTOTAL:		**$ 1,448,700**
				Estimated Project Total:	**$ 1,448,700**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 18 — **Phase:** Buildout

Project Name: 8-inch Rolling Acres Trail Water Line (Zone A)

Project Description:

This project consists of a 8-inch water line along Rolling Acres Trail from the existing 6-inch water line near Post Oak Creek to the existing 12-inch water line at Meadow Creek Trail.

Project Drivers:

This project will serve growth and improve fire flow in Zone A.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" WL & Appurtenances	3,340	LF	$ 80	$ 267,168
2	Water Pavement Repair	3,340	LF	$ 50	$ 167,000
				SUBTOTAL:	**$ 434,200**
			CONTINGENCY	30%	$ 130,300
				SUBTOTAL:	**$ 564,500**
			ENG/SURVEY	15%	$ 84,700
				SUBTOTAL:	**$ 649,200**
				Estimated Project Total:	**$ 649,200**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 19 — **Phase:** Buildout

Project Name: 8-inch Post Oak Trail Water Line (Zone A)

Project Description:

This project consists of an 8-inch water line along Post Oak Trail from the proposed water line in Project 18 along Rolling Acres Trail to Silver Spur Trail.

Project Drivers:

This project will serve growth and improve fire flow in Zone A.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" WL & Appurtenances	6,665	LF	$ 80	$ 533,192
2	Water Pavement Repair	6,665	LF	$ 50	$ 333,250
				SUBTOTAL:	**$ 866,500**
			CONTINGENCY	30%	$ 260,000
				SUBTOTAL:	**$ 1,126,500**
			ENG/SURVEY	15%	$ 169,000
				SUBTOTAL:	**$ 1,295,500**
				Estimated Project Total:	**$ 1,295,500**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 20 — **Phase:** Buildout

Project Name: 8-inch Silver Spur Trail Water Line (Zone A)

Project Description:

This project consists of an 8-inch water line along Silver Spur Trail from the existing 4-inch water line at Robin Dale Drive to the existing 6-inch Zone B water line along Ralph Fair Road. This line must be closed west of the connection to the Zone B water line on Ralph Fair Road.

Project Drivers:

This project will serve growth and improve fire flow in Zone A.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" WL & Appurtenances	3,485	LF	$ 80	$ 278,784
2	Water Pavement Repair	3,485	LF	$ 50	$ 174,250
				SUBTOTAL:	**$ 453,100**
			CONTINGENCY	30%	$ 136,000
				SUBTOTAL:	**$ 589,100**
			ENG/SURVEY	15%	$ 88,400
				SUBTOTAL:	**$ 677,500**
				Estimated Project Total:	**$ 677,500**

APPENDIX G
WASTEWATER CAPITAL IMPROVEMENT PLAN
COST ESTIMATES

City of Fair Oaks Ranch

Capital Improvement Cost Estimate	**January 2019**
Construction Project Number: 1	**Phase: 2023**
Project Name:	**8-inch Gravity Line and Decommission Falls Lift Station**

Project Description:

Decommission the Falls Lift Station and extend an 8-inch gravity line to existing 10-inch line along Battle Intense.

Project Drivers:

This project removes a lift station from service to reduce future maintenance.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Lift Station - Decomm	1	LS	$ 200,000	$ 200,000
2	8" Pipe	1,730	LF	$ 80	$ 138,400
3	48" Diameter Manhole	4	EA	$ 7,500	$ 30,000
			SUBTOTAL:		**$ 368,400**
		CONTINGENCY		30%	$ 110,600
			SUBTOTAL:		**$ 479,000**
		ENG/SURVEY		15%	$ 71,900
			SUBTOTAL:		**$ 550,900**
				Estimated Project Total:	**$ 550,900**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 2 — **Phase:** 2023

Project Name: New Wastewater Treatment Plant

Project Description:

New 0.6 MGD Wastewater Treatment Plant and 1.6 MGD Lift Station with a 12-inch force main to the treatment plant.

Project Drivers:

This project will build a new WWTP to allow for future growth.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	0.6 MGD WWTP	1	EA	$ 12,300,000	$ 12,300,000
2	1.6 MGD Lift Station	1	EA	$ 1,800,000	$ 1,800,000
3	12" Force Main	1,270	LF	$ 120	$ 152,400
4	20" Boring and Casing	200	LF	$ 400	$ 80,000
				SUBTOTAL:	**$ 14,332,400**
			CONTINGENCY	30%	$ 4,299,800
				SUBTOTAL:	**$ 18,632,200**
			ENG/SURVEY	15%	$ 2,794,900
				SUBTOTAL:	**$ 21,427,100**
				Estimated Project Total:	**$ 21,427,100**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 3 — **Phase:** 2023

Project Name: New Gravity Line from Old WWTP to New WWTP

Project Description:

A new 12/15/18-inch gravity line from the existing WWTP to the proposed lift station to the new WWTP.

Project Drivers:

This line will carry existing flows to the new WWTP and serve growth in the future.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe	2,690	LF	$ 150	$ 403,500
2	15" Pipe	2,640	LF	$ 160	$ 422,400
3	18" Pipe	1,320	LF	$ 190	$ 250,800
4	48" Diameter Manhole	7	EA	$ 7,500	$ 52,500
5	60" Diameter Manhole	10	EA	$ 8,500	$ 85,000
6	Sewer Pavement Repair	200	LF	$ 50	$ 10,000
			SUBTOTAL:		**$ 1,224,200**
		CONTINGENCY		30%	$ 367,300
			SUBTOTAL:		**$ 1,591,500**
		ENG/SURVEY		15%	$ 238,800
			SUBTOTAL:		**$ 1,830,300**
				Estimated Project Total:	**$ 1,830,300**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate			**January 2019**
Construction Project Number:	**4**		**Phase: 2023**
Project Name:	**Decommission Existing WWTP**		

Project Description:

Decommission Existing WWTP.

Project Drivers:

Decommission the existing WWTP site to allow the site to be used for other purposes.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	WWTP - Decomm	1	EA	$ 1,000,000	$ 1,000,000

		SUBTOTAL:	**$ 1,000,000**
	CONTINGENCY	30%	$ 300,000
		SUBTOTAL:	**$ 1,300,000**
	ENG/SURVEY	15%	$ 195,000
		SUBTOTAL:	**$ 1,495,000**
		Estimated Project Total:	**$ 1,495,000**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 5 — **Phase:** 2028

Project Name: 12/15-inch Gravity Line in the ETJ

Project Description:

A new 12/15-inch gravity line in the ETJ.

Project Drivers:

This project will serve new development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe	530	LF	$ 150	$ 79,500
2	15" Pipe	2,710	LF	$ 160	$ 433,600
3	48" Diameter Manhole	2	EA	$ 7,500	$ 15,000
4	60" Diameter Manhole	7	EA	$ 8,500	$ 59,500
				SUBTOTAL:	**$ 587,600**
		CONTINGENCY		30%	$ 176,300
				SUBTOTAL:	**$ 763,900**
		ENG/SURVEY		15%	$ 114,600
				SUBTOTAL:	**$ 878,500**
				Estimated Project Total:	**$ 878,500**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 6 — **Phase:** 2028

Project Name: 12-inch Gravity Line in the ETJ

Project Description:

A new 12-inch gravity line in the ETJ.

Project Drivers:

This project will serve new development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe	2,900	LF	$ 150	$ 435,000
2	48" Diameter Manhole	7	EA	$ 7,500	$ 52,500
				SUBTOTAL:	**$ 487,500**
		CONTINGENCY		30%	$ 146,300
				SUBTOTAL:	**$ 633,800**
		ENG/SURVEY		15%	$ 95,100
				SUBTOTAL:	**$ 728,900**
				Estimated Project Total:	**$ 728,900**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 7 — **Phase:** 2028

Project Name: 12-inch Gravity Line in the ETJ

Project Description:

A new 12-inch gravity line in the ETJ.

Project Drivers:

This project will serve new development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe	2,030	LF	$ 150	$ 304,500
2	48" Diameter Manhole	5	EA	$ 7,500	$ 37,500
			SUBTOTAL:		**$ 342,000**
		CONTINGENCY		30%	$ 102,600
			SUBTOTAL:		**$ 444,600**
		ENG/SURVEY		15%	$ 66,700
			SUBTOTAL:		**$ 511,300**
				Estimated Project Total:	**$ 511,300**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 8 — **Phase:** 2028

Project Name: 10-inch Gravity Line north of Ralph Fair Road

Project Description:

A new 10-inch gravity line north of Ralph Fair Road.

Project Drivers:

This project will serve new development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	10" Pipe	3,830	LF	$ 100	$ 383,000
2	48" Diameter Manhole	10	EA	$ 7,500	$ 75,000
3	Sewer Pavement Repair	200	LF	$ 50	$ 10,000
				SUBTOTAL:	**$ 468,000**
				CONTINGENCY 30%	$ 140,400
				SUBTOTAL:	**$ 608,400**
				ENG/SURVEY 15%	$ 91,300
				SUBTOTAL:	**$ 699,700**
				Estimated Project Total:	**$ 699,700**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 9 — **Phase:** 2028

Project Name: 8/10-inch Gravity Line north of Ralph Fair Road

Project Description:

A new 8/10-inch gravity line north of Ralph Fair Road.

Project Drivers:

This project will serve new development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	10" Pipe	1,200	LF	$ 100	$ 120,000
2	8" Pipe	4,740	LF	$ 80	$ 379,200
3	48" Diameter Manhole	15	EA	$ 7,500	$ 112,500
4	Sewer Pavement Repair	200	LF	$ 50	$ 10,000
				SUBTOTAL:	**$ 621,700**
				CONTINGENCY 30%	$ 186,600
				SUBTOTAL:	**$ 808,300**
				ENG/SURVEY 15%	$ 121,300
				SUBTOTAL:	**$ 929,600**
				Estimated Project Total:	**$ 929,600**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 10 — **Phase:** 2028

Project Name: 8-inch Gravity Line north of Dietz Elkhorn Road

Project Description:

A new 8-inch gravity line north of Dietz Elkhorn Road.

Project Drivers:

This project will serve new development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Pipe	3,290	LF	$ 80	$ 263,200
2	48" Diameter Manhole	8	EA	$ 7,500	$ 60,000
				SUBTOTAL:	**$ 323,200**
			CONTINGENCY	30%	$ 97,000
				SUBTOTAL:	**$ 420,200**
			ENG/SURVEY	15%	$ 63,100
				SUBTOTAL:	**$ 483,300**
				Estimated Project Total:	**$ 483,300**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 11 — **Phase:** 2028

Project Name: 8-inch Gravity Line east of Ralph Fair Road

Project Description:

A new 8-inch gravity line east of Ralph Fair Road.

Project Drivers:

This project will serve new development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	8" Pipe	2,430	LF	$ 80	$ 194,400
2	48" Diameter Manhole	6	EA	$ 7,500	$ 45,000
				SUBTOTAL:	**$ 239,400**
			CONTINGENCY	30%	$ 71,900
				SUBTOTAL:	**$ 311,300**
			ENG/SURVEY	15%	$ 46,700
				SUBTOTAL:	**$ 358,000**
				Estimated Project Total:	**$ 358,000**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 12 — **Phase:** 2028

Project Name: 10-inch Gravity Line crossing Cibolo Creek

Project Description:

A new 10-inch gravity line from the ETJ crossing Cibolo Creek and connecting to the existing gravity line.

Project Drivers:

This project will serve new development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	10" Pipe	2,060	LF	$ 100	$ 206,000
2	48" Diameter Manhole	5	EA	$ 7,500	$ 37,500
3	Sewer Pavement Repair	200	LF	$ 50	$ 10,000
4	20" Boring and Casing	200	LF	$ 400	$ 80,000
			SUBTOTAL:		**$ 333,500**
		CONTINGENCY		30%	$ 100,100
			SUBTOTAL:		**$ 433,600**
		ENG/SURVEY		15%	$ 65,100
			SUBTOTAL:		**$ 498,700**
				Estimated Project Total:	**$ 498,700**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 13 — **Phase:** 2028

Project Name: 12-inch Gravity Line to the new WWTP

Project Description:

A new 12-inch gravity line north of the new WWTP.

Project Drivers:

This project will serve new development.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" Pipe	1,500	LF	$ 150	$ 225,000
2	48" Diameter Manhole	4	EA	$ 7,500	$ 30,000
				SUBTOTAL:	**$ 255,000**
		CONTINGENCY		30%	$ 76,500
				SUBTOTAL:	**$ 331,500**
		ENG/SURVEY		15%	$ 49,800
				SUBTOTAL:	**$ 381,300**
				Estimated Project Total:	**$ 381,300**

City of Fair Oaks Ranch

Capital Improvement Cost Estimate — **January 2019**

Construction Project Number: 14 — **Phase:** Buildout

Project Name: 10-inch Gravity Line and Decommission Setterfeld Lift Station

Project Description:

A new 10-inch gravity line will convey flow from the Setterfeld Lift Station and allow it to be decommissioned.

Project Drivers:

This project will eliminate a lift station.

Opinion of Probable Construction Cost

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	10" Pipe	2,490	LF	$ 100	$ 249,000
2	48" Diameter Manhole	6	EA	$ 7,500	$ 45,000
3	Lift Station - Decomm	1	LS	$ 200,000	$ 200,000
				SUBTOTAL:	**$ 494,000**
				CONTINGENCY 30%	$ 148,200
				SUBTOTAL:	**$ 642,200**
				ENG/SURVEY 15%	$ 96,400
				SUBTOTAL:	**$ 738,600**
				Estimated Project Total:	**$ 738,600**

APPENDIX H
WASTEWATER TREATMENT PLANT EVALUATION MEMO

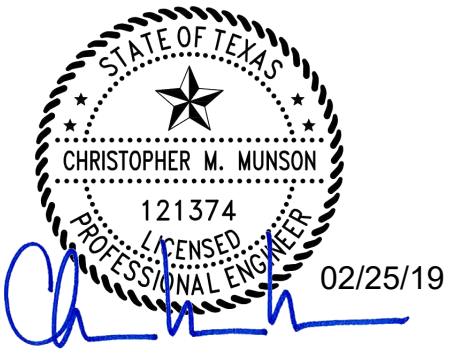
Memo

To: Jessica Vassar, P.E., Freese and Nichols, Inc.

From: Christopher Munson, P.E.

Date: February 25, 2019

Re: City of Fair Oaks Ranch, TX
Water and Wastewater Master Plan Project
Wastewater Treatment Plant Technical Memorandum



As part of the City of Fair Oaks Ranch, Texas (City) Water and Wastewater Master Plan Project, Freese and Nichols, Inc. (FNI) tasked Ardurra Group, LLC (Ardurra) with the development of rehabilitation recommendations for the City's Wastewater Treatment Plant (WWTP) and recommendations to allow the existing WWTP, or a new WWTP at a different site, to treat future flows based on the results of the wastewater collection system hydraulic model. This technical memorandum summarizes the results of these tasks.

Existing WWTP Rehabilitation

Ardurra attended a WWTP site visit with FNI and City staff on Wednesday, July 19, 2017 to review the condition of the WWTP. A summary memorandum of the site visit, which was presented at Progress Meeting 3 is included as **Appendix A**. The major issues either observed or detailed by City staff during the site visit were as follows:

- City would like finer influent screening. Existing screen lacks screenings wash press.
- There is no grit removal at existing WWTP, which results in grit buildup at the In-Yard Lift Station and Oxidation Ditch.
- Lack of concrete deck at mixing ends of Oxidation Ditch creates unsightly and inconvenient overspray.
- Oxidation Ditch aerators, motors and gearboxes are approaching the end of their useful life and may fail within the next 5 to 10 years.
- There are no digesters or aerated sludge holding tanks at the existing WWTP, which makes plant operations (wasting sludge) difficult.
- Issues with wasting sludge leads to sludge bulking and/or denitrification in the clarifier resulting in floating solids being carried over the weir with the effluent.
- The sludge drying beds are limited in capacity, which exacerbates the lack of digesters or sludge storage, and causes the City to wet haul sludge. At the time of the site visit, the cost of wet hauling was approximately $20,000/month in the winter.
- The WWTP has received odor complaints related to the screening structure and sludge drying beds. Some WWTP process units likely fall within TCEQ's required 150 ft buffer zone to the nearest property line (30 TAC 309).

Based on these observations, the recommended rehabilitation projects at the existing WWTP are as follows:

1. Installation of new mechanical fine screen and screening wash press.
2. Installation of new Oxidation Ditch aerators, motors and gearboxes.
3. Construction of concrete deck at mixing ends of the Oxidation Ditch.
4. Sludge wasting and dewatering improvements.
5. Electrical improvements required to support process upgrades.

Additional details on these projects and conceptual opinions of probable construction cost for each project are as follows:

Influent Screening Improvements

The Influent Screening Improvements project consists of removal of the existing mechanical screen and installation of a new mechanical fine screen (1/4" bar spacing or less) and a screenings wash press. Ardurra also recommends replacement of the existing isolation gates and coating the screening structure channels to protect the concrete from additional corrosion. Electrical improvements to replace wire, conduit, control panels, etc. are also recommended.

The conceptual level Total Project Cost for the Influent Screening Improvements project is $750,000, which includes a 30% construction contingency and 25% for Engineering Design, Bidding, Construction and Additional Services. A detailed version of the Opinion of Probable Construction Cost (OPCC) may be found in **Appendix B**.

Oxidation Ditch Improvements

The Oxidation Ditch Improvements project consists of removal of the existing aerators, motors and gearboxes and installation of new oxidation ditch aerators, motor and gearboxes. The recommended aerators are 40 HP LSC Aerators by Ovivo (Eimco), which is the original manufacturer of the oxidation ditch aerators. In addition to aerator replacement, Ardurra recommends that concrete deck be constructed at the mixing ends of the oxidation ditch. Electrical improvements to replace wire, conduit, control panels, etc. are also recommended.

The conceptual level Total Project Cost for the Oxidation Ditch Improvements project is $730,000, which includes a 30% construction contingency and 25% for Engineering Design, Bidding, Construction and Additional Services. A detailed version of the OPCC may be found in Appendix B.

Sludge Handling Improvements

The Sludge Handling Improvements project consists of the construction of a new 40,000 gallon glass lined steel aerated sludge holding tank for sludge wasting, construction of a new screw press feed pump station, purchase of a trailer mounted screw press for sludge dewatering, construction of canopy for the screw press and polymer equipment and associated site, yard piping, process mechanical and electrical improvements to support the new sludge handling process.

The conceptual level Total Project Cost for the Sludge Handling Improvements project is $2,400,000, which includes a 30% construction contingency and 25% for Engineering Design, Bidding, Construction and Additional Services. A detailed version of the OPCC may be found in Appendix B.

Buildout Flow WWTP Improvements

The population projections and collection system model developed by FNI indicate that the City's required buildout WWTP treatment capacity is 0.56 MGD. To develop the OPCCs for the improvements required to expand the existing WWTP or to construct a new WWTP at a different site, WWTP design influent characteristics must be developed based on existing influent data. This section will summarize the design influent characteristics and the improvements required to treat the City's buildout wastewater flow.

Design Influent Characteristics

This section of the technical memorandum will summarize existing WWTP influent data and develop design influent characteristics for an expansion of the existing WWTP or a new WWTP at a different site. Per TCEQ requirements, design organic loading parameters will be the average value of each parameter plus one standard deviation.

Influent wastewater samples are collected by City staff at the existing WWTP. Ardurra obtained all available influent data for the WWTP from January 2015 through June 2017 and analyzed the data to determine the characteristics of the influent wastewater at the WWTP. A summary of the influent characteristics is presented in **Table TM-1**.

Table TM-1 Existing WWTP Influent Characteristics

Parameter	Value
Average Daily Flow (MGD)	0.24
Average Daily BOD5 (mg/L)	188
Average Daily TSS (mg/L)	255
Average Ammonia (mg/L)	46
Average Phosphorus (mg/L)	7

The average daily flow of 0.24 MGD for the last two years is approximately 48% of the design and permitted flow of the WWTP. The maximum month flow at the WWTP from the 2015 and 2017 flow data is 0.28 MGD and the maximum daily flow is 0.33 MGD (95 percentile of all daily flows).

The value of each influent parameter with the average value from Table TM-1 plus one standard deviation is presented in **Table TM-2**. These are the design organic loading parameters required by TCEQ in 30 TAC Chapter 217.32 and 217.34 for the re-rating or alteration of an existing facility (217.34) and for a new facility (217.32).

Table TM-2 WWTP Design Influent Characteristics

Parameter	Value
Average Daily Flow (MGD)	0.56
Peak Hourly Flow (MGD)	1.96
Average Daily BOD5 (mg/L)	244
Average Daily TSS (mg/L)	357
Average Ammonia (mg/L)	57
Average Phosphorus (mg/L)	8

Figures TM-1 through **TM-4** display scatter plot data for the January 2015 through Jun 2017 BOD_5, TSS, Ammonia and Phosphorus. The red line in each figure represents the average of the parameter, as shown in Table TM-1, and the green line represents the average value plus one standard deviation as shown in Table TM-2. In general, the data appeared to be consistent throughout the course of the two and half year period.

Figure TM-1 WWTP Daily Influent BOD5 Data

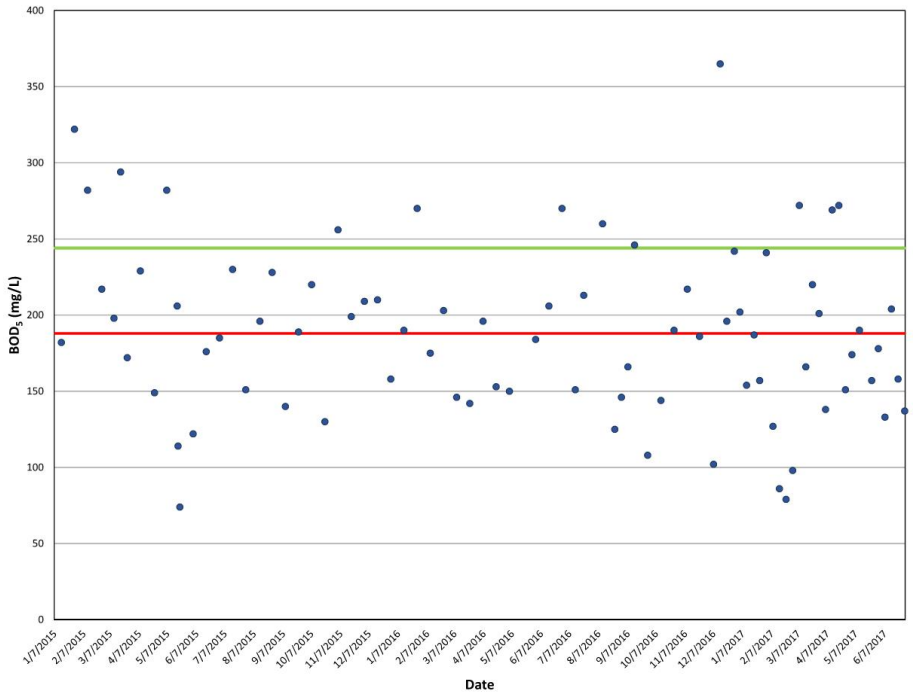


Figure TM-2 WWTP Daily Influent TSS Data

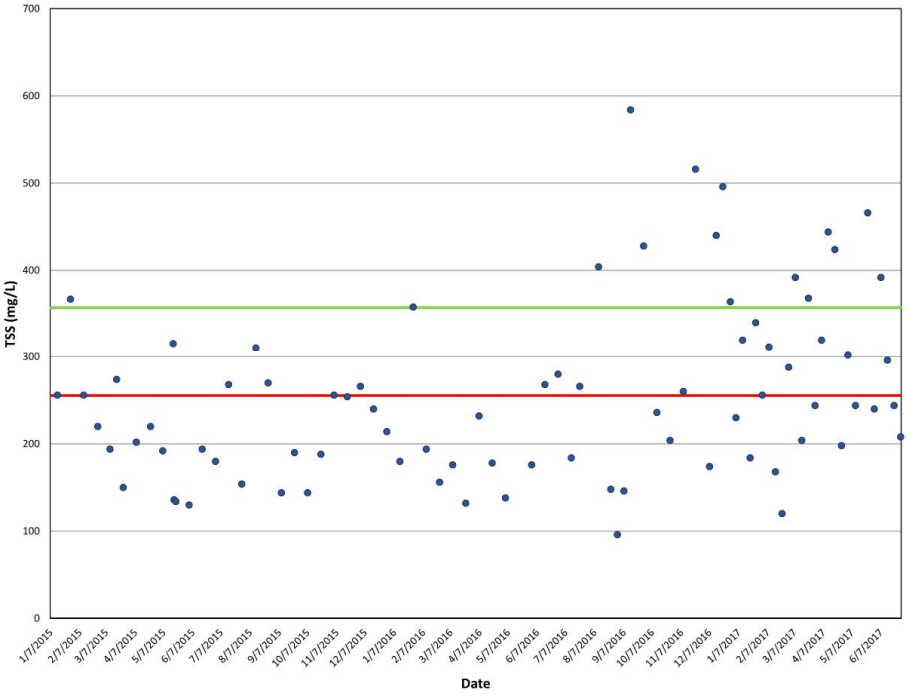


Figure TM-3 WWTP Daily Influent Ammonia Data

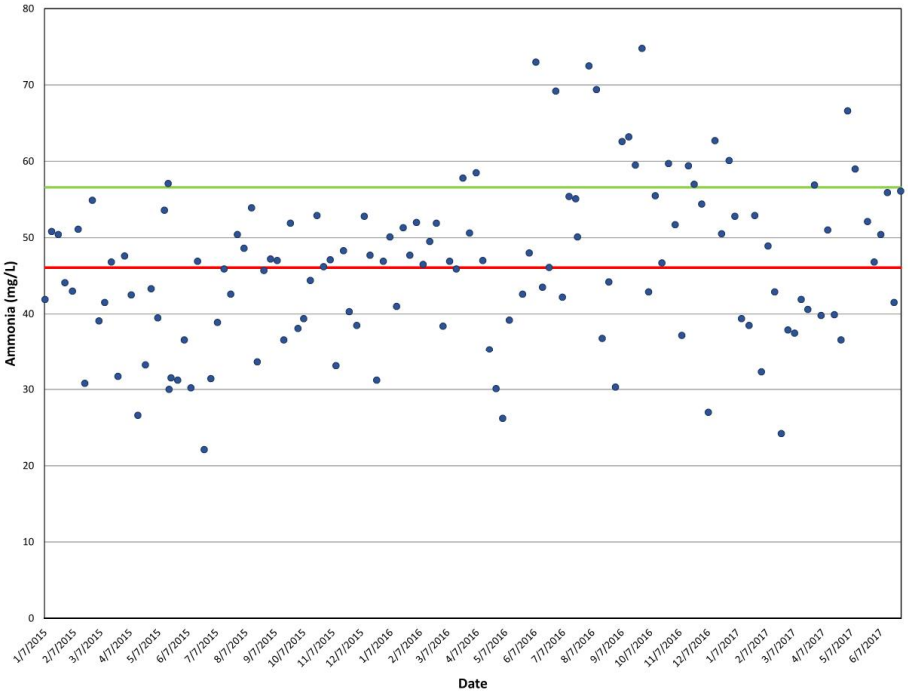
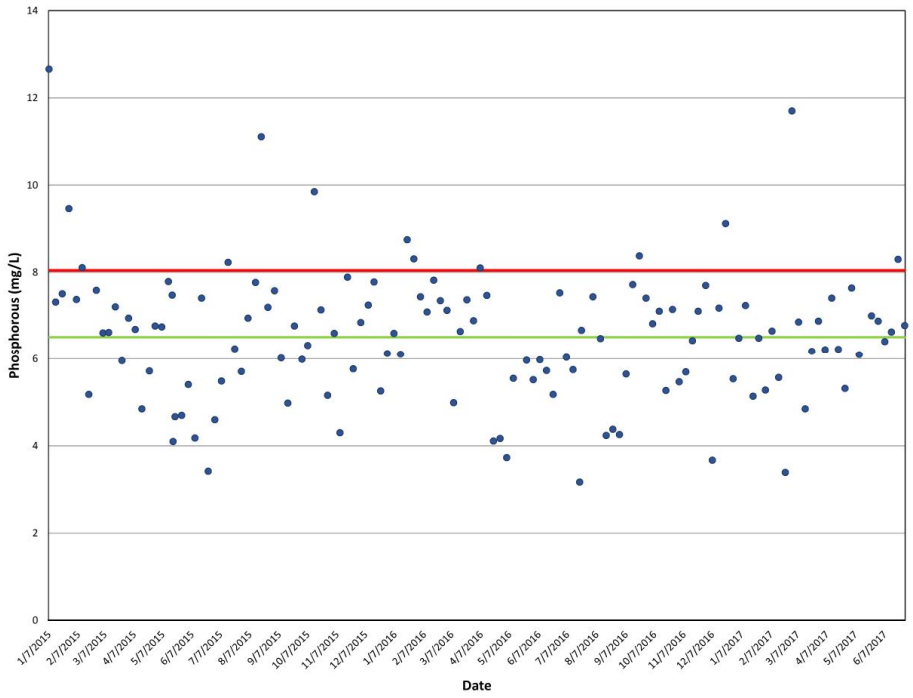


Figure TM-4 Daily Influent Phosphorus Data



Existing WWTP Improvements

To determine the improvements required at the existing WWTP, the capacity of each unit process was verified based on TCEQ requirements and the design criteria listed Table TM-2. The results of that verification are as follows:

Influent Screening

The capacity of the influent screening facility is approximately 3.85 MGD, which is sufficient to treat the buildout peak hourly flow of 1.96 MGD. Improvements to influent screening to treat the buildout flow would be identical to those described within the Existing WWTP Rehabilitation section of this Technical Memorandum.

Oxidation Ditch

Based on 30 TAC Chapter 217.154 Table F.1, extended aeration basins including oxidation ditches have a maximum organic loading rate of 15 lbs BOD_5/day/1,000 ft^3. The existing oxidation ditch has a volume of approximately 46,760 ft^3, which provides a capacity of approximately 0.34 MGD at the design influent BOD_5 concentration from Table TM-2. To treat the total buildout average daily flow of 0.56 MGD, a second oxidation ditch with a minimum volume of 30,000 ft^3 would be required. The existing oxidation would also require rehabilitation as described within the Existing WWTP Rehabilitation section of this Technical Memorandum.

Final Clarifiers

Based on 30 TAC Chapter 217.154 Table F.2, clarifiers for extended aeration systems have a maximum overflow rate at 2-hour peak flow of 900 gpd/sq ft. The capacity of Final Clarifier No. 1

(36’ diameter) is approximately 916,000 gpd and the capacity of Final Clarifier No. 2 (30’ diameter) is approximately 636,000 gpd. The combined capacity of the two clarifiers is approximately 1.55 MGD, which is not adequate to treat the buildout peak hourly flow of 1.96 MGD. To treat the peak hourly flow and meet TCEQ criteria, a new 30’ diameter Final Clarifier No. 3 would be required. Along with the new final clarifier, a new RAS/WAS pump station would be constructed. A new Final Clarifier Flow Splitter Box would also be constructed, if hydraulic head allows, to accurately split flow between the three final clarifiers.

Chlorine Contact Chamber

Per the City’s current TPDES Permit (WQ0011867001), the minimum detention time of the chlorine contact basin shall be 20 minutes. The existing chlorine contact chamber has a capacity of approximately 1.3 MGD, which is not adequate to meet the disinfection criteria for the buildout peak hourly flow of 1.96 MGD. To meet the TPDES Permit disinfection criteria, the existing chlorine contact chamber would be expanded by a minimum of 1,225 ft^3.

Sludge Handling Improvements

If the City were to expand the existing WWTP to treat buildout flows, the Sludge Handling Improvements described within the Existing WWTP Rehabilitation section of this Technical Memorandum may be adequate; however, the construction of concrete aerated sludge holding tanks and a Dewatering Building to house the dewatering screw press is recommended.

Electrical Improvements

Improvements to the existing electrical feed and distribution system will be required to support the increased electrical load from the rehabilitated and new treatment process units. In addition to new duct bank to supply power to the new process units, a new Electrical Building may be required to house motor control centers and other electrical gear. Increased electrical load may also required a larger utility transformer and an additional generator to power new process units during electrical outages and emergencies.

Opinion of Probable Construction Cost

The conceptual level Total Project Cost for the Existing WWTP Expansion project is $8,800,000, which includes a 30% construction contingency and 25% for Engineering Design, Bidding, Construction and Additional Services. This OPCC does not include any costs for odor control or required upgrades at the In-Yard Lift Station. A previous study by Kimley-Horn and Associates, Inc. estimated the cost of odor control improvements for the existing WWTP at $1,800,000 to $2,800,000. A detailed version of the OPCC may be found in Appendix B.

New WWTP Alternative

In lieu of expanding the existing WWTP, the City could decommission the existing plant and pump raw wastewater from the site to a New WWTP for treatment. The City has identified a geographical area for the New WWTP, but the City has not procured the site to-date. The land available for the site may be limited, so we have assumed that Sequencing Batch Reactors (SBRs) would be used for biological treatment to eliminate the need for separate clarifier structures. In general, the New WWTP would consist of the following unit processes:

- Headworks
    - Mechanical fine screen and screenings wash press

    - Vortex grit removal
- Sequencing Batch Reactors
    - Fine bubble diffusers for aeration
    - Positive Displacement Blowers
    - Waste Activated Sludge Pumps
- Chlorine for Sodium Hypochlorite Feed System
- Chlorine Contact Basin
- Non-Potable Water Pump Station
- Aerated Sludge Holding Tanks (Digesters)
    - Coarse or fine bubble diffusers for aeration
    - Positive Displacement Blowers
    - Telescoping valves for decant and sludge thickening
- Screw Press Feed Pump Station
    - Positive Displacement Pumps
- Dewatering Building
    - Relocated Screw Press from Existing WWTP
    - Polymer System
- Emergency Generator

The conceptual level Total Project Cost for the New WWTP project is $12,300,000, which includes a 30% construction contingency, 25% for Engineering Design, Bidding, Construction and Additional Services and $190,000 place holder for land acquisition This OPCC does not include any costs for odor control, which may not be necessary at a new WWTP site. Also, the OPCC does not contain any costs for an Administration/Operations Building. A detailed version of the OPCC may be found in Appendix B.

Recommendations

Existing WWTP Expansion or New WWTP Alternative

During the Progress Meeting held on August 14, 2018, the City expressed an interest in pursuing the construction of a new WWTP at a different site, which is the recommended alternative for treating the City's buildout wastewater flows. While there is space to expand the existing WWTP on the current site, the location is undesirable due to its proximity to nearby homes. Also, a previous study performed by Kimley-Horn and Associates, Inc. noted the following regarding TCEQ's buffer zone requirement "*while the building setback lines meet the intent of the TAC Chapter 309 requirements, there must be documentation within the City's permit identifying that the TCEQ agrees that the setbacks are a valid buffer in accordance with TAC Chapter 309. The City's current permit does not appear to include any documentation to this effect. As a result, any installations of new infrastructure within the current WWTP site will likely require formal approval by the neighboring landowners in order to be approved by the TCEQ*." Obtaining the approvals required to construct new process units on the existing WWTP

may prove difficult. A new WWTP site allows the City to design and construct a facility that meets operational and treatment requirements while also being adequately buffered from adjacent properties.

Rehabilitation Project Prioritization

Depending on the timing of transition to a new WWTP, the rehabilitation projects may not all be necessary. The City should consider moving forward with the Sludge Handling Improvements project as soon as capital improvement funds allow. This project improves existing WWTP operations relative to sludge wasting and reduces sludge hauling costs by eliminating the need for liquid sludge hauling. Furthermore, the sludge dewatering screw press could be relocated to the new WWTP and installed in a permanent Sludge Dewatering Building.

If the planning and design of a new WWTP is initiated such that the new WWTP is operational in the 5 to 7 year time frame, the Influent Screening Improvements and Oxidation Ditch Improvements projects may not be necessary; however, the mechanical equipment should be evaluated regularly to ensure continuous performance of the existing WWTP. If the construction of a new WWTP is further out in the City's planning, then these projects should be implemented after the Sludge Handling Improvements project as capital improvements funds allow.

Appendix A

ARDURRA
2032 Buffalo Terrace
Houston, Texas 77019
www.ardurragroup.com
TBPE Firm No. 17004

Memo

To: Jessica Vassar, P.E., Freese and Nichols, Inc.

From: Chris Munson, P.E.

Date: October 25, 2017

Re: City of Fair Oaks Ranch Water and Wastewater Master Plan
Progress Meeting No. 3
WWTP Observations and Recommendation Discussion Items

General Site Observations

- WWTP is well operated and maintained.
- Limited solids handling capabilities create operational/process difficulties.
- Site access roadway is within the 100-year flood plain. Access to the site can be cutoff during flood events.
- Consider handrail at original Oxidation Ditch?

Photograph No. 1 – Original Oxidation Ditch

Influent Screening

Existing Conditions/Observations

- Existing screen ½" screen opening
- No screenings washer/compactor.
- Minor aggregate exposure within channels
- Odor issues at screening structure
- No grit removal
- No influent flow metering

Photograph No. 2 – Influent Screening Structure

Photograph 3 – Screen and Minor Aggregate Exposure

Influent Screening Recommendations

- Existing Structure – Install fine screen (with cover), screenings washer/compactor and new aluminum checker plate/FRP channel cover. Repair and install protective coating on concrete channels
- New Influent Screening Structure (Headworks) with fine screen, screenings washer/compactor, grit removal and odor control.

Splitter Box

Existing Conditions/Observations

- Structure appears to be in good condition; however, the splitter box cover requires improvement.

Photograph No. 4 – Splitter Box

Photograph No. 5 – Splitter Box Cover

Splitter Box Recommendations

- Install handrail or new aluminum checker plate/FRP channel cover.
- Rework yard piping to eliminate splitter box.

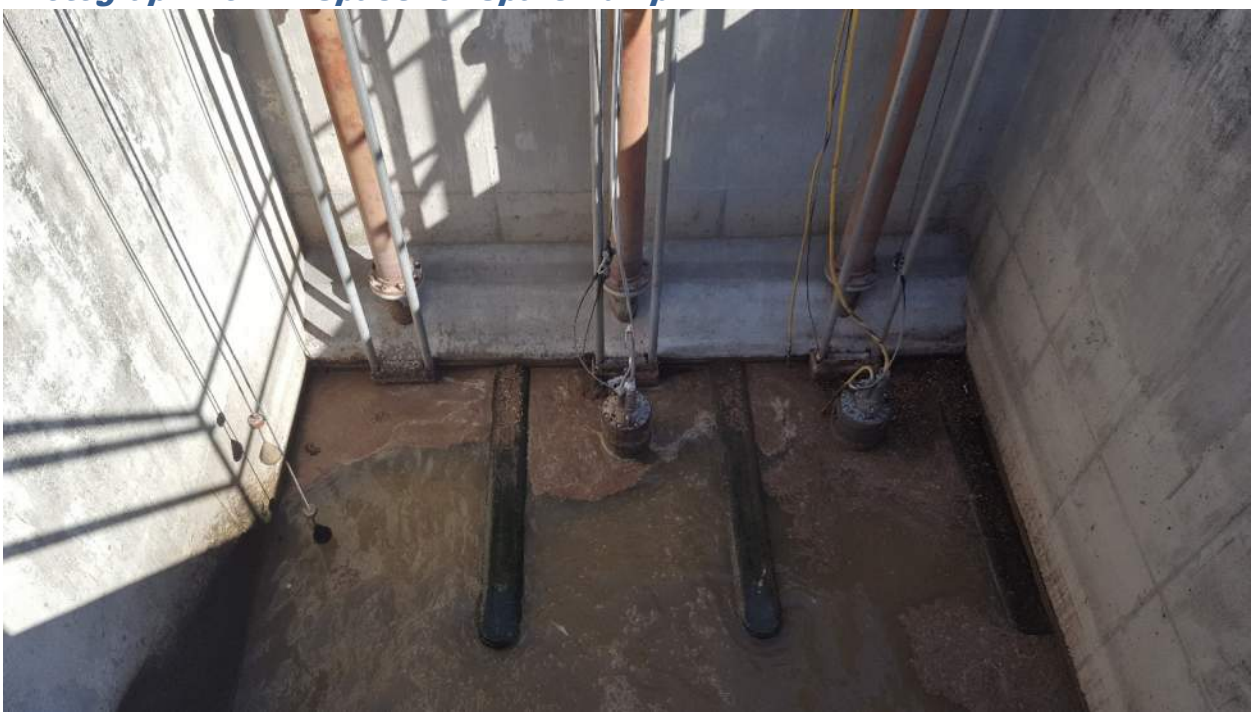
In-Yard Lift Station

Existing Conditions/Observations

- Structure appears to be in good condition
- No spare pump installed
- Discharge pipe and hoist structure require coating

Photograph No. 6 – In-Yard Lift Station

Photograph No. 7 – Space for Spare Pump



Photograph No. 8 – In-Yard Lift Station Discharge Piping

Photograph No. 9 – In-Yard Lift Station Hoist Structure

In-Yard Lift Station Recommendations

- Install spare pump for redundancy.
- Coat discharge piping and hoist structure.

Aeration Basin

Existing Conditions/Observations

- Structure appears to be in good condition; however, the ends of the structure at the Carrousel aerators should be covered.
- PVC pipe for Aeration Basin Influent and RAS
- Flow meter on Aeration Basin Influent is not functional
- No aeration basin redundancy for basin maintenance or cleaning

Photograph No. 10 – Carrousel Aeration Basin

Photograph 11 – Open End at Carrousel Aerator

Photograph No. 12 – PVC Pipe at Aeration Basin

Aeration Basin Recommendations

- Cover ends of structure at Carrousel aerators.
- Replace PVC with Ductile Iron pipe
- Install flow meter on influent line from In-Yard Lift Station
- Consider: Redundant Aeration Basin and addition of Anoxic Zone

Final Clarifier

Existing Conditions/Observations

- Final clarifier structures and mechanical equipment appears to be in good condition.
- Flow split to clarifiers controlled by slide gate adjustment rather than weirs
- Floating sludge visible in clarifiers (denitrification)

Photograph No. 13 – Final Clarifier No. 1

Photograph No. 14 – Final Clarifier No. 2

Aeration Basin Recommendations

- Addition of anoxic zone at aeration basins may improve settling.
- See Solids Handling Recommendations.

Effluent Disinfection

Existing Conditions/Observations

- Chlorine contact chamber structure and mechanical equipment appears to be in good condition.
- Chlorine gas (150 lb. cylinders) used for disinfection
- Chlorine gas dosage is set and controlled manually

Photograph 15 – Chlorine Contact Chamber

Photograph 16 – Chlorine Contact Chamber

Photograph 17 – Effluent Flow Measurement (Parshall Flume)

Photograph 18 – Chlorine Gas Cylinder

Photograph 19 – Chlorine Gas Cylinder Storage

Effluent Disinfection Recommendations

- Consider conversion to sodium hypochlorite (bleach) for disinfection.
- Pace chlorine (or sodium hypochlorite) dose based on effluent flow rate.

Solids Handling

Existing Conditions/Observations

- The WWTP has no sludge holding or digestion capacity, which limits sludge wasting capabilities making WWTP operation difficult.
- Wasted sludge sent to drying beds resulting in odors.
- Limited drying bed capacity. WWTP relies on liquid hauling of sludge during winter months.

Photograph 20 – Sludge Drying Beds

Solids Handling Recommendations

- Construct aerated sludge holding tank(s) or convert original oxidation ditch to sludge holding tank (if the volume is sufficient).
- Construct Solids Handling Building with mechanical dewatering (belt filter press, centrifuge, etc.) with odor control and abandon use of sludge drying beds.

Appendix B

City of Fair Oaks Ranch, Texas
Existing Wastewater Treatment Plant Rehabilitation
Influent Screening Improvements
Conceptual Opinion of Probable Construction Cost

Description	*Quantity*	*Unit*	*Cost/Unit*	*Raw Cost*	*Installation*	*Amount*
Inlet Structure						
Coatings						
Remove Unsound Concrete	310	SF	$ 15	$ 4,650		$ 4,650
Application of Cementitious Material	310	SF	$ 15	$ 4,650		$ 4,650
Application of Epoxy Coating	310	SF	$ 20	$ 6,200		$ 6,200
Gate						
Slide Gates	4	EA	$ 8,000	$ 32,000	$ 11,200	$ 43,200
Equipment						
Mechanical Screen	1	EA	$ 100,000	$ 100,000	$ 35,000	$ 135,000
Screenings Wash Press	1	EA	$ 85,000	$ 85,000	$ 29,750	$ 114,750
Electrical/ Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 54,000	$ 54,000		$ 54,000
Inlet Structure						**$ 362,000**
Subtotal Direct Construction Cost						**$ 362,000**

Insurance	1%	$ 3,620
Bonds	1.5%	$ 5,430
Contractor's General Conditions	10%	$ 36,200
Contractor's Overhead and Profit	8%	$ 28,960
Subtotal		**$ 440,000**
Construction Contingency	30%	$ 130,000
Escalation to Mid Point of Construction	3%	$ 30,000
Total Estimated Construction Cost		**$ 600,000**
Engineering Design, Bidding, Construction and Additional Services	25%	$ 150,000
TOTAL PROJECT COST		**$ 750,000**

City of Fair Oaks Ranch, Texas
Existing Wastewater Treatment Plant Rehabilitation
Oxidation Ditch Improvements
Conceptual Opinion of Probable Construction Cost

Description	*Quantity*	*Unit*	*Cost/Unit*	*Raw Cost*	*Installation*	*Amount*
Oxidation Ditch						
Concrete						
Concrete Deck	12	CY	$ 1,500	$ 18,000		$ 18,000
Equipment						
Replace Aerators, Motors and Gearboxes	2	EA	$ 102,500	$ 205,000	$ 71,750	$ 276,750
Electrical/ Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 52,100	$ 52,100		$ 52,100
Oxidation Ditch						**$ 347,000**
Subtotal Direct Construction Cost						**$ 347,000**

Insurance	1%	$ 3,470
Bonds	1.5%	$ 5,205
Contractor's General Conditions	10%	$ 34,700
Contractor's Overhead and Profit	8%	$ 27,760
Subtotal		**$ 420,000**
Construction Contingency	30%	$ 130,000
Escalation to Mid Point of Construction	3%	$ 30,000
Total Estimated Construction Cost		**$ 580,000**
Engineering Design, Bidding, Construction and Additional Services	25%	$ 150,000
TOTAL PROJECT COST		**$ 730,000**

City of Fair Oaks Ranch, Texas
Existing Wastewater Treatment Plant Rehabilitation
Sludge Handling Improvements
Conceptual Opinion of Probable Construction Cost

Description	*Quantity*	*Unit*	*Cost/Unit*	*Raw Cost*	*Installation*	*Amount*
Civil/Site Work						
Site Work						
Site Work (Paving, Grading and Drainage)	1	LS	$ 57,000	$ 57,000		$ 57,000
Yard Piping						
Yard Piping	1	LS	$ 86,000	$ 86,000		$ 86,000
Civil/Site Work						**$ 140,000**
New Aerated Sludge Holding Tank (40,000 Gallon Steel Tank)						
Earthwork						
Structural Excavation	52	CY	$ 25	$ 1,300		$ 1,300
Concrete						
Foundation	52	CY	$ 500	$ 26,000		$ 26,000
Steel Tank						
Steel Tank (40,000 Gallon)	1	EA	$ 45,000	$ 45,000	$ 11,250	$ 56,250
Equipment						
Tank Mixing/Aeration System	1	EA	$ 60,000	$ 60,000	$ 21,000	$ 81,000
Process Mechanical						
Mechanical Piping and Valves	10%	MECH	$ 163,000	$ 16,000		$ 16,000
Electrical/ Instrumentation						
Electrical	10%	JOB	$ 200,000	$ 20,000		$ 20,000
New Aerated Sludge Holding Tank (40,000 Gallon Steel Tank)						**$ 200,000**
New Screw Press Feed Pump Station						
Earthwork						
Structural Excavation	5	CY	$ 25	$ 125		$ 125
Concrete						
Pump Station Slab	12	CY	$ 500	$ 6,000		$ 6,000
Equipment						
Progressive Cavity Pumps	2	EA	$ 20,000	$ 40,000	$ 14,000	$ 54,000
Process Mechanical						
Mechanical Piping and Valves	20%	MECH	$ 60,000	$ 12,000		$ 12,000
Electrical/ Instrumentation						
Electrical	10%	JOB	$ 80,000	$ 8,000		$ 8,000
New Screw Press Feed Pump Station						**$ 80,000**
New Screw Press Facility (Mobile Press, Canopy, Piping, Electrical and Appurtenances)						
Earthwork						
Structural Excavation	60	CY	$ 25	$ 1,500		$ 1,500
Concrete						
Concrete Foundation	166	CY	$ 500	$ 83,000		$ 83,000
Screw Press Canopy	800	SF	$ 50	$ 40,000		$ 40,000
Equipment						
Screw Press System	1	EA	$ 360,000	$ 360,000	$ 72,000	$ 432,000
Process Mechanical						
Mechanical Piping and Valves	3%	MECH	$ 555,000	$ 16,650		$ 16,650
Electrical/ Instrumentation						
Electrical and Instrumentation	20%	JOB	$ 720,000	$ 144,000		$ 144,000
New Screw Press Facility (Mobile Press, Canopy, Piping, Electrical and Appurtenances)						**$ 720,000**
Subtotal Direct Construction Cost						**$ 1,140,000**

Insurance	1%	$ 11,000
Bonds	1.5%	$ 17,000
Contractor's General Conditions	10%	$ 114,000
Contractor's Overhead and Profit	8%	$ 90,000
Subtotal		**$ 1,370,000**
Construction Contingency	30%	$ 410,000
Escalation to Mid Point of Construction	3%	$ 100,000
Total Estimated Construction Cost		**$ 1,880,000**
Engineering Design, Bidding, Construction and Additional Services	25%	$ 470,000
TOTAL PROJECT COST		**$ 2,400,000**

City of Fair Oaks Ranch, Texas
Existing Wastewater Treatment Plant Expansion
Conceptual Opinion of Probable Construction Cost

Description	Quantity	Unit	Cost/Unit	Raw Cost	Installation	Amount
Civil/Site Work						
Site Work						
Site Work (Paving, Grading and Drainage)	1	LS	$ 211,000	$ 211,000		$ 211,000
Yard Piping						
Yard Piping	1	LS	$ 317,000	$ 317,000		$ 317,000
Site Electrical and Instrumentation						
Electrical and Instrumentation	25%	JOB	$ 704,000	$ 176,000	$ -	$ 176,000
Civil/Site Work						**$ 704,000**
Inlet Structure						
Coatings						
Remove Unsound Concrete	310	SF	$ 15	$ 4,650		$ 4,650
Application of Cementitious Material	310	SF	$ 15	$ 4,650		$ 4,650
Application of Epoxy Coating	310	SF	$ 20	$ 6,200		$ 6,200
Gate						
Slide Gates	4	EA	$ 8,000	$ 32,000	$ 11,200	$ 43,200
Equipment						
Mechanical Screen	1	EA	$ 100,000	$ 100,000	$ 35,000	$ 135,000
Screenings Wash Press	1	EA	$ 85,000	$ 85,000	$ 29,750	$ 114,750
Electrical/ Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 54,000	$ 54,000		$ 54,000
Inlet Structure						**$ 362,000**
Existing Oxidation Ditch						
Concrete						
Concrete Deck	12	CY	$ 1,500	$ 18,000		$ 18,000
Equipment						
Replace Aerators, Motors and Gearboxes	2	EA	$ 102,500	$ 205,000	$ 71,750	$ 276,750
Existing Oxidation Ditch						**$ 295,000**
New Oxidation Ditch						
Earthwork						
Structural Excavation	1800	CY	$ 25	$ 45,000	$ -	$ 45,000
Concrete						
Foundation	228	CY	$ 500	$ 114,000	$ -	$ 114,000
Walls	230	CY	$ 750	$ 172,500	$ -	$ 172,500
Walkways and Elevated Deck	90	CY	$ 1,000	$ 90,000	$ -	$ 90,000
Concrete Stairs	5	CY	$ 1,000	$ 5,000	$ -	$ 5,000
Metal Fabrications						
Handrail	260	LF	$ 100	$ 26,000	$ -	$ 26,000
Equipment						
Aerators, Motors and Gearboxes	2	EA	$ 102,500	$ 205,000	$ 71,750	$ 276,750
Process Mechanical						
Influent/Effluent Pipe	10%	JOB	$ 684,000	$ 68,000	$ -	$ 68,000
Electrical and Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 938,000	$ 140,700	$ -	$ 140,700
New Oxidation Ditch						**$ 938,000**

City of Fair Oaks Ranch, Texas
Existing Wastewater Treatment Plant Expansion
Conceptual Opinion of Probable Construction Cost

Description	*Quantity*	*Unit*	*Cost/Unit*	*Raw Cost*	*Installation*	*Amount*
New Final Clarifier Splitter Box						
Earthwork						
Structural Excavation	65	CY	$ 25	$ 1,625	$ -	$ 1,625
Concrete						
Foundation	12	CY	$ 500	$ 6,000	$ -	$ 6,000
Walls	30	CY	$ 750	$ 22,500	$ -	$ 22,500
Metal Fabrications						
Handrail	50	LF	$ 100	$ 5,000	$ -	$ 5,000
Equipment						
Weir Gates	3	EA	$ 8,000	$ 24,000	$ 9,600	$ 33,600
Process Mechanical						
Mechanical Piping and Valves	25%	MECH	$ 67,000	$ 17,000	$ -	$ 17,000
Electrical and Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 101,000	$ 15,150	$ -	$ 15,150
New Final Clarifier Splitter Box						**$ 101,000**
New Final Clarifier						
Earthwork						
Structural Excavation	680	CY	$ 25	$ 17,000	$ -	$ 17,000
Concrete						
Foundation	75	CY	$ 500	$ 37,500	$ -	$ 37,500
Walls	85	CY	$ 750	$ 63,750	$ -	$ 63,750
Effluent Trough	15	CY	$ 1,000	$ 15,000	$ -	$ 15,000
Metal Fabrications						
Handrail	260	LF	$ 100	$ 26,000	$ -	$ 26,000
Equipment						
Clarifier Mechanism	1	EA	$ 110,000	$ 110,000	$ 44,000	$ 154,000
Scum Pumps	2	EA	$ 10,000	$ 20,000	$ 8,000	$ 28,000
Process Mechanical						
Influent/Effluent/Scum/RAS Pipe	15%	MECH	$ 324,000	$ 49,000	$ -	$ 49,000
Electrical and Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 459,000	$ 68,850	$ -	$ 68,850
New Final Clarifier						**$ 459,000**
New RAS/WAS Pump Station						
Earthwork						
Structural Excavation	5	CY	$ 25	$ 125		$ 125
Concrete						
Pump Station Building Slab	12	CY	$ 500	$ 6,000		$ 6,000
Pump Station Building Slab	144	SF	$ 200	$ 28,800		$ 28,800
Equipment						
RAS/WAS Pumps	2	EA	$ 25,000	$ 50,000	$ 20,000	$ 70,000
Process Mechanical						
Pipes	1	LS	$ 26,000	$ 26,000		$ 26,000
Valves	1	LS	$ 17,000	$ 17,000		$ 17,000
Electrical/ Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 26,000	$ 26,000		$ 26,000
New RAS/WAS Pump Station						**$ 174,000**

City of Fair Oaks Ranch, Texas
Existing Wastewater Treatment Plant Expansion
Conceptual Opinion of Probable Construction Cost

Description	*Quantity*	*Unit*	*Cost/Unit*	*Raw Cost*	*Installation*	*Amount*
Chlorine Contact Basin						
Earthwork						
Structural Excavation	250	CY	$ 25	$ 6,250		$ 6,250
Concrete						
Chamber Basin	11	CY	$ 500	$ 5,500		$ 5,500
Basin Wall	41	CY	$ 750	$ 30,750		$ 30,750
Effluent Channel Wall	7	CY	$ 750	$ 5,250		$ 5,250
Chlorine Contact Basin						**$ 48,000**
New Aerated Sludge Holding Tanks						
Earthwork						
Structural Excavation	111	CY	$ 25	$ 2,775		$ 2,775
Concrete						
Foundation	111	CY	$ 500	$ 55,500		$ 55,500
Walls	87	CY	$ 750	$ 65,250		$ 65,250
Walkways	10	CY	$ 1,000	$ 10,000		$ 10,000
Concrete Stairs	10	CY	$ 1,000	$ 10,000		$ 10,000
Blower Slab	24	CY	$ 500	$ 12,000		$ 12,000
Blower Canopy	320	SF	$ 50	$ 16,000		$ 16,000
Equipment						
Coarse Bubble Aeration System	2	LS	$ 10,000	$ 20,000	$ 7,000	$ 27,000
Positive Displacemet Blowers	3	EA	$ 24,000	$ 72,000	$ 25,200	$ 97,200
Process Mechanical						
Mechanical Piping and Valves	10%	MECH	$ 293,000	$ 29,000		$ 29,000
Electrical/ Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 382,000	$ 57,000		$ 57,000
New Aerated Sludge Holding Tanks						**$ 382,000**
New Screw Press Feed Pump Station						
Earthwork						
Structural Excavation	5	CY	$ 25	$ 125		$ 125
Concrete						
Pump Station Slab	12	CY	$ 500	$ 6,000		$ 6,000
Pump Station Canopy	144	SF	$ 50	$ 7,200		$ 7,200
Equipment						
Progressive Cavity Pumps	2	EA	$ 20,000	$ 40,000	$ 14,000	$ 54,000
Process Mechanical						
Mechanical Piping and Valves	20%	MECH	$ 67,000	$ 13,400		$ 13,400
Electrical/ Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 95,000	$ 14,250		$ 14,250
New Screw Press Feed Pump Station						**$ 95,000**

City of Fair Oaks Ranch, Texas
Existing Wastewater Treatment Plant Expansion
Conceptual Opinion of Probable Construction Cost

Description	*Quantity*	*Unit*	*Cost/Unit*	*Raw Cost*	*Installation*	*Amount*
New Dewatering Building						
Earthwork						
Structural Excavation	60	CY	$ 25	$ 1,500		$ 1,500
Concrete						
Concrete Foundation	166	CY	$ 500	$ 83,000		$ 83,000
Dewatering Building	800	SF	$ 150	$ 120,000		$ 120,000
Roll Off Bin Canopy	800	SF	$ 50	$ 40,000		$ 40,000
Equipment						
Relocate Screw Press to New Building	1	EA	$ -	$ -	$ 100,000	$ 100,000
Process Mechanical						
Mechanical Piping and Valves	10%	MECH	$ 343,000	$ 34,300		$ 34,300
Electrical/ Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 446,000	$ 66,900		$ 66,900
New Dewatering Building						**$ 446,000**
Electrical System Improvements						
Incoming Electrical Service (Single Transformer)						
Installation of New Service	1	LS	$ 75,000	$ 75,000	$ -	$ 100,000
Emergency Generator						
Generator	1	LS	$ 75,000	$ 75,000	$ -	$ 75,000
Electrical Building						
Foundation	8	CY	$ 500	$ 4,000	$ -	$ 4,000
Electrical Building	200	SF	$ 200	$ 40,000	$ -	$ 40,000
Electrical System Improvements						**$ 219,000**
Subtotal Direct Construction Cost						**$ 4,223,000**

Insurance	1%	$ 42,230
Bonds	1.5%	$ 63,345
Contractor's General Conditions	10%	$ 422,300
Contractor's Overhead and Profit	8%	$ 337,840
Subtotal		**$ 5,090,000**
Construction Contingency	30%	$ 1,530,000
Escalation to Mid Point of Construction	3%	$ 380,000
Total Estimated Construction Cost		**$ 7,000,000**
Engineering Design, Bidding, Construction and Additional Services	25%	$ 1,750,000
TOTAL PROJECT COST		**$ 8,800,000**

City of Fair Oaks Ranch, Texas
New Wastewater Treatment Plant
Conceptual Opinion of Probable Construction Cost

Description	Quantity	Unit	Cost/Unit	Raw Cost	Installation	Amount
Civil/Site Work						
Site Work						
Site Work (Paving, Grading and Drainage)	1	LS	$ 294,000	$ 294,000		$ 294,000
Yard Piping						
Yard Piping	1	LS	$ 440,000	$ 440,000		$ 440,000
Site Electrical and Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 863,000	$ 129,000	$ -	$ 129,000
Civil/Site Work						**$ 863,000**
Headworks						
Concrete						
Foundation	220	CY	$ 500	$ 110,000	$ -	$ 110,000
Walls	120	CY	$ 750	$ 90,000	$ -	$ 90,000
Elevated Slabs	35	CY	$ 1,000	$ 35,000	$ -	$ 35,000
Columns	15	CY	$ 1,000	$ 15,000	$ -	$ 15,000
Metal Fabrications						
Alum. Cover Plates	900	SF	$ 45	$ 40,500	$ -	$ 40,500
Handrail	110	LF	$ 100	$ 11,000	$ -	$ 11,000
Metal Stairs	1	LS	$ 20,000	$ 20,000	$ -	$ 20,000
Gates						
Slide gates	4	EA	$ 8,000	$ 32,000	$ 11,200	$ 43,200
Weir gates	2	EA	$ 5,000	$ 10,000	$ 3,500	$ 13,500
Equipment						
Mechanical Screen	1	EA	$ 100,000	$ 100,000	$ 35,000	$ 135,000
Screenings Wash Press	1	EA	$ 85,000	$ 85,000	$ 29,750	$ 114,750
Grit Removal Equipment	1	LS	$ 206,000	$ 206,000	$ 72,100	$ 278,100
Grit Pumps	2	EA	$ 10,000	$ 20,000	$ 7,000	$ 27,000
Process Mechanical						
Influent/Effluent Pipe, Valves & Fittings	15%	MECH	$ 933,050	$ 140,000	$ -	$ 140,000
Electrical and Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 1,262,000	$ 189,300	$ -	$ 189,300
Headworks						**$ 1,262,000**
Sequencing Batch Reactors						
Earthwork						
Structural Excavation	710	CY	$ 25	$ 17,750	$ -	$ 17,750
Concrete						
Slab on grade	475	CY	$ 500	$ 237,500	$ -	$ 237,500
Walls	305	CY	$ 750	$ 228,750	$ -	$ 228,750
Walkways	20	CY	$ 1,000	$ 20,000	$ -	$ 20,000
Concrete Stairs	5	CY	$ 1,000	$ 5,000	$ -	$ 5,000
Metal Fabrications						
Handrail	650	LF	$ 100	$ 65,000	$ -	$ 65,000
Equipment						
Aeration Equipment and Blowers	1	LS	$ 700,000	$ 700,000	$ 245,000	$ 945,000
Process Mechanical						
Influent/Effluent Pipe	10%	MECH	$ 1,501,000	$ 150,000	$ -	$ 150,000
Aeration Piping & Valves	15%	MECH	$ 1,501,000	$ 225,000	$ -	$ 225,000
Electrical and Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 2,228,000	$ 334,200	$ -	$ 334,200
Sequencing Batch Reactors						**$ 2,228,000**

City of Fair Oaks Ranch, Texas
New Wastewater Treatment Plant
Conceptual Opinion of Probable Construction Cost

Description	*Quantity*	*Unit*	*Cost/Unit*	*Raw Cost*	*Installation*	*Amount*
Chlorine Contact Basin						
Earthwork						
Structural Excavation	750	CY	$ 25	$ 18,750		$ 18,750
Concrete						
Chamber Basin Foundation	35	CY	$ 500	$ 17,500		$ 17,500
Basin Wall	120	CY	$ 750	$ 90,000		$ 90,000
Effluent Channel Wall	25	CY	$ 750	$ 18,750		$ 18,750
Non-Potable Water Pump Skid Foundation	5	CY	$ 500	$ 2,500		$ 2,500
Non-Potable Water Pump Skid Canopy	144	SF	$ 50	$ 7,200		$ 7,200
Equipment						
Non-Potable Water Pump Skid	1	LS	$ 75,000	$ 75,000	$ 26,250	$ 101,250
Electrical and Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 301,000	$ 45,000	$ -	$ 45,000
Chlorine Contact Basin						**$ 301,000**
Aerated Sludge Holding Tanks						
Earthwork						
Structural Excavation	111	CY	$ 25	$ 2,775		$ 2,775
Concrete						
Foundation	111	CY	$ 500	$ 55,500		$ 55,500
Walls	87	CY	$ 750	$ 65,250		$ 65,250
Walkways	10	CY	$ 1,000	$ 10,000		$ 10,000
Concrete Stairs	10	CY	$ 1,000	$ 10,000		$ 10,000
Blower Slab	24	CY	$ 500	$ 12,000		$ 12,000
Blower Canopy	320	SF	$ 50	$ 16,000		$ 16,000
Equipment						
Coarse Bubble Aeration System	2	LS	$ 10,000	$ 20,000	$ 7,000	$ 27,000
Positive Displacemet Blowers	3	EA	$ 24,000	$ 72,000	$ 25,200	$ 97,200
Process Mechanical						
Mechanical Piping and Valves	10%	MECH	$ 293,000	$ 29,000		$ 29,000
Electrical/Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 382,000	$ 57,000		$ 57,000
Aerated Sludge Holding Tanks						**$ 382,000**
Screw Press Feed Pump Station						
Earthwork						
Structural Excavation	5	CY	$ 25	$ 125		$ 125
Concrete						
Pump Station Slab	12	CY	$ 500	$ 6,000		$ 6,000
Pump Station Canopy	144	SF	$ 50	$ 7,200		$ 7,200
Equipment						
Progressive Cavity Pumps	2	EA	$ 20,000	$ 40,000	$ 14,000	$ 54,000
Process Mechanical						
Mechanical Piping and Valves	20%	MECH	$ 67,000	$ 13,400		$ 13,400
Electrical/Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 95,000	$ 14,250		$ 14,250
Screw Press Feed Pump Station						**$ 95,000**
Dewatering Building						
Earthwork						
Structural Excavation	60	CY	$ 25	$ 1,500		$ 1,500
Concrete						
Concrete Foundation	166	CY	$ 500	$ 83,000		$ 83,000
Dewatering Building	800	SF	$ 150	$ 120,000		$ 120,000
Roll Off Bin Canopy	800	SF	$ 50	$ 40,000		$ 40,000
Equipment						
Relocate Screw Press from Existing WWTP	1	EA	$ -	$ -	$ 100,000	$ 100,000
Process Mechanical						
Mechanical Piping and Valves	10%	MECH	$ 343,000	$ 34,300		$ 34,300
Electrical/Instrumentation						
Electrical and Instrumentation	15%	JOB	$ 446,000	$ 66,900		$ 66,900
Dewatering Building						**$ 446,000**

City of Fair Oaks Ranch, Texas
New Wastewater Treatment Plant
Conceptual Opinion of Probable Construction Cost

Description	*Quantity*	*Unit*	*Cost/Unit*	*Raw Cost*	*Installation*	*Amount*
Miscellaneous Electrical						
Incoming Electrical Service (Single Transformer)						
Installation of New Service	1	LS	$ 75,000	$ 75,000	$ -	$ 100,000
Emergency Generators						
Generator	1	LS	$ 150,000	$ 150,000	$ -	$ 150,000
Electrical Building						
Foundation	8	CY	$ 500	$ 4,000	$ -	$ 4,000
Electrical Building	200	SF	$ 200	$ 40,000	$ -	$ 40,000
Miscellaneous Electrical						**$ 294,000**
Subtotal Direct Construction Cost						**$ 5,871,000**

Insurance	1%	$ 58,710
Bonds	1.5%	$ 88,065
Contractor's General Conditions	10%	$ 587,100
Contractor's Overhead and Profit	8%	$ 469,680
Subtotal		**$ 7,070,000**
Construction Contingency	30%	$ 2,120,000
Escalation to Mid Point of Construction	3%	$ 530,000
Total Estimated Construction Cost		**$ 9,700,000**
Land Acquisition (ASSUMED COST)	2%	$ 190,000
Engineering Design, Bidding, Construction and Additional Services	25%	$ 2,400,000
TOTAL PROJECT COST		**$ 12,300,000**

APPENDIX I
EFFLUENT DISPOSAL AGREEMENT

EFFLUENT DISPOSAL AGREEMENT

This Agreement is made and entered into this 20 day of June, 2003 by and between The City of Fair Oaks Ranch and Fair Oaks Club Corp.:

WHEREAS, The City of Fair Oaks Ranch (the City) and Fair Oaks Club Corp. (the Club) have contractual obligations for the utilization of effluent from the WWTP to irrigate the golf courses and whereas there is a desire to keep up this mutually beneficial relationship in the future, this agreement formalizes, updates, and clarifies those obligations; and

WHEREAS, The contract to purchase the Golf Course and Country Club, dated October 30, 1986 by and between Fair Oaks Country Club, Inc., as Seller, and Fair Oaks Club Corp., as Purchaser ("Contract of Sale"), stipulates in section 12.023 that "All effluent produced" from the WWTP will be delivered to the golf course storage ponds at no cost to the Club; and, the Club will accept and use all such effluent for irrigation of the golf course; and such contract obligation was assigned by Ralph E. Fair, Inc. to City in that certain Assignment between Ralph E. Fair, Inc. and the City of Fair Oaks Ranch dated 12 December, 1997.

WHEREAS, The City and the Club, on June 20, 2003, entered into an agreement for the financing and construction of a new 41 million gallon (approximate) effluent storage pond located adjacent to fairway No. 14 on the Blackjack golf course (Blackjack 14). The purpose of this pond being an additional irrigation water and emergency wet weather effluent storage facility.

NOW, THEREFORE, in consideration of the mutual benefits to be derived by each party and the community as a whole:

Definitions.

Waste Water Treatment Plant (WWTP): That Wastewater Recycling plant owned and operated by The City of Fair Oaks Ranch under Texas Commission on Environmental Quality (TCEQ) permit No. WQ0011867-001 and located and 29755 No Le Hace, Fair Oaks Ranch, Texas.

Fair Oaks Ranch Utilities: (FORU): The department of the City of Fair Oaks Ranch with the responsibility to operate and maintain the public water and wastewater systems of the city.

Storage Ponds: Compacted clay or synthetic lined ponds located on Fair Oaks Ranch golf course which were constructed to receive and store effluent for subsequent use as irrigation water for the golf course. The storage ponds are identified as: the pond on fairway No. 4 Live Oak Course (Live Oak # 4); the pond on fairway No. 13 Live Oak Course (Live Oak # 13); the pond on fairway No. 4 Blackjack course (Blackjack # 4); and the pond on fairway No. 14 Blackjack course (Blackjack # 14).

Effluent: Treated water discharged from the wastewater treatment plant.

Golf Course: That 280 (plus or minus) acres, including the areas for tees, fairways, greens, rough, ponds and appurtenances owned and operated by Fair Oaks Club Corp. and identified as Fair Oaks Ranch Golf Country Club.

Wet Weather Storage Facilities: Live Oak # 13 (The overflow pond) and the last 8.2 million gallons or twenty percent (20%) of storage capacity of Blackjack # 14.

Water Emergency: Any situation or occurrence where the amount of water being discharged from the WWTP exceeds the capacity of the effluent storage ponds or irrigation system. This includes treatment plant upsets or plant equipment failure and or malfunction that result in incomplete or partially treated wastewater being transferred to the effluent storage facilities.

Agreement: This Agreement shall amend the contractual obligations of both parties in Section 12.023 of the Contract of Sale.

All (100%) of the effluent produced from the WWTP shall be delivered by City to the Club's storage Ponds located on the golf course. The Effluent shall be used only for irrigation of said Golf Course in accordance with the applicable Texas Commission on Environmental Quality (TCEQ) rules and regulations.

The Effluent shall be delivered to the Storage Ponds at no charge or cost to Club.

The Club is hereby obligated to receive, store and utilize 100% of the Effluent for irrigation within the confines of the 280-acre Golf Course.

The golf course irrigation system and Storage Ponds are owned by Club and will be operated, controlled, and maintained by the Cub. The Wet Weather Storage Facilities will be owned, operated and controlled by the Club, except that City shall control the storage level for Blackjack #14 to insure that up to twenty percent (20%) or 8.2 million gallons of emergency storage is available to City. Club will allow the City access to the Wet Weather Storage Facilities at all times. The chlorine injection equipment installed by the City for the irrigation system will be owned, operated, controlled and maintained by City.

By separate agreement, the Club and the City have agreed to build an additional Storage Pond on Blackjack # 14. This pond will be the primary effluent storage and irrigation pond for the Club and will be built to TCEQ specifications. This pond will function to store water and effluent for golf course irrigation and to provide emergency effluent storage at times when effluent volume exceeds irrigation needs. To meet these two objectives, the water level will be monitored to insure that up to twenty percent (20%) or 8.2 million gallons of emergency storage is available and controlled by the City. The remaining storage capacity is to be utilized and controlled by the Club. The City may, at its sole discretion, release some of its emergency storage capacity for use as irrigation storage.

The Club assumes ownership, responsibility and control of all irrigation water (including Effluent) upon delivery of the water to each Storage Pond. The City will exercise due diligence and maximum effort to always produce as high quality Effluent as possible under the City's operating policies and budgetary parameters. The Club will exercise due diligence and maximum effort to maintain the quality of the water received. The City will be responsible for producing Effluent that meets or exceeds TCEQ rules and regulations.

In the event of a Water Emergency the City and Club shall cooperate fully in all ways to remedy and or rectify the emergency as soon as possible. This cooperation shall include personnel, equipment, supplies and financial resources reasonably and legal available to each. The City recognizes its water quality obligation and responsibility and shall put forth maximum effort to achieve and maintain acceptable effluent water quality.

This Agreement in no way eliminates or modifies the Club's obligation to take and utilize 100% of the Effluent produced by and received from the WWTP. The City will be allowed to collect samples for water and soil analysis and install and maintain warning signs at the storage ponds as required by TCEQ regulations.

The Club and the City agree to discuss, amend or modify this Agreement as required for the renewal of the WWTP permit and to insure this beneficial use of the Effluent continues. Such amendments and modifications will not be unreasonably withheld by either party.

Compliance. In performing the services provided for in this Agreement, both parties shall comply with all applicable federal, state, county and city statutes, ordinances and regulations and shall be liable, according to responsibilities outlined above, for any consequences arising from failure to do so.

Notices. All notices under this Agreement shall be provided to City at the address below and to Club at the address below, Attention: General Manager; and to P.O. Box 819012, Dallas, Texas 75381-9012, Attention: General Counsel.

Miscellaneous. In case any one or more of the provisions contained in this Agreement shall for any reason be held invalid, illegal, or unenforceable in any respect, such invalidity, illegality, or unenforceability shall not affect any other provision, and this Agreement shall be construed as if such invalid, illegal, or unenforceable provision had never been contained herein. Neither Club nor City shall be required to perform any term, conditions, or covenant in this Agreement so long as such performance is delayed or prevented by force majeure, which shall mean acts of God, strikes, lockouts, material or labor restrictions by any governmental authority, or any other cause not reasonably within the control of Club or City and which by the exercise of due diligence of Club or City is unable, wholly or in part, to prevent or overcome. This Agreement and attachments embody the entire agreement and understanding of the parties relating to the subject matter hereof, is nonassignable, may not be amended except in writing signed by both parties, and supersedes any prior representations, agreements, and understandings, oral or written, if any, relating to such subject matter.

Special Provision: Should the Club cease operation for any reason whatsoever, Club will give City six (6) months written notice of such. If Club cannot give City six (6) months notice or fails to provide sufficient notice, City shall have the right to mandate that Club continue to control and operate the Club's effluent storage pond for up to six (6) months following receipt of such notice. If Club is unable to do so, City may operate the Club's effluent storage pond for up to six (6) months following the receipt of notice or until such time the new owner(s) and/or operator(s) of the Club or Storage Ponds are able to do so.

TO HAVE AND TO HOLD the above described Agreement between the City of Fair Oaks Ranch and Fair Oaks Club Corp., its successors and assigns, until this Agreement shall be cancelled as evidenced by a Certificate of Termination executed by the City of Fair Oaks Ranch and Fair Oaks Club Corp.

Agreed to this date by:

Club:

Fair Oaks Club Corp.

By: _____
Jack T. Lupton
Senior Vice President
Address: 3333 Golfing Green Drive
Farmers Branch, Texas 75234
Date: _____

City:

City of Fair Oaks Ranch

By: _____
Printed Name: E.L. GAUBATZ
Title: mayor
Address: 7286 Dietz Elkhorn
Fair Oaks Ranch TX 78015
Date: June 20, 2003
F.E.I. No.: _____

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ATTACHMENT AR1-A

IRRIGATION AGREEMENT
2 pages

Effluent from the waste water treatment plant is used to irrigate the Fair Oaks Ranch golf course which is adjacent to the plant. The original owners of the golf course were the same as the applicant and in the original application, the golf course was designated as the land to be irrigated with effluent. When the golf course was sold to Club Corporation of America, it was stipulated in the Contract for Sale that effluent would continue to be used for irrigation. (A copy of this provision of the contract is attached). Therefore, by perpetual contractual arrangement, the effluent will be used for golf course irrigation.

described in (i), (ii) and (iii) above, that to the extent a given category of membership in the Club does not have a full complement of members, membership in the Club will be available to the prospective owner if he or she acquires a residential lot within the Fair Oaks Ranch and meets the standards for admission prescribed by the admissions committee.

12.021. Participation in Club Board. Purchaser intends to establish a Board of Governors, composed of members, to which Purchaser in its sole discretion will delegate certain functions or authority pertaining to the internal operations, rules, and policies of the Club. Purchaser agrees that, until the Purchase Money Note is paid in full, at least one third of the persons comprising such board shall be members of the Club nominated by Seller.

12.022. Sale of Club. Purchaser agrees that for a period of eight (8) years from the Closing Date, it will not sell the Property or any part thereof without the prior approval of Seller, which will not be unreasonably withheld.

12.023. Effluent. All effluent produced from the sewer plant located in the Fair Oaks Ranch will be caused by Seller to be delivered to storage areas on or about the golf course on the Property, free of cost to Purchaser to the delivery point. Purchaser will accept and use all such effluent for irrigation of the golf course, unless the volume of such effluent exceeds the capacity of the Property to absorb the effluent for irrigation, and the capacity of the storage ponds on the Property, which Purchaser will maintain at least existing storage capacity. Until the additional 9 hole golf course is constructed on the land designated as its location, Seller, at its expense, may irrigate such additional land if required in connection with a governmental permit, and after construction of the additional 9 hole golf course, the effluent shall be used by Purchaser for golf course irrigation. Any water needed by Purchaser for golf course irrigation, to supplement the available volume of effluent, will be purchased and paid for by Purchaser.

12.024. Employment Contracts. Purchaser agrees that if it should default under the terms of this agreement or any agreement contemplated herein and such default should result in the termination of Purchaser's

APPENDIX J
RISK-BASED ANALYSIS SUMMARY SHEETS

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Elmo Davis Pump Station

Inspection Date: 7/19/2017

Facility Information	
Address:	29035 Dapper Dan Dr Fair Oaks Ranch, TX 78015
Year in Service:	1977
Type of Facility:	Water Plant
Number of Pumps:	3
Pumping (gpm):	2-400 (VFD) 1-650
Horsepower:	2-15 1-30
Monitoring:	SCADA
Generator:	Generator

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	4	25%	1.00	Rec. replacing tap box with distribution panelboard to provide isolation when working on any starters. Rec. replacing original Pump 3 starter and other older equipment (panelboard, transformer, etc.) in next rehab. Rec. adding lightning protection to building and tanks.
Pumps and Motors	2	30%	0.60	Minor water leak observed on pump discharge by meter. Pumps, piping, chlorine solution lines - coated and labeled per TCEQ standard colors. Pump station - insulated to improve heating and cooling efficiency
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Some of perimeter fence is < TCEQ min. height and corroded - replace or rehab. Chlorine room door corroding - recoat. Trees overhanging fence can be security risk. Exterior of building could use coat of paint to seal exposed wood and penetrations.
Mechanical - HVAC, Piping, Valves, Meters	1.75	15%	0.26	
Total Inspection Score	-	100%	2.46	
Condition Rating	-	-	**2.46**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Pump Station Risk Rating	**2.46**	**3.00**	**5.46**	**Moderate Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant #2 Pump Station

Inspection Date: 7/20/2017

Facility Information	
Address:	28129 Royal Ascot Dr Fair Oaks Ranch, TX 78015
Year in Service:	1979
Type of Facility:	Water Plant
Number of Pumps:	3
Pumping (gpm):	2-400 (VFD) 1-450
Horsepower:	15
Monitoring:	SCADA
Generator:	Generator

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	3.5	25%	0.88	Recommend replacing the original Pump 1 and 3 control panels, panelboard, small transformer and older equipment in next rehab. Site includes a VFD, recommend for longer life to provide cooling.
Pumps and Motors	2	30%	0.60	Corrosion of chlorine storage room and pump station doors - recoat. Coat/label pumps, piping, and chlorine solution system per TCEQ. One pump out of service during inspection. Pump station experiences water hammer when pumps cut off. City should consider changing type of check valve on pump discharges or install surge anticipator valve to prevent pump damage.
Instrumentation - SCADA, alarms	1.5	10%	0.15	
Structure - Walls, Roof, Foundation	2	20%	0.40	Stain or coat fence to extend life. Some cracking of CMU at wall joints - seal and recoat. Further shifting of foundation should be monitored. Trees overhanging fence can be a security risk.
Mechanical - HVAC, Piping, Valves, Meters	1.7	15%	0.26	Minor replacement of damaged gauges and piping required.
Total Inspection Score	-	100%	2.28	
Condition Rating	-	-	**2.28**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Pump Station Risk Rating	**2.28**	**3.00**	**5.28**	**Moderate Risk**

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Plant #3 Pump Station

Inspection Date: 7/18/2017

Facility Information	
Address:	32078 Wild Oak Hill Fair Oaks Ranch, TX 78015
Year in Service:	Pre-1982
Type of Facility:	Water Plant
Number of Pumps:	3
Pumping (gpm):	1-400 2-450
Horsepower:	15
Monitoring:	SCADA
Generator:	Recently installed (Olympian model)

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	4	25%	1.00	The electrical equipment inside appears to be original and pass its expected service life. The incoming electrical service equipment and ATS were recently installed.
Pumps and Motors	1.5	30%	0.45	Water hammer is damaging pumps. Consider installing a surge anticipator valve or replace silent check valves with swing check valves. Check pumps and piping for minor leaks. Pumps are short cycling, +/- 2 minutes. Evaluate On/Off settings, pump capacity and coordination with hydro tank.
Instrumentation - SCADA, alarms	2.5	10%	0.25	Site uses cellular for SCADA, and also serves as a repeater for well sites.
Structure - Walls, Roof, Foundation	1.3	20%	0.26	Chain link fence meets TCEQ req'ts. Rec. minor corrosion improvements and replace rusted barbed wire. Coat and label chlorine solution lines per TCEQ req'ts. Coat chlorine room door to prevent further corrosion or replace with corrosion resistant door.
Mechanical - HVAC, Piping, Valves, Meters	2.3	15%	0.35	Coat piping and valves per TCEQ requirements.
Total Inspection Score	-	100%	2.31	
Condition Rating	-	-	**2.31**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	1	100%	1.00	Connections: 370
Criticality Rating	-	100%	**1.00**	**Very Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Pump Station Risk Rating	**2.31**	**1.00**	**3.31**	**Low Risk**

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Water and Wastewater Master Plan
Risk Based Assessment

Plant #4 Pump Station

Inspection Date: 7/18/2017

Facility Information	
Address:	26365 Old Fredericksburg Rd Boerne, TX 78015
Year in Service:	1983
Type of Facility:	Water Plant
Number of Pumps:	2
Pumping (gpm):	-
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	2	25%	0.50	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	3.5	10%	0.35	Recommend adding continuous measurement of discharge flow or pressure at site.
Structure - Walls, Roof, Foundation	1	20%	0.20	Large gaps are present under the chain link fence and need to be filled. Barbed wire needs to be extended to 45-degree outward from fence at some locations.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Pumps and piping should be coated and labeled per TCEQ standards.
Total Inspection Score	-	100%	1.95	
Condition Rating	-	-	1.95	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	3.00	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Pump Station Risk Rating	1.95	3.00	4.95	Moderate Risk

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Water and Wastewater Master Plan
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Plant #5 Zone A Pump Station

Inspection Date: 7/18/2017

Facility Information	
Address:	9108 Jodhpur Dr Fair Oaks Ranch, TX 78015
Year in Service:	2006
Type of Facility:	Water Plant
Number of Pumps:	2
Pumping (gpm):	2-750 (VFD)
Horsepower:	30
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	2.5	25%	0.63	Recommend adding lightning protection to the building. Some of the VFDs have been recently replaced and located in a climate controlled panel.
Pumps and Motors	1	30%	0.30	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	1	20%	0.20	Trim trees overhanging and near fence to improve site security. Paint and label chlorine and chlorine solution lines per TCEQ standards.
Mechanical - HVAC, Piping, Valves, Meters	1.3	15%	0.20	General corrosion was observed on several ductile iron fittings.
Total Inspection Score	-	100%	1.52	
Condition Rating	-	-	1.52	Good

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Population Served	1	100%	1.00	Connections: 370
Criticality Rating	-	100%	1.00	Very Low

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Pump Station Risk Rating	1.52	1.00	2.52	Low Risk

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Plant #5 Zone B Pump Station

Inspection Date: 7/18/2017

Facility Information	
Address:	9108 Jodhpur Dr Fair Oaks Ranch, TX 78015
Year in Service:	2006
Type of Facility:	Water Plant
Number of Pumps:	2
Pumping (gpm):	2-390 (VFD)
Horsepower:	50
Monitoring:	-
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	2.5	25%	0.63	Recommend adding lightning protection to the building. Some of the VFDs have been recently replaced and located in a climate controlled panel.
Pumps and Motors	1	30%	0.30	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	1	20%	0.20	Trim trees overhanging and near fence to improve site security. Paint and label chlorine and chlorine solution lines per TCEQ standards.
Mechanical - HVAC, Piping, Valves, Meters	1.3	15%	0.20	General corrosion was observed on several ductile iron fittings.
Total Inspection Score	-	100%	1.52	
Condition Rating	-	-	1.52	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	4	100%	4.00	Connections: 1470
Criticality Rating	-	100%	4.00	High

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Pump Station Risk Rating	1.52	4.00	5.52	High Risk

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Well 1

Inspection Date: 7/20/2017

Facility Information	
Address:	30260 Saratoga Ln Fair Oaks Ranch, TX 78015
Year in Service:	-
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	-
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	5	25%	1.25	Control panel shows significant signs of corrosion and deterioration. Panel appears to be original and pass its expected service life.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	No fence is present. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.75	
Condition Rating	-	-	**2.75**	**Fair**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	**2.75**	**2.00**	**4.75**	**Moderate Risk**

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Well 2

Inspection Date: 7/20/2017

Facility Information	
Address:	29166 Preakness Ln Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2014
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	45.0
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	Service Disconnect and Control Panel was installed within the last 3 years. Old wireway shows signs of corrosion.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Pump has not been pulled in last 10 years.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	1.75	
Condition Rating	-	-	1.75	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	50 gpm
Criticality Rating	-	100%	2.00	Low

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	1.75	2.00	3.75	Low Risk

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Well 3

Inspection Date: 7/19/2017

Facility Information	
Address:	29035 Dapper Dan Dr Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2017
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	-
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	3	25%	0.75	Control panel shows significant signs of corrosion and deterioration. Panel also includes an opening at the bottom. Panels appear to be original and pass its expected service life.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	0	10%	0.00	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Irrigation well with hydrogen sulfide present.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.05	
Condition Rating	-	-	**2.05**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.05**	**2.00**	**4.05**	**Low Risk**

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Well 4

Inspection Date: 7/19/2017

Facility Information	
Address:	29035 Dapper Dan Dr Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2003
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	68.0
Horsepower:	-
Monitoring:	-
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	3	25%	0.75	Electrical panels show significant signs of corrosion and deterioration. Panels appear to be original and pass its expected service life.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	Connected to the Plant SCADA system.
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.25	
Condition Rating	-	-	**2.25**	**Fair**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	3	100%	3.00	70 gpm
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	**2.25**	**3.00**	**5.25**	**Moderate Risk**

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Well 5

Inspection Date: 7/20/2017

Facility Information	
Address:	28344 Aqueduct Ln Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2009
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	75.0
Horsepower:	-
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	4.5	25%	1.13	Recommend replacing the PVC conduit routed along the ground with rigid metallic conduit. The conduit shows signs of crushing.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.63	
Condition Rating	-	-	**2.63**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	3	100%	3.00	80 gpm
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.63**	**3.00**	**5.63**	**High Risk**

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Well 6

Inspection Date: 7/20/2017

Facility Information	
Address:	7724 Rocking Horse Ln Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2012
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	58.0
Horsepower:	15
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Maintain fence w/ stain or coating to extend life. Improved insulation system may prevent accelerated corrosion under insulation (CUI). Horse pens adjacent to well site. TCEQ - no livestock pastures are allowed within 50' of potable water supply wells.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	1.75	
Condition Rating	-	-	1.75	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	60 gpm
Criticality Rating	-	100%	2.00	Low

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	1.75	2.00	3.75	Low Risk

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Well 7

Inspection Date: 7/20/2017

Facility Information	
Address:	28843 Ralph Fair Rd Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2014
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	108.1
Horsepower:	20
Monitoring:	SCADA
Generator:	Quick Connect for Generator

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	2	25%	0.50	Recommend removing the old control panel that is being used as a disconnect in order to utilize the quick connect for the portable generator. Old control panel appears to be original and shows significant signs of corrosion.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.00	
Condition Rating	-	-	2.00	Good

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	5	100%	5.00	110 gpm
Criticality Rating	-	100%	5.00	Very High

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	2.00	5.00	7.00	High Risk

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Well 8

Inspection Date: 7/20/2017

Facility Information	
Address:	28245 Ralph Fair Rd Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2004
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	82.0
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	2	25%	0.50	Control Panel was installed within the last 3 years
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.00	
Condition Rating	-	-	**2.00**	**Good**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	4	100%	4.00	90 gpm
Criticality Rating	-	100%	**4.00**	**High**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	**2.00**	**4.00**	**6.00**	**High Risk**

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Well 9

Inspection Date: 7/20/2017

Facility Information	
Address:	7202 Saddle Star Fair Oaks Ranch, TX 78015
Year in Service:	-
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	68.0
Horsepower:	-
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	5	25%	1.25	Electrical panels show significant signs of corrosion and deterioration. Panels appear to be original and pass its expected service life. Significant insulation wear on cables visible.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Well has not been pulled in last 10-years.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.75	
Condition Rating	-	-	**2.75**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	3	100%	3.00	70 gpm
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.75**	**3.00**	**5.75**	**High Risk**

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Well 10

Inspection Date: 7/20/2017

Facility Information	
Address:	7721 Keeneland Dr Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2007
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	43.0
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Well has been pulled in the last 7-8 years.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	1.75	
Condition Rating	-	-	1.75	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	50 gpm
Criticality Rating	-	100%	2.00	Low

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	1.75	2.00	3.75	Low Risk

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Well 12

Inspection Date: 7/20/2017

Facility Information	
Address:	29762 Cojack Cir Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2005
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	50.0
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	Control Panel was installed within the last 3 years
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	4	20%	0.80	Fence needs to be replaced. Neighbor breaks wood fence boards. Rec. 6' chain link fence with 3-strands of barbed wire. Improved insulation system may prevent accelerated corrosion under insulation (CUI). Well has been pulled in last 7-8 years.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.15	
Condition Rating	-	-	**2.15**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	50 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.15**	**2.00**	**4.15**	**Low Risk**

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Well 13

Inspection Date: 7/20/2017

Facility Information	
Address:	7910 Triple Crown Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2003
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	22.0
Horsepower:	-
Monitoring:	-
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	4	25%	1.00	Recommend rewiring so that the original control panel is not used as a pass thru for the new conductors routed to the starter.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.50	
Condition Rating	-	-	**2.50**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	30 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.50**	**2.00**	**4.50**	**Moderate Risk**

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Well 14

Inspection Date: 7/20/2017

Facility Information	
Address:	29895 Ralph Fair Rd Fair Oaks Ranch, TX 78015
Year in Service:	-
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	-
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	5	25%	1.25	Electrical panels show significant signs of corrosion and deterioration. Panels appear to be original and pass its expected service life.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	4	20%	0.80	Fence needs to be replaced. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Well has not been pulled in the last 10-years.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	3.15	
Condition Rating	-	-	**3.15**	**Poor**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	**3.15**	**2.00**	**5.15**	**Moderate Risk**

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Well 15

Inspection Date: 7/20/2017

Facility Information	
Address:	8107 Pintado Ln Fair Oaks Ranch, TX 78015
Year in Service:	Currently Out of Service
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	52.0
Horsepower:	-
Monitoring:	-
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	0	25%	0.00	
Pumps and Motors	0	30%	0.00	Well was being rehabbed at time of inspection.
Instrumentation - SCADA, alarms	0	10%	0.00	
Structure - Walls, Roof, Foundation	0	20%	0.00	
Mechanical - HVAC, Piping, Valves, Meters	0	15%	0.00	Piping and valves may be coated to extend late and mitigate general corrosion. Consider replacing above grade PVC discharge piping with ductile iron piping.
Total Inspection Score	-	100%	0.00	
Condition Rating	-	-	**0.00**	**Very Good**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	2	100%	2.00	60 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	**0.00**	**2.00**	**2.00**	**Low Risk**

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Well 16

Inspection Date: 7/20/2017

Facility Information	
Address:	8227 Rocking Horse Ln Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2016
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	89.0
Horsepower:	20
Monitoring:	SCADA
Generator:	Quick Connect for Generator

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	2.5	25%	0.63	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.13	
Condition Rating	-	-	**2.13**	**Fair**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	4	100%	4.00	90 gpm
Criticality Rating	-	100%	**4.00**	**High**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	**2.13**	**4.00**	**6.13**	**High Risk**

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Well 17

Inspection Date: 7/18/2017

Facility Information	
Address:	26365 Old Fredericksburg Rd Boerne, TX 78015
Year in Service:	Rehab 2014
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	132.0
Horsepower:	20
Monitoring:	-
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	2	25%	0.50	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	Well site connected to Plant 4 SCADA system.
Structure - Walls, Roof, Foundation	1	20%	0.20	Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	1.80	
Condition Rating	-	-	1.80	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	5	100%	5.00	140 gpm
Criticality Rating	-	100%	5.00	Very High

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	1.80	5.00	6.80	High Risk

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Well 18

Inspection Date: 7/20/2017

Facility Information	
Address:	7455 Mellow Ridge Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2009
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	15
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	2.5	25%	0.63	Recommend closing off the openings in the control panel. Openings are creating deterioration to the panel.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.13	
Condition Rating	-	-	**2.13**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.13**	**2.00**	**4.13**	**Low Risk**

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Well 19

Inspection Date: 7/20/2017

Facility Information	
Address:	30625 Ralph Fair Rd Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2013
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	10
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	4.5	25%	1.13	Electrical panels show significant signs of corrosion and deterioration. Panels appear to be original and pass its expected service life.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.63	
Condition Rating	-	-	**2.63**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.63**	**2.00**	**4.63**	**Moderate Risk**

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Well 21

Inspection Date: 7/20/2017

Facility Information	
Address:	28085 Ralph Fair Rd Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2011
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	83.0
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	Control Panel was installed within the last 3 years
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	1	10%	0.10	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Piping has small leak.
Total Inspection Score	-	100%	1.65	
Condition Rating	-	-	1.65	Good

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	4	100%	4.00	90 gpm
Criticality Rating	-	100%	4.00	High

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	1.65	4.00	5.65	High Risk

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Well 22

Inspection Date: 7/20/2017

Facility Information	
Address:	28035 Ralph Fair Rd Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2014
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	87.0
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	Control Panel was installed within the last 3 years
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	1.75	
Condition Rating	-	-	1.75	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	4	100%	4.00	90 gpm
Criticality Rating	-	100%	4.00	High

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	1.75	4.00	5.75	High Risk

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Well 23

Inspection Date: 7/20/2017

Facility Information	
Address:	7814 Dietz Elkhorn Rd Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2014
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	15
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	Control Panel was installed within the last 5 years
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Backfill required to fill gap under fence. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Piping has small leak.
Total Inspection Score	-	100%	1.75	
Condition Rating	-	-	1.75	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	2.00	Low

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	1.75	2.00	3.75	Low Risk

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Well 25

Inspection Date: 7/18/2017

Facility Information	
Address:	27201 Woodland Green Boerne, TX 78015
Year in Service:	Rehab 2011
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	29.0
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	5	25%	1.25	Electrical panels show significant signs of corrosion and heat deterioration. Panels appear to be original.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	4	20%	0.80	Large oak tree adjacent to fence has limb extending over/near fence that may be a security risk. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	3.15	
Condition Rating	-	-	3.15	Poor

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	30 gpm
Criticality Rating	-	100%	2.00	Low

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	3.15	2.00	5.15	Moderate Risk

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Well 26

Inspection Date: 7/18/2017

Facility Information	
Address:	8340 Reunion Oak Boerne, TX 78015
Year in Service:	-
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	42.0
Horsepower:	-
Monitoring:	-
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	5	25%	1.25	Electrical panels show significant signs of corrosion and damage from a fire within the panel. Panels appear to be original.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	4	20%	0.80	Trees adj. to fence may be security risk -trim. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Barbed wire on top of fence should be restretched.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	3.15	
Condition Rating	-	-	3.15	Poor

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	50 gpm
Criticality Rating	-	100%	2.00	Low

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	3.15	2.00	5.15	Moderate Risk

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Well 27

Inspection Date: 7/18/2017

Facility Information	
Address:	8147 Tradition Trail Boerne, TX 78015
Year in Service:	Rehab 2017
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	79.2
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	5	25%	1.25	Rec. new electrical connection to the well head, the flexible conduit has worn off exposing the power cables. Electrical panels show significant signs of corrosion and heat deterioration. Panels appear to be 20+ years old.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	1	20%	0.20	Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.55	
Condition Rating	-	-	**2.55**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	3	100%	3.00	80 gpm
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.55**	**3.00**	**5.55**	**High Risk**

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Well 28

Inspection Date: 7/18/2017

Facility Information	
Address:	27603 Oak Brook Way Boerne, TX 78015
Year in Service:	Rehab 2002
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	38.0
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	4.5	25%	1.13	Electrical panels show significant signs of corrosion and heat deterioration. Panels appear to be original.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	1	20%	0.20	Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.43	
Condition Rating	-	-	**2.43**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	40 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.43**	**2.00**	**4.43**	**Low Risk**

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Well 30

Inspection Date: 7/20/2017

Facility Information	
Address:	30365 Saratoga Ln Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2009
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	10
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	1.75	
Condition Rating	-	-	1.75	Good

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	2.00	Low

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	1.75	2.00	3.75	Low Risk

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Well 31

Inspection Date: 7/20/2017

Facility Information	
Address:	30310 Saratoga Ln Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2014
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	75.0
Horsepower:	20
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	4	20%	0.80	Fence needs to be replaced. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Well has been pulled in last 10 years.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.15	
Condition Rating	-	-	**2.15**	**Fair**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	3	100%	3.00	80 gpm
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	**2.15**	**3.00**	**5.15**	**Moderate Risk**

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Well 32

Inspection Date: 7/20/2017

Facility Information	
Address:	7927 Windemere Dr Fair Oaks Ranch, TX 78015
Year in Service:	-
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	30.0
Horsepower:	-
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	4	25%	1.00	Rec. routing cables from well pump in new conduit. Flexible conduit has signs of wear with duct tape to prevent cables from being exposed. Control Panel and mounting hardware shows signs of corrosion.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	4	20%	0.80	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.90	
Condition Rating	-	-	**2.90**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	30 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.90**	**2.00**	**4.90**	**Moderate Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well 34

Inspection Date: 7/18/2017

Facility Information	
Address:	7798 Battle Intense Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2014
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	15
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	3.5	25%	0.88	Service Disconnect and Control Panel showing signs of corrosion and water damage. Insulation on cables showing wear within the panels.
Pumps and Motors	2	30%	0.60	Pump was replaced around 2009.
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	1	20%	0.20	Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.18	
Condition Rating	-	-	**2.18**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.18**	**2.00**	**4.18**	**Low Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well 35

Inspection Date: 7/18/2017

Facility Information	
Address:	7797 Battle Intense Fair Oaks Ranch, TX 78015
Year in Service:	-
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	-
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	3.5	25%	0.88	Service disconnect showing signs of corrosion and water damage.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	1	20%	0.20	Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.18	
Condition Rating	-	-	**2.18**	**Fair**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	**2.18**	**2.00**	**4.18**	**Low Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well 36

Inspection Date: 7/18/2017

Facility Information	
Address:	8100 Keeneland Dr Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2005
Type of Facility:	Irrigation Well
Number of Pumps:	1
Pumping (gpm):	-
Horsepower:	5
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	3	25%	0.75	Electrical Panels showing signs of corrosion and water damage.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	1	20%	0.20	Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation.
Total Inspection Score	-	100%	2.05	
Condition Rating	-	-	**2.05**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	0 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.05**	**2.00**	**4.05**	**Low Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well CR1

Inspection Date: 7/18/2017

Facility Information	
Address:	205 Cibolo Ridge Trail Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2016
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	63.0
Horsepower:	8
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	4	25%	1.00	Starter appears to be original and passed expected service life. Rec. replacing cable at the starter. A larger than req. cable was pulled, but only some cable strands have been trimmed, so only part of the cable is connected.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	1	10%	0.10	SCADA cabinet replaced within the last 3 years.
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Meters remotely read.
Total Inspection Score	-	100%	2.40	
Condition Rating	-	-	**2.40**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	3	100%	3.00	70 gpm
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.40**	**3.00**	**5.40**	**Moderate Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well JW1

Inspection Date: 7/20/2017

Facility Information	
Address:	26435 Ralph Fair Rd Boerne, TX 78015
Year in Service:	Rehab 2016
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	94.0
Horsepower:	-
Monitoring:	No SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	Control Panel was installed within the last 5 years
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	-	10%	-	
Structure - Walls, Roof, Foundation	4	20%	0.80	Maintain fence w/ stain or coating. Improved insulation system may prevent accelerated corrosion under insulation (CUI). Lightning strikes at this site are common. Well has some trace contaminants and is not used. Livestock are located within 50'.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Meters remotely read.
Total Inspection Score	-	100%	1.95	
Condition Rating	-	-	1.95	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	4	100%	4.00	100 gpm
Criticality Rating	-	100%	4.00	High

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	1.95	4.00	5.95	High Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well K1

Inspection Date: 7/18/2017

Facility Information	
Address:	8220 Rolling Acres Trail Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2016
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	40.0
Horsepower:	15
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	2	25%	0.50	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Pump rehabbed in last 3 years. Meters remotely read.
Total Inspection Score	-	100%	2.00	
Condition Rating	-	-	2.00	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	40 gpm
Criticality Rating	-	100%	2.00	Low

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	2.00	2.00	4.00	Low Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well K2

Inspection Date: 7/18/2017

Facility Information	
Address:	7935 Rolling Acres Trail Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2016
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	69.0
Horsepower:	15
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Electrical – MCC, Switch Gear, Alternate Power	2	25%	0.50	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	1	10%	0.10	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Meters remotely read.
Total Inspection Score	-	100%	1.90	
Condition Rating	-	-	1.90	Good

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Capacity (gpm)	3	100%	3.00	70 gpm
Criticality Rating	-	100%	3.00	Moderate

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Well Risk Rating	1.90	3.00	4.90	Moderate Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well K3

Inspection Date: 7/18/2017

Facility Information	
Address:	7730 Intrepid Dr Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2016
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	94.0
Horsepower:	15
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	3	25%	0.75	It appears 480V power passes thru one panel to get to another which is a safety concern. Recommend adding an access gate to where the electrical panels are located for accessibility.
Pumps and Motors	2	30%	0.60	Pump was rehabbed in 2015.
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Horses/livestock are around the well site.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Meters remotely read.
Total Inspection Score	-	100%	2.25	
Condition Rating	-	-	**2.25**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	4	100%	4.00	100 gpm
Criticality Rating	-	100%	**4.00**	**High**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.25**	**4.00**	**6.25**	**High Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well K5

Inspection Date: 7/18/2017

Facility Information	
Address:	32125 Burnt Cedar W Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2011
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	110.0
Horsepower:	-
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	3	25%	0.75	There is a few feet of PVC conduit routed above grade, recommend burying or providing protection against being damaged by lawn mower, etc. Service disconnect appears to be pass its expected service life.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	1	10%	0.10	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Minor leak observed on piping. Meters remotely read.
Total Inspection Score	-	100%	2.15	
Condition Rating	-	-	**2.15**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	5	100%	5.00	110 gpm
Criticality Rating	-	100%	**5.00**	**Very High**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.15**	**5.00**	**7.15**	**High Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well K6

Inspection Date: 7/18/2017

Facility Information	
Address:	8566 Rolling Acres Trail Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2002
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	110.0
Horsepower:	15
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	4	25%	1.00	The service entrance disconnect and the old controller show significant signs of corrosion. Equipment appears to be original and pass its expected service life. Recommend replacement.
Pumps and Motors	2	30%	0.60	Pump and motor not rehabbed in last 14 years.
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Maintain fence w/ stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Trim trees over hanging and near fences to improve site security.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Meters remotely read.
Total Inspection Score	-	100%	2.50	
Condition Rating	-	-	**2.50**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	5	100%	5.00	110 gpm
Criticality Rating	-	100%	**5.00**	**Very High**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.50**	**5.00**	**7.50**	**Extreme Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well K7

Inspection Date: 7/18/2017

Facility Information	
Address:	8762 Rolling Acres Trail Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2012
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	31.0
Horsepower:	-
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	1	25%	0.25	
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	1	10%	0.10	
Structure - Walls, Roof, Foundation	4	20%	0.80	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI). Well not pulled in approx. 5-6 years.
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Meters remotely read.
Total Inspection Score	-	100%	2.05	
Condition Rating	-	-	**2.05**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	2	100%	2.00	40 gpm
Criticality Rating	-	100%	**2.00**	**Low**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	**2.05**	**2.00**	**4.05**	**Low Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Well K8

Inspection Date: 7/18/2017

Facility Information	
Address:	8540 Flagstone Dr Fair Oaks Ranch, TX 78015
Year in Service:	Rehab 2015
Type of Facility:	Potable Water Well
Number of Pumps:	1
Pumping (gpm):	93.0
Horsepower:	15
Monitoring:	SCADA
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Switch Gear, Alternate Power	2	25%	0.50	Electrical panels in good condition. The utility's pole mounted transformers show signs of heat damage. City has not indicated an issue with the electrical service.
Pumps and Motors	2	30%	0.60	
Instrumentation - SCADA, alarms	2	10%	0.20	
Structure - Walls, Roof, Foundation	2	20%	0.40	Fence needs to be maintained with stain or coating to extend life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Mechanical - HVAC, Piping, Valves, Meters	2	15%	0.30	Piping and valves may be coated to extend late and mitigate general corrosion. Piping was insulated and limited area was available for observation. Meters remotely read.
Total Inspection Score	-	100%	2.00	
Condition Rating	-	-	2.00	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Capacity (gpm)	4	100%	4.00	100 gpm
Criticality Rating	-	100%	4.00	High

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Well Risk Rating	2.00	4.00	6.00	High Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Elmo Davis GST #1

Inspection Date: 7/19/2017

Facility Information	
Address:	29035 Dapper Dan Dr Fair Oaks Ranch, TX 78015
Year in Service:	1977, Rehab 2010
Type of Facility:	Steel GST
Capacity (MG):	0.5
Overflow Elevation:	1460.0
Diameter (feet):	60
Monitoring:	-
Tank Entry Point:	Roof Hatch & Access Manway

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	5	20%	1.00	Vent does not have a pressure/vacuum relief mechanism as req. by TCEQ; vent hood doesn't extend below screen and allows for wind blown rain and contaminants to enter tank - replace. Verify size of vent - may need to be increased.
Tank Structure and Roof Slope	2	50%	1.00	Rehabbed in 2014. Exist. roof hatches don't meet AWWA/OSHA req. for size - replace during next rehab. Minor corrosion on interior - monitor for future tank coating. No sample tap observed - rec. installing. Soil against tank can accelerate corrosion of tank floor and base plate - recomm. addressing site drainage to drain away from tank and keep soil 6" below top of foundation per
Instrumentation and SCADA	4	10%	0.40	Tank does not include any level instrumentation. Level of the tank is based on the level signal for GST#2.
Tank Overflow	2	10%	0.20	Exterior water level indicator does not work.
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	2.60	
Condition Rating	-	-	**2.60**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	5	100%	5.00	Connections: 2520
Criticality Rating	-	100%	**5.00**	**Very High**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	**2.60**	**5.00**	**7.60**	**Extreme Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Elmo Davis GST #2

Inspection Date: 7/19/2017

Facility Information	
Address:	29035 Dapper Dan Dr Fair Oaks Ranch, TX 78015
Year in Service:	1987, Rehab 2004
Type of Facility:	Steel GST
Capacity (MG):	0.5
Overflow Elevation:	1460.0
Diameter (feet):	60
Monitoring:	-
Tank Entry Point:	Roof Hatch & Access Manway

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	5	20%	1.00	Tank has above ground PVC fill line. UV rays degrade PVC - Rec. replacing with DIP. Recoat rusted/uncoated pipe. Vent doesn't have pressure relief mechanism as req. by TCEQ; vent hood doesn't extend below screen and allows for wind blown rain and contaminants to enter tank - replace. Verify size of
Tank Structure and Roof Slope	2	50%	1.00	~~Rehabbed in 2004, isolated gen'l. corrosion on exterior of tank - small areas~~ should be prepared and over coated to arrest corrosion and prevent further damage to existing coating. No sample tap observed - rec. installing. Exist. roof hatches don't meet AWWA/OSHA regulations for size - replace during next ~~rehab. Minor corrosion on interior - monitor for future maintenance of tank~~
Instrumentation and SCADA	2	10%	0.20	
Tank Overflow	2	10%	0.20	Overflow from tank appears to drain to private property. Evaluate impacts to private property during an event.
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	2.40	
Condition Rating	-	-	2.40	Fair

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	5	100%	5.00	Connections: 2520
Criticality Rating	-	100%	5.00	Very High

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	2.40	5.00	7.40	High Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant #2 GST #1

Inspection Date: 7/20/2017

Facility Information	
Address:	28129 Royal Ascot Dr Fair Oaks Ranch, TX 78015
Year in Service:	1979, Rehab 2004
Type of Facility:	Steel GST
Capacity (MG):	0.35
Overflow Elevation:	1457.0
Diameter (feet):	63
Monitoring:	-
Tank Entry Point:	Roof Hatch & Access Manway

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	3	20%	0.60	Rec. coating of inlet/outlet piping and fittings that are not coated. Vent doesn't have a pressure relief mechanism as req. by TCEQ. Existing roof hatches don't meet AWWA/OSHA regulations for size - replace during next rehab.
Tank Structure and Roof Slope	2	50%	1.00	Minor ponding on roof slope. Minor corrosion on interior - monitor for future maintenance of tank coatings. No sample tap observed - rec. installing. Steel ring around tank allows water ponding and traps soil against tank which can accelerate corrosion of the tank floor and base plate. Recommend addressing site drainage to drain away from the tank and keep soil 6" below top of
Instrumentation and SCADA	2	10%	0.20	
Tank Overflow	2	10%	0.20	Mechanical level indicator not working - open hole on top of tank. Rec. adding boot/sealer to close. Overflow structure and drain piping may be undersized (overflows to private prop.) Not clear where drainage pipe for overflow drain to. Configuration of overflow flap valve may not allow for positive closure after an event.
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	2.00	
Condition Rating	-	-	2.00	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	3.00	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	2.00	3.00	5.00	Moderate Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant #2 GST #2

Inspection Date: 7/20/2017

Facility Information

Address:	28129 Royal Ascot Dr Fair Oaks Ranch, TX 78015
Year in Service:	1994, Rehab 2010
Type of Facility:	Steel GST
Capacity (MG):	0.15
Overflow Elevation:	1457.0
Diameter (feet):	41
Monitoring:	-
Tank Entry Point:	Roof Hatch & Access Manway

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	3	20%	0.60	Vent does not have a pressure/vacuum relief mechanism as req. by TCEQ, vent hood doesn't extend below screen and allows for wind blown rain and contaminants to enter the tank and should be replaced. Size of vent should be verified and may need to be increased. Existing roof hatches don't meet AWWA/OSHA for adeq. exfiltration rates and should be replaced during next rehab.
Tank Structure and Roof Slope	2	50%	1.00	for size - replace next rehab. Minor corrosion on interior - monitor for future tank coatings. No sample tap observed - rec. installing. Tree touching tank, rec. trim. City should confirm that filling of tanks can be controlled by the level in either tank if one tank is taken out of service.
Instrumentation and SCADA	4	10%	0.40	Tank does not include any level instrumentation. Level of the tank is based on the level signal for GST#1.
Tank Overflow	1	10%	0.10	Mechanical level indicator was not working - open hole on top of tank. Rec. adding boot/sealer to close. No visual level indicator req. by TCEQ. Install blind flange on tank drain. Overflow structure and drain piping may be undersized (overflows to private prop.) Not clear where drainage pipe flow overflow drains to. Configuration of overflow flap valve may not allow for positive closure after
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	2.10	
Condition Rating	-	-	2.10	Fair

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	3.00	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	2.10	3.00	5.10	Moderate Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant #3 GST #1

Inspection Date: 7/18/2017

Facility Information	
Address:	32078 Wild Oak Hill Fair Oaks Ranch, TX 78015
Year in Service:	Pre-1982, Rehab 2008
Type of Facility:	Steel GST
Capacity (MG):	0.35
Overflow Elevation:	1398.0
Diameter (feet):	63
Monitoring:	-
Tank Entry Point:	Roof Hatch & Access Manway

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	2	20%	0.40	
Tank Structure and Roof Slope	1.5	50%	0.75	Interior and exterior coating systems are protecting tank. Interior corrosion should be evaluated yearly. Tank does not have a nameplate. Need to seal opening where visual level indicator cable entered tank.
Instrumentation and SCADA	4	10%	0.40	
Tank Overflow	2	10%	0.20	Tank not have level sensor and cable visual system not in operation. Tank level cannot be observed/controlled indep. of tank No. 2. TCEQ req. tanks to have level gauge or be capable to observe water level. Overflows onto adjacent private property. Balancing between tanks Nos. 1&2 is completed through
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	1.75	
Condition Rating	-	-	1.75	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	1	100%	1.00	Connections: 370
Criticality Rating	-	100%	1.00	Very Low

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.75	1.00	2.75	Low Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant #3 GST #2

Inspection Date: 7/18/2017

Facility Information	
Address:	32078 Wild Oak Hill Fair Oaks Ranch, TX 78015
Year in Service:	1990, Rehab 2008
Type of Facility:	Steel GST
Capacity (MG):	0.15
Overflow Elevation:	1398.0
Diameter (feet):	41
Monitoring:	-
Tank Entry Point:	Roof Hatch & Access Manway

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	2	20%	0.40	Exposed PVC piping on inlet should be replaced with duct. Iron to avoid UV degradation of PVC. Coating exposed piping on inlet should be considered per TCEQ requirements.
Tank Structure and Roof Slope	1.5	50%	0.75	Interior and exterior coating systems are protecting tank. Interior corrosion should be evaluated yearly. Tank does not have nameplate. Coat and label chlorine solution lines per TCEQ requirements.
Instrumentation and SCADA	2	10%	0.20	
Tank Overflow	2	10%	0.20	Tank not have level sensor and cable visual system not in operation. Tank level cannot be observed/controlled indep. of tank No. 2. TCEQ req. tanks to have level gauge or be capable to observe water level. Overflows onto adjacent private property. Balancing between tanks Nos. 1&2 is completed through
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	1.55	
Condition Rating	-	-	1.55	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	1	100%	1.00	Connections: 370
Criticality Rating	-	100%	1.00	Very Low

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.55	1.00	2.55	Low Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant #4 GST

Inspection Date: 7/18/2017

Facility Information	
Address:	26365 Old Fredericksburg Rd Boerne, TX 78015
Year in Service:	1985
Type of Facility:	Fiberglass GST
Capacity (MG):	0.0225
Overflow Elevation:	1225.0
Diameter (feet):	16
Monitoring:	-
Tank Entry Point:	Roof Hatch & Access Manway

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	2	20%	0.40	Minor coating improvements on tank flanges, ladder, vales and appurtenances required. PVC overflow pipe may be coated to prevent degradation from UV exposure.
Tank Structure and Roof Slope	1.5	50%	0.75	Tank exterior was expressing some degradation and coating or rehabilitation may extend life of tank. Interior of tank was not accessible.
Instrumentation and SCADA	3	10%	0.30	Tank includes level electrodes.
Tank Overflow	2	10%	0.20	Tank mechanical level indicator was operational. Overflow pipe flap valve may be interpreted by TCEQ of not having proper air gap and can be inundated. Consider raising to provide air gap if required.
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	1.65	
Condition Rating	-	-	1.65	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	3.00	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.65	3.00	4.65	Moderate Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant #5 GST

Inspection Date: 7/18/2017

Facility Information	
Address:	9108 Jodhpur Dr Fair Oaks Ranch, TX 78015
Year in Service:	2006
Type of Facility:	Steel GST
Capacity (MG):	0.125
Overflow Elevation:	1339.0
Diameter (feet):	30
Monitoring:	-
Tank Entry Point:	Roof Hatch & Access Manway

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	1	20%	0.20	Not accessible during inspection.
Tank Structure and Roof Slope	1	50%	0.50	Tank doesn't have a nameplate. Tank baseplate/chime should be caulked to prevent water intrusion under tank floor. Corrosion profess. check/calibrate cathodic protection system yearly. Roof access and tank interior not accessible (exterior ladder needed extension ladder). Exterior coating in good condition.
Instrumentation and SCADA	1	10%	0.10	
Tank Overflow	1	10%	0.10	
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	0.90	
Condition Rating	-	-	**0.90**	**Very Good**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	5	100%	5.00	Connections: 1830
Criticality Rating	-	100%	**5.00**	**Very High**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	**0.90**	**5.00**	**5.90**	**High Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Elmo Davis Hydro Tank #1

Inspection Date:

Facility Information	
Address:	29035 Dapper Dan Dr Fair Oaks Ranch, TX 78015
Year in Service:	1977
Type of Facility:	Hydropneumatic Tank
Capacity (Gallons):	5,000
Overflow Elevation:	-
Diameter (feet):	6
Monitoring:	-
Tank Entry Point:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Mechanical-Piping, Hatches, Valves, Vents	2	20%	0.40	
Tank Structure and Roof Slope	1	50%	0.50	Tank recently rehabbed. Only minor corrosion on piping observed.
Instrumentation and SCADA	1	10%	0.10	
Tank Overflow	0	10%	0.00	
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	1.00	
Condition Rating	-	-	**1.00**	**Very Good**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Lift Station Risk Rating	**1.00**	**3.00**	**4.00**	**Low Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Elmo Davis Hydro Tank #2

Inspection Date:

Facility Information	
Address:	29035 Dapper Dan Dr Fair Oaks Ranch, TX 78015
Year in Service:	1977
Type of Facility:	Hydropneumatic Tank
Capacity (Gallons):	5,000
Overflow Elevation:	-
Diameter (feet):	6
Monitoring:	-
Tank Entry Point:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Mechanical-Piping, Hatches, Valves, Vents	2	20%	0.40	
Tank Structure and Roof Slope	1	50%	0.50	Tank recently rehabbed. Only minor corrosion on piping observed.
Instrumentation and SCADA	1	10%	0.10	
Tank Overflow	0	10%	0.00	
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	1.00	
Condition Rating	-	-	**1.00**	**Very Good**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Lift Station Risk Rating	**1.00**	**3.00**	**4.00**	**Low Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant 2 Hydro Tank #1

Inspection Date:

Facility Information	
Address:	28129 Royal Ascot Dr Fair Oaks Ranch, TX 78015
Year in Service:	1979
Type of Facility:	Hydropneumatic Tank
Capacity (Gallons):	5,000
Overflow Elevation:	-
Diameter (feet):	6
Monitoring:	-
Tank Entry Point:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	1	20%	0.20	
Tank Structure and Roof Slope	1	50%	0.50	
Instrumentation and SCADA	1	10%	0.10	
Tank Overflow	0	10%	0.00	
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	0.80	
Condition Rating	-	-	**0.80**	**Very Good**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	**0.80**	**3.00**	**3.80**	**Low Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant 2 Hydro Tank #2

Inspection Date:

Facility Information	
Address:	28129 Royal Ascot Dr Fair Oaks Ranch, TX 78015
Year in Service:	1979
Type of Facility:	Hydropneumatic Tank
Capacity (Gallons):	8,000
Overflow Elevation:	-
Diameter (feet):	8
Monitoring:	-
Tank Entry Point:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Mechanical-Piping, Hatches, Valves, Vents	1	20%	0.20	
Tank Structure and Roof Slope	1	50%	0.50	Site glass was insulated so couldn't observe.
Instrumentation and SCADA	1	10%	0.10	
Tank Overflow	0	10%	0.00	
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	0.80	
Condition Rating	-	-	**0.80**	**Very Good**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Population Served	3	100%	3.00	Connections: 1060
Criticality Rating	-	100%	**3.00**	**Moderate**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	**0.80**	**3.00**	**3.80**	**Low Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Plant #3 Hydro Tank #2

Inspection Date:

Facility Information	
Address:	32078 Wild Oak Hill Fair Oaks Ranch, TX 78015
Year in Service:	Pre-1982
Type of Facility:	Hydropneumatic Tank
Capacity (Gallons):	2,500
Overflow Elevation:	-
Diameter (feet):	6
Monitoring:	-
Tank Entry Point:	-

CONDITION ASSESSMENT				
Component Group	**Component Condition Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Mechanical-Piping, Hatches, Valves, Vents	1	20%	0.20	
Tank Structure and Roof Slope	2	50%	1.00	Exterior tank coating needs minor repairs. Interior was not evaluated.
Instrumentation and SCADA	1	10%	0.10	
Tank Overflow	0	10%	0.00	
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	1.30	
Condition Rating	-	-	**1.30**	**Good**

CRITICALITY ASSESSMENT				
Component Group	**Component Criticality Rating**	**Weight Factor**	**Weighted Component Rating**	**Comments**
Population Served	1	100%	1.00	Connections: 370
Criticality Rating	-	100%	**1.00**	**Very Low**

RISK BASED ASSESSMENT				
	Condition Rating	**Criticality Rating**	**Overall Risk Rating**	**Risk Category**
Lift Station Risk Rating	**1.30**	**1.00**	**2.30**	**Low Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

WWTP Lift Station (Upper)

Inspection Date: 7/19/2017

Facility Information

Address:	29749 No Lehace Dr Fair Oaks Ranch, TX 78015
Year in Service:	1995
Type of Facility:	Duplex Submersible Lift Station
Number of Pumps:	2
Capacity (gpm):	-
Horsepower:	-
Monitoring:	-
Generator:	Generator

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	2	20%	0.40	
Pumps and Motors	2	20%	0.40	Both pumps come on during peak flows; Evaluate capacity vs. flow for expansion to require redundant pump. Pumps were last replaced in 1995 and the valves in 1993. Pumps equipped with VFD's.
Instrumentation - SCADA, alarms	2	15%	0.30	lift Station connected to Plant SCADA
Structure - Wet Well, Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	2	20%	0.40	Safety rails and other improvements need to be considered at platform used to pull pumps. Verify strength of guard rail with corroded attachment hardware to concrete.
Piping and Valves	3	15%	0.45	Coating improvements to pumps, piping, electrical components, pump hoist frame, etc. is recommended to prolong life of assets
Site - Drainage, Access Drive, Security, Fencing	1	10%	0.10	
Total Inspection Score	-	100%	2.05	
Condition Rating	-	-	2.05	Fair

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Environmentally Sensitive Areas	1	25%	0.25	
Population Served	5	50%	2.50	
High Impact Areas	4	25%	1.00	
Criticality Rating	-	100%	3.75	High

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	2.05	3.75	5.80	High Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Setterfeld Lift Station

Inspection Date: 7/19/2017

Facility Information	
Address:	30276 Setterfeld Cir Fair Oaks Ranch, TX 78015
Year in Service:	2013
Type of Facility:	Duplex Submersible Lift Station
Number of Pumps:	2
Capacity (gpm):	-
Horsepower:	5
Monitoring:	SCADA
Generator:	Quick Connect for Generator

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	1	20%	0.20	Equipment in very good condition. Includes a quick connect with two breakers mechanically interlocked.
Pumps and Motors	1	20%	0.20	
Instrumentation - SCADA, alarms	1	15%	0.15	Lift station locally operated based on 4 level floats in the wet well.
Structure - Wet Well, Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	1	20%	0.20	Consider improved insulation to mitigate corrosion under insulation (CUI).
Piping and Valves	1	15%	0.15	Piping was insulated so couldn't inspect all of it. Minor coating improvements are recommended to piping. Piping should be painted color and labeled as required by the TCEQ.
Site - Drainage, Access Drive, Security, Fencing	1	10%	0.10	
Total Inspection Score	-	100%	1.00	
Condition Rating	-	-	1.00	Very Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Environmentally Sensitive Areas	5	25%	1.25	
Population Served	1	50%	0.50	
High Impact Areas	3	25%	0.75	
Criticality Rating	-	100%	2.50	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.00	2.50	3.50	Low Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Deer Meadows Lift Station #2

Inspection Date: 7/19/2017

Facility Information

Address:	8206 High Cliff Dr Fair Oaks Ranch, TX 78015
Year in Service:	2002
Type of Facility:	Duplex Submersible Lift Station
Number of Pumps:	2
Capacity (gpm):	-
Horsepower:	10
Monitoring:	SCADA
Generator:	No Generator

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	2.5	20%	0.50	Recommend adding a quick connection for a portable generator. Also recommend placing exposed service entrance cables to disconnect in conduit (either rigid or flexible) to provide protection.
Pumps and Motors	2	20%	0.40	Pumps, piping, and valves may be coated to extend late and mitigate general corrosion.
Instrumentation - SCADA, alarms	1	15%	0.15	
Structure - Wet Well, Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	1	20%	0.20	Wood fence should be maintained with paint or stain to prolong life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Piping and Valves	2	15%	0.30	Piping was insulated and limited area available for observation. Piping inside of wet well exhibits corrosion and should be monitored for rehabilitation.
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	
Total Inspection Score	-	100%	1.75	
Condition Rating	-	-	1.75	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Environmentally Sensitive Areas	4	25%	1.00	
Population Served	1	50%	0.50	
High Impact Areas	4	25%	1.00	
Criticality Rating	-	100%	2.50	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.75	2.50	4.25	Low Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Deer Meadows Lift Station #1

Inspection Date: 7/19/2017

Facility Information

Address:	8622 Delta Dawn Ln Fair Oaks Ranch, TX 78015
Year in Service:	Mid-Late 90s
Type of Facility:	Duplex Submersible Lift Station
Number of Pumps:	2
Capacity (gpm):	-
Horsepower:	-
Monitoring:	SCADA
Generator:	Quick Connect for Generator

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	3	20%	0.60	Recommend adding a quick connection for a portable generator. Also recommend placing exposed service entrance cables to disconnect in conduit (either rigid or flexible) to provide protection.
Pumps and Motors	2	20%	0.40	Pumps, piping, and valves may be coated to extend late and mitigate general corrosion.
Instrumentation - SCADA, alarms	1	15%	0.15	
Structure - Wet Well, Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	1	20%	0.20	Wood fence should be maintained with paint or stain to prolong life. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Piping and Valves	2	15%	0.30	Piping was insulated and limited area available for observation. Piping inside of wet well exhibits corrosion and should be monitored for rehabilitation.
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	
Total Inspection Score	-	100%	1.85	
Condition Rating	-	-	1.85	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Environmentally Sensitive Areas	4	25%	1.00	
Population Served	1	50%	0.50	
High Impact Areas	4	25%	1.00	
Criticality Rating	-	100%	2.50	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.85	2.50	4.35	Low Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

The Falls Lift Station

Inspection Date: 7/19/2017

Facility Information	
Address:	55 Falls Terrace Fair Oaks Ranch, TX 78015
Year in Service:	Early 90s
Type of Facility:	Duplex Submersible Lift Station
Number of Pumps:	2
Capacity (gpm):	-
Horsepower:	-
Monitoring:	SCADA
Generator:	Quick Connect for Generator

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	4.5	20%	0.90	City noted that most issues with this pump station are related to the electrical provider. Recommend relocating electrical panels facing canopy in order to maintain minimum required Code clearance.
Pumps and Motors	3	20%	0.60	
Instrumentation - SCADA, alarms	3	15%	0.45	Lift station locally operated based on 4 level floats in the wet well.
Structure - Wet Well, Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	1	20%	0.20	Gaps under chain link fence need to be addressed. City noted I&I contributing to this lift station and can struggle to meet demand during rain events.
Piping and Valves	1	15%	0.15	Piping inside of wet well exhibits corrosion and should be monitored for rehabilitation.
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	
Total Inspection Score	-	100%	2.50	
Condition Rating	-	-	**2.50**	**Fair**

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Environmentally Sensitive Areas	4	25%	1.00	
Population Served	1	50%	0.50	
High Impact Areas	4	25%	1.00	
Criticality Rating	-	100%	**2.50**	**Moderate**

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	**2.50**	**2.50**	**5.00**	**Moderate Risk**

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

The School Lift Station

Inspection Date: 7/19/2017

Facility Information	
Address:	28843 Ralph Fair Rd Fair Oaks Ranch, TX 78015
Year in Service:	1990's
Type of Facility:	Duplex Submersible Lift Station
Number of Pumps:	2
Capacity (gpm):	-
Horsepower:	8
Monitoring:	SCADA
Generator:	Quick Connect for Generator

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	3.5	20%	0.70	Lightning protection issues, corrosion shown on control panel supports and hardware.
Pumps and Motors	1	20%	0.20	Pumps, piping, and valves may be coated to extend late and mitigate general corrosion.
Instrumentation - SCADA, alarms	2	15%	0.30	Includes Level floats and SCADA Cabinet was installed within the last 3 years
Structure - Wet Well, Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	1	20%	0.20	Restretch barbed wire on top of fence and backfill gaps under fence. Freezing is an issue - rec. wood privacy fence to decrease the chance of freezing. Improved insulation system may be provided to prevent accelerated corrosion under insulation (CUI).
Piping and Valves	2	15%	0.30	Piping was insulated and limited area available for observation. Piping inside of wet well exhibits corrosion and should be monitored for rehabilitation.
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	
Total Inspection Score	-	100%	1.90	
Condition Rating	-	-	1.90	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Environmentally Sensitive Areas	5	25%	1.25	
Population Served	1	50%	0.50	
High Impact Areas	5	25%	1.25	
Criticality Rating	-	100%	3.00	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.90	3.00	4.90	Moderate Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Bottom of the Hill Lift Station

Inspection Date: 7/19/2017

Facility Information	
Address:	29749 No Lehace Dr Fair Oaks Ranch, TX 78015
Year in Service:	2017
Type of Facility:	Duplex Submersible Lift Station
Number of Pumps:	2
Capacity (gpm):	-
Horsepower:	-
Monitoring:	No SCADA
Generator:	No Generator

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	1	20%	0.20	Lift station recently installed in the last year.
Pumps and Motors	1	20%	0.20	Pumps replaced in 2017 and wetwell recoated in 2008. City indicated no issues with lift station. Pumps equipped with VFD's.
Instrumentation - SCADA, alarms	1	15%	0.15	City should verify that audio/visual alarms are enabled.
Structure - Wet Well, Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	2	20%	0.40	Minor structural repairs are recommended at exposed exterior wet well rebar. Recommend filling around wet well to prevent water draining towards structure.
Piping and Valves	3	15%	0.45	Recommend coating and labeling discharge piping per TCEQ standards. Rec. coating vent pipe to prolong life. Rec. more stable and permanent pipe support for by-pass check valve (Safety issue).
Site - Drainage, Access Drive, Security, Fencing	2	10%	0.20	
Total Inspection Score	-	100%	1.60	
Condition Rating	-	-	1.60	Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Environmentally Sensitive Areas	4	25%	1.00	
Population Served	5	50%	2.50	
High Impact Areas	4	25%	1.00	
Criticality Rating	-	100%	4.50	Very High

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.60	4.50	6.10	High Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Blackjack Chlorine Station

Inspection Date: 7/19/2017

Facility Information	
Address:	30499 Fairway Run Fair Oaks Ranch, TX 78015
Year in Service:	-
Type of Facility:	Chlorination Station
Number of Pumps:	1
Capacity (gpm):	-
Horsepower:	-
Monitoring:	-
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	2	20%	0.40	
Pumps and Motors	1	20%	0.20	
Instrumentation - SCADA, alarms	2	15%	0.30	Site doesn't include SCADA monitoring , but visited several times a week by operators.
Structure - Wet Well, Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	1	20%	0.20	
Piping and Valves	1	15%	0.15	
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	1.25	
Condition Rating	-	-	1.25	Very Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Environmentally Sensitive Areas	5	25%	1.25	
Population Served	1	50%	0.50	
High Impact Areas	5	25%	1.25	
Criticality Rating	-	100%	3.00	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.25	3.00	4.25	Low Risk

City of Fair Oaks Ranch
Water and Wastewater Master Plan
Risk Based Assessment

Live Oak Chlorine Station

Inspection Date: 7/19/2017

Facility Information

Address:	7548 Fair Oaks Parkway Fair Oaks Ranch, TX 78015
Year in Service:	-
Type of Facility:	Chlorination Station
Number of Pumps:	1
Capacity (gpm):	-
Horsepower:	-
Monitoring:	-
Generator:	-

CONDITION ASSESSMENT

Component Group	Component Condition Rating	Weight Factor	Weighted Component Rating	Comments
Electrical – MCC, Back-up Power, Cables	2	20%	0.40	
Pumps and Motors	1	20%	0.20	
Instrumentation - SCADA, alarms	2	15%	0.30	Site doesn't include SCADA monitoring , but visited several times a week by operators.
Structure - Wet Well, Hatches, Corrosion, Cracks, Leaking, Ventilation, Odor Control	1	20%	0.20	
Piping and Valves	1	15%	0.15	
Site - Drainage, Access Drive, Security, Fencing	0	10%	0.00	
Total Inspection Score	-	100%	1.25	
Condition Rating	-	-	1.25	Very Good

CRITICALITY ASSESSMENT

Component Group	Component Criticality Rating	Weight Factor	Weighted Component Rating	Comments
Environmentally Sensitive Areas	5	25%	1.25	
Population Served	1	50%	0.50	
High Impact Areas	5	25%	1.25	
Criticality Rating	-	100%	3.00	Moderate

RISK BASED ASSESSMENT

	Condition Rating	Criticality Rating	Overall Risk Rating	Risk Category
Lift Station Risk Rating	1.25	3.00	4.25	Low Risk