

WATER MASTER PLAN

AUGUST 2021

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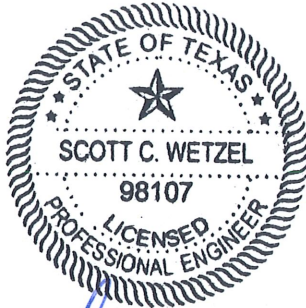
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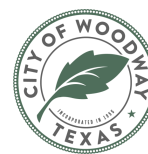
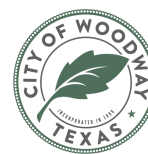


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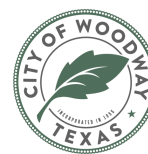


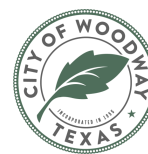
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1 INTRODUCTION

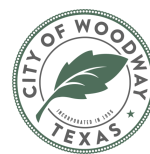
1.1 GENERAL

The purpose of this master plan is to identify the changing needs of the City of Woodway's water system and to recommend a Capital Improvement Program (CIP) to satisfy these needs for the next 20 years. This study is an overview of the major components of the water supply, distribution, pumping capacities, and storage systems for the City of Woodway. A hydraulic system model based on growth projections has been developed and is incorporated into this study to adequately assess the existing system and proposed future improvements. The CIP portion of the plan provides Woodway with a compilation of the recommended improvements needed for continued service to its residents and allows the City to budget the capital required to finance the improvements. This study is intended to assist Woodway in maintaining compliance with applicable Texas Commission on Environmental Quality (TCEQ) rules and regulations. This study also provides opinions of cost and scheduling for the improvements required to provide a safe and reliable water system.

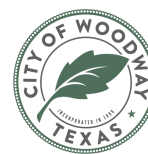
1.2 ABBREVIATIONS

Table 1-1. Abbreviations

Abbreviation	Definition
ADD	Average Day Demand
CCN	Certificate of Convenience and Necessity
CIP	Capital Improvements Program
EPS	Extended Period Simulation
ETJ	Extraterritorial Jurisdiction
GAL	Gallons
GIS	Geographic Information System
GPCD	Gallons per Capita per Day
GPD	Gallons per Day



Abbreviation	Definition
GPM	Gallons per Minute
GST	Ground Storage Tank
HGL	Hydraulic Grade Line
HP	Horsepower
LF	Linear Feet
MCL	Maximum Contaminate Level
MDD	Maximum Day Demand
MG	Million Gallons
MGD	Million Gallons per Day
MG/L	Milligrams per Liter
PDSI	Palmer Drought Severity Index
PF	Peaking Factor
PHD	Peak Hour Demand
PRV	Pressure Reducing Valve
PS	Pump Station
PSI	Pounds per Square Inch
PSV	Pressure Sustaining Valve
PVC	Polyvinyl Chloride
SCADA	Supervisory Control and Data Acquisition
TCEQ	Texas Commission on Environmental Quality
TWDB	Texas Water Development Board
WAGAM	Northern Trinity and Woodbine Aquifers Groundwater Availability Model
WCID	Water Control and Improvement District
WSC	Water Supply Corporation
WWTP	Wastewater Treatment Plant



2 EXISTING WATER SYSTEM

2.1 GENERAL

The existing water distribution system is portioned into six distinct pressure planes named Tater Hill, Business Acres, Acorn, Highway 84, Bosque and Santa Fe. Each pressure plane has its own groundwater plant with well pump, ground storage tank, pressure vessel, and distribution system pump station. All pressure planes operate independently and are isolated from each other except for the Acorn and Bosque pair that are interconnected at various points along Estates Dr., and the Santa Fe and Business Acres pair that are interconnected along Highway 84.

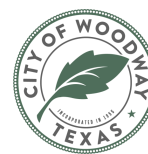
To supplement the water supply, the City of Woodway also purchases treated surface water from the City of Waco. There are 10 Pressure Reducing Valves (PRVs) located throughout the distribution system to assist in controlling water line pressures. A map of the existing water system is provided, Exhibit 1, City of Woodway Existing Water System. A more detailed description of each facility is provided in this study.

2.2 GROUNDWATER SUPPLY

The City of Woodway obtains 50% or more of their water supply from six (6) groundwater wells. Figure 2-1 shows the location of these wells and Table 2-1 illustrates their capacity.

Table 2-1. Groundwater Supply per City of Woodway Pressure Plane

Pressure Plane	Plant	Well Pump (HP)	GPM
1	Tater Hill	250	500 GPM
2	Business Acres	225	500 GPM
3	Acorn	200	540 GPM
4	Highway 84	200	480 GPM
5	Bosque	200	540 GPM
6	Santa Fe	117	240 GPM



2.3 WACO INTERCONNECTIONS

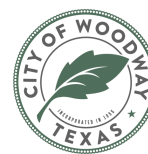
The City of Waco sells treated surface water from Lake Waco to several communities in McLennan County, including the City of Woodway. Historically, City of Woodway has had eight (8) separate interconnections to the City of Waco system. However, only four of them are normally open, the Wickson Rd connection, the Sunn Dr. double metered connection, the American Plaza connection and the Delhi Rd. connection. The Bosque Blvd and Broad Avenue connections are normally closed but are opened during unusually large demands. The Bush Industrial Park and Ritchie Rd. connections are no longer in service. The City of Woodway has currently contracted with the City of Waco for up to 365 million gallons per year of treated water for wholesale or retail sale.

Table 2-2. City of Woodway Interconnections with the City of Waco System

Pressure Plane Serviced	Pressure Plane Name	Connection	Size of Metered Connection	Contracted (GPM)	Contracted (MGD)	Normal Position
1	Tater Hill	Wickson	6"	800	1.152	Open
2	Business Acres	Broad Avenue	6"	800	1.152	Closed
4	Highway 84	Sunn	3" and 4"	800	1.152	Open
5 & 6	Bosque/ Santa Fe	Bosque	6"	800	1.152	Closed
6	Santa Fe	American Plaza	6"	800	1.152	Open
6	Santa Fe	Delhi	6"	200	0.288	Open

2.4 PUMP STATION FACILITIES

The City of Woodway currently operates 6 pump stations to maintain the pressure of the transmission lines at proper operating levels and to provide adequate supply to consumers in



the system. Table 2-3 summarizes the pump station capacities provided by the City of Woodway.

Table 2-3. Service Pump Station Capacity per City of Woodway Pressure Plane

Pressure Plane	Pump Station	Pumps	Flow (GPM)	Total Capacity (GPM)	Firm Capacity (GPM)
1	Tater Hill	1 @ 60 HP	1,670	3,840	2,170
		1 @ 60 HP	1,670		
		1 @ 25 HP	500		
2	Business Acres	1 @ 125 HP	1,450	5,080	3,630
		1 @ 125 HP	1,450		
		1 @ 125 HP	1,450		
		1 @ 50 HP	730		
3	Acorn	1 @ 40 HP	500	1,000	500
		1 @ 40 HP	500		
4	Highway 84	1 @ 50 HP	1,100	2,200	1,100
		1 @ 50 HP	1,100		
5	Bosque	1 @ 40 HP	500	2,150	1,325
		1 @ 60 HP	825		
		1 @ 60 HP	825		
6	Santa Fe	1 @ 40 HP	650	1,950	1,300
		1 @ 40 HP	650		
		1@ 40 HP	650		
Totals				17,420	11,085

2.5 WATER STORAGE FACILITIES

The City of Woodway system operates seven (7) ground storage tanks distributed among the six groundwater plants. Each groundwater plant operates with one aboveground storage tank, except for Acorn Pump Station which operates with one aboveground and one underground storage tank. Table 2-4. Ground Storage Tank Capacity per City of Woodway Pressure Plane summarizes the ground storage tank capacity provided at the City of Woodway facilities.

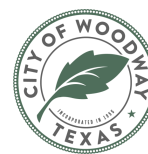


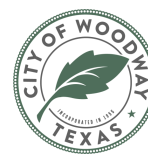
Table 2-4. Ground Storage Tank Capacity per City of Woodway Pressure Plane

Pressure Plane	Location	Existing Storage	
		Type	(MG)
1	Tater Hill	Aboveground	2.000
2	Business Acres	Aboveground	1.000
3	Acorn	1 Aboveground and 1 Underground	0.480
4	Hwy 84	Aboveground	2.700
5	Bosque	Aboveground	1.500
6	Santa Fe	Aboveground	1.000
		Totals	8.680

Each groundwater plant also provides a hydropneumatic pressure tank that maintains pressure in the distribution system when the service pumps are off. Table 2-5 shows the hydropneumatic pressure tank capacity provided at the City of Woodway pump station facilities.

Table 2-5. Hydropneumatic Pressure Tank Capacity per City of Woodway Pressure Plane

Pressure Plane	Location	Existing Hydropneumatic Pressure Tank Volume (Gal)
1	Tater Hill	32,000
2	Business Acres	20,000
3	Acorn	10,000
4	Hwy 84	16,000
5	Bosque	17,000
6	Santa Fe	13,000
	Totals	108,000



2.6 MAINTENANCE AND RENEWAL PROJECTS

The City of Woodway is actively replacing 2-inch and 4-inch water lines in the distribution system. These improvements are conducted as the City's budget and opportunity warrant. This water study does not include the identification of maintenance upgrades. In addition, the life cycle of well pumps, pumps, valves and other water system inventory is not reviewed herein nor identified for improvements.

2.7 FIRE PROTECTION

One of the goals of a water distribution system is to provide adequate capacity to fight fires. During the evaluation of Woodway's water system, CP&Y conducted a review of the volume and capacity of the system to meet current TCEQ requirements. TCEQ requires a minimum residual pressure of 20 psi be maintained throughout the system while delivering the fire flow demand. CIP projects were identified where either capacity alone or volume and capacity combined were not sufficient.

Table 2-6. City of Woodway Minimum Fire Flow Requirements

Area	Minimum Flow
Heavy commercial and industrial areas	3,000 GPM
Light commercial areas	1,500 GPM
High density residential areas	750 GPM
Low density residential areas	500 GPM

2.8 STANDBY POWER

Currently the City has standby power generators at each of their water plants that are designed to operate the existing high service water booster pumps. The existing ground water well pumps are not equipped with standby power generators nor are they connected to the existing generators. Although not specifically identified or evaluated herein, the City should evaluate the capacity of the existing standby power generators to also power the ground water well



pumps and what additional electrical equipment and controls would be necessary to provide standby power generation for the well pumps, and whether that could be accomplished with the existing standby power generators or whether it would require additional generator capacity. Also, the City of Woodway does have the ability to switch over to receive water from the City of Waco, as long as Waco maintains power to deliver water to the City of Woodway.

Service Pump Station Capacity per City of Woodway Pressure Plane

Pressure Plane	Pump Station	Pumps	Flow (GPM)	Storage Tank Capacity (MG)
1	Tater Hill	1 @ 60 HP	1,670	2.00
		1 @ 60 HP	1,670	
		1 @ 25 HP	500	
2	Business Acres	1 @ 125 HP	1,450	1.00
		1 @ 125 HP	1,450	
		1 @ 125 HP	1,450	
		1 @ 50 HP	730	
3	Acorn	1 @ 40 HP	500	0.48
		1 @ 40 HP	500	
4	Highway 84	1 @ 50 HP	1,100	2.70
		1 @ 50 HP	1,100	
5	Bosque	1 @ 40 HP	500	1.50
		1 @ 60 HP	825	
		1 @ 60 HP	825	
6	Santa Fe	1 @ 40 HP	650	1.00
		1 @ 40 HP	650	
		1 @ 40 HP	650	

PRESSURE PLANE
LEGEND

ACORN

BOSQUE

BUSINESS ACRES

HWY 84

SANTA FE

TATER HILL

PIPE LEGEND

2W

EXISTING 2" WATERLINE

4W

EXISTING 4" WATERLINE

6W

EXISTING 6" WATERLINE

8W

EXISTING 8" WATERLINE

10W

EXISTING 10" WATERLINE

12W

EXISTING 12" WATERLINE

14W

EXISTING 14" WATERLINE

16W

EXISTING 16" WATERLINE

WOODWAY CITY LIMIT

811

Know what's below.
Call before you dig.

05001000

0

500

1000

2000

(IN FEET)

KEY PLAN

CITY OF WOODWAY

2021 WATER MASTER PLAN

WOODWAY, TX

DATE	ISSUED FOR

CP&Y

CP&Y, INC.

TEXAS REGISTERED
ENGINEERING FIRM
F-1741

PROJ. # COWO1900076	PM: SCW
CK. BY: DLM	DN. BY: CDG

EXISTING SYSTEM
MAP

North

1



3 POPULATION DATA

3.1 GENERAL

In assessing the viability of the City's water system into the future, it is important to know historic growth trends for the area and projected population growth rates. Historical City of Woodway population data was obtained from the U.S. Census Bureau, and projected population data was taken from the Texas Water Development Board (TWDB) Regional Population Projections. The TWDB information contains data projections out to the year 2070. The limits of this study is to the year 2040.

3.2 SERVICE AREA

The City of Woodway's service area for water is defined by their two CCNs (Certificate of Convenience and Necessity) held by the State. Woodway has two types of CCNs. One is a boundary CCN, which mostly parallels the city limit line. The other is a line CCN which covers seven separate water lines that lie beyond the CCN boundary borders. The total service area for the City of Woodway is approximately 4,400 acres or almost seven square miles and is shown on Figure 3-1.

3.3 HISTORIC POPULATION

The City of Woodway contains a mix of heavy and light commercial and industrial areas, along with both high and low density residential areas. However, the primary land use of Woodway can be described as single family use. Development of industry and businesses in nearby cities has contributed to the City of Woodway's ability to remain primarily residential with neighboring industrial parks and shopping areas providing jobs and services to the area. The City of Woodway is bordered primarily by the City of Waco, limiting the growth potential of the City.

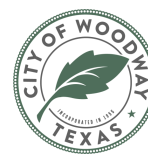


Figure 3-1. City of Woodway CCN Map



Approximately 80% of the land area within the City of Woodway's city limits is developed. Most of the remaining undeveloped 20% is located in the northern and western portions of the City. Approximately half of this undeveloped land is located close to Lake Waco where the terrain varies greatly. This area, when developed, will most likely be low density, single family residential. The southern undeveloped lands can be a mix of residential commercial and industrial uses.

Continued growth along the US Highway 84 corridor has increased commercial and industrial land uses. These businesses are vital to the City to help support the tax base and to assist in development and maintenance of a strong utility infrastructure.



Historical population data, based upon U.S. Census Data, is shown below on Table 3-1.

Table 3-1. City of Woodway Historic Population

Year	Population	% Increase
1955	250	-
1960	1,244	398%
1970	4,819	287%
1980	7,091	47%
1990	8,517	20%
2000	8,363	(2%)
2010	8,460	1%
2016	8,699	3%

The City of Woodway has maintained a stable population over the past 25 years.

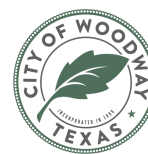
3.4 POPULATION PROJECTIONS

Population projections have been obtained from the TWDB as part of the regularly updated State Water Plan. Projections are produced regionally and provide populations through the year 2070. However, for this study, only data to the year 2040 will be used to coincide with the water master planning period. A summary of these projections is shown in the Table 3-2.

Population Projection Estimated by TWDB.

Table 3-2. Population Projection Estimated by TWDB

Year	Population Projections	Population Growth
2020	9,045	-
2030	9,762	717
2040	10,396	634
2050	11,033	637
2060	11,669	636
2070	12,292	623



As seen in Table 3-2, the increase in population between 2020 and 2030 is estimated to be 717 people. CP&Y has identified various new residential developments in the City of Woodway service area which appear to indicate the TWDB projects to be low. Most notably, the Western Star development between Poage and Harbor Dr. with 115 lots and the WDA/Tanglewood development along Old McGregor Rd. with 150 lots in the first phase and 258 lots in the second phase.

Assuming one connection meter per lot and 4 people per lot, the growth in these developments significantly exceed the TWDB growth projections. Table 3-3 summarizes the adjusted population projections that take into account the identified developments and the TWDB projections. These adjusted population projections will be used to calculate the projected water demands in this study.

Table 3-3. Adjusted Population Projection Using Residential Lot Development

Year	Population Projections	Population Growth	Residential Connection Growth
2020	9,045	-	-
2030	10,524	1,479	338
2040	11,810	1,286	276



4 WATER DEMANDS

4.1 GENERAL

The City of Woodway's Water Master Plan primary focus is on the water distribution system with an overview of the supply system to assess their adequacy.

The demands utilized to evaluate the performance of Woodway's water system include:

- Average Day Demand (ADD): Annual total water usage divided by 365 days.
- Maximum Day Demand (MDD): Highest usage in the system within any given 24-hour period.
- Peak Hour Demand (PHD): Highest usage in the system within any given one-hour period during the day.

Average day and maximum day water demand were calculated using data provided by the City of Woodway. The City provided daily water production per pressure plane as well as daily water purchased per active connection in the City of Waco system. The data comprehended the period from January 2019 to December 2020. The data was scrubbed of outliers by removing data that exceeded the average by at least three times the standard deviation.

Typically, maximum day demand is 2.0 to 4.0 times the average day demand with peak hour demand normally 3.0 to 5.0 times the average day demand. The data set analyzed determined the maximum day water demand to be between 2.3 and 3.9 times the average day water demand depending on the pressure plane. Hourly water demand data was not available, therefore, the TCEQ recommended peaking factor of 1.85 was used to calculate peak hour water demand from maximum day demand ($PHD = 1.85 \text{ MDD}$ as per TAC 290.38 (60)).

Water requirements in Central Texas are typically highest in the summer periods when additional water is required for landscape watering when rainfall is limited and evaporation is at its highest. Weather patterns for the year greatly affect water usage. Dry years can push



water usage up by more than 30 percent over average historical usage. Therefore, water systems should strive to have reserve capacity built in to allow for demands during exceptionally dry periods. Table 4-1 shows the City of Woodway monthly water usage records for the 2-year time period utilized for this report's analysis. Table 4-2 depicts the average day, maximum day, and peak hour demands for 2019 through 2020.

4.2 HISTORICAL WATER DEMANDS

As the State of Texas and the U.S. continue to grow, the use of water becomes more and more regulated. Most studies show that most western states do not have enough available water at some point in the future. Conservation policies and water use restrictions have been implemented in various cities in Texas during periods of drought.

Currently, Texas cities use an average of 130 gallons per capita per day (GPCD), and Region G has a median usage of 166 GPCD and an average usage of 126 GPCD. This information is based on the published TWDB 2019 GPCD Data by Region and Utility. The City of Woodway's water use, however, is significantly above average. From 2019 to 2020, the average usage was approximately 261 GPCD. These higher usage rates have been historically attributed to landscape maintenance and recreational use. This value, 261 GPCD, was used together with the population projections described in Section 3.4 to calculate projected water demands.

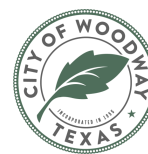


Table 4-1. Monthly City of Woodway Water Usage from 2019 to 2020

2019 Water Usage				
Month	Woodway Well Water	Water from Waco	Total Consumption	Average Day (MGD)
January	23,675,000	20,788,400	44,463,400	1.4
February	22,898,000	16,303,914	39,201,914	1.6
March	24,494,000	25,093,000	49,587,000	1.6
April	16,854,000	32,860,000	49,714,000	1.4
May	15,424,000	38,303,972	53,727,972	1.6
June	31,590,000	36,501,300	68,091,300	2.4
July	53,204,000	54,718,800	107,922,800	3.0
August	65,447,000	63,849,800	129,296,800	4.1
September	54,460,000	61,373,200	120,376,000	3.9
October	36,051,000	47,444,300	83,495,300	2.9
November	20,455,000	28,263,000	48,718,000	1.9
December	29,185,000	18,095,100	47,280,100	1.6
Total	393,737,000	443,594,786	841,874,586	AVG 2.3
2020 Water Usage				
Month	Woodway Well Water	Water from Waco	Total Consumption	Average Day(MGD)
January	20,995,000	26,151,400	47,146,400	1.5
February	21,645,000	22,503,500	44,148,500	1.5
March	20,036,000	26,055,200	46,091,200	1.5
April	21,610,000	26,514,700	48,124,700	1.6
May	28,676,000	40,655,300	69,331,300	2.2
June	61,741,000	43,457,300	105,198,300	3.5
July	62,542,000	52,096,500	114,638,500	3.9
August	70,251,000	66,148,300	136,399,300	4.5
September	35,034,000	46,971,100	82,005,100	2.7
October	37,365,000	47,037,000	84,402,000	2.8
November	47,299,000	24,583,200	71,882,200	2.4
December	41,326,000	19,904,401	61,230,401	2.0
Total	630,982,000	681,028,686	910,597,901	AVG 2.5

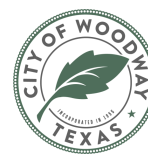


Table 4-2. Summary of Average, Maximum Day and Peak Hour Demands for the City of Woodway System from 2019-2020

2019									
Pressure Plane	Connect.	Well Water (MG)	Purchased Water (MG)	Total Water Use (MG)	Avg Day (MGD)	ADD/Conn. (gal/conn.)	Max Day (MGD)	MDD/Conn. (gal/conn.)	Calc. Peak Hour (MGD)
Tater Hill	1116	66	193	260	0.712	638	1.848	1,656	3.419
Business Acres	119	76	-	76	0.210	1,761	0.586	4,924	1.084
Acorn	825	53	-	53	0.141	171	0.721	874	1.334
Highway 84	619	57	179	236	0.621	1,003	1.656	2,675	3.063
Bosque	957	111	-	111	0.303	317	0.934	976	1.728
Santa Fe	450	27	76	103	0.271	602	1.043	2,318	1.930
2020									
Pressure Plane	Connect.	Well Water (MG)	Purchased Water (MG)	Total Water Use (MG)	Avg Day (MGD)	ADD/Conn. (gal/conn.)	Max Day (MGD)	MDD/Conn. (gal/conn.)	Calc. Peak Hour (MGD)
Tater Hill	1116	80	199	280	0.750	672	1.989	1,782	3.680
Business Acres	119	91	-	91	0.243	2,045	0.619	5,202	1.145
Acorn	825	106	-	106	0.278	337	0.814	987	1.506
Highway 84	619	52	151	204	0.540	872	1.631	2,634	3.016
Bosque	957	124	-	124	0.336	351	0.936	978	1.732
Santa Fe	450	26	100	126	0.326	724	1.075	2,389	1.989

The City of Woodway also made available a years' worth of water usage of commercial water meters. CP&Y categorized each meter as office park, retail store or industrial meter according to the City of Woodway Zoning Map of 2020 (Appendix A). The water use data was then averaged with the water demand per category and this average was used to estimate projected water demands of future commercial connections. Table 4-3 summarizes the historic water demand per connection for each category of commercial connection.

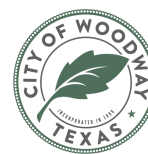


Table 4-3. Historic Water Demand for the City of Woodway Commercial Connections

Category	Water Demand per Connection (gpm/connection)
Industrial	2.5
Office Park	4.0
Retail	2.5

4.2.1 Water Meter Replacement Program

Water meters experience wear over time and under record the volume of water that passes through them as a result. The rate of meter loss that results in under recording varies with many variables, including chemical composition and temperature of the water, as well as customer usage patterns. Therefore, it is not possible to accurately predict the rate of decay/decline in a water meter. In a 2000 study conducted by Dr. Hans D. Allender in Anne Arundel County (Maryland), he found that the breakeven point for replacing water meters exposed to the conditions of that area was 16 years, meaning that prior to 16 years it cost the utility provider more to replace the meter than was recovered in revenue due to meter decay. However, after 16 years meter replacement became economically justifiable and with lost revenue increasing linearly with the age of the meter. Therefore, we recommend that the City of Woodway assess their water meters and systematically begin replacing those that are oldest first by categorizing them into age brackets, e.g., 30-35 years old, 25-30 years old, etc.

4.3 PROJECTED WATER DEMANDS

Utilizing the historic water demands summarized in Table 4-3, the population projections described in Section 3.4, and the historic average water usage per capita of 261 GPD the residential water demand projections for the years 2020, 2030 and 2040 were calculated. These projections were used for modeling and development of the Capital Improvement Projects Plan. A summary of the projected water demands through the year 2040 is shown in Table 4-4.



Table 4-4. Water Demand Projections for 2020 to 2040

Pressure Plane	Projected Population Increase	Avg Day Demand MGD	Maximum Day Demand MGD	Peak Hour Demand MGD	Ratio of MDD to ADD	Ratio of PHD to ADD
2020						
Tater Hill	-	0.731	1.989	3.680	2.7	5.0
Business Acres	-	0.226	0.619	1.145	2.7	5.1
Acorn	-	0.210	0.814	1.506	3.9	7.2
Highway 84	-	0.580	1.656	3.064	2.9	5.3
Bosque	-	0.319	0.936	1.732	2.9	5.4
Santa Fe	-	0.298	1.075	1.989	3.6	6.7

Table 4-4. Water Demand Projections for 2020 to 2040 (Continued)

Pressure Plane	Projected Population Increase	Avg Day Demand MGD	Maximum Day Demand MGD	Peak Hour Demand MGD	Ratio of MDD to ADD	Ratio of PHD to ADD
2030						
Tater Hill	703	0.915	2.489	4.605	2.7	5.0
Business Acres	-	0.226	0.619	1.145	2.7	5.1
Acorn	-	0.210	0.814	1.506	3.9	7.2
Highway 84	600	0.737	2.104	3.892	2.9	5.3
Bosque	36	0.328	0.964	1.783	2.9	5.4
Santa Fe	140	0.335	1.207	2.233	3.6	6.7
2040						
Tater Hill	190	0.964	2.624	4.855	2.7	5.0
Business Acres	-	0.226	0.619	1.145	2.7	5.1
Acorn	-	0.210	0.814	1.506	3.9	7.2
Highway 84	1032	1.007	2.874	5.317	2.9	5.3



Table 4-4. Water Demand Projections for 2020 to 2040 (Continued)

Pressure Plane	Projected Population Increase	Avg Day Demand MGD	Maximum Day Demand MGD	Peak Hour Demand MGD	Ratio of MDD to ADD	Ratio of PHD to ADD
Bosque	64	0.345	1.013	1.874	2.9	5.4
Santa Fe	-	0.335	1.207	2.233	3.6	6.7

MGD: Million Gallons Per Day
MDD: Maximum Day Demand
PHD: Peak Hour Demand

GPCD: Gallons Per Person Per Day
ADD: Average Day Demand

4.3.1 Projected Commercial Water Demands

Commercial development is projected to increase mainly in the Hwy 84 corridor. To correctly allocate the commercial demand in the model, these areas were identified as either retail, industrial or office in the City of Woodway Zoning Map of 2020 (Appendix A). Areas with the most potential for commercial growth were the Santa Fe - Business Acres pressure plane pair and the Hwy 84 pressure plane. CP&Y estimated approximately 13 major commercial connections to be gained in the Santa Fe - Business Acres pressure plane pair by 2030 and 11 more major connections by 2040. Hwy 84 pressure plane is projected to gain 13 major commercial connections by 2030 and 5 more major connections by 2040. The remaining projected commercial connections are summarized in Table 4-5. These connections were multiplied times the water demands shown in Table 4-3 to obtain a projected water demand per pressure plane or pressure plane pair.

Table 4-5. Projected Commercial Connections Increase

Pressure Zone	Gained Commercial Connections 2020-2030	Water Demand Increase 2020-2030 (gpm)	Gained Commercial Connections 2030-2040	Water Demand Increase 2030-2040 (gpm)
Tater Hill	5	12	5	12
Bus Acres – Santa Fe	13	32	11	27
Acorn – Bosque	10	32	0	0
Hwy 84	13	34	5	12



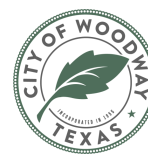
5 GROUNDWATER SUPPLY ANALYSIS

5.1 GENERAL

The City of Woodway uses both groundwater and surface water resources to supply its customers. The City of Woodway has six water wells that produce water at an approximate maximum capacity of 2.97 MGD. However, these water wells alone are not enough to meet the City's water demands. Treated surface water is purchased from the City of Waco to supplement the water demand shortfall. The City of Waco is under contract to provide the City of Woodway with up to 365 million gallons per year via the seven connections between the two cities' systems.

CP&Y utilized numerous resources in the development of Section 5, Groundwater Supply Analysis. Much of the information was obtained directly from these other resources, verbatim in some cases, and we want to credit the sources and authorship of this information. The information presented throughout Section 5 was directly obtained and copied from the following sources:

- City of Waco Water Master Plan, October 2015, prepared by:
 - The Wallace Group, Inc., Waco, Texas
 - Freese and Nichols, Inc., Fort Worth, Texas
 - R.W. Harden and Associates, Inc., Austin, Texas
- Southern Trinity Groundwater Conservation District, Waco, Texas
- Texas Water Development Board, Austin, Texas
 - Population and Demand Data and Water Use
 - Region G Planning Report, 2011 and 2016
- McLennan County Water Resources Group, Waco, Texas



5.2 GROUNDWATER DEMANDS

Water usage throughout the year is variable with changing seasons and peak usages throughout each day. The amount of water usage changes each year depending upon infrastructure development and weather conditions. In planning for future water use, peaking factors were applied to the maximum usage day, which generally occurs at the hottest and driest times in summer. City of Woodway water usage figures for the year 2014 are shown in Table 5-1. For purposes of this study, the year 2014 was used because this was the highest overall water demands over the past 5 years for the City of Woodway.

Table 5-1. 2014 Water Usage Data

Month	Woodway Well Water	Water from Waco	Total Consumption	Average Day (MG)	Max Day (MG)	Peak Hour (MG)
January	15,249,000	31,000,000	46,249,000	1.49	2.98	4.48
February	13,758,000	27,561,700	41,319,700	1.33	2.67	4.00
March	13,285,000	38,945,900	52,230,900	1.68	3.37	5.05
April	19,728,000	40,566,500	60,294,500	1.94	3.89	5.83
May	35,129,000	45,664,200	80,793,200	2.61	5.21	7.82
June	56,306,000	56,342,200	112,648,200	3.63	7.27	10.90
July	67,454,000	70,117,100	137,571,100	4.44	8.88	13.31
August	61,665,000	66,818,316	128,483,316	4.14	8.29	12.43
September	44,151,000	34,005,300	78,156,300	2.52	5.04	7.56
October	30,550,000	29,518,800	60,068,800	1.94	3.88	5.81
November	17,739,000	30,732,300	48,471,300	1.56	3.13	4.69
December	22,904,000	23,273,300	46,177,300	1.49	2.98	4.47

A projection of the maximum water requirements for Woodway over the 2020 – 2040 planning period is shown in Table 5-2. The City’s peak hour requirement is projected to grow from 13.11 MGD in 2020 to 16.93 MGD in 2040. Based on this rate of growth and the anticipated loss of



future groundwater well supplies, the City will need to amend their contract with the City of Waco to secure additional quantities of water to support the City of Woodway's future water needs.

Table 5-2. Projected Water Usage

Year	Population	Annual Consumption MG	Avg Day Demand		Maximum Day Demand MGD	Peak Hour Demand MGD	MDD to ADD	PHD to ADD
			MG	GPCD				
2020	9,045	901	2.36	261	7.09	13.11	3.0	5.5
2030	10,524	1043	2.75	261	8.20	15.16	3.0	5.5
2040	11,810	1168	3.09	261	9.15	16.93	3.0	5.5

5.3 GROUNDWATER SUPPLY

5.3.1 Trinity Group

The below information was sourced from the City of Waco's Water Master Plan, 2015, and was prepared by R. W. Harden and Associates, Inc.

In McLennan County, the Trinity Group consists of the following five stratigraphic units: The Glen Rose Limestone, Hensell Sandstone, Pearsall Formation, Sligo Formation, and the basal Hosston Sandstone. Sycamore gravels are located at lower elevations of the base of the Trinity and are hydraulically connected to the overlying Hosston, where present. For purposes of this report, the Sycamore is considered part of the Hosston. The Hensell and Hosston sandstones act as the principal aquifers in the county, while the other interbedded units act as confining beds. Both aquifers (Hensell and Hosston) act as major sources of water. Production from the Hensell, predominantly used for domestic, public supply, and industrial use, occurs mainly west of the Balcones Fault Zone, which bisects the county from northeast to southwest and has been observed to vertically offset subsurface formations in McLennan County by up to 400 feet. The



Hosston sandstone is a major source of water for public and industrial wells throughout the county. A small subset of wells in the county screen and produce from both aquifers.

5.3.1.1 Hensell Sandstone

The Hensell sandstone is composed of fine to coarse-grained white quartz sand with minor interbedded layers of green to red clay. In the Woodway area, the Hensell has a thickness of about 50 to 70 feet and lies at depths of 1,000 to 2,000 feet. Recharge to the aquifer occurs mainly through downward percolation of precipitation and stream seepage received on the outcrop located about 50 to 100 miles west of Waco. Water levels measured since the year 2000 show an average water level depth of about 550 feet. A pumping test in the Hensell in the town of McGregor shows a transmissivity value of 1,100 GPD/FT and a hydraulic conductivity of 26 gallons per day per square foot (GPD/SF). The aquifer test, hydraulic conductivity and formation thickness data suggest a transmissivity values between 1,000 and 2,000 GPD/FT are likely in the aquifer. In general, transmissivity is lower east of the Balcones Fault Zone than to the west. This has resulted in the majority of Hensell wells constructed west of the Balcones Fault Zone.

Water quality of the Hensell aquifer in McLennan County is generally fresh. Although elevated concentrations of TDS, nitrate, fluoride, chloride and sulfate have been observed in individual wells, the average water is typically fresh with an average TDS concentration of 851 MG/L and, on average, all major constituents tested by the TWDB are below state MCLs. In many states the MCL for TDS is only 500 MG/L.

5.3.1.2 Hosston Sandstone

The Hosston sandstone is composed of fine to coarse, red to white silty sand, interbedded with shale and cemented locally with calcite. Coarse gravels have been encountered at the base of the formation in a number of wells and contributes to the higher average hydraulic conductivity of the Hosston. The Hosston generally thickens to the east, ranging from about 100 feet in the northwestern portion of the Waco region to over 600 feet in the southeastern portion. The top



of the aquifer exists at depths around 1,100 to 2,500 feet in the Woodway region. Recharge to the aquifer occurs mainly through downward percolation of precipitation and stream losses where streams cross the outcrop. Data collected since 2000 shows an average water level depth of about 630 feet. Transmissivity in the Hosston has been found to range from 5,000 to 10,000 GPD/FT and the hydraulic conductivity has been observed to range 18 to 71 GPD/SF. Generally, the transmissivity increases to the east with the thickening of the sands.

Water quality of the Hosston aquifer in McLennan County is generally fresh. Although elevated concentrations of TDS, fluoride, chlorides and sulfates have been observed in individual wells, the average water is fresh with a TDS value of 721 and, on average, all major constituents tested for by the TWDB are below state MCLs. In many states the MCL for TDS is only 500 MG/L.

5.3.2 Groundwater Modeling

This section was sourced from the City of Waco Water Master Plan, 2015.

Local groundwater strategy assumes that all regional groundwater users continue to use groundwater as they have in the past and increases in pumpage will continue as they have in the past. Groundwater modeling was conducted to evaluate regional impacts of incremental groundwater pumping increases on artesian water levels of the Hosston and Hensell members of the Trinity aquifer. The Texas Water Development Board (TWDB) Northern Trinity and Woodbine Aquifers Groundwater Availability Model (WAGAM) Run 08-06 was used as the basis for analyses, utilizing the MODFLOW code distributed by the U.S. Geological Survey to analyze impacts.

Pumpage inputs were not modified from the original model inputs except for the project participants shown in the follow table, Table 5-3, which were developed from past surveys of each entity's projected growth.



Table 5-3. Historic Increases In Pumpage Distribution

Water Producer	Pumpage (ac-ft/year)				Number of Wells	Aquifer Distribution	
	2012	2020	2030	2040		Hensell	Hosston
Aqua Texas WSC	926	1,022	1,148	1,291	16	100%	0%
City of Bellmead	1,262	1,392	1,565	1,759	5	0%	100%
Bold Spring WSC	197	218	245	275	4	0%	100%
Cargill	387	428	481	540	1	0%	100%
Chalk Bluff WSC	389	429	482	542	3	0%	100%
Cross Country WSC	438	483	543	610	4	100%	0%
City of Hewitt*	2,426	2,678	3,010	3,383	4	0%	100%
City of Lacy Lakeview	-	-	-	-	0	0%	0%
McLennan Co. WCID 2	190	209	235	265	3	0%	100%
North Bosque WSC	407	449	504	567	3	100%	0%
City of Robinson	1,497	1,652	1,857	2,087	5	0%	100%
Ross WSC	314	347	390	438	3	0%	100%
Sanderson Farms	1,162	1,283	1,442	1,621	2	0%	100%
South Bosque	10	11	13	14	1	100%	0%
City of Waco	211	232	261	293	2	0%	100%
City of West	184	203	228	256	1	0%	100%
City of Woodway*	1,749	1,930	2,169	2,438	6	0%	100%
County-Other	3,575	3,945	4,434	4,984	n/a	47%	53%

* Woodway's historic groundwater usage has decreased due to well issues. Hewitt has also reportedly reduced the usage of groundwater.

5.3.3 Groundwater Pumpage Distribution

Table 5-3 shows pumpage from historic data in 2012 to projections in 2040, including pumpage from individual producers and "county-other" pumpage, which represents other minor water usage in the County such as irrigation, livestock, and domestic pumpage from unidentified producers. Pumpage for the entities listed in Table 5-3 is distributed between the Hensell and Hosston layers according to information provided by each entity listed in the table.

The location of pumping wells was unmodified from the locations shown in the WAGAM, except as described below. Because the pumpage amounts for the project participants are different than those shown in the WAGAM, differences in pumpage between 1999 and 2012



were linearly interpolated to obtain a starting point for the simulations contained herein. For entities with multiple pumping wells, the total pumpage was distributed evenly between wells.

5.3.4 Groundwater Model Construction

Figure 5-1 shows the general extent of the model in Central and North-Central Texas. The up dip boundary of the model to the west is defined by the outcrop of the aquifer. The down dip boundary to the east is defined by the Mexia-Talco Fault Zone. The down dip boundary is representing a no-flow boundary imposed by the vertical offset of the Trinity created by the faulting, which prevents meaningful hydraulic communication between the areas east and west of the Mexia-Talco Fault Zone. The Balcones Fault Zone which trends north-south through McLennan County also creates more localized boundaries within the Trinity that restrict hydraulic communication across the fault and result in artesian pressure declines that are larger than declines in unfaulted regions of the Trinity. No changes were made to the original model inputs for structure, boundary conditions, transmissivity, or recharge.

5.3.5 Groundwater Model Results

Figures 5-2 and 5-3 depict artesian water pressure decline from 2012 to 2040 in the Hensell and Hosston aquifers, respectively. Artesian pressure declines of up to about 400 feet in the Hosston, and 340 feet in the Hensell are projected to occur in Waco under the increasing pumpage option.



Figure 5-1. Regional Model Extent

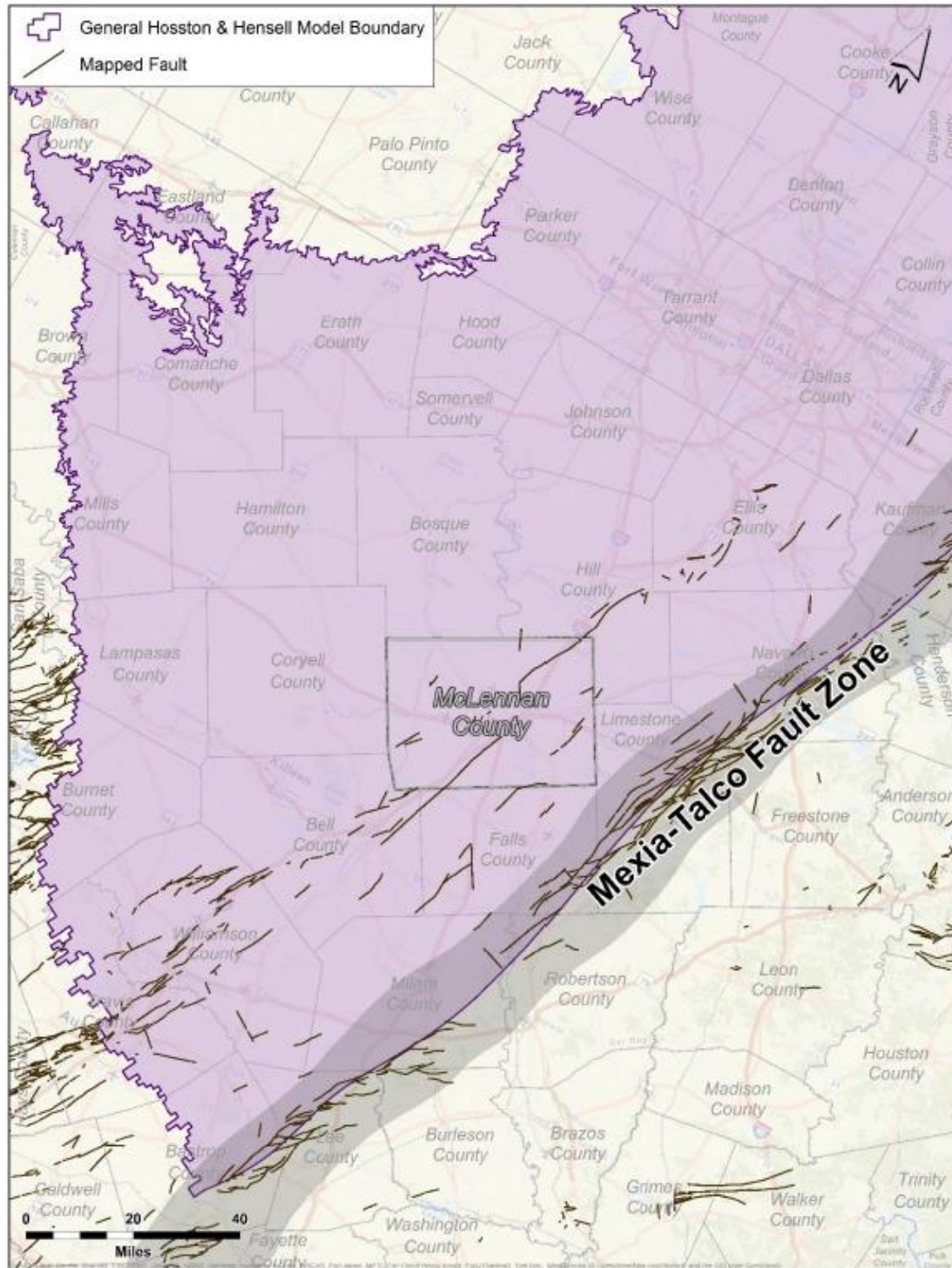
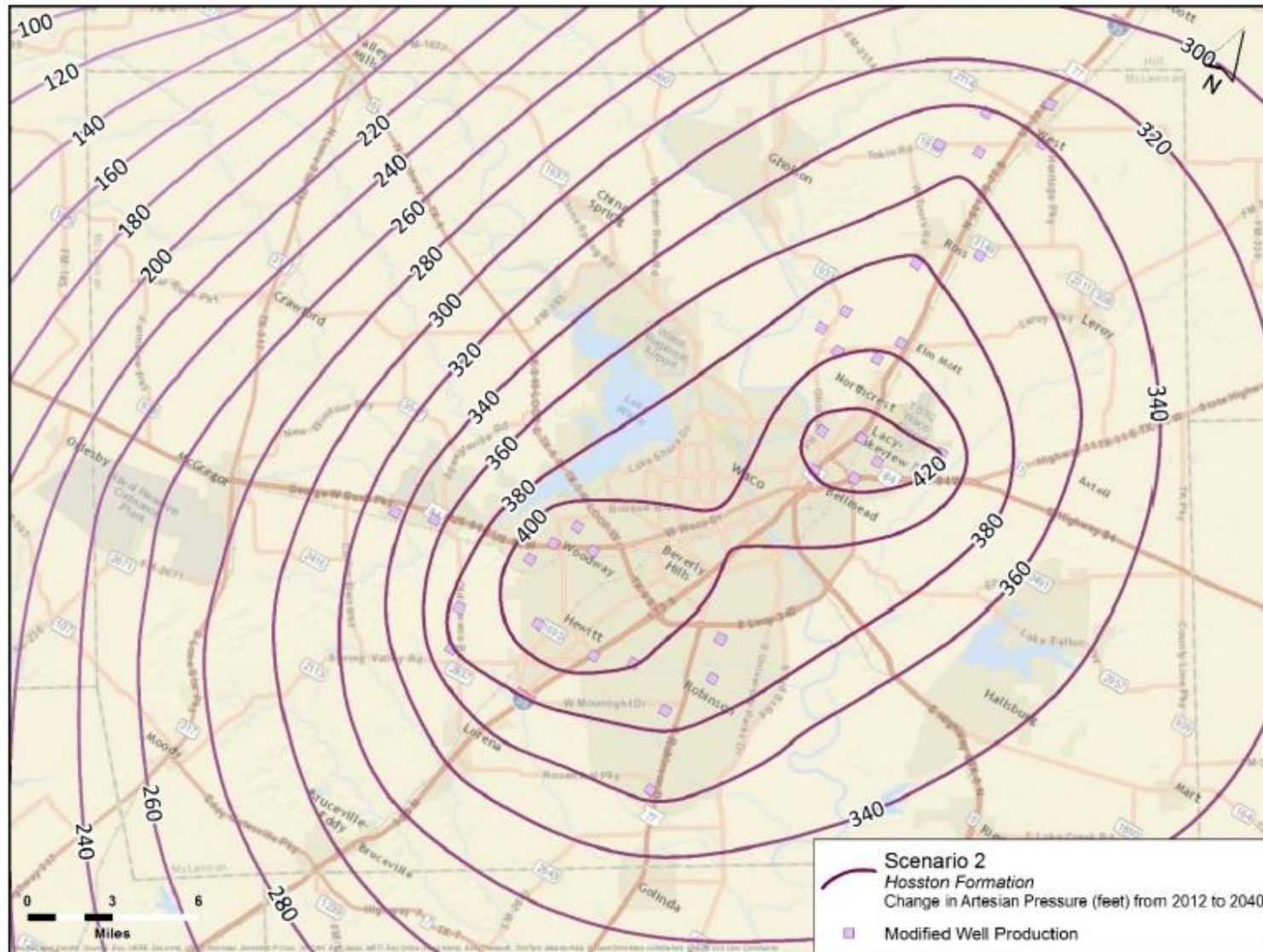




Figure 5-2. Increasing Pumpage – Artesian Pressure Decline, 2012 and 2040, Hosston Aquifer



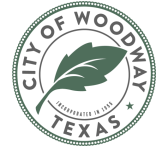
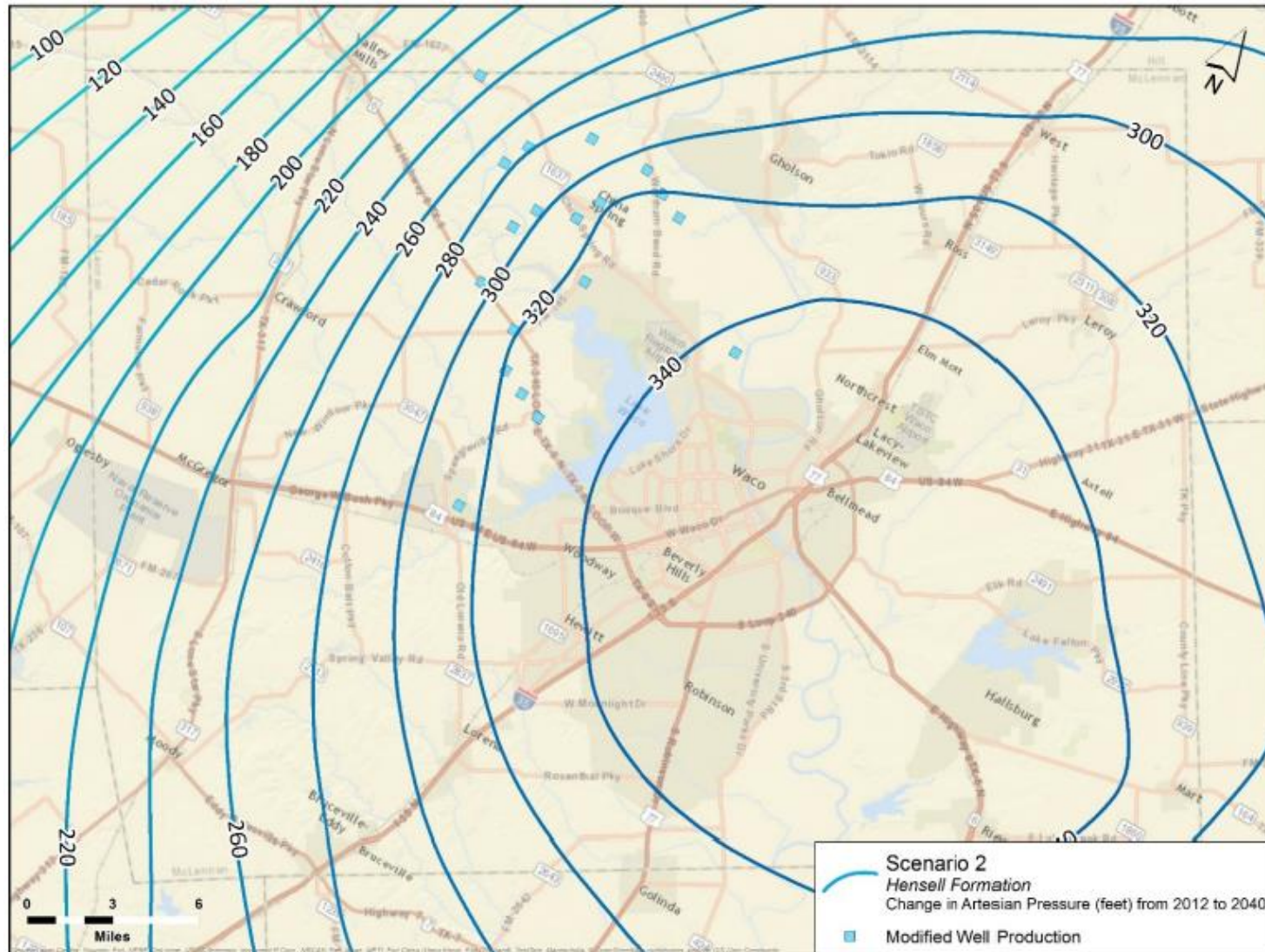
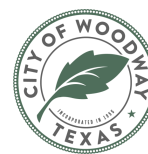


Figure 5-3. Increasing Pumpage – Artesian Pressure Decline, 2012 and 2040, Hensell Aquifer





5.4 CONSERVATION

These results of significant pressure decline (drawdown) of aquifer levels assume continued use with some growth. Studies also show that with a decrease in pumping in McLennan County, the decline in levels will slow or stop. A reduction of 40-50% in pumpage is needed to stop the decline. The decline is worse in the Waco area.

Major users in the Waco area are Hewitt, Woodway, Robinson, Bellmead, and Sanderson Farms. Smaller systems are grouped as “County Other”, and in total are a significant number. These smaller systems are spread out over a larger geographic area, which reduces their impact.

The Cities of Hewitt, Woodway, and Robinson have reduced their use of groundwater in the last decade or so by approximately 25%. This should be reflected in a reduction of the decline of the aquifer levels. Groundwater usage over the last few years is shown in Table 5-4 and Table 5-5.

Table 5-4. Total Trinity Groundwater Production 2012 through 2019
McLennan County

Year	Production/Gallons	Acre-Feet	Permitted Gallons	Permitted Acre-Feet	% Permitted
2012	4,968,178,000	15,247	5,562,477,000	17,071	89%
2013	4,442,629,900	13,634	5,562,477,000	17,071	80%
2014	3,971,541,618	12,188	5,562,477,000	17,071	71%
2015	4,229,777,190	12,981	5,562,477,000	17,071	76%
2016	4,389,753,100	13,472	5,562,477,000	17,071	79%
2017	4,095,717,380	12,569	5,562,477,000	17,071	74%
2018	3,997,545,140	12,268	5,562,477,000	17,071	72%
2019	4,229,122,460	12,979	5,562,477,000	17,071	76%
				Average	77.13%



**Table 5-5. Groundwater Production 2012 through 2020
City of Woodway, Texas**

Year	Production/Gallons	Acre-Feet	Permitted Gallons	% Permitted
2012	569,718,000	1,748	664,213,000	85.75%
2013	414,419,000	1,272	664,213,000	62.4%
2014	386,687,000	1,187	664,213,000	50.23%
2015	404,459,000	1,241	664,213,000	60.88%
2016	264,366,000	811*	664,213,000	39.79%
2017	516,377,000	1,585	664,213,000	77.76%
2018	403,911,000	1,240	664,213,000	60.83%
2019	406,728,000	1,248	664,213,000	61.22%
2020	487,852,000	1,493**	664,213,000	73.45%
			Average	63.59%

* 2016 was a very heavy rain year

** 2020 is ~85% of 2012

The projected declines in the water levels are based upon using the permitted amounts. The County is currently averaging 77% of that amount and Woodway is averaging 63%. Robinson reports they are at 75% and the City of Hewitt now buys a significant portion of their water needs from Waco.

Estimates for typical costs for groundwater production is \$1.00 to \$2.00 per thousand gallons, depending upon how the well cost is depreciated. Woodway currently pays Waco \$3.20 per thousand gallons for the first 365,000,000 gallons and \$3.40 for additional water.

If Woodway's groundwater wells are depleted so that the City must acquire more water from Waco, the cost per thousand gallons will be \$4.00 based on Waco's current rates. Using an average demand of 420,845,000 gallons per year (groundwater converted to surface water), the cost would be \$1,683,000.00.



Obviously, purchasing treated surface water in lieu of pumping groundwater will have a significant impact on water rates for the City of Woodway.

5.5 GROUNDWATER SUPPLY RELIABILITY

Suburban communities in the Waco metropolitan area have historically relied on groundwater supplies from the Trinity aquifer. Extended groundwater usage has resulted in artesian pressure declines of up to 700 feet or more and has presented challenges to the design of groundwater production infrastructure, resulting in increased groundwater production costs. The “supply” itself remains an essential water supply and resource.

The principal issue with the Trinity aquifers is the static water level in the wells which is caused by the hydraulic pressure within the aquifer. This pressure causes the “artesian” effect, the water level rising above the level of the aquifer. In the early 1900’s, it was common in Central Texas for Trinity wells to flow out of the well at the ground surface. Sometimes there was enough pressure to give a “geyser” effect. As more water is withdrawn from the aquifer than can be recharged, the aquifer level goes down. Since the 1960’s the level of decline has generally averaged 8-10 feet per year. In the Woodway area declines of up to 40 feet per year have been recorded by the TWDB. The current aquifer level varies, but is generally around 800 feet below the ground surface. When a well pump turns on, there is a significant drawdown effect at the well intake in the aquifer called the “cone of depression,” and can result in the aquifer dropping water 160 to 200 feet at the pump intake. **The Southern Trinity Groundwater Conservation District (STGCD) estimates the current rate of decline in the groundwater levels at sixteen (16) feet per year.**

As the well static level drops undesirable things often occur. Pumping rates go down as the distance to the surface grows due to higher pumping head pressures required. As a result, the cost of pumping and the required size of pump increases in order to maintain a given rate of well production.



A lower aquifer static level also can allow undesirable water from other aquifers to migrate into the City’s aquifer or well casing. Some undesirable aquifers have poor water quality and are very corrosive. These aquifers are generally located in the Glen Rose Formation which is well above the Trinity Aquifer. Two of Woodway’s wells, Highway 84 and Business Acres, have “plating” characteristics due to minerals in the water that require the addition of inhibitors in the well to keep the pumps from seizing. The Highway 84 well also requires blending with Waco water to mitigate taste and odor problems associated with the well water.

In 1997 the Texas Legislature directed the Texas Commission on Environmental Quality (TCEQ) to designate Priority Groundwater Management Areas. These are areas where there is concern with the possible loss of a water resource due to over use. In 2005 TCEQ included McLennan County in such an area. In an attempt to maintain local control over groundwater, McLennan County created the Southern Trinity Groundwater Conservation District (STGCD). After much data collection and study, the District adopted initial rules in 2007. The intent is to preserve and conserve groundwater in McLennan County for future generations.

Current rules effectively limit any new water supply well (other than small residential wells) to only be a “replacement well” for an existing well that is going out of service. The new well cannot produce more water than the old well was producing. Any need for additional water now or in the future cannot come from new or enlarged groundwater wells, but must come from other sources.



6 SURFACE WATER SUPPLY

6.1 GENERAL

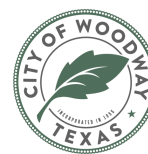
The City of Woodway's major source of surface water is from Lake Waco and contracted through the City of Waco. The majority of this section refers to that contract, however, the City of Woodway also has an allotment of 112 acre feet/year of water rights in Lake Belton via a contract with the Bluebonnet Water Supply Corporation. In addition to Woodway, Bruceville-Eddy, McGregor, and Moody are interconnected to Bluebonnet WSC, which provides wholesale surface water from Lake Belton. A 2009 report titled *Updated Water Management Strategies for McLennan County*, by HDR, states that Bluebonnet WSC has a production capacity of 8.64 MGD and an average daily demand of 2.738 MGD.

CP&Y utilized the *City of Waco Water Master Plan, October 2015*, in the development of Section 6, Surface Water Supply. Much of the information was obtained directly from this report, verbatim in some cases, and we want to credit the sources and authorship of this information.

The City of Waco holds surface water rights for both Lake Brazos and Lake Waco.

Lake Waco is owned and operated by the U.S. Army Corps of Engineers (USACE). The reservoir is located on the Bosque River in McLennan County. The City of Waco contracts with USACE for water storage space in the reservoir and has water rights authorizing storage and use from the reservoir. The reservoir serves as a water supply for the City of Waco. The reservoir's total storage is 781,000 acre-feet. The reservoir's conservation pool storage is 158,700 acre-feet.

With respect to City of Waco water rights in the Brazos River, the City of Waco primarily uses this water source for recreational purposes. However, it can be used in emergency situations to supplement the Lake Waco supply. The City of Waco is authorized to use up to 5,600 acre-feet of water each year from the Brazos River.



The City of Waco also has access annually to 42,344 acre-feet of reuse water from their Bull Hide Creek WWTP (formerly known as the Waco Metropolitan Area Regional Sewage System or WMARSS WWTP). Presently, this water is not used as a potable source.

6.2 SURFACE WATER LONG-TERM DEPENDABILITY

The total permitted diversions from Lake Waco are 79,870 acre-feet/year. The firm yield of Lake Waco based on the water availability modeling is about 81,070 acre-feet/year. The total permitted diversions limit the supply available to City of Waco (and its wholesale customers), as the firm yield is greater than the total permitted diversions. Available supplies are compared against the projected demands to identify any supply shortages or surpluses. If a shortage is identified in the future decades, water supply strategies will be evaluated to meet the shortage in the supply availability. Comparison of the supply and demand projections for the near-term and long-term from the City of Waco Water Master Plan is included in Table 6-1.

Table 6-1. Summary of Demand Projection Scenarios for the City of Waco

Description	Supply/Demand (MGD)			
	2014	2020	2030	2040
Average Day Demand Projection Scenarios				
100% Wholesale Demand	36.24	42.87	47.93	52.67
50% Wholesale Demand	32.28	37.31	41.83	46.08
100% Wholesale Demand with FHLM WSC	36.24	45.83	53.78	64.54
Supply				
Lake Waco	71.2	71.2	71.2	71.2

It should be noted that Lake Waco supplies are sufficient to meet the average day demands for the three scenarios shown above. In the worst case demand projection scenario using maximum day demands (includes FHLM WSC future water demand), the City of Waco will need an additional 7 MGD in 2020, increasing to an additional 38 MGD in 2040. In the best case



demand project scenario using maximum day demands, the City of Waco will need an additional 3 MGD in 2030 and an additional 11 MGD in 2040.

At the time of the 2015 report, there wasn't enough information available to define the trend of future demand projections for the City.



7 MODEL DEVELOPMENT

7.1 GENERAL

System analyses consisted of evaluating the performance of the water system under varying system conditions, taking into account TCEQ regulations, maximum day demands, peak hour demands, and fire flow scenarios. Historical water usage patterns within the City of Woodway have been analyzed and considered when modeling the system. Field tests were also performed at key locations throughout the study period to ensure as best possible that the model accurately represented the City of Woodway system. The system was established based on input from City staff, existing system maps, field-collected data, utility reports, and construction plans.

WaterCAD has two modes of operation, Steady-State or Extended Period Simulation (24-hr). The City of Woodway computer model was set-up and calibrated to run Steady-State simulations depending on conditions established by the user. Steady-State simulations are acceptable industrywide for Capital Improvement Project development and planning.

The model currently is not able to run 24-hr simulations because continuous 24-hr data on tank levels, pump status and pressures are not easily extracted from the SCADA historian. If simulations regarding water quality are required in the future, the model needs to be calibrated to run Extended Period Simulations.

7.2 MODEL DEVELOPMENT

A significant amount of time and effort was spent on creating, developing and calibrating the computer water model. The computer water model is the central tool used to evaluate the distribution system for both existing and future conditions. It also serves as the basis for determining the system needs and improvements. The City of Woodway's water model was developed using WaterCAD software by Bentley. The computer model consists of all existing



water supply points, water storage tanks, hydropneumatic pressure tanks, service pumps and existing distribution piping.

7.2.1 Physical Network

The water model pipe network was developed in WaterCAD from a water distribution map provided by City staff. The map contains water mains, pressure reducing valves and isolation valves. Elevations were assigned to the junction nodes in ArcGIS and then converted to WaterCAD format. The node elevation data was checked against data from Google Earth. Once all the pipes and nodes were brought into WaterCAD, a connectivity check was made to see if there were any discrepancies between the imported network and the network map. Discrepancies ranged from water lines that crossed in the model but were not connected to water lines that were not joined together at endpoints.

An initial Hazen-Williams roughness coefficient of 130 was assumed for all pipes. This coefficient was slightly modified during the calibration process, if needed, to reconcile with the hydrant flow test data.

7.2.2 Facility Information

All pumping, storage and valve facilities were manually added to the model based on as-built drawings and information provided by the City. There are six groundwater plants, each with its own water source, ground storage tank, pressure tank and distribution pumps included in the model.

The groundwater wells are modeled in WaterCAD as a reservoir with a pump that goes into a storage tank. The service pumps were connected in the model to pull suction from the ground storage tanks and pump into distribution. There are no specific pressure tank modules in WaterCAD. Therefore, the pressure tanks were modeled using a very tall and narrow tank that branches out from the pump discharge headers. The maximum operating height of the tank corresponds to the maximum operating pressure of the hydropneumatic pressure tank.



There are also four active connection points where the City of Waco water is introduced into the Woodway water system. These were modeled by adding a negative demand at the nodes near to the location of the Woodway-Waco interconnections. The Wickson Rd. connection delivers water into the Tater Hill ground storage tank without connecting directly to the City of Woodway system. The Sunn Dr. connection delivers water directly into the Highway 84 pressure zone. The American Plaza and Delhi Rd. connections deliver into the Santa Fe ground storage tank without connecting directly to the City of Woodway system.

Elevations for facility components (tanks, pumps, and valves) were assigned using as-built drawings and information from City staff.

7.2.3 Demand Allocation

The City of Woodway provided CP&Y with the water production per groundwater plant and meter readings from the interconnections with the City of Waco system. The pressure zone demands were then divided by the number of nodes inside the pressure zone and assigned to these nodes. The nodes inside the groundwater plants and along the pipelines that connect the City of Waco system with the groundwater storage tanks were excluded.

The City of Woodway also made available a years' worth of water usage of commercial water meters. These commercial meters were connected to the system using a customer meter node in WaterCAD and assigned with their respective average day, maximum day and peak hour demands.

7.2.4 Model Calibration

In order to verify that the hydraulic model accurately represents the actual distribution system operation, a model calibration analysis was performed. The calibration process involves adjusting system operations, roughness coefficients, pressure reducing valve settings and demand allocation to match known conditions of elevation, pressure, and flow in several field



tested areas throughout the system and at the groundwater plant tanks. Details describing the field testing are described in the sub-section below.

7.2.4.1 Field Testing

Field testing was performed in all six pressure planes so that the model could be accurately calibrated.

Hydrant flow testing was performed at key locations throughout the distribution system to get a feel for both instantaneous pressure and flow under certain demand times.

Pressure recorders were also installed at or near the same locations in order to get real-time pressure data over a period of several days. These values were reviewed during peak time usage and the model was calibrated accordingly.

Pressure recorders were installed in a total of 30 locations throughout the distribution system. Pressures were recorded every 5 seconds at each location. From this data, maximum, minimum and average pressures were determined for each location. The field test data results are shown in Table 7-1.



Table 7-1. Summary of the Field Test Data Including Pressure Recorder Data and Hydrant Flow Test Data

Testing Location			Pressure Hydrant		Flow Hydrant			Pressure Readings		
#	Pressure Plane	Location	Static Pressure (PSI)	Drawdown Pressure (PSI)	Static Pressure (PSI)	Dynamic Pressure (PSI)	Flow Rate (GPM)	Low (PSI)	High (PSI)	Average (PSI)
TH-1	Tater Hill	406 Riverview	55	35	58	30	865	49	62	55
TH-2	Tater Hill	14018 Harbor	75	38	72	25	775	73	79	75
TH-3 A	Tater Hill	Poage and Sandlewood	65	65	65	50	1115	66	78	71
TH- 3 B	Tater Hill	Ramblewood and Burgundy	56	58	53	25	775	54	66	59
TH-4	Tater Hill	Badger Ranch @ Creek 100 ft West	88	60	88	50	1115	87	92	90
TH-5	Tater Hill	Dominion and Stone Brier	80	45	82	40	1000	81	87	84
TH-6	Tater Hill	Sorrento and Ritchie Rd.	40	38	46	30	865			
BA-1	Business Acres	6813 Cactus	79	76	84	65	1275	79	94	86
BA-2	Business Acres	12-inch near by	74	68	74	40	1000	72	86	79
BA-3	Business Acres	2201 Atlas	70	48	66	35	925	60	76	68
A-1	Acorn	White Oak and Red Oak	54	49	58	40	1000	50	66	56
A-2	Acorn	9562 Brook Hollow	74	66	58	35	925	53	67	61
A-3	Acorn	Stoney Point and Arlington	56	46	64	35	925	66	79	72
A-4	Acorn	Bryce and Sharron	56	43	54	35	925	55	65	60
H84-1	Hwy 84	HEB Pharmacy	62	50	64	40	1000	60	76	67
H84-2	Hwy 84	8011 Ridge Point	64	62	62	50	1115	59	69	64
H84-3	Hwy 84	Treeline and Creek Bend	58	48	54	35	925	48	60	54
B-1	Bosque	Woodland West and Raven	78	58	69	40	1000	60	72	65
B-2	Bosque	412 Charleston Park	78	44	79	30	865	75	87	83
B-3	Bosque	Cardinal and Whippoorwill	58	49	56	40	1000	57	68	61
B-4	Bosque	Woodland West & Gladedale	70	54	75	50	1115	69	81	75
B-5	Bosque	109 Stone Lake	66	32	67	25	775	71	76	74
B6-A	Bosque	Stonewood Ct	-	-	-	-	-	43	50	47
B6-B	Bosque	Stonewood Ct	-	-	-	-	-	46	54	50
SF-1	Santa Fe	Delhi	71	71	45	25	790	25	46	38
SF 1B	Santa Fe	Santa Fe and E. Fairway	76	69	72	55	1175	68	79	73
SF-2	Santa Fe	1332 Circlewood	90	22	118	30	865	117	135	124
SF-3	Santa Fe	Behind 5901 Woodway Drive on Old McGregor	70	56	72	45	1075	66	83	74
SF-4	Santa Fe	8200 Old McGregor	61	50	75	45	1075	72	87	77
SF-5	Santa Fe	Chadwick and East Fairway	70	56	84	30	865	78	97	86

7.2.5 Pump Controls and Adjustments

Because the model is set to run Steady-State simulations, the pump on/off status was manually modified during the model runs. Pumps were not tested at the time of calibration. Original manufacturer's curves were used in modeling.

7.2.6 Valve Controls and Adjustments

The City of Woodway currently has 10 pressure reducing valves in operation throughout the distribution system. Table 7-2. Summary of the Pressure Reducing Valves summarizes the location, diameter and pressure setting as reported by the City of Woodway.

Table 7-2. Summary of the Pressure Reducing Valves

PRV #	Location	Pipe Diameter (in)	Pressure Setting (PSI)
1	Estates Dr., West of Bosque Blvd. Intersection	12	45
2	Lake Forest Pkwy, East of the Lazy River Dr. Intersection	6	40
3	Wandering Trail, East of the Stone Lake Dr. Intersection	8	50
4	W Hwy 84 South Side, East of Ritchie Rd.	6	42
5	W Hwy 84 North Side, East of Wickson Rd.	6	35
6	Ritchie Rd, North of Sandalwood Dr.	12	35
7	Harbor Dr., South of Rick Dr.	6	45
8	Poage Dr., North of Stony Point Dr.	8	30
9	Western Oaks Dr., South of Briargrove Dr.	6	35
10	Stone Lake Dr. & Lake Forest Pkwy	8	50

There are also key isolation valves that are closed in order to maintain isolation between pressure zones or to route flow through a PRV. Table 7-3 summarizes the setting of some key isolation valves.

Table 7-3. Summary of Key Isolation Valves

Location	Pipe Diameter	Function
Bosque Blvd, West of Redondo Dr.	12	Separate Bosque and Santa Fe
Bosque Blvd, South of Fairway Rd.	6	Separate Bosque and Santa Fe
North side of Hwy 84 between Elysian Ln and Rainbow Dr.	8	Separate Bosque and Santa Fe
Forest Shadows Dr., East of Forest View Dr.	6	Separate Acorn and Tater Hill
Stony Point Dr. and Wooded Crest Dr.	6	Separate Acorn and Tater Hill
Hwy 84 North Side, East of Merrifield Dr.	8	Separate Tater Hill and Hwy 84
Northeast corner of Estates Dr. and Midway Ln	6	Separate Acorn and Hwy 84
Southwest corner of Estates Dr. and Midway Ln	8	Separate Acorn and Hwy 84
Estates Dr. and Panther Dr.	8	Separate Acorn and Hwy 84
Highway 84 at Bryce	6	Separate Acorn and Hwy 84
Sharron Dr. and Hwy 84	6	Separate Acorn and Hwy 84
Merrifield Dr., North of Hwy 84	8	Separate Tater Hill system and Wickson Rd. Connection Main
Old McGregor East of Bent Oak Dr.	8	Separate Hwy 84 system with Sunn Dr. Connection Main
Old McGregor and Old Farm Rd.	8	Separate Hwy 84 system with Sunn Dr. Connection Main
Old McGregor Rd and Sunn Dr.	8	Separate Hwy 84 system with Sunn Dr. Connection Main
North of Woodland West Dr. and Knotty Oaks	8	Route flow through PRV north on Western Oaks Dr.

7.2.7 Calibration Results

The model was calibrated utilizing the measurements from the field test described in Section 7.2.4.1. Before and during hydrant flow testing, the tank levels, hydropneumatic pressures and pumps status were recorded. These boundary conditions were put into the water model and the simulation results compared to the static and drawdown pressures recorded in the field.

The model was calibrated such that when storage tank level, hydropneumatic pressure level and pump status were matched to the SCADA system, the hydraulic grade line in the field matched within 10 ft of the field recorded values.

The model closely matched on all three of the Tater Hill field tests east of the Ritchie Rd. pressure reducing valve. West of the Ritchie Rd. pressure reducing valve the model was only able to match the Static Hydraulic Grade Lines (HGLs) and not the HGLs during the hydrant flow. After sensitivity analysis on C factors and closing valves in the model, it was determined that the reason for discrepancy was the PRV response time due to sudden changes in flow. To confirm this theory an extra hydrant flow test was run with a longer wait before measuring pressures. The model was able to replicate this situation and the theory confirmed.

The discrepancy is just a transient response in the field that cannot be replicated by this type of model. CP&Y believes there is nothing wrong with the PRV. Field crews did have to wait longer when taking measurements to allow for the system to stabilize.

The Highway 84 and Business Acres pressure zone field tests closely matched the simulation results from the WaterCAD model with no changes. The Santa Fe pressure zone field test closely matched the simulation results from WaterCAD with a slight reduction of C roughness factor from 130 to 120.

7.2.7.1 Acorn-Bosque Investigation

To date the Acorn and Bosque pressure pair calibration has not been able to be validated with the field data. The static pressure HGLs match closely with the simulated HGLs from the model for all field tests and indicate the elevations input to the model nodes are appropriate.

However, during hydrant flow, the model consistently overestimated the HGLs compared to what was recorded in the field. Sensitivity analysis was done by varying C factors and results did not match. After meeting with the City of Woodway on several occasions it was determined that the pipe locations, connections, and sizes depicted in the model are a good representation

of the system. CP&Y suggested an investigation of both valves and pumps to determine the origin of this discrepancy. City staff field tested the pumps and these closely matched the performance of the pumps in the model. The City also checked the position of the isolation valves along Estates Dr. The City found a partially closed valve on a 12-inch main along Acorn Dr. This pipe supplies flow from the Acorn Pump Station to the Bosque pressure plane. The City also found a closed valve on Whippoorwill Dr. that helps maintains a connection between the Acorn and Bosque pressure planes. These closures were still not enough to make the model match the field tests.

CP&Y then suggested to repeat three hydrant field tests while closing the valves that connect Acorn and Bosque except for the connection at the intersection of Bosque Blvd and Estates Dr. The results showed that the two pressure planes were interconnected but Acorn Pump Station (PS) was the main source of water to a large portion of the Bosque pressure plane and thus there must be a significant restriction at the main pipes supplying flow from Bosque PS. Additional model simulations suggested that the 6-inch coming out of the Bosque PS was significantly restricted. A field investigation by the City found a closed valve underneath the pavement near Bosque Blvd and Woodland West Dr. It was concluded that a full investigation of the entire Bosque-Acorn pressure plane pair should be done as part of the City of Woodway capital improvement plan. This would allow the calibration and validation of the water model and allow the City to use all of the capacity of their existing infrastructure. This investigation should be completed by City of Woodway staff and should include all valve positions, confirm connections and locations, and pipe configurations and sizes.

With exception of the Bosque and Acorn pump station, the model is calibrated well within engineering standards and provide confidence in the accuracy of the model results.

7.2.8 Model Scenarios

Thirteen model scenarios were analyzed for the City of Woodway system to determine required improvements. They are as follows:

- 2020 Existing Water System
 - Average Day Demand (ADD)
 - Maximum Day Demand (MDD)
 - Peak Day Demands (PDD)
 - Fire Flow Testing
- 2030 Existing Water System
 - Average Day Demand (ADD)
 - Maximum Day Demand (MDD)
 - Peak Day Demands (PDD)
 - Fire Flow Testing
- 2040 Existing Water System
 - Average Day Demand (ADD)
 - Maximum Day Demand (MDD)
 - Groundwater + Purchased Water Supply
 - Purchased Water Supply Only
 - Peak Day Demands (PDD)
 - Fire Flow Testing

Average Day, Maximum Day and Peak Day demand scenario simulations were run with half-full ground storage tanks, the lowest hydrostatic tank pressure setting, and service pumps on. Fire flow scenario simulations were run with half-full ground storage tanks, the lowest hydrostatic tank pressure, and service pumps off.

For 2030 and 2040 scenarios, the identified residential developments were added to the model network. Most of these developments were located in the Tater Hill pressure plane and the Hwy 84 pressure plane. Commercial development was added to all of the pressure zones along the Highway 84 corridor and on designated zones identified in the City of Woodway Zoning

Map of 2020. Areas with the most potential for commercial and industrial growth were the Santa Fe and Business Acres pressure planes.

After the simulation, the model automatically flags nodes with pressures under 35 psi and pipes with velocities above 9 ft/s. These were the criteria set to identify potential improvements to the system.

8 CAPACITY ANALYSIS AND MODELING RESULTS

To evaluate the capacity of the City of Woodway system and identify future improvements required, CP&Y evaluated the system using both TCEQ requirements and modeling scenario results.

8.1 CAPACITY ANALYSIS AS PER TAC § 290.45 RULES

Texas Administrative Code Title 30 Chapter 290.45 (30 TAC § 290.45) defines the minimum capacity that a public water system should provide per pressure plane that is hydraulically separated or incapable of serving another pressure plane. Each City of Woodway pressure plane and pressure plane pair is classified as community water systems with more than 250 connections and therefore needs to comply with all subsections of rule TAC § 290.45 (b) (D). Currently, the City of Woodway system meets all these requirements as summarized in Table 8-1.

Table 8-1. Summary of City of Woodway System Capacities per Pressure Plane.

Pressure Plane	Connections	Well Production (gpm) ^a		Service Pumping (gpm) ^b		Storage (MG) ^c		Hydropneumatic Pressure Tank Volume (gal) ^d	
		Required	Provided	Required	Provided	Required	Provided	Required	Provided
Tater Hill	1,116	670	1,300	2,232	3,840	0.22	2.00	22,320	32,000
Bus Acres	119	566	1,610	1,888	6,300	0.19	2.00	18,880	33,000
Santa Fe	825								
Acorn	619	946	1,080	3,152	3,150	0.32	1.98	30,000	27,000
Bosque	957								
Hwy 84	450	270	1,280	900	2,200	0.09	2.70	9,000	16,000

^a Requirement is 0.6 gpm per connection.

^b Requirement is 2 gpm per connection.

^c Requirement is 200 gallons per connection.

^d Requirement is 20 gallons per connection and 30,000 gallons are sufficient up to 2,500 connections.

CP&Y extended this analysis by adding future projected connections from residential and commercial development described in Sections 2 and 3. Table 8-2 summarizes the projected required capacity compared to the provided capacity.

Table 8-2. Projected System Capacity Evaluation of City of Woodway System.

2030 Projection									
Pressure Plane	Connections	Well Production (gpm) ^a		Service Pumping (gpm) ^b		Storage (MG) ^c		Hydropneumatic Pressure Tank Volume (gal) ^d	
		Required	Provided	Required	Provided	Required	Provided	Required	Provided
Tater Hill	1,268	761	1,300	2,536	3,840	0.25	2.00	25,360	32,000
Bus Acres	129	589	1,610	1,964	6,300	0.20	2.00	19,636	33,000
Santa Fe	853								
Acorn	629	961	1,080	3,204	3,150	0.32	1.98	30,000	27,000
Bosque	973								
Hwy 84	613	368	1,280	1,226	2,200	0.12	2.70	12,260	16,000
2040 Projection									
Pressure Plane	Connections	Well Production (gpm) ^a		Service Pumping (gpm) ^b		Storage (MG) ^c		Hydropneumatic Pressure Tank Volume (gal) ^d	
		Required	Provided	Required	Provided	Required	Provided	Required	Provided
Tater Hill	1,356	814	1,300	2,712	3,840	0.27	2.00	27,120	32,000
Bus Acres	129	591	1,610	1,970	6,300	0.20	2.00	19,696	33,000
Santa Fe	856								
Acorn	629	978	1,080	3,260	3,150	0.33	1.98	30,000	27,000
Bosque	1,001								
Hwy 84	876	526	1,280	1,752	2,200	0.18	2.70	17,520	16,000

^a Requirement is 0.6 gpm per connection.

^b Requirement is 2 gpm per connection.

^c Requirement is 200 gallons per connection.

^d Requirement is 20 gallons per connection.

As shown in Table 8-1, an extra 3,000 gallons of hydropneumatic pressure tank volume is required for the Acorn-Bosque pressure plane pair and additional service pumping is currently required.

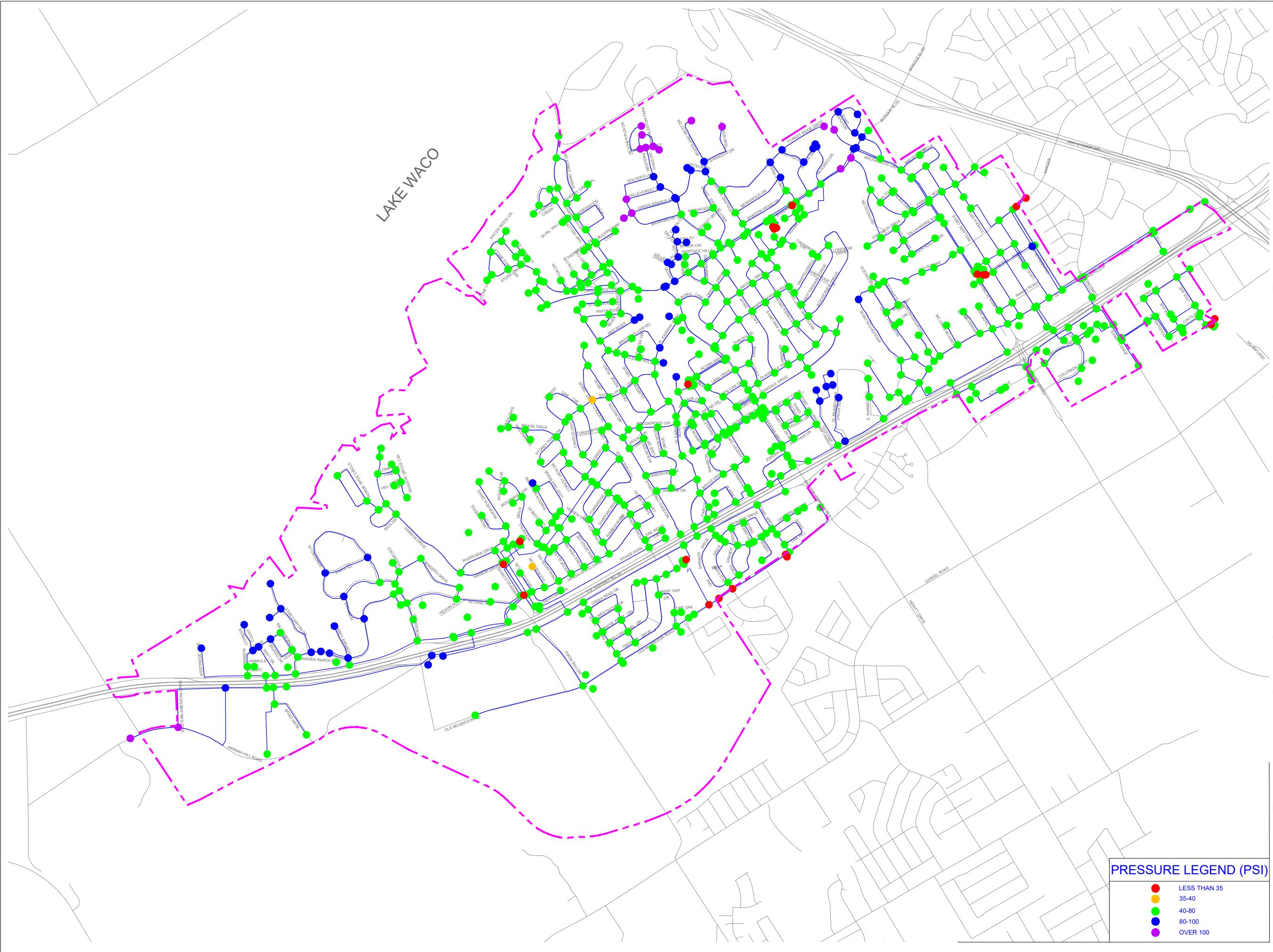
Due to the significant residential developments in the Hwy 84 pressure plane, there will be a requirement to increase the hydropneumatic pressure tank volume by 520 gallons before 2040. Finally, although the Hwy 84 service pumping capacity in 2040 will still be compliant with TAC §290.45 rules, it is recommended that the pump capacity be increased to provide a larger safety margin.

8.2 2020 SCENARIO RESULTS – EXISTING SYSTEM


As described previously, the model was run with the existing infrastructure for average day, max day and peak hour demands as well as fire flows. The model automatically flagged velocities greater than 9 fps, pressures below 35 psi, and fire flows under 750 gpm at 20 psi or pressure under 20 psi during fire flows.

At average day flow, only the corner of Ritchie Rd and Old McGregor Rd was flagged to have a pressure under 35 psi (Exhibit 2). This occurs only when the pressure tank at the Hwy 84 plant is at its lowest setting. No additional issues were flagged under max day flow (Exhibit 3). At peak hour flow, the model flagged the end of Glenview Circle to have a pressure of exactly 35 psi. This is a high point in the Tater Hill pressure plane and only occurs when the hydropneumatic pressure tank is at its lowest setting.

Fire flow simulations flagged only two spots in the system that would experience low flow and pressure at 20 psi or below 20 psi. The end of Woodfall Dr. and Woodfall Circle in the Tater Hill pressure zone will experience flows of 678 and 659 gpm, respectively, at a pressure of 20 psi, based on the model. In the Santa Fe pressure plane, the corner of Elmwood Ln. and Mulberry Ln. has a fire hydrant served by two 2-inch service lines. At a pressure 20 psi, the hydrant would only be able to provide 114 gpm.



8-24-21
DATE
NAME



Know what's below.
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0 500 1000 2000
(IN FEET)


KEY PLAN

CITY OF WOODWAY

2021 WATER MASTER PLAN

WOODWAY, TX

DATE	ISSUED FOR
▲	
▲	
▲	




CP&Y, INC.

TEXAS REGISTERED
ENGINEERING FIRM
F-1741

PROJ. # COWO1900076 PM: SCW
CK. BY: DLM DN. BY: CDG

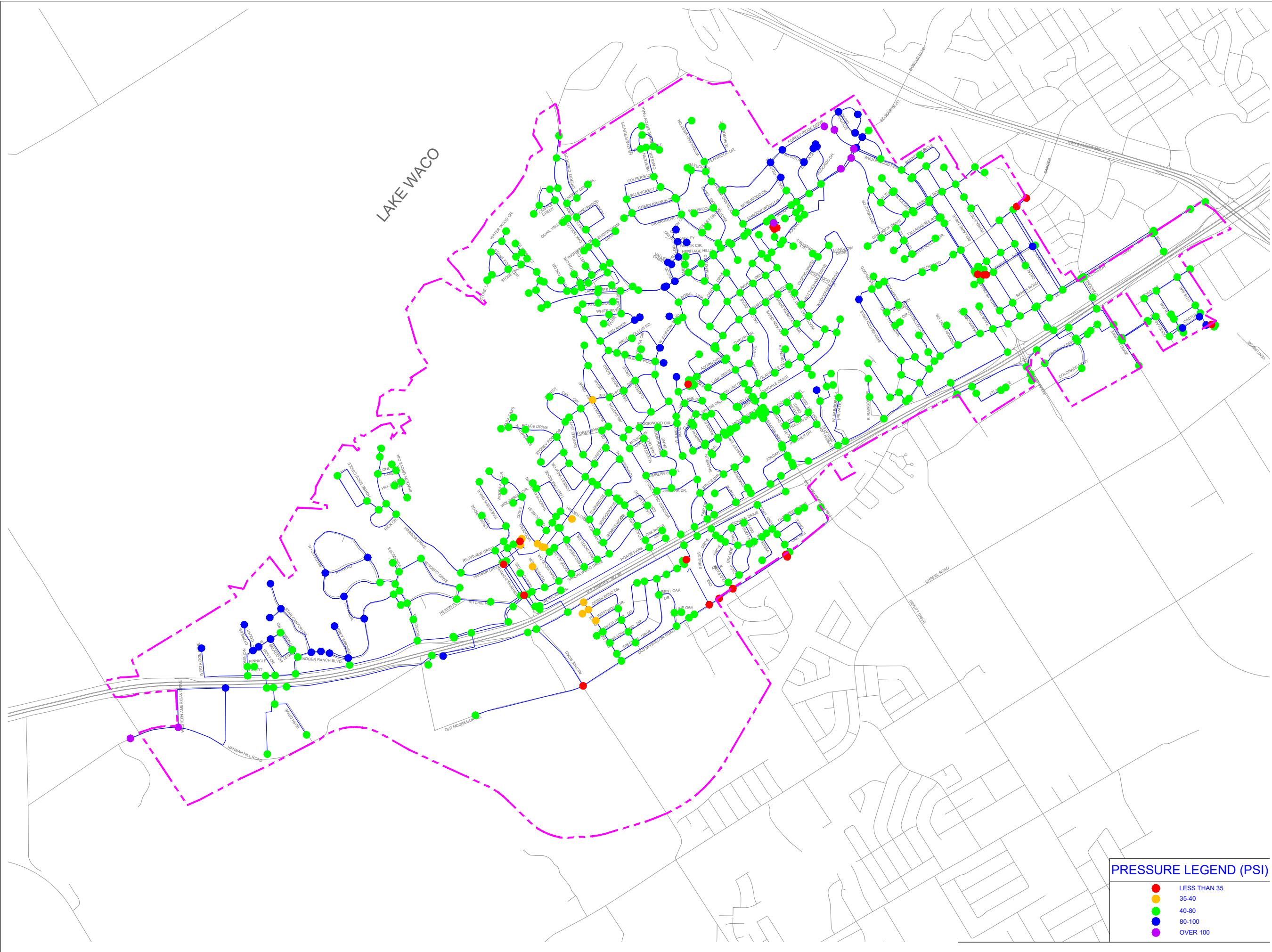
EXISTING PRESSURE
MAP
AVERAGE DAY



2

PRESSURE LEGEND (PSI)

- LESS THAN 35
- 35-40
- 40-80
- 80-100
- OVER 100



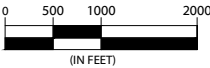
PRESSURE LEGEND (PSI)

- LESS THAN 35
- 35-40
- 40-80
- 80-100
- OVER 100

8-24-21
DATE NAME



Know what's below.
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KEY PLAN

CITY OF WOODWAY

2021 WATER MASTER PLAN

WOODWAY, TX

DATE	ISSUED FOR

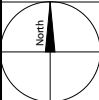


CP&Y, INC.

TEXAS REGISTERED
ENGINEERING FIRM
F-1741

PROJ. # COWO1900076 PM: SCW
CK. BY: DLM DN. BY: CDG

**EXISTING PRESSURE
MAP
MAX DAY**



8.3 2030 SCENARIO RESULTS

For the 2030 Scenario, the projected residential developments and additional commercial connections were added to the model. At average day flow and maximum day flow, there were no additional flagged items other than the low pressures at the corner of Ritchie Rd. and Old McGregor Rd.

At peak hour flow, the model identified low pressures of 29 psi at Ritchie Rd. and Old McGregor Rd, and 34 psi at the end of Creek Bend Dr of the Hwy 84 pressure plane. In the Tater Hill pressure plane, there were pressures under 34 psi at the end of Glenview Circle and at the corner of Lost Oak Ridge Dr. and Woodfall Dr.

Under fire flow simulations, the same locations were identified for not meeting requirements as in the 2020 simulations.

8.4 2040 SCENARIO RESULTS

For the 2040 scenario, the projected residential developments and additional commercial connections were added to the model. At average day flow, there were no additional flagged items other than the low pressure at the corner of Ritchie Rd. and Old McGregor Rd.

At maximum day flow, the connections at the end of Creek Bend Dr. were flagged as having pressures at 35 psi. At peak hour flow, there were velocities above 10 fps flagged in the 12-inch pipe coming out of the Hwy 84 plant into the pressure plane. There were also velocities above 9 fps flagged in the 6-inch pipe on Oak Ridge Ln between Treeline and Old McGregor Rd in the Hwy 84 pressure plane. This pipe conveys a bulk of the flow that feeds the major WDA/Tanglewood development on the southside of Old McGregor Rd. The headlosses in this 6-inch pipe combined with the 12-inch pipe at the Hwy 84 plant, generates pressures at or under 35 psi in the entire development.

There were additional areas in the Hwy 84 pressure plane with pressures at or under 35 psi. These included the intersections of Oak Ridge Dr. with Westwood Dr, Creek Bend Dr. and Hwy 84. Also, the commercial connection at the First Baptist Church was flagged as experiencing a pressure of 33 psi. Under fire flows, no additional issues were flagged by the model in the 2040 scenario.

8.4.1 2040 Maximum Day Demand with Purchased Water Only (City of Waco)

Apart from the 2040 Maximum Day Demand scenario described above another sub-scenario was developed to test the system in the event purchased water from City of Waco is the only water source available.

The analysis concluded that Tater Hill, Highway 84, Business Acres, Acorn and Bosque cannot meet their future 2040 Maximum Day demand when solely supplied with City of Waco Water. Although Business Acres can receive water from the Santa Fe connections, the combined demand of Santa Fe and Business Acres exceeds the allowed water purchase from City of Waco.

Table 8-3. Comparison of Projected 2040 Maximum Day Demand and City of Waco Water Availability for the Woodway System.

Pressure Plane	Projected 2040 Maximum Day Demand (gpm)	City of Waco Water Availability (gpm)
Tater Hill	1,822	800
Business Acres	430	N/A
Acorn	565	N/A
Hwy 84	1,996	800
Bosque	703	N/A
Santa Fe	838	1,000

8.5 IMPROVEMENT RECOMMENDATIONS

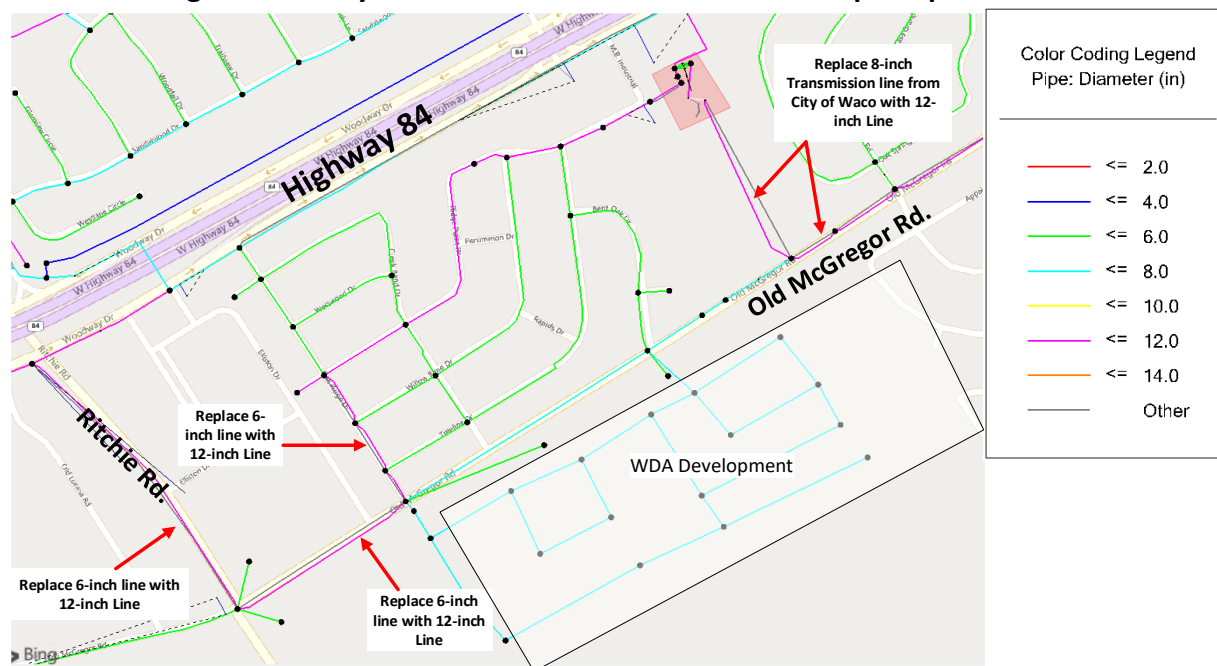
Given the results described in this section there are important improvements that are required to correct the identified issues. The timeline for these improvements will be outlined in Section 10, Capital Improvements Plan.

8.5.1 Highway 84 Pressure Plane

To correct the low pressures at the intersection of Old McGregor Rd. and Ritchie Rd., and near Oak Ridge Dr. and Hwy 84 it is recommended that the pressure tank settings be adjusted to operate at a minimum pressure of 66 psi. Currently the minimum pressure is 56 psi. To confirm this change would not produce excessive pressures in the system, the model was run with pressure tank settings up to 80 psi. The majority of the pressure plane experienced pressures below 95 psi and the maximum pressure experienced was between 100-108 psi at Rainbow Dr. on the north-east corner of the pressure plane.

The major recommended pipe replacements are related to the WDA/Tanglewood development located on the south side of Old McGregor Rd. Some recommendations include replacing the 6-inch pipe along Ritchie Rd. from Hwy-84 to Old McGregor Rd. with a 12-inch pipe, replacing the 6-inch pipe on Old McGregor Rd. from Ritchie Rd. to Oak Ridge Dr. with a 12-inch pipe, and replacing the 6-inch pipe on Oak Ridge Dr. with a 12-inch pipe from Ridge Point Dr. to Old McGregor Dr. Recommended pipe replacements are shown in Figure 8-1.

Figure 8-1. Hwy 84 Pressure Plane Recommended Pipe Replacements



Due to the significant residential developments in the Hwy 84 pressure plane, there will be a need to increase the hydropneumatic pressure tank volume and service pump capacity. It is recommended that a total volume of 30,000 gallons be available in order to be in compliance for future demands beyond 2040. It is also recommended that a matching 1,100 gpm pump be added to the Hwy 84 plant to provide a larger safety margin on the service pump capacity.

To meet 2040 maximum day demands with supply solely from the City of Waco, it is recommended that the transmission line connecting the Sunn Dr. interconnection meters with the Hwy 84 GST be upsized to a 12-inch pipe and be able to convey at least 2,100 gpm of water. Negotiations with the City of Waco to increase the capacity of this interconnection from 800 gpm to at least 2,100 gpm will be required.

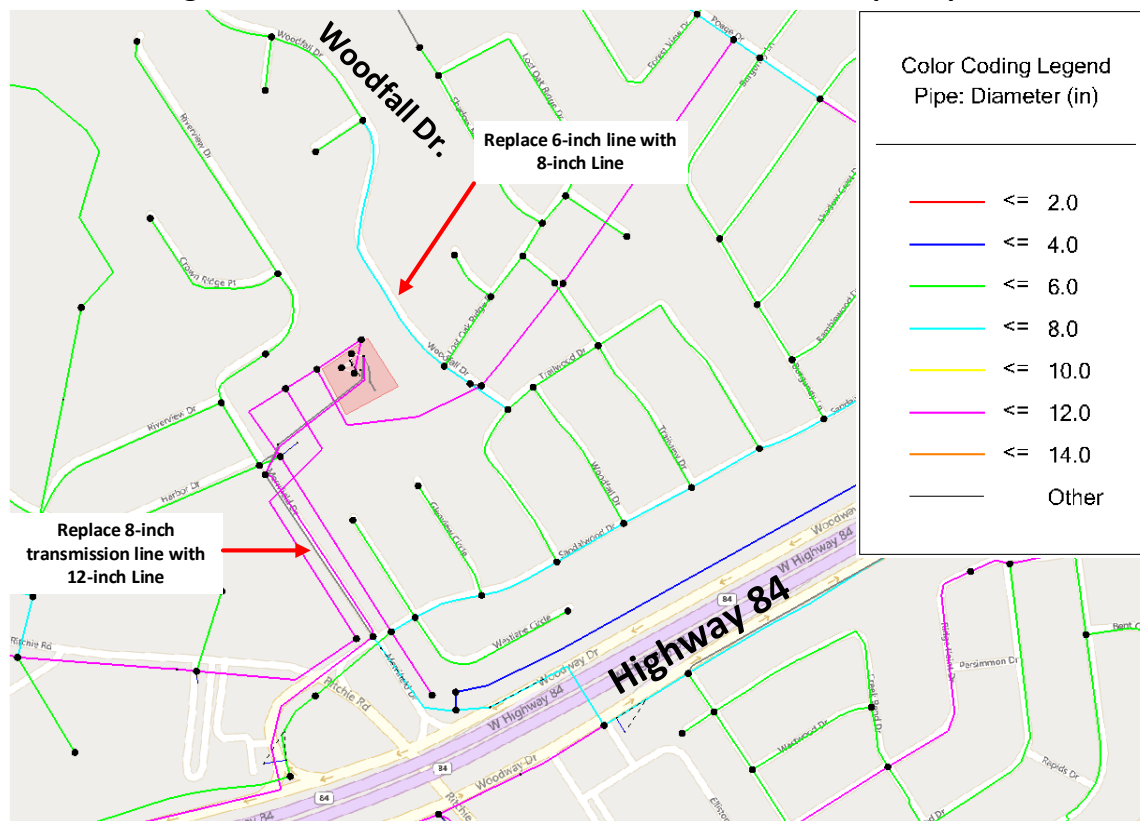
8.5.2 Tater Hill Pressure Plane

To correct the low pressure at the end of Glenview Circle, it is recommended that the pressure tank setting be adjusted to operate at a minimum pressure of 43 psi. Currently the minimum

pressure is 40 psi. The change does not generate excessive pressures elsewhere in the pressure plane.

The areas at the end of Woodfall Dr. located just north of the Tater Hill plant are served by 6-inch pipes connected to the 8-inch main at Sandalwood Dr. and Poage Dr. several blocks away. During fire flow above 650 gpm, the distance and size of the pipes result in pressures below 20 psi. To correct this condition the 6-inch line on Woodfall Dr. is recommended to be replaced with an 8-inch line from Trailwood Dr. to Woodbriar Circle. Figure 8-2 shows the recommended pipe to be replaced.

Figure 8-2. Tater Hill Pressure Plane Recommended Pipe Replacements



Finally, it is important to note that a portion of the pipe that conveys water from the Wickson Connection to the Tater Hill plant tank is an 8-inch pipe. It is recommended that this portion be

replaced with a 12-inch pipe to convey at least 1,900 gpm of water and satisfy the 2040 maximum day demand with no groundwater and supplied with water solely purchased from the City of Waco. Negotiations with the City of Waco to increase the capacity of this connection from 800 gpm to at least 1,900 gpm will be required.

8.5.3 Santa Fe-Business Acres Pressure Pair

For the Santa Fe portion, the hydrant located in the intersection of Mulberry Ln. and Elmwood Rd. is currently served by two 2-inch lines. These pipes are recommended to be replaced by 8-inch pipes. Also, it is important to note that most of the pumping capacity of this pressure plane pair is from the Business Acres plant. If in the future the City of Woodway decides to operate the Santa Fe pressure plane as an isolated system, it will need to install larger pumps at the plant. Two 1,000 gpm pumps and one 650 gpm jockey pump are recommended.

The Business Acres system will require the negotiation of a 600 gpm connection with the City of Waco to operate in the event groundwater wells are unavailable. It is recommended that a metered connection be added at Venture Dr. and a 6-inch line be extended to the Business Acres GST.

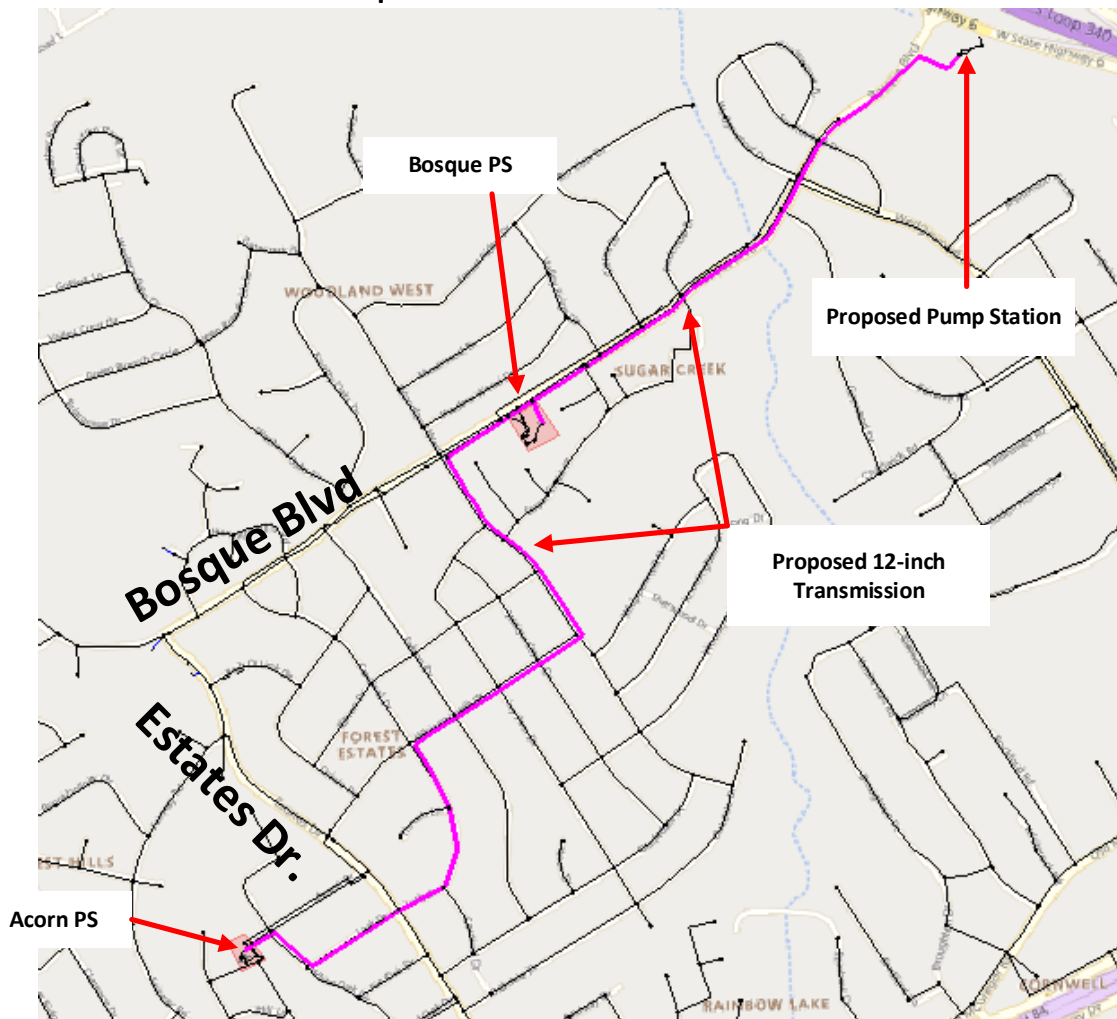
8.5.4 Acorn-Bosque Pressure Pair

It is recommended that a volume of 3,000 gallons at hydropneumatic pressure tankage be added to reach a total volume of 30,000 gallons in the pressure plane pair. This amount of volume will bring the pressure plane pair into compliance to meet the maximum allowed per TAC § 290.45.

Also, the Acorn-Bosque pressure pair does not currently have City of Waco water supply. In order to provide a more reliable system in the future, it is proposed that a 1,500 gpm connection be negotiated with the City of Waco at Bosque and Hwy 6. The connection will require a pump station consisting of two 1,500 gpm pumps and a 1 MG tank that will deliver water to the Bosque GST and the Acorn GST. A new 12-inch transmission line should be

installed from the new pump station to both the Bosque and Acorn GSTs. Figure 8-3 shows the proposed site for the pump station and alignment for the transmission lines.

Figure 8-3. Proposed Interconnection with the City of Waco System for the Bosque-Acorn Pressure Plane Pair.



8.6 AVAILABLE WATER SOURCES

The City of Woodway currently has two viable sources of water including supply from six (6) existing groundwater wells and treated surface water purchased from the City of Waco. It is anticipated that the City of Woodway will rely more and more on purchased treated surface water to prevent further depletion of existing groundwater. CP&Y recommends that the City set

up a groundwater monitoring system for each well. It is also recommended that the City begin negotiations with the City of Waco to reserve water for anticipated needs in the future. The demand for the limited surface water supply will become very competitive with the Waco Metropolitan Area water suppliers desperately trying to lock in their required future water reserves to meet their ever increasing customer demands due to rapid population and business growth in the Waco Metro Area.

9 CAPITAL IMPROVEMENTS PLAN

9.1 GENERAL

The recommended projects for the water system are presented on Exhibits 4, 5, and 6 at the end of this section. The following projects are a part of the Capital Improvements Plan (CIP) and are categorized by priority. All opinions of probable cost (OPCC) included are preliminary.

The costs contained in these OPCCs will likely vary from the final project costs once the final project design is developed. The Consultant's OPCC is based on preliminary information and assumptions that were made in the absence of detailed design information required to develop more precise cost opinions. Therefore, these costs are based on the experience and best judgment of the Consultant, and the Consultant has no control over the cost of labor, materials, or equipment furnished by the contractor; or over the competitive bidding or market conditions that can greatly fluctuate and influence final project costs. The Consultant cannot and does not guarantee the OPCC.

9.2 2021 – 2025 CAPITAL IMPROVEMENT PLAN

The 2021 – 2025 CIP contains eight (8) projects which have an estimated cost of \$2,830,350.00. Detailed single sheet summaries are provided at the end of this section for each of the below itemized projects broken out by pressure plane (PP). OPCCs do not include resident project representation.

Table 9-1. 2021 – 2025 Capital Improvement Projects

PP ID	PP Name	Project #	Project	Cost
1	Tater Hill	1-1	Increase Operating Pressure at Hydropneumatic Tank	City Staff
1	Tater Hill	1-2	Woodfall Dr. Fire Flow Improvements	\$685,580.00
3	Acorn	3-1	Increase Pumping Capacity	\$536,980.00
4	Hwy 84	4-1	Increase Operating Pressure at Hydropneumatic Tank	City Staff
5	Bosque	5-1	Evaluate Field Conditions in Bosque PP	City Staff
5	Bosque	5-2	Increase Hydropneumatic Capacity	\$429,880.00
6	Santa Fe	6-1	Rockford Road – Whitehall Road Fire Flow Improvements	\$967,560.00
6	Santa Fe	6-2	Santa Fe PS Pump Capacity Improvements	\$497,080.00
TOTAL 2021-2025 CIP PROJECTS				\$3,117,080.00

9.3 2025 - 2030 CAPITAL IMPROVEMENT PLAN

The 2025 – 2030 CIP contains one (1) project which has an estimated cost of \$429,880.00. Detailed single sheet summaries are provided at the end of this section for each of the below itemized projects broken out by PP. OPCCs do not include resident project representation. Preliminary work for projects 2-1 and 5-3 in the 2030-2040 CIP, including Waco contract negotiations and obtaining property for the proposed storage tank and pump station, are recommended to be performed during this time due to the anticipated length of time required to perform these project tasks. There is also the option of moving projects up from 2030-2040 if funds are available.

Table 9-2. 2025 – 2030 Capital Improvement Projects

PP ID	PP Name	Project #	Project	Cost
4	Hwy 84	4-2	Increase Hydropneumatic Capacity in PP 4	\$429,880.00
TOTAL 2025-2030 CIP PROJECTS				\$429,880.00

9.4 2030 – 2040 CAPITAL IMPROVEMENT PLAN

The 2030 – 2040 CIP contains ten (10) projects which have an estimated cost of \$13,940,730.00. Detailed single sheet summaries are provided at the end of this section for each of the below itemized projects, also broken out by PP. OPCCs do not include resident project representation.

Table 9-3. 2030 – 2040 Capital Improvement Projects

PP ID	PP Name	Project #	Project	Cost
1	Tater Hill	1-3	12-Inch Water Line at Wickson Connection (Sandalwood Dr. to Tater Hill Tank)	\$519,970.00
2	Business Acres	2-1	6-Inch Water Line (Waco Connection)	\$509,470.00
3	Acorn	3-2	12-Inch Water Line from Bosque PP (Waco Connection)	\$2,706,740.00
4	Hwy 84	4-3	12-Inch Water Line along Ritchie Road (Hwy 84 to Old McGregor Rd)	\$927,020.00
4	Hwy 84	4-4	12-Inch Water Line along Old McGregor Road (Ritchie Road to Oak Ridge Drive)	\$569,400.00
4	Hwy 84	4-5	12-Inch Water Line along Oak Ridge Drive (Treeline Drive to Old McGregor Drive)	\$151,650.00
4	Hwy 84	4-6	12-Inch Water Line along Oak Ridge Drive (Ridge Point Drive to Old McGregor Road)	\$353,480.00
4	Hwy 84	4-7	New Pump at Hwy 84 Pump Station	\$355,750.00
4	Hwy 84	4-8	12-Inch Water Line (Waco Connection)	\$1,177,425.00
5	Bosque	5-3	New Pumping and Storage Facility and 12-Inch Water Line (Waco Connection)	\$6,669,825.00
TOTAL 2030-2040 CIP PROJECTS				\$13,940,730.00



9.5 CIP PROJECT STATUS AND CHECK LIST

Pressure Plane	PP Name	Project #	Project	Cost	FY Schedule	Design	Bid	Construction	Complete
2021 – 2025 CIP									
1	Tater Hill	1-1	Increase Operating Pressure at Hydropneumatic Tank	City Staff					
1	Tater Hill	1-2	Woodfall Dr. Fire Flow Improvements	\$685,580.00					
3	Acorn	3-1	Increase Pumping Capacity	\$536,980.00					
4	Hwy 84	4-1	Increase Operating Pressure at Hydropneumatic Tank	City Staff					
5	Bosque	5-1	Evaluate Field Conditions in Bosque PP	City Staff					
5	Bosque	5-2	Increase Hydropneumatic Capacity	\$429,880.00					
6	Santa Fe	6-1	Rockford Road – Whitehall Road Fire Flow Improvements	\$967,560.00					
6	Santa Fe	6-2	Santa Fe PS Pump Capacity Improvements	\$497,080.00					
2025 – 2030 CIP									
4	Hwy 84	4-2	Increase Hydropneumatic Capacity in PP 4	\$429,880.00					
2030 – 2040 CIP									
1	Tater Hill	1-3	12-Inch Water Line at Wickson Connection (Sandalwood Dr. to Tater Hill Tank)	\$519,970.00					
2	Business Acres	2-1	6-Inch Water Line (Waco Connection)	\$509,470.00					
3	Acorn	3-2	12-Inch Water Line from Bosque PP (Waco Connection)	\$2,706,740.00					
4	Hwy 84	4-3	12-Inch Water Line along Ritchie Road (Hwy 84 to Old McGregor Rd)	\$927,020.00					
4	Hwy 84	4-4	12-Inch Water Line along Old McGregor Road (Ritchie Road to Oak Ridge Drive)	\$569,400.00					
4	Hwy 84	4-5	12-Inch Water Line along Oak Ridge Drive (Treeline Drive to Old McGregor Drive)	\$151,650.00					
4	Hwy 84	4-6	12-Inch Water Line along Oak Ridge Drive (Ridge Point Drive to Old McGregor Road)	\$353,480.00					
4	Hwy 84	4-7	New Pump at Hwy 84 Pump Station	\$355,750.00					
4	Hwy 84	4-8	12-Inch Water Line (Waco Connection)	\$1,177,425.00					
5	Bosque	5-3	New Pumping and Storage Facility and 12-Inch Water Line (Waco Connection)	\$6,669,825.00					

9.6 CIP PROJECT SUMMARY SHEETS AND EXHIBITS

This section contains individual summary sheets for each of the above listed projects. In addition, these projects have been mapped for fiscal years 2021-2025, 2025-2030, and 2030-2040, respectively on Exhibits 4, 5, and 6.

CITY OF WOODWAY

Prioritized CIP Project Summary

2021 - 2025



INCREASE OPERATING PRESSURE AT HYDROPNEUMATIC TANK - TATER HILL

PROJECT # 1-1

Project Description:

Pressure Plane 1 - Tater Hill

This project will increase minimum operating pressure at the hydropneumatic tank to 43 psi.

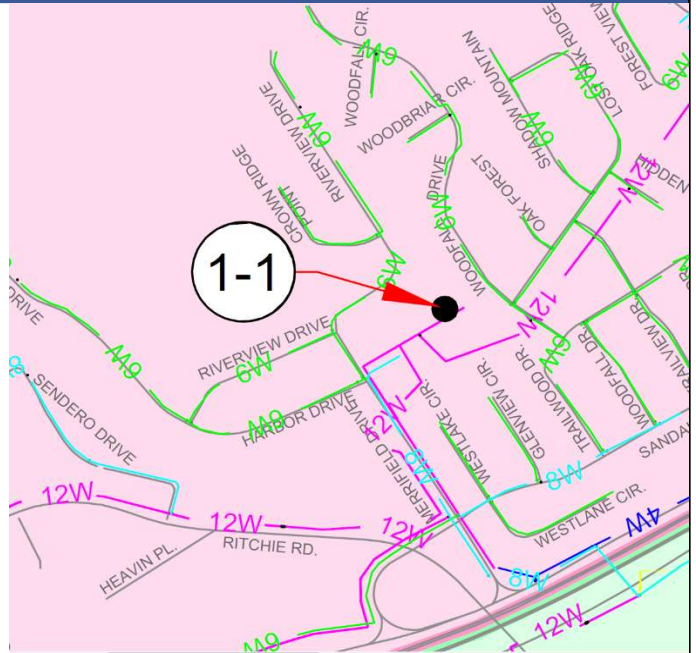
Current Status

Minimum pressure is currently set at 40 psi. Average pressure is 45 psi.

Resolution

By increasing the minimum operating pressure to 43 psi, the low pressure at the end of Glenview Circle will be eliminated.

Vicinity Map:



Opinion of Probable Cost:

IMPROVEMENTS BY CITY STAFF

\$0.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2021 - 2025



WOODFALL DRIVE FIRE FLOW IMPROVEMENTS - TATER HILL

PROJECT # 1-2

Project Description:

Pressure Plane 1 - Tater Hill

This project will replace the 6-inch water line at Woodfall Drive between Lost Oak Ridge Drive and Trailwood Drive with an 8-inch water line to meet TCEQ fire flow requirements.

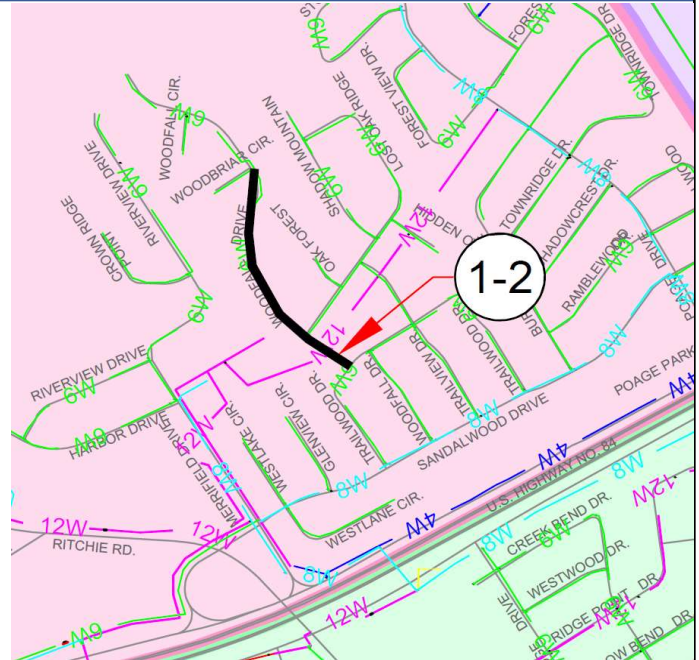
Current Status

The current 6-inch water line does not allow for enough fire flow. Fire flow is currently 650 GPM at 20 psi.

Resolution

By increasing the pipe size, fire flow will be approximately 750 GPM at 20 psi at the end of Woodfall Drive, and meet the minimum fire flow requirements.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Connect to Existing 6" Water Line	5	EA	\$2,500.00	\$12,500.00
2	8" C-900 PVC Water Line	1,500	LF	\$140.00	\$210,000.00
3	8" Gate Valve	6	EA	\$2,500.00	\$15,000.00
4	8" x 8" DIP Tee	3	EA	\$1,000.00	\$3,000.00
5	8" x 6" DIP Reducer	5	EA	\$750.00	\$3,750.00
6	Standard Fire Hydrant Assembly	3	EA	\$8,000.00	\$24,000.00
7	Trench Safety Implementation	1,500	LF	\$2.00	\$3,000.00
8	Class 'A' Surface Replacement	1,500	LF	\$70.00	\$105,000.00
9	Testing, Flushing, and Disinfection	1	LS	\$12,000.00	\$12,000.00
10	Fill Existing 6" Water Line with Grout	1,500	LF	\$13.00	\$19,500.00
SUBTOTAL:					\$407,750.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$61,160.00
SUBTOTAL:					\$468,910.00
CONTINGENCY				30%	\$140,670.00
SUBTOTAL:					\$609,580.00
ENGINEERING					\$52,000.00
SURVEY					\$9,000.00
CONSTRUCTION ADMINISTRATION					\$15,000.00
SUBTOTAL:					\$76,000.00
ESTIMATED TOTAL PROJECT COST:					\$685,580.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2021 - 2025



INCREASE PUMPING CAPACITY - ACORN

PROJECT # 3-1

Project Description:

Pressure Plane 3 - Acorn

This project will increase pump capacity at Highway 84 PS by upsizing the two existing pumps with 1,000 GPM pumps.

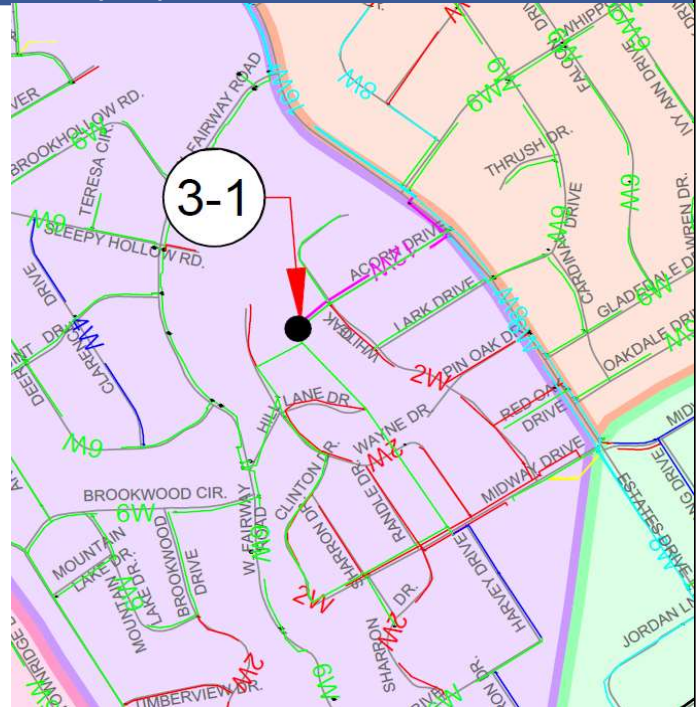
Current Status

Acorn PS currently has two 500 GPM pumps. The suction and header are 12-inch pipes.

Resolution

The two 1,000 GPM pumps will eliminate the current insufficient pump capacity and meet TAC 290.45 rules.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1,000 GPM Pump and Equipment	2	EA	\$60,000.00	\$120,000.00
2	Electrical Improvements	1	LS	\$75,000.00	\$75,000.00
3	Instrumentation Controls and SCADA	1	LS	\$40,000.00	\$40,000.00
4	Yard and Pump Piping	1	LS	\$55,000.00	\$55,000.00
5	Demolition of Existing Pumps and Equipment	1	LS	\$15,000.00	\$15,000.00
SUBTOTAL:					\$305,000.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$45,750.00
SUBTOTAL:					\$350,750.00
CONTINGENCY				30%	\$105,230.00
SUBTOTAL:					\$455,980.00
ENGINEERING					\$55,000.00
SURVEY					\$6,000.00
CONSTRUCTION ADMINISTRATION					\$20,000.00
SUBTOTAL:					\$81,000.00
ESTIMATED TOTAL PROJECT COST:					\$536,980.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2021 - 2025



INCREASE OPERATING PRESSURE AT HYDROPNEUMATIC TANK - HIGHWAY 84

PROJECT # 4-1

Project Description:

Pressure Plane 4 - Highway 84

This project will increase minimum operating pressure at the hydropneumatic tank to 66 psi.

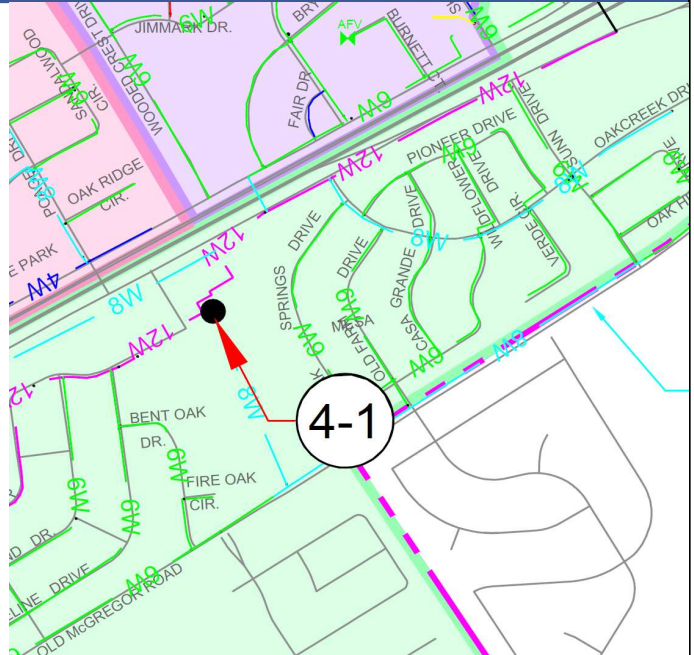
Current Status

Minimum pressure is currently set at 56 psi. Average pressure is 64 psi with maximum pressure at 70 psi.

Resolution

By increasing the minimum operating pressure to 66 psi, the low pressure at Old McGregor Road and Ritchie Road will be eliminated. This will eliminate the low pressure of 56 psi has been recorded on several occasions in the 2019 and 2020 well logs

Vicinity Map:



Opinion of Probable Cost:

IMPROVEMENTS BY CITY STAFF

\$0.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2021 - 2025



EVALUATE FIELD CONDITIONS IN BOSQUE PRESSURE PLANE - BOSQUE

PROJECT # 5-1

Project Description:

Vicinity Map:

Pressure Plane 5 - Bosque

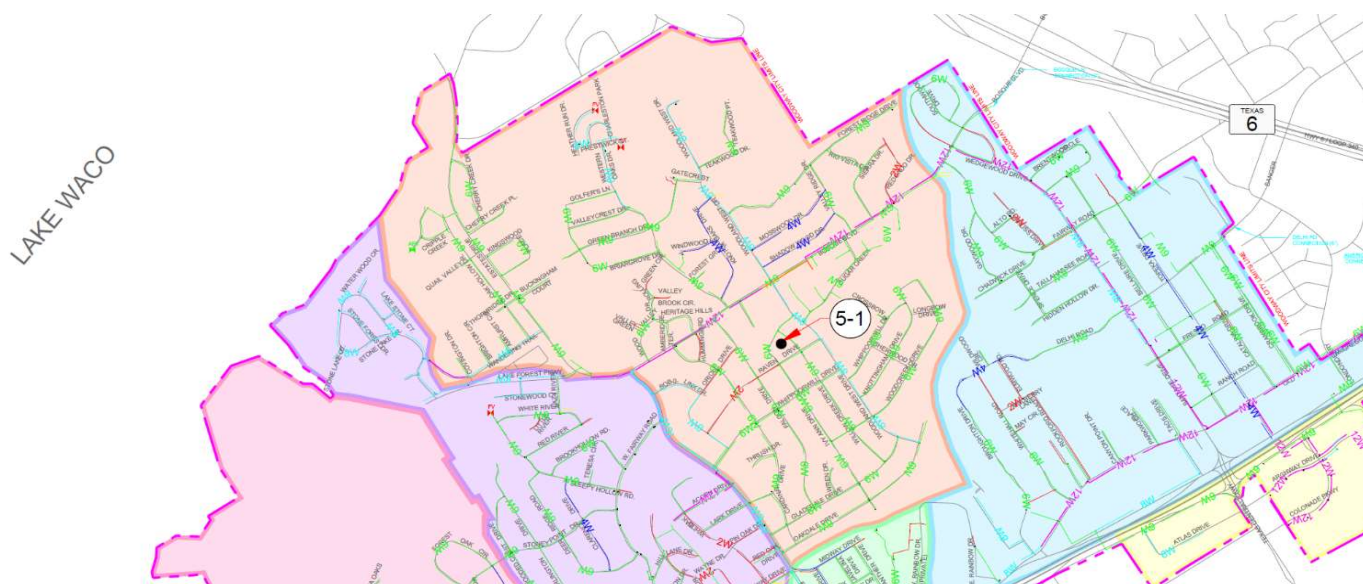
This project will help the City to identify closed valves, connections to undersized water mains, and disconnects between the Bosque Pressure Plane distribution mains and the Bosque Pump Station.

Current Status

Until more recent years, the Bosque and Acorn Pressure Planes operated independently. Currently, the two pressure planes are intended to operate together and as a result, are intended to be fully cross connected. Throughout the calibration work on the model, field investigations were conducted in the distribution system to help identify existing field conditions that are resulting in the computer water model not concurring with field test data. The model indicates that the two pressure planes are not cross connected as believed. As a result, pressures in the actual distribution system during high demands are significantly below (approximately 10 psi or more) those indicated in the model. Numerous closed valves and unconnected mains have been identified along Bosque Boulevard and Estates Drive as a result of additional field investigations. This has provided critical information to help calibrate the model and more accurately reflect the current water distribution system conditions in the field in these two pressure planes.

Resolution

The City will need to systematically investigate the ring connects between the 14-inch main coming out of the Bosque Pump Station and the distribution mains that are thought to connect the distribution mains in the Bosque Pressure Plane to this 14-inch main (i.e., Woodland West Drive, Falcon Drive, Cardinal Drive). Also, further investigation should be conducted on the valve positions and connection of mains, specifically the ring connects, at these intersections. In addition, the City should systematically check valve positions and cross connections of mains throughout the Bosque Pressure Plane to ensure the accuracy of distribution system so that the model can be configured to match.



Opinion of Probable Cost:

IMPROVEMENTS BY CITY STAFF

\$0.00

2021 - 2025



INCREASE HYDROPNEUMATIC CAPACITY IN PP 5 - BOSQUE

PROJECT # 5-2

Project Description:

Pressure Plane 5 - Bosque

This project will increase hydropneumatic capacity in this pressure plane to at least 30,000 gallons. A volume of 30,000 gallons is recommended to be compliant up to 2,500 water connections.

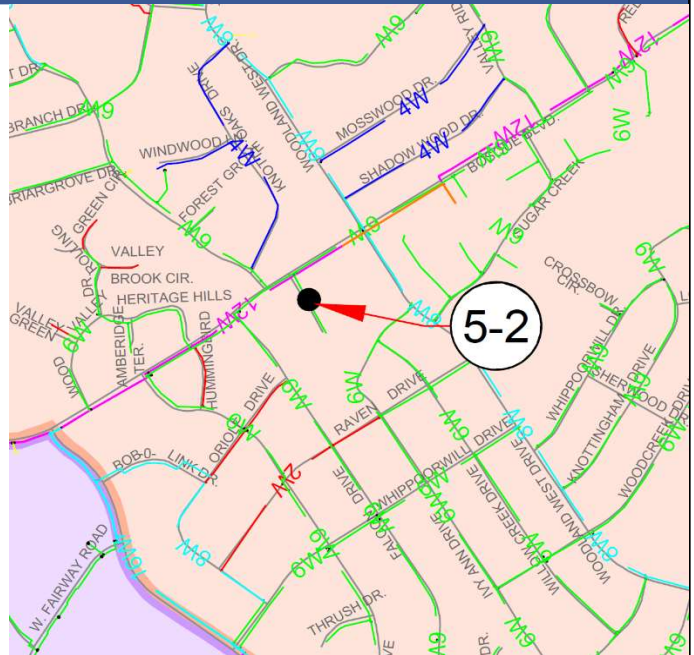
Current Status

The current hydropneumatic capacity is 27,000 gallons and is an insufficient volume per TAC 290.45 rules.

Resolution

By increasing the hydropneumatic capacity to 30,000 gallons, the City will meet current requirements per TAC 290.45 rules. The increased capacity can be accomplished by either replacing the oldest tank with a larger tank or adding a tank to the PS with more space.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	30,000 Gallon Hydropneumatic Tank	1	LS	\$125,000.00	\$125,000.00
2	Instrumentation/Controls	1	LS	\$70,000.00	\$70,000.00
3	Yard and Tank Piping	1	LS	\$50,000.00	\$50,000.00
SUBTOTAL:					\$245,000.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$36,750.00
SUBTOTAL:					\$281,750.00
CONTINGENCY				30%	\$84,530.00
SUBTOTAL:					\$366,280.00
ENGINEERING					\$42,600.00
SURVEY					\$6,000.00
CONSTRUCTION ADMINISTRATION					\$15,000.00
SUBTOTAL:					\$63,600.00
ESTIMATED TOTAL PROJECT COST:					\$429,880.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2021 - 2025



ROCKFORD ROAD - WHITEHALL ROAD FIRE FLOW IMPROVEMENTS - SANTA FE

PROJECT # 6-1

Project Description:

Pressure Plane 6 - Santa Fe

This project will replace the 2-inch water lines with 6-inch water lines on a section of roadway between Old McGregor Highway and Delhi Road, specifically along Rockford Road, Mulberry Lane, and Whitehall Road.

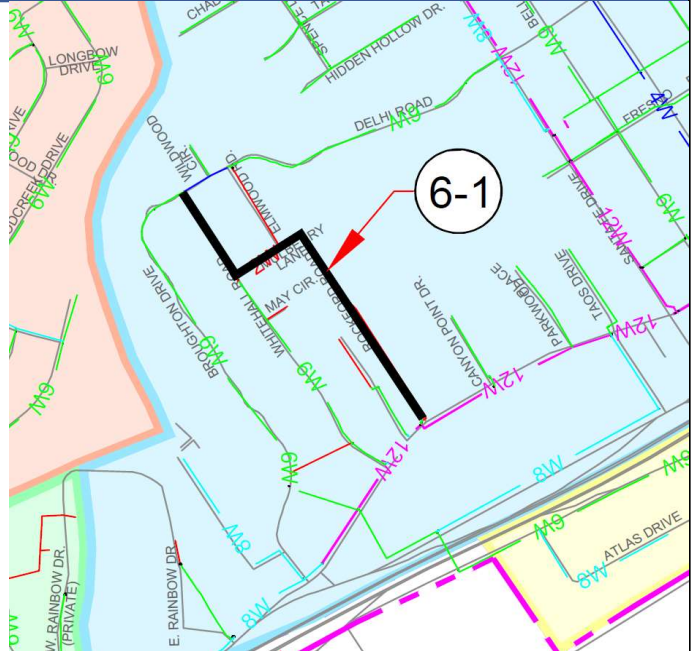
Current Status

The current 2-inch water lines do not meet fire flow requirements. The current fire flow is 114 GPM at 20 psi.

Resolution

By replacing the 2-inch water line in this area with a 6-inch water line, fire flow requirements are met with the fire flow being approximately 2,000 GPM at 22 psi.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Connect to Existing Water Lines (All Sizes)	4	EA	\$2,500.00	\$10,000.00
2	6" C-900 PVC Water Line	2,250	LF	\$140.00	\$315,000.00
3	6" Gate Valve	4	EA	\$2,500.00	\$10,000.00
4	12" x 6" DIP Tee	1	EA	\$1,400.00	\$1,400.00
5	6" x 6" DIP Tee	3	EA	\$1,000.00	\$3,000.00
6	6" x 4" DIP Reducer	2	EA	\$600.00	\$1,200.00
7	Standard Fire Hydrant Assembly	3	EA	\$8,000.00	\$24,000.00
8	2" Threaded Connection	1	EA	\$700.00	\$700.00
9	1" Residential Service and Connection to Existing Meter	30	EA	\$1,200.00	\$36,000.00
10	Trench Safety Implementation	2,250	LF	\$2.00	\$4,500.00
11	Class 'A' Surface Replacement	2,250	LF	\$70.00	\$157,500.00
12	Testing, Flushing, and Disinfection	1	LS	\$17,000.00	\$17,000.00
SUBTOTAL:					\$580,300.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$87,050.00
SUBTOTAL:					\$667,350.00
CONTINGENCY				30%	\$200,210.00
SUBTOTAL:					\$867,560.00
ENGINEERING					\$72,000.00
SURVEY					\$14,000.00
CONSTRUCTION ADMINISTRATION					\$14,000.00
SUBTOTAL:					\$100,000.00
ESTIMATED TOTAL PROJECT COST:					\$967,560.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2021 - 2025



SANTA FE PS PUMP CAPACITY IMPROVEMENTS - SANTA FE

PROJECT # 6-2

Project Description:

Pressure Plane 6 - Santa Fe

This project will increase pump capacity at Santa Fe PS by replacing two 650 GPM pumps with two 1,000 GPM pumps.

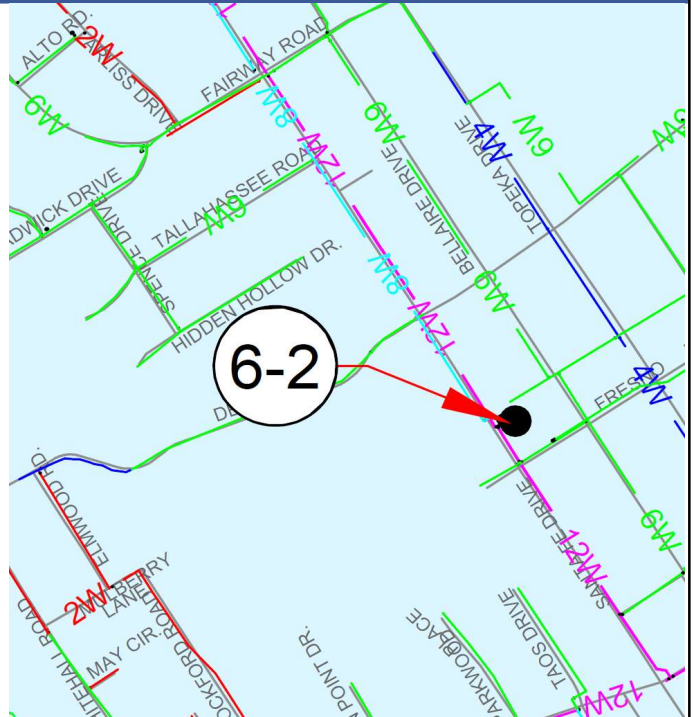
Current Status

Santa Fe PS currently has three 650 GPM pumps. When this PS is combined with Business Acres PP, the pressure zone has enough pumping capacity but by itself, the Santa Fe PS is reported to need more pumping capacity based on TCEQ criteria for the number of water connections in this pressure plane.

Resolution

The replacement of two 650 GPM pumps with 1,000 GPM pumps enables the Santa Fe PS to meet capacity requirements while operating independent of Business Acres. This project is optional depending on pump cycling and system operations.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1,000 GPM Pump and Equipment	2	EA	\$60,000.00	\$120,000.00
2	Electrical Improvements	1	LS	\$75,000.00	\$75,000.00
3	Instrumentation Controls / SCADA	1	LS	\$20,000.00	\$20,000.00
4	Yard and Pump Piping	1	LS	\$55,000.00	\$55,000.00
5	Demolition of Existing Pumps and Equipment	1	LS	\$15,000.00	\$15,000.00
SUBTOTAL:					\$285,000.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$42,750.00
SUBTOTAL:					\$327,750.00
CONTINGENCY				30%	\$98,330.00
SUBTOTAL:					\$426,080.00
ENGINEERING					\$50,000.00
SURVEY					\$6,000.00
CONSTRUCTION ADMINISTRATION					\$15,000.00
SUBTOTAL:					\$71,000.00
ESTIMATED TOTAL PROJECT COST:					\$497,080.00

2025 - 2030



INCREASE HYDROPNEUMATIC CAPACITY IN PP 4 - HIGHWAY 84

PROJECT # 4-2

Project Description:

Pressure Plane 4 - Highway 84

This project will increase hydropneumatic capacity in this pressure plane to at least 25,000 gallons. A volume of 30,000 gallons is recommended to be compliant up to 2,500 water connections.

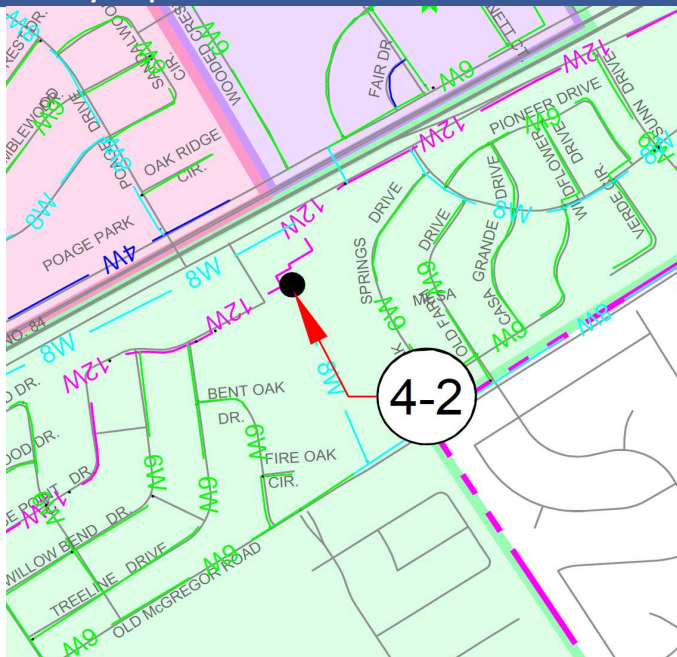
Current Status

The current hydropneumatic capacity is 16,000 gallons and is an insufficient volume per TAC 290.45 rules.

Resolution

By increasing the hydropneumatic capacity to 30,000 gallons, the City will meet current requirements per TAC 290.45 rules.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	30,000 Gallon Hydropneumatic Tank	1	LS	\$125,000.00	\$125,000.00
2	Instrumentation/Controls	1	LS	\$70,000.00	\$70,000.00
3	Yard and Tank Piping	1	LS	\$50,000.00	\$50,000.00
SUBTOTAL:					\$245,000.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$36,750.00
SUBTOTAL:					\$281,750.00
CONTINGENCY				30%	\$84,530.00
SUBTOTAL:					\$366,280.00
ENGINEERING					\$42,600.00
SURVEY					\$6,000.00
CONSTRUCTION ADMINISTRATION					\$15,000.00
SUBTOTAL:					\$63,600.00
ESTIMATED TOTAL PROJECT COST:					\$429,880.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2030 - 2040



12-INCH WATER LINE AT WICKSON CONNECTION - TATER HILL

PROJECT # 1-3

Project Description:

Pressure Plane 1 - Tater Hill

This project will replace the existing 8-inch water line for Wickson Connection with a 12-inch water line. The upsized line will run from Sandalwood Drive to the Tater Hill Ground Storage Tank.

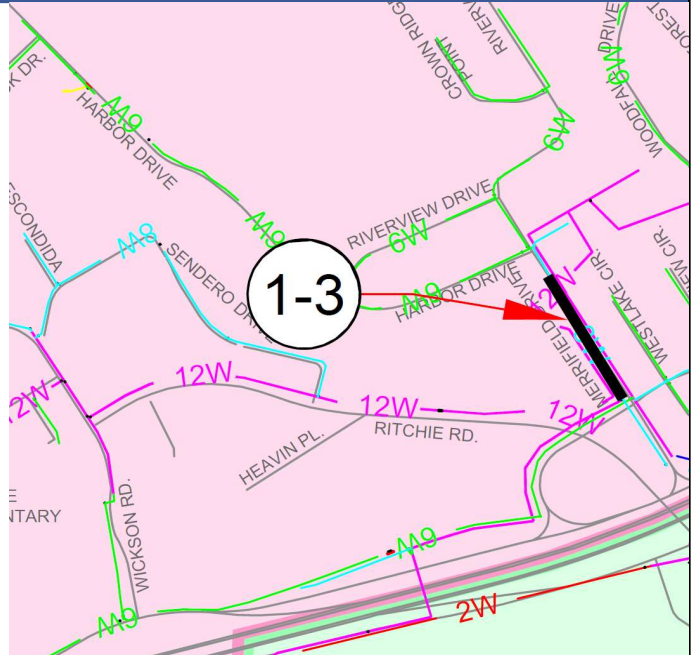
Current Status

The current 8-inch water line does not allow the City to increase flow.

Resolution

By increasing the pipe size to 12-inch, the City will be able to increase flow from the City of Waco. A 12-inch line is required to maintain velocities under 6 fps at the 2,100 gpm required.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Connect to Existing 12" Water Line	1	EA	\$4,300.00	\$4,300.00
2	12" C-900 PVC Water Line	1,100	LF	\$175.00	\$192,500.00
3	12" 45° Bend	2	EA	\$850.00	\$1,700.00
4	Connect to Existing Yard Piping	1	EA	\$6,000.00	\$6,000.00
5	Trench Safety Implementation	1,100	LF	\$2.00	\$2,200.00
6	Class 'A' Surface Replacement	1,100	LF	\$70.00	\$77,000.00
7	Testing, Flushing, and Disinfection	1	LS	\$9,000.00	\$9,000.00
8	Fill Existing 8" Water Line with Grout	1,100	LF	\$13.00	\$14,300.00
SUBTOTAL:					\$307,000.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$46,050.00
SUBTOTAL:					\$353,050.00
CONTINGENCY				30%	\$105,920.00
SUBTOTAL:					\$458,970.00
ENGINEERING					\$45,000.00
SURVEY					\$7,000.00
CONSTRUCTION ADMINISTRATION					\$9,000.00
SUBTOTAL:					\$61,000.00
ESTIMATED TOTAL PROJECT COST:					\$519,970.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2030 - 2040



6-INCH WATER LINE (WACO CONNECTION) - BUSINESS ACRES

PROJECT # 2-1

Project Description:

Pressure Plane 2 - Business Acres

This project will increase capacity to at least 600 GPM to meet 2040 maximum day demands.

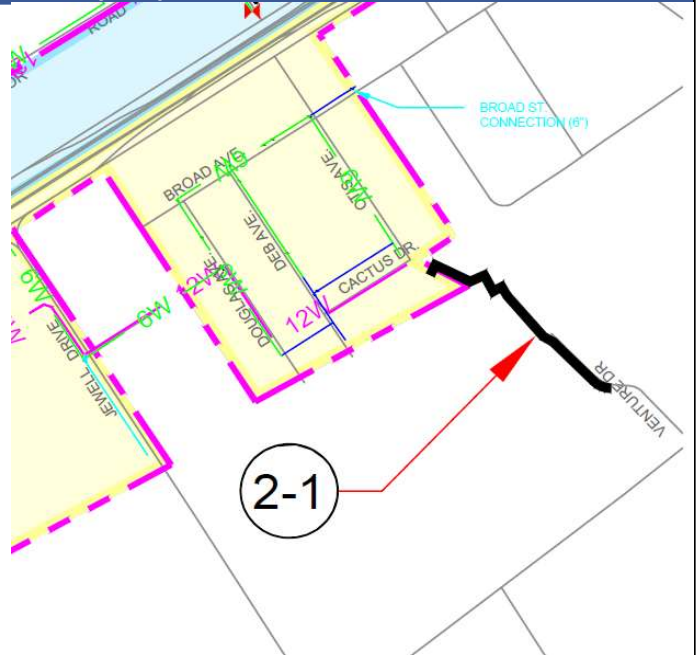
Current Status

The current well water capacity is 370 GPM and the existing Waco connection at Broad Ave. delivers water to the distribution system.

Resolution

By negotiating a change in the Waco Connection to Venture Drive, adding a new 6-inch water connection, capacity will increase to at least 600 GPM to meet the projected 2040 maximum day demand of 537 GPM.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Connect to Existing 8" Water Line	1	EA	\$2,500.00	\$2,500.00
2	6" C-900 PVC Water Line	1,200	LF	\$100.00	\$120,000.00
3	Bore UPRR with 12" Steel Encasement Pipe	100	LF	\$500.00	\$50,000.00
4	6" C-900 PVC Water Line by Directional Drill	50	LF	\$250.00	\$12,500.00
5	6" C-900 PVC Installed in Casing Pipe	100	LF	\$125.00	\$12,500.00
6	Connection to Existing Yard Piping	1	LS	\$5,000.00	\$5,000.00
7	Instrumentation, Controls, and Electrical	1	LS	\$30,000.00	\$30,000.00
8	1" Air Release Valve	1	EA	\$8,000.00	\$8,000.00
9	Hydromulch and Seeding	1,200	LF	\$3.00	\$3,600.00
10	Trench Safety Implementation	1,200	LF	\$2.00	\$2,400.00
11	Testing, Flushing, and Disinfection	1	LS	\$10,000.00	\$10,000.00
SUBTOTAL:					\$256,500.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$38,480.00
SUBTOTAL:					\$294,980.00
CONTINGENCY				30%	\$88,490.00
SUBTOTAL:					\$383,470.00
ENGINEERING					\$24,000.00
SURVEY					\$20,000.00
CONSTRUCTION ADMINISTRATION					\$10,000.00
EASEMENT ACQUISITION					\$72,000.00
SUBTOTAL:					\$126,000.00
ESTIMATED TOTAL PROJECT COST:					\$509,470.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2030 - 2040



12-INCH WATER LINE FROM BOSQUE PP (WACO CONNECTION) - ACORN

PROJECT # 3-2

Project Description:

Pressure Plane 3 - Acorn

This project will add a transmission main to meet the upcoming 2040 maximum day demands.

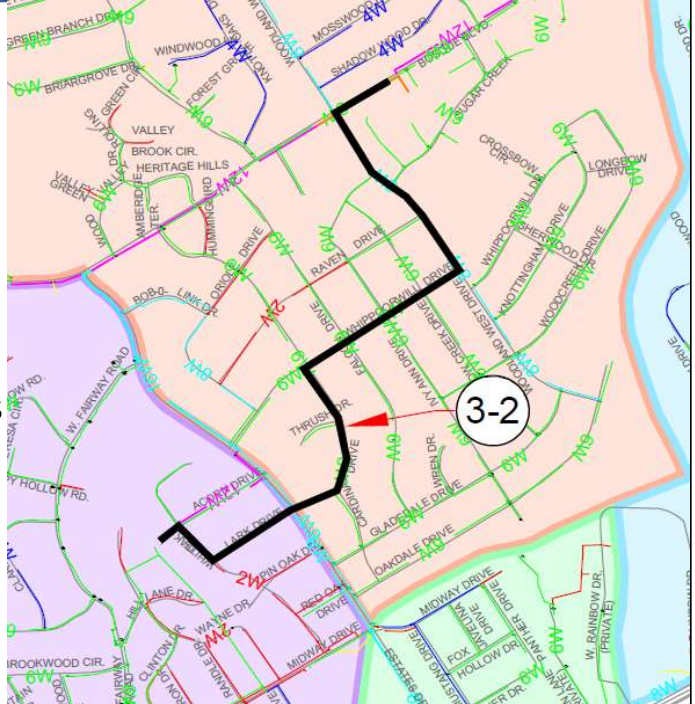
Current Status

Well water capacity at the Acorn well is 540 GPM. There is no City of Waco water connection for this pressure plane.

Resolution

A 12" Transmission main for the water supply from Bosque Pump Station (5-3) will be extended to the Acorn GST. The PS and GST in Project 5-3 will be sized to accommodate the Acorn PP.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	12" C-900 PVC Water Line	6,000	LF	\$175.00	\$1,050,000.00
2	12" Gate Valve	8	EA	\$3,700.00	\$29,600.00
3	Connect to Existing Yard Piping	1	LS	\$6,000.00	\$6,000.00
4	Instrumental, Controls, and Electrical	1	LS	\$50,000.00	\$50,000.00
5	2" Air Release Valve	3	EA	\$10,000.00	\$30,000.00
6	Repair to Existing Services	1	LS	\$20,000.00	\$20,000.00
7	Trench Safety Implementation	6,000	LF	\$2.00	\$12,000.00
8	Class 'A' Surface Replacement	6,000	LF	\$70.00	\$420,000.00
9	Testing, Flushing, and Disinfection	1	LS	\$15,000.00	\$15,000.00
SUBTOTAL:					\$1,632,600.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$244,890.00
SUBTOTAL:					\$1,877,490.00
CONTINGENCY				30%	\$563,250.00
SUBTOTAL:					\$2,440,740.00
ENGINEERING					\$200,000.00
SURVEY					\$36,000.00
CONSTRUCTION ADMINISTRATION					\$30,000.00
SUBTOTAL:					\$266,000.00
ESTIMATED TOTAL PROJECT COST:					\$2,706,740.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2030 - 2040



12-INCH WATER LINE ALONG RITCHIE ROAD - HIGHWAY 84

PROJECT # 4-3

Project Description:

Pressure Plane 4 - Highway 84

This project will replace the existing 6-inch water line along Ritchie Road with a 12-inch water line. The upsized line will run from Highway 84 to Old McGregor Road.

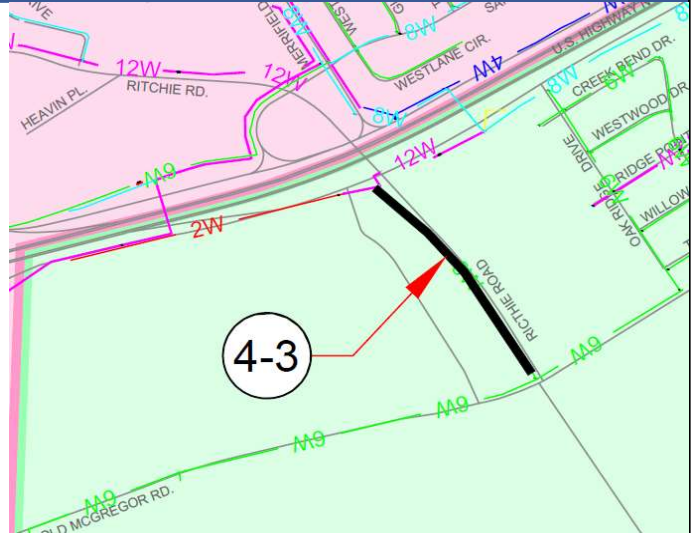
Current Status

The current 6-inch water line experiences low pressures.

Resolution

By increasing the pipe size to 12-inch, the City will be able to increase pressure at Old McGregor Road and Ritchie Road.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Connect to 12" Water Line	2	EA	\$4,300.00	\$8,600.00
2	Connect to 6" Water Line	3	EA	\$2,500.00	\$7,500.00
3	12" C-900 PVC Water Line	1,700	LF	\$175.00	\$297,500.00
4	6" DIP Water Line	25	LF	\$130.00	\$3,250.00
5	12" Gate Valve	6	EA	\$3,700.00	\$22,200.00
6	12" x 12" DIP Tee	2	EA	\$2,000.00	\$4,000.00
7	12" x 6" DIP Tee	2	EA	\$1,800.00	\$3,600.00
8	12" x 6" DIP Reducer	2	EA	\$900.00	\$1,800.00
9	Standard Fire Hydrant Assembly	4	EA	\$9,500.00	\$38,000.00
10	Connect to 6" Fire Line	1	EA	\$3,000.00	\$3,000.00
11	2" Commercial Service and Connection to Existing Meter	3	EA	\$3,500.00	\$10,500.00
12	Trench Safety Implementation	1,700	LF	\$2.00	\$3,400.00
13	Class 'A' Surface Replacement	1,725	LF	\$70.00	\$120,750.00
14	Testing, Flushing, and Disinfection	1	LS	\$10,000.00	\$10,000.00
15	Fill Existing 6" Water Line with Grout	1,700	LF	\$13.00	\$22,100.00
SUBTOTAL:					\$556,200.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$83,430.00
SUBTOTAL:					\$639,630.00
CONTINGENCY				30%	\$191,890.00
SUBTOTAL:					\$831,520.00
ENGINEERING					\$70,000.00
SURVEY					\$10,500.00
CONSTRUCTION ADMINISTRATION					\$15,000.00
SUBTOTAL:					\$95,500.00
ESTIMATED TOTAL PROJECT COST:					\$927,020.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2030 - 2040



12-INCH WATER LINE ALONG OLD MCGREGOR ROAD - HIGHWAY 84

PROJECT # 4-4

Project Description:

Pressure Plane 4 - Highway 84

This project will replace the existing 6-inch water line along Old McGregor Road with a 12-inch water line. The upsized line will run from Ritchie Road to Oak Ridge Drive.

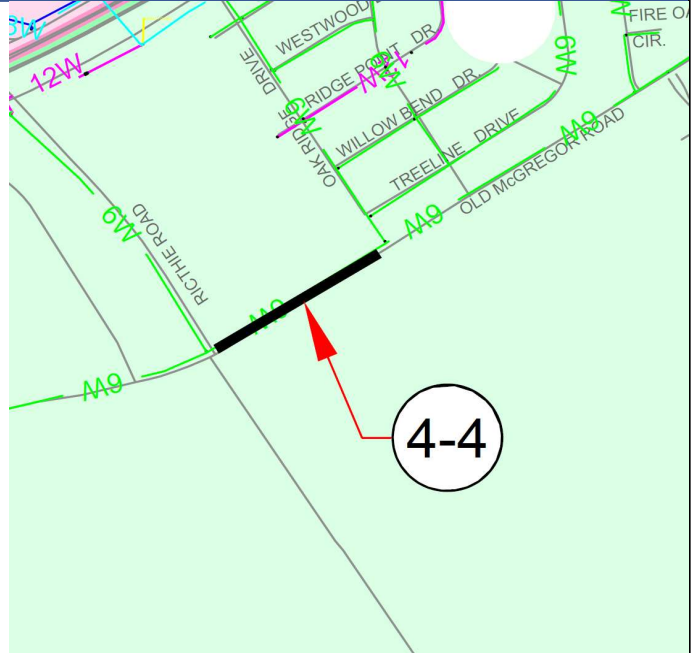
Current Status

The current 6-inch water line experiences low pressures during peak hours.

Resolution

By increasing the pipe size to 12-inches, the City will be able to increase pressure at Old McGregor Road and Oak Ridge Drive.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Connect to Existing 12" Water Line	1	EA	\$4,300.00	\$4,300.00
2	Connect to Existing 8" Water Line	1	EA	\$3,000.00	\$3,000.00
3	Connect to Existing 6" Water Line	2	EA	\$2,500.00	\$5,000.00
4	12" C-900 PVC Water Line	1,025	LF	\$175.00	\$179,375.00
5	12" Gate Valve	5	EA	\$3,700.00	\$18,500.00
6	12" x 12" DIP Tee	1	EA	\$2,000.00	\$2,000.00
7	12" x 8" DIP Tee	1	EA	\$2,000.00	\$2,000.00
8	12" x 6" DIP Reducer	2	EA	\$900.00	\$1,800.00
9	Standard Fire Hydrant Assembly	3	EA	\$9,500.00	\$28,500.00
10	Trench Safety Implementation	1,025	LF	\$2.00	\$2,050.00
11	Class 'A' Surface Replacement	1,025	LF	\$70.00	\$71,750.00
12	Testing, Flushing, and Disinfection	1	LS	\$9,000.00	\$9,000.00
13	Fill Existing 6" Water Line with Grout	1,025	LF	\$13.00	\$13,325.00
SUBTOTAL:					\$340,600.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$51,090.00
SUBTOTAL:					\$391,690.00
CONTINGENCY				30%	\$117,510.00
SUBTOTAL:					\$509,200.00
ENGINEERING					\$45,000.00
SURVEY					\$6,200.00
CONSTRUCTION ADMINISTRATION					\$9,000.00
SUBTOTAL:					\$60,200.00
ESTIMATED TOTAL PROJECT COST:					\$569,400.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2030 - 2040



12-INCH WATER LINE ALONG OAK RIDGE DRIVE - HIGHWAY 84

PROJECT # 4-5

Project Description:

Pressure Plane 4 - Highway 84

This project will replace the existing 6-inch water line along Oak Ridge Drive with a 12-inch water line. The upsized line will run from Treeline Drive to Old McGregor Road.

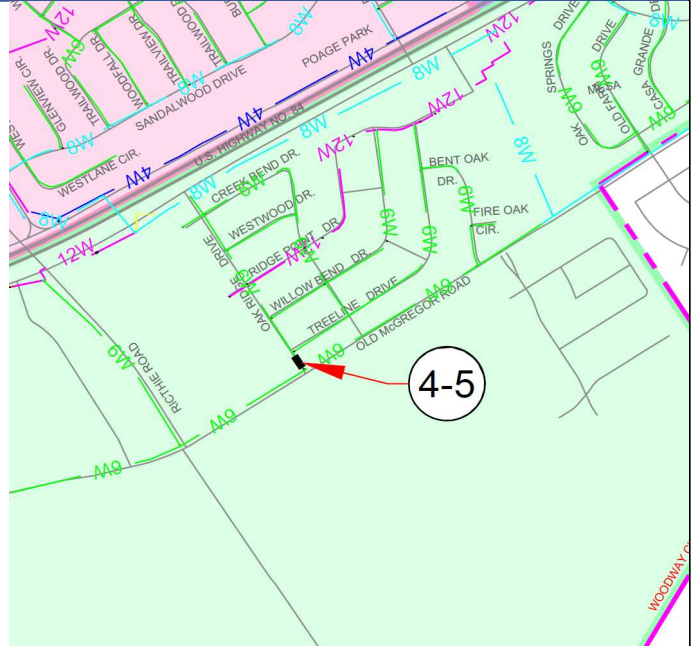
Current Status

The current 6-inch water line experiences both low pressures and high velocities.

Resolution

By increasing the pipe size to 12-inches, the City will be able to increase pressure at Old McGregor Road and Ritchie Road in addition to reducing current high velocities of approximately 10 fps.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Connect to Existing 12" Water Line	1	EA	\$4,300.00	\$4,300.00
2	Connect to Existing 6" Water Line	2	EA	\$2,500.00	\$5,000.00
3	12" C-900 PVC Water Line	200	LF	\$175.00	\$35,000.00
4	12" Gate Valve	2	EA	\$3,700.00	\$7,400.00
5	12" x 12" DIP Tee	1	EA	\$2,000.00	\$2,000.00
6	12" x 6" DIP Reducer	2	EA	\$900.00	\$1,800.00
7	Standard Fire Hydrant Assembly	1	EA	\$9,500.00	\$9,500.00
8	1" Residential Service including Connection to Existing Meter	2	EA	\$1,200.00	\$2,400.00
9	Trench Safety Implementation	200	LF	\$2.00	\$400.00
10	Class 'A' Surface Replacement	200	LF	\$70.00	\$14,000.00
11	Testing, Flushing, and Disinfection	1	LS	\$5,000.00	\$5,000.00
12	Fill Existing 6" Water Line with Grout	200	LF	\$13.00	\$2,600.00
SUBTOTAL:					\$89,400.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$13,410.00
SUBTOTAL:					\$102,810.00
CONTINGENCY				30%	\$30,840.00
SUBTOTAL:					\$133,650.00
ENGINEERING					\$12,000.00
SURVEY					\$2,000.00
CONSTRUCTION ADMINISTRATION					\$4,000.00
SUBTOTAL:					\$18,000.00
ESTIMATED TOTAL PROJECT COST:					\$151,650.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2030 - 2040



12-INCH WATER LINE ALONG OAK RIDGE DRIVE - HIGHWAY 84

PROJECT # 4-6

Project Description:

Pressure Plane 4 - Highway 84

This project is an extension to Project 4-5 and will replace the existing 6-inch water line along Oak Ridge Drive with a 12-inch water line. The upsized line will run from Ridge Point Drive to Treeline Drive and create a loop around the pressure plane.

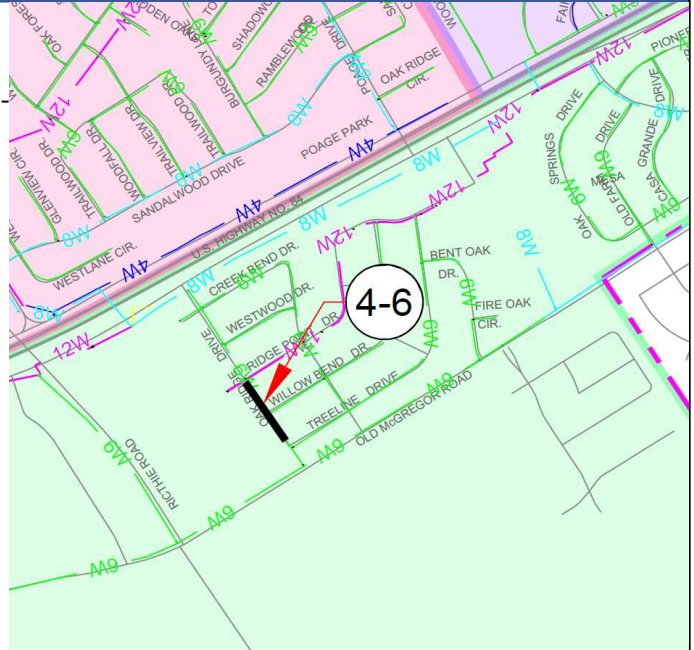
Current Status

The current 6-inch water line experiences both low pressures and high velocities.

Resolution

By increasing the pipe size to 12-inches, the City will be able to increase pressure at Old McGregor Road and Ritchie Road, reduce current high velocities of approximately 10 fps, and create a loop around the Highway 84 PP.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Connect to Existing 12" Water Line	2	EA	\$4,300.00	\$8,600.00
2	Connect to Existing 6" Water Line	1	EA	\$2,500.00	\$2,500.00
3	12" C-900 PVC Water Line	600	LF	\$175.00	\$105,000.00
4	12" Gate Valve	3	EA	\$3,700.00	\$11,100.00
5	12" x 12" DIP Tee	1	EA	\$2,000.00	\$2,000.00
6	12" x 6" DIP Reducer	1	EA	\$900.00	\$900.00
7	Standard Fire Hydrant Assembly	1	EA	\$9,500.00	\$9,500.00
8	1" Residential Service including Connection to Existing Meter	5	EA	\$1,200.00	\$6,000.00
9	Trench Safety Implementation	600	LF	\$2.00	\$1,200.00
10	Class 'A' Surface Replacement	600	LF	\$70.00	\$42,000.00
11	Testing, Flushing, and Disinfection	1	LS	\$8,000.00	\$8,000.00
12	Fill Existing 6" Water Line with Grout	600	LF	\$13.00	\$7,800.00
SUBTOTAL:					\$204,600.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$30,690.00
SUBTOTAL:					\$235,290.00
CONTINGENCY				30%	\$70,590.00
SUBTOTAL:					\$305,880.00
ENGINEERING					\$37,000.00
SURVEY					\$3,600.00
CONSTRUCTION ADMINISTRATION					\$7,000.00
SUBTOTAL:					\$47,600.00
ESTIMATED TOTAL PROJECT COST:					\$353,480.00

2030 - 2040



NEW PUMP AT HIGHWAY 84 PUMP STATION - HIGHWAY 84

PROJECT # 4-7

Project Description:

Pressure Plane 4 - Highway 84

This project will increase pump capacity at Highway 84 PS by adding a third matching pump at 1,100 GPM for a total of 3,300 GPM.

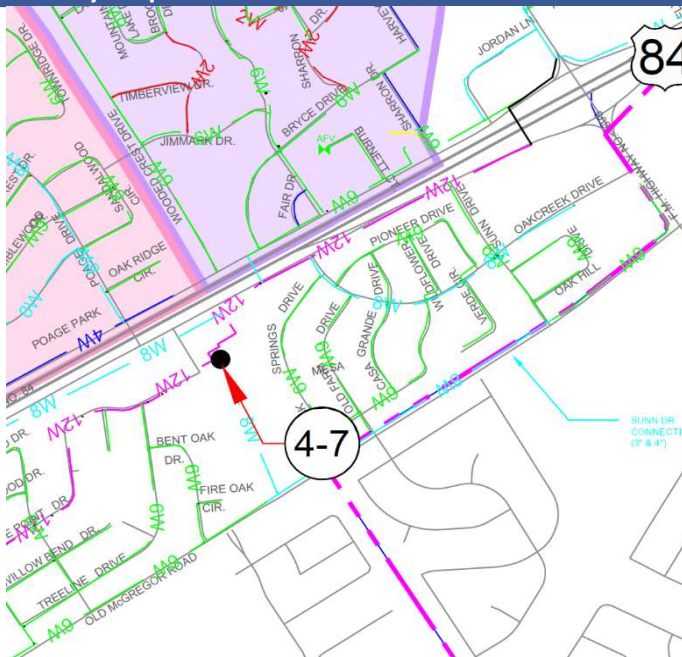
Current Status

Highway 84 PS currently has two 1,100 GPM pumps.

Resolution

The addition of a third 1,100 GPM pump will eliminate the current insufficient pump capacity and meet TAC 290.45 rules.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1,100 GPM Pump and Equipment	1	EA	\$75,000.00	\$75,000.00
2	Electrical Improvements	1	LS	\$50,000.00	\$50,000.00
3	Instrumentation / Controls	1	LS	\$20,000.00	\$20,000.00
4	Yard and Pump Piping	1	LS	\$55,000.00	\$55,000.00
SUBTOTAL:					\$200,000.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$30,000.00
SUBTOTAL:					\$230,000.00
CONTINGENCY				30%	\$69,000.00
SUBTOTAL:					\$299,000.00
ENGINEERING					\$36,750.00
SURVEY					\$5,000.00
CONSTRUCTION ADMINISTRATION					\$15,000.00
SUBTOTAL:					\$56,750.00
ESTIMATED TOTAL PROJECT COST:					\$355,750.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2030 - 2040



12-INCH WATER LINE (WACO CONNECTION) - HIGHWAY 84

PROJECT # 4-8

Project Description:

Pressure Plane 4 - Highway 84

This project will replace the existing 8-inch water line with a 12-inch water line along Old McGregor Road from the Sunn Waco Connection to the Highway 84 GST to meet 2040 maximum day demands.

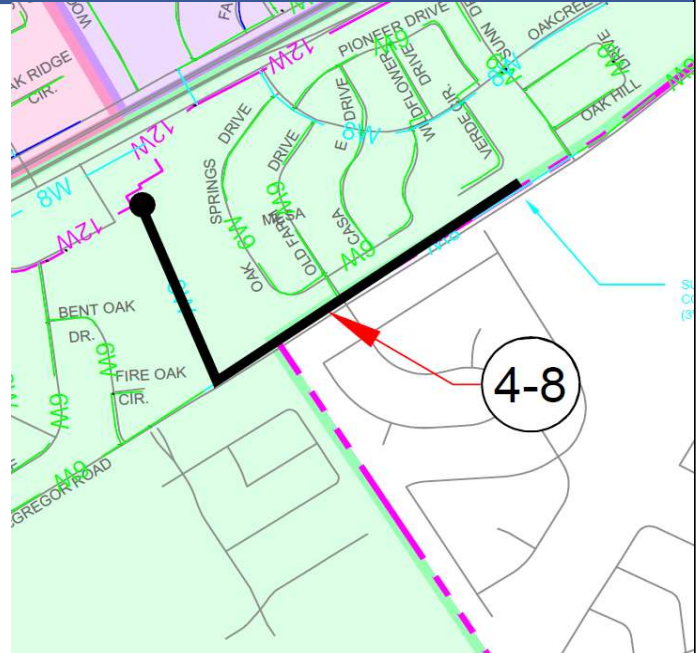
Current Status

The current well water capacity is 480 GPM. The City of Waco connection availability is 800 GPM. The existing 8-inch line will not meet 2040 maximum day demands.

Resolution

By increasing the size of the connection to a 12-inch water line, velocities will be maintained under 6 fps at the 2,100 GPM required. The head loss should be maintained low so that water flows from the City of Waco.

Vicinity Map:



Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	Connect to Existing Water Line	1	EA	\$4,000.00	\$4,000.00
3	12" C-900 PVC Water Line	2,900	LF	\$175.00	\$507,500.00
4	12" Gate Valve	3	EA	\$3,700.00	\$11,100.00
2	Connect to Existing Yard Piping	1	EA	\$8,000.00	\$8,000.00
5	Instrumentation, Controls, and Electrical	1	LS	\$30,000.00	\$30,000.00
5	Hydromulch and Seeding	1,075	LF	\$3.00	\$3,225.00
6	Trench Safety Implementation	2,900	LF	\$2.00	\$5,800.00
7	Class 'A' Surface Replacement	1,825	LF	\$70.00	\$127,750.00
8	Testing, Flushing, and Disinfection	1	LS	\$11,000.00	\$11,000.00
SUBTOTAL:					\$708,375.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$106,260.00
SUBTOTAL:					\$814,635.00
CONTINGENCY				30%	\$244,390.00
SUBTOTAL:					\$1,059,025.00
ENGINEERING					\$76,000.00
SURVEY					\$17,400.00
CONSTRUCTION ADMINISTRATION					\$25,000.00
SUBTOTAL:					\$118,400.00
ESTIMATED TOTAL PROJECT COST:					\$1,177,425.00

CITY OF WOODWAY

Prioritized CIP Project Summary

2030 - 2040



NEW PUMPING AND STORAGE FACILITY AND 12-INCH WATER LINE - BOSQUE

PROJECT # 5-3

Project Description:

Vicinity Map:

Pressure Plane 5 - Bosque

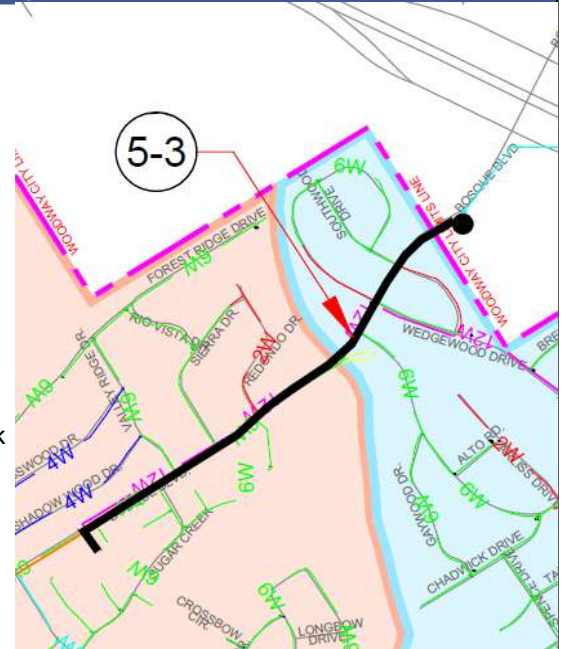
This project will add a new pump station, including ground storage tank and transmission main to meet the upcoming 2040 maximum day demands.

Current Status

Well water capacity at the Bosque well is 540 GPM. The closed City of Waco water connection does not have sufficient pressure head to deliver water to Bosque GST.

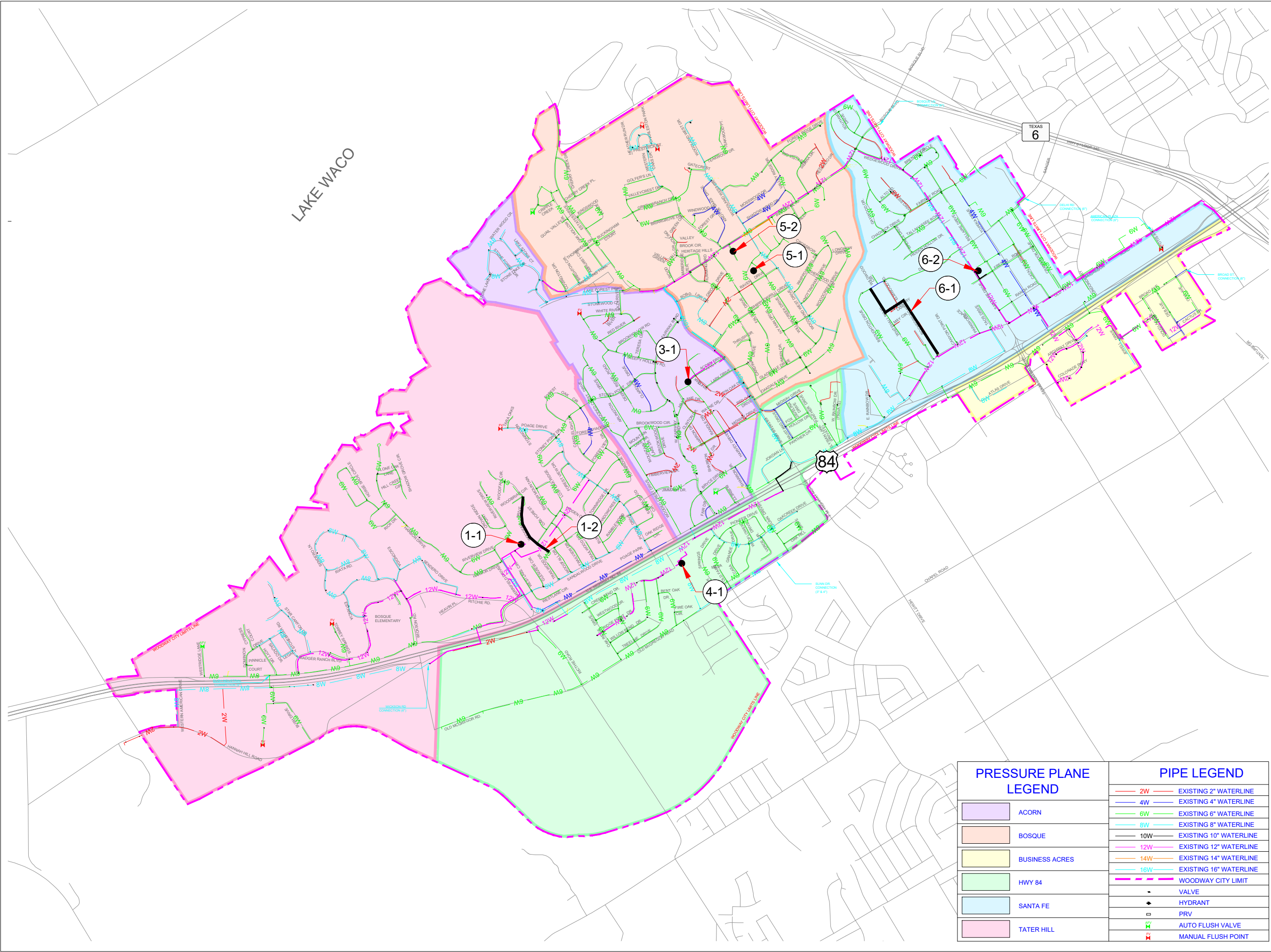
Resolution

By adding a new pump station that includes a 1 MG ground storage tank (30 ft maximum height), a pump station with a firm capacity of at least 1,500 GPM and a 12-inch transmission main from the Bosque PP at Highway 6 to the Bosque GST, there will be enough capacity to pump the 2040 maximum day demand of 664 GPM. Bosque Pump Station will be over-sized to supply water to Acorn GST.




Opinion of Probable Cost:

ITEM	DESCRIPTION	QUANTITY	UNIT	UNIT PRICE	TOTAL
1	1 MG Ground Storage Tank	1	LS	\$1,750,000.00	\$1,750,000.00
2	1,500 GPM Pump Station and Chemical System	1	LS	\$650,000.00	\$650,000.00
3	Instrumentation, Controls, Electrical and Generator	1	LS	\$250,000.00	\$250,000.00
3	12" C-900 PVC Water Line	825	LF	\$175.00	\$144,375.00
4	12" Water Line Installed by Pipe Bursting	2,500	LF	\$260.00	\$650,000.00
5	2" Air Release Valve	2	EA	\$10,000.00	\$20,000.00
6	12" Gate Valve	4	EA	\$3,700.00	\$14,800.00
7	Connect to Existing Yard Piping	1	LS	\$10,000.00	\$10,000.00
8	Repair to Existing Services	1	LS	\$35,000.00	\$35,000.00
9	Trench Safety Implementation	825	LF	\$2.00	\$1,650.00
10	Class 'A' Surface Replacement	825	LF	\$70.00	\$57,750.00
11	Testing, Flushing, and Disinfection	1	LS	\$25,000.00	\$25,000.00
SUBTOTAL:					\$3,608,575.00
GENERAL CONDITIONS / MOBILIZATION				15%	\$541,290.00
SUBTOTAL:					\$4,149,865.00
CONTINGENCY				30%	\$1,244,960.00
SUBTOTAL:					\$5,394,825.00
ENGINEERING					\$450,000.00
SURVEY					\$20,000.00
CONSTRUCTION ADMINISTRATION					\$150,000.00
PROPERTY ACQUISITION					\$655,000.00
SUBTOTAL:					\$1,275,000.00
ESTIMATED TOTAL PROJECT COST:					\$6,669,825.00



8-24-21
DATE
NAME


Know what's below.
Call before you dig.
0 500 1000 2000
(IN FEET)


KEY PLAN

CITY OF WOODWAY

CAPITAL IMPROVEMENT
PROJECT


WOODWAY, TX

DATE	ISSUED FOR

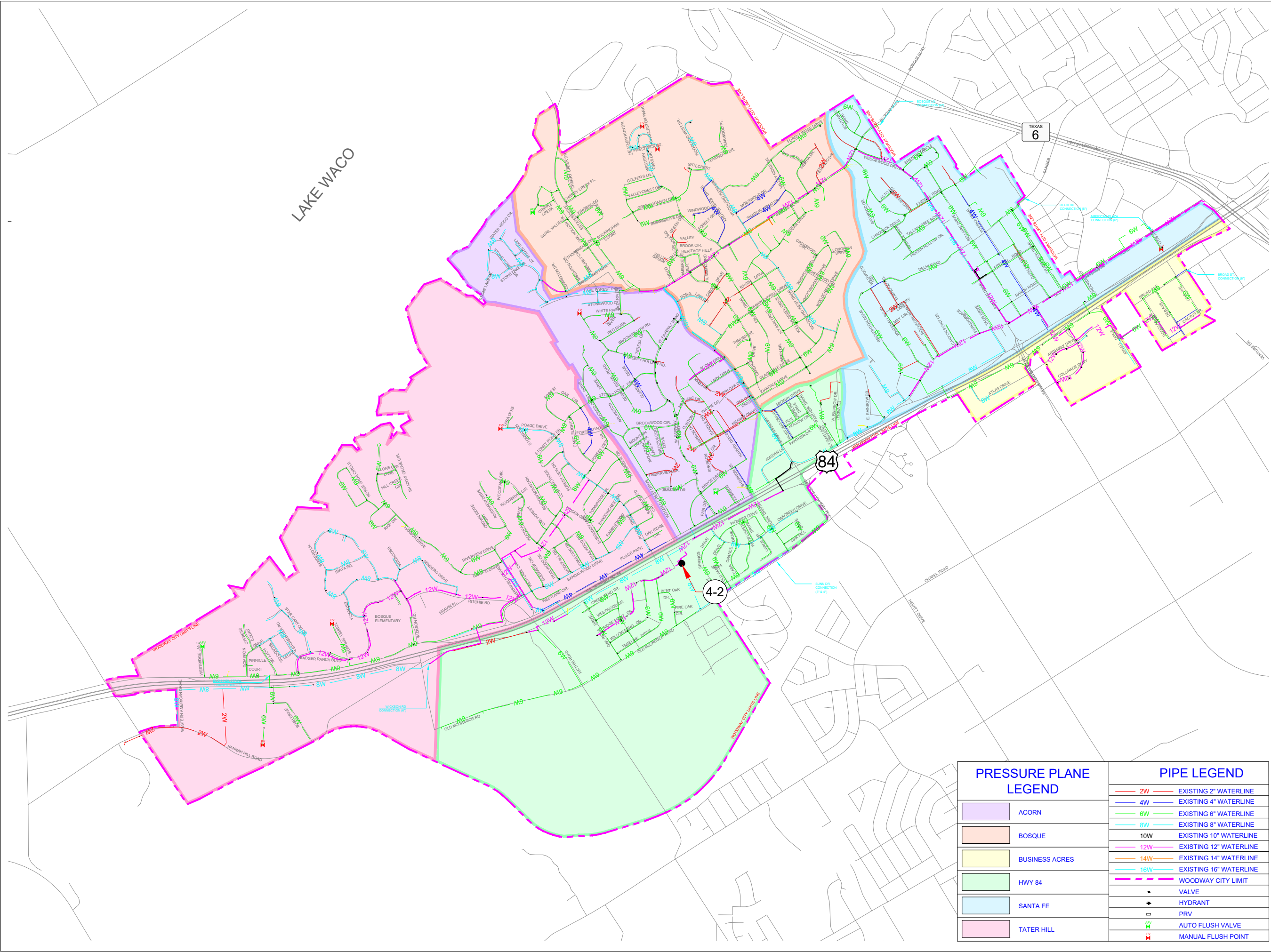

CP&Y, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-1741

PROJ. # COWO1900076 PM: SCW
CK. BY: DLM DN. BY: CDG

PRIORITIZED CIP
FY 2021-2025



4



PRESSURE PLANE LEGEND		PIPE LEGEND	
	ACORN		EXISTING 2" WATERLINE
	BOSQUE		EXISTING 4" WATERLINE
	BUSINESS ACRES		EXISTING 6" WATERLINE
	HWY 84		EXISTING 8" WATERLINE
	SANTA FE		EXISTING 10" WATERLINE
	TATER HILL		EXISTING 12" WATERLINE
			EXISTING 14" WATERLINE
			EXISTING 16" WATERLINE
			WOODWAY CITY LIMIT
			VALVE
			HYDRANT
			PRV
			AUTO FLUSH VALVE
			MANUAL FLUSH POINT

8-24-21
DATE
NAME

Know what's below.
Call before you dig.
0 500 1000 2000
(IN FEET)

KEY PLAN

CITY OF WOODWAY

CAPITAL IMPROVEMENT PROJECT

WOODWAY, TX

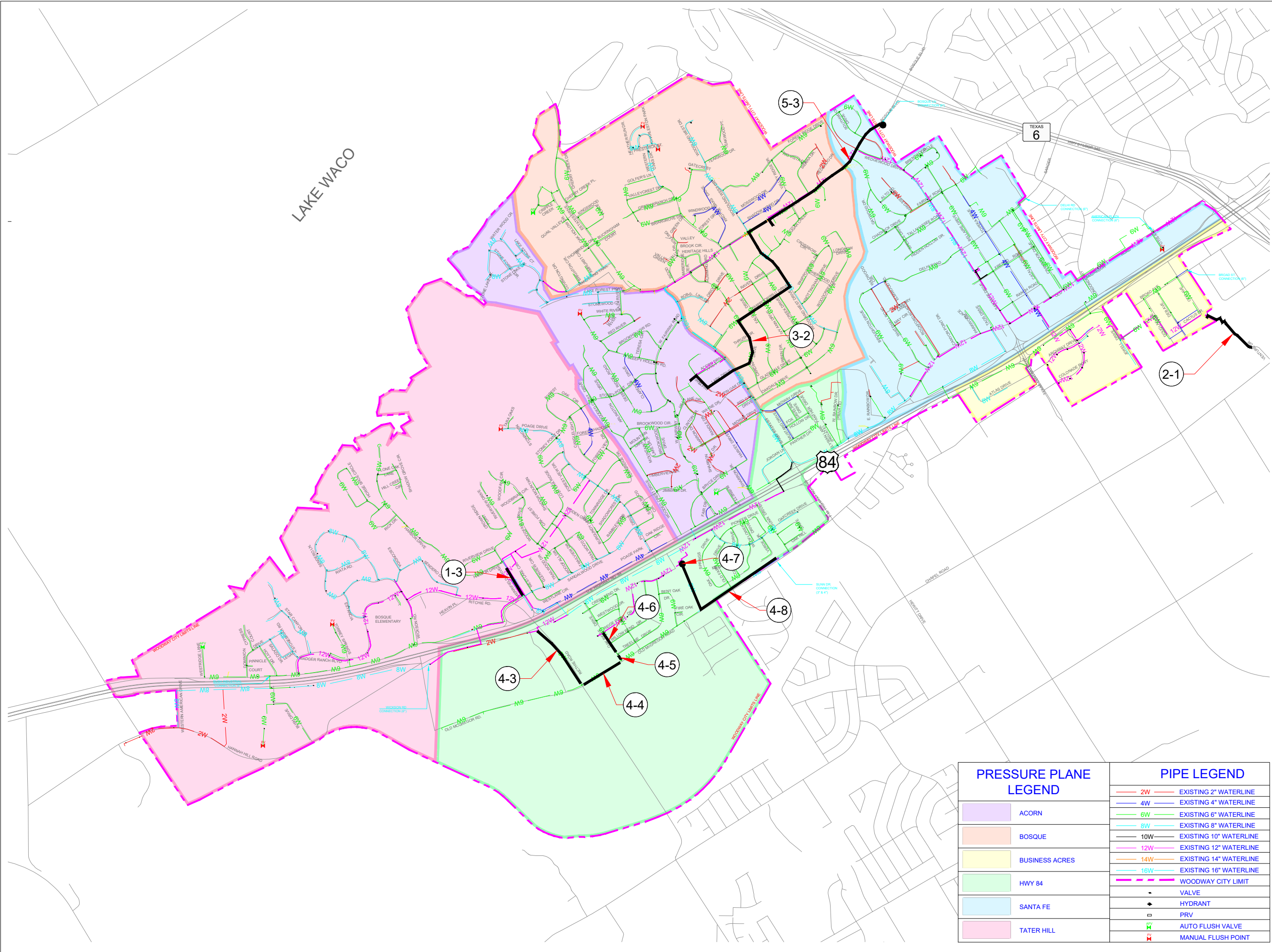
DATE	ISSUED FOR

CP&Y, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-1741

PROJ. # COWO1900076 PM: SCW
CK. BY: DLM DN. BY: CDG

PRIORITIZED CIP
FY 2025-2030

5



PRESSURE PLANE LEGEND		PIPE LEGEND	
	ACORN		EXISTING 2" WATERLINE
	BOSQUE		EXISTING 4" WATERLINE
	BUSINESS ACRES		EXISTING 6" WATERLINE
	HWY 84		EXISTING 8" WATERLINE
	SANTA FE		EXISTING 10" WATERLINE
	TATER HILL		EXISTING 12" WATERLINE
			EXISTING 14" WATERLINE
			EXISTING 16" WATERLINE
			WOODWAY CITY LIMIT
			VALVE
			HYDRANT
			PRV
			AUTO FLUSH VALVE
			MANUAL FLUSH POINT

8-24-21
DATE
NAME

Know what's below.
Call before you dig.
0 500 1000 2000
(IN FEET)

KEY PLAN

CITY OF WOODWAY

CAPITAL IMPROVEMENT PROJECT

WOODWAY, TX

DATE	ISSUED FOR

CP&Y, INC.
TEXAS REGISTERED
ENGINEERING FIRM
F-1741

PROJ. # COWO1900076 PM: SCW
CK. BY: DLM DN. BY: CDG

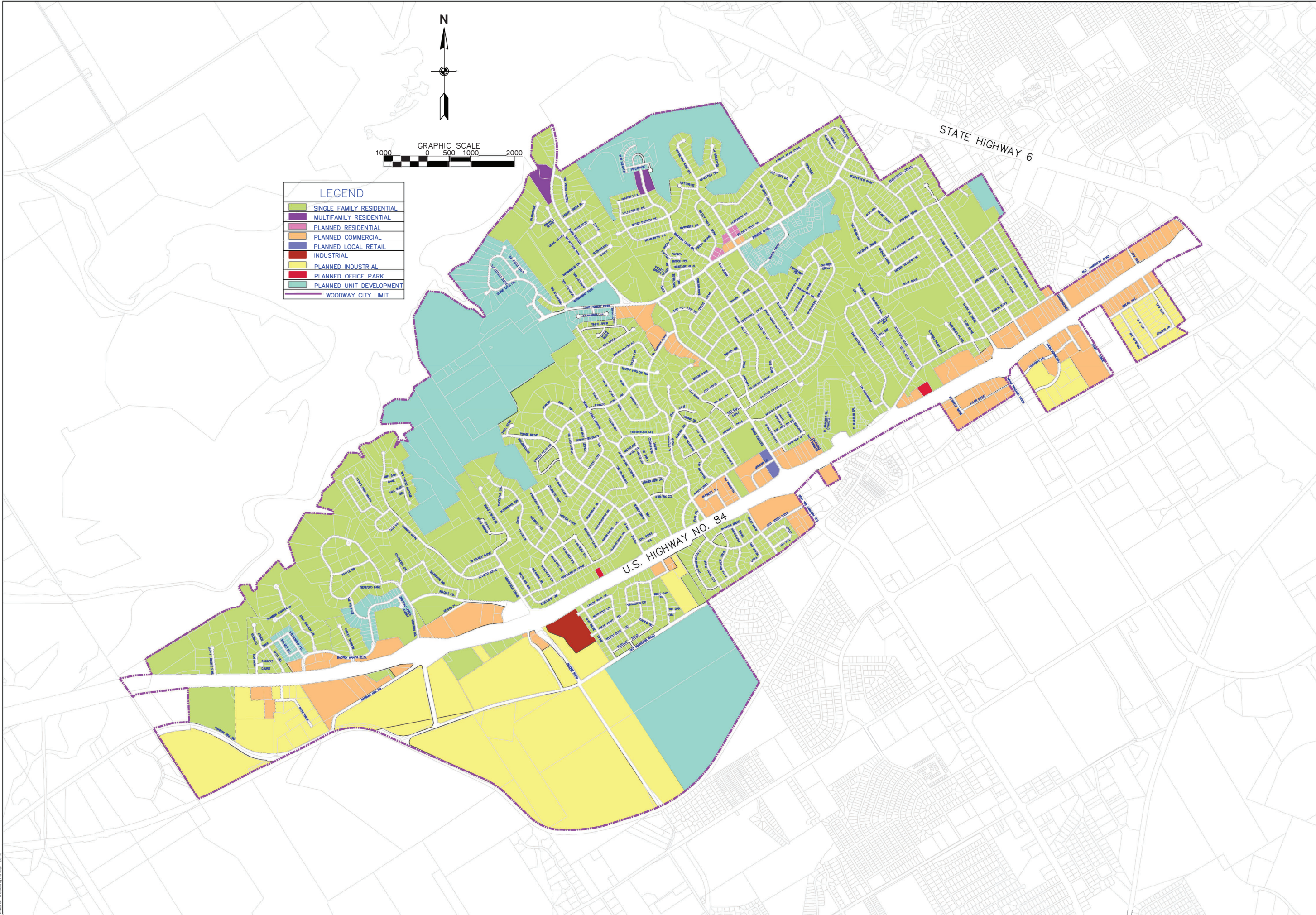
PRIORITIZED CIP
FY 2030-2040

6

10 APPENDIX A

CITY OF WOODWAY ZONING MAP OF 2020

C:\Users\mdavison\Desktop\City Eng Documents\MAP\ZONING MAP.dwg midvision Plotted: December 22, 2020 - 9:22am Layout: Zoning Map XREFS: WoodwayForest-2019



LEGEND	
	SINGLE FAMILY RESIDENTIAL
	MULTIFAMILY RESIDENTIAL
	PLANNED RESIDENTIAL
	PLANNED COMMERCIAL
	PLANNED LOCAL RETAIL INDUSTRIAL
	PLANNED INDUSTRIAL
	PLANNED OFFICE PARK
	PLANNED UNIT DEVELOPMENT
	WOODWAY CITY LIMIT



ONE INCH
LENGTH OF BAR ON ORIGINAL DRAWING
EQUALS ONE INCH. FOR REDUCED OR ENLARGED PRINTS OF THIS PLAN ADJUST THE SCALE ACCORDINGLY.

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CITY OF WOODWAY

ZONING MAP

DECEMBER 2020

SCALE: AS SHOWN	DESIGNED BY:
DRAWN BY: M. DAVISON	CHECKED BY: M. DAVISON
APPROVED BY: CITY COUNCIL	PROJECT NO:

Sheet Number

APPENDIX A

OF 1 SHEETS



200 West State Highway 6, Suite 620
Waco, TX 76712
o. 254.772.9272 | f. 254.776.2924
TBPE F-1741 | TBPLS 10194124
stvinc.com

MEMORANDUM

10/31/2023

To: City of Woodway
Attn: Dr. Shawn Oubre
From: Scott Wetzel, PE
Cc: Mitch Davison, PE

Project: City of Woodway 2021 Water Master Plan – Amendment
Project No.: COWO1700384

Dear Shawn,

This memorandum is to follow up on the comments posed by Councilmember Russell concerning the above referenced project as raised during the City Council meeting on Monday, October 23, 2023. It was brought forth that a mathematical error was contained in Table 4-1, Monthly City of Woodway Water Usage from 2019 to 2020 (page 16). After reviewing the table, STV has confirmed that there were several typographical errors contained in Table-4-1 that have now been corrected. Although some of the table totals were in error, the actual calculations for Total Consumption and Average Day (Consumption) were correct as shown in the original Water Master Plan report, as they were calculated using correct water record values and not the values in error that had been entered into Table 4-1. As a result, the Average Day (MGD) Totals remain unchanged from those shown in Table 4-1 of the original report for both 2019 and 2020. Consequently, there were no impacts to the subsequent values and findings contain in the original Water Master Plan dated August 2021.

For your records, please find attached an Amendment to the 2021 Water Master Plan for page 16 with the updated table values.

A second concern identified during the council meeting by Councilmember Russell was the population projections used by STV to evaluate future water system conditions. As I stated during the meeting, at the time of the writing of this report the 2020 U.S. Census data was not

published or available. As a result, STV used the best available population information from both the U.S. Census Bureau and the Texas Water Development Board (TWDB), which is standard practice by engineering firms working on similar project and conditions. Based on Councilmember Russell's statement during the council meeting that STV's projected 2020 population data was approximately 4%-5% below the actual tabulated U.S. Census data, it does not adversely impact the findings and conclusions STV stipulated in the 2021 Master Plan due to the Water Master Plan model and calculations being based on a projected 2040 population of 11,810 which is considerably above the actual 2020 population measured by the U.S. Census Bureau of 9,383. As a result, the proposed water system improvements required to serve the 2040 population as outlined in the Master Plan are still valid and encompass the 2020 actual population currently served by the City's water system.

It is generally standard practice (and STV recommends) for cities to update their water master plans every 5-years or so to keep current with population changes and major developments within their water systems. As such, any major changes in population experienced by the City of Woodway prior to 2040 can be addressed in the next or subsequent water master plan revisions scheduled for approximately 2025, 2030 and/or 2035.

Please let me know if you have any questions.

Thank you,

A handwritten signature in blue ink, appearing to read "Scott C. Wetzel", with a large, sweeping loop at the end.

Scott C. Wetzel, PE
CP&Y, Inc. dba STV Infrastructure

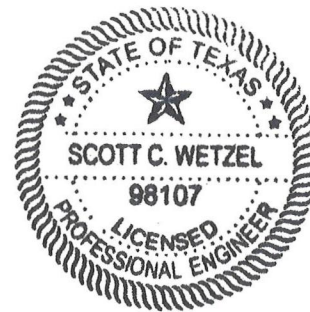




Table 4-1. Monthly City of Woodway Water Usage from 2019 to 2020

2019 Water Usage				
Month	Woodway Well Water	Water from Waco	Total Consumption	Average Day (MGD)
January	23,675,000	20,788,400	44,463,400	1.4
February	22,898,000	16,303,914	39,201,914	1.4
March	24,494,000	25,093,000	49,587,000	1.6
April	16,854,000	32,860,000	49,714,000	1.7
May	15,424,000	38,303,972	53,727,972	1.7
June	31,590,000	36,501,300	68,091,300	2.3
July	53,204,000	54,718,800	107,922,800	3.5
August	65,447,000	63,849,800	129,296,800	4.2
September	54,460,000	61,373,200	115,833,200	3.9
October	36,051,000	47,444,300	83,495,300	2.7
November	20,455,000	28,263,000	48,718,000	1.6
December	29,185,000	18,095,100	47,280,100	1.5
Total	393,737,000	443,594,786	837,331,786	AVG 2.3
2020 Water Usage				
Month	Woodway Well Water	Water from Waco	Total Consumption	Average Day(MGD)
January	20,995,000	26,151,400	47,146,400	1.5
February	21,645,000	22,503,500	44,148,500	1.6
March	20,036,000	26,055,200	46,091,200	1.5
April	21,610,000	26,514,700	48,124,700	1.6
May	28,676,000	40,655,300	69,331,300	2.2
June	61,741,000	43,457,300	105,198,300	3.5
July	62,542,000	52,096,500	114,638,500	3.7
August	70,251,000	66,148,300	136,399,300	4.4
September	35,034,000	46,971,100	82,005,100	2.7
October	37,365,000	47,037,000	84,402,000	2.7
November	47,299,000	24,583,200	71,882,200	2.4
December	41,326,000	19,904,401	61,230,401	2.0
Total	468,520,000	442,077,901	910,597,901	AVG 2.5