CITY OF TULARE

Water System Master Plan

July 2009

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FINAL REPORT

CITY OF TULARE

Water System Master Plan

FINAL

July 2009

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75 YEARS Working Wonders

July 13, 2009
7608A00

City of Tulare
411 East Kern Avenue
Tulare, California 93277

Attention: Kenneth Ramage, P.E.

Subject: City of Tulare Water System Master Plan

Dear Mr. Ramage:

We are pleased to submit this final report for the City of Tulare (City) Water System Master Plan (Master Plan). Enclosed are ten copies of the Master Plan report. The report presents planning assumptions, the evaluation of the water distribution system, recommended facility improvements to correct existing deficiencies and to serve future growth, and a capital improvement program.

We would like to extend our thanks to you, Mr. Darrel Pyle, City Manager; Mr. Lew Nelson, Public Works Director; Mr. Mike Whitlock, Senior Civil Engineer; Mr. Dan Boggs, Water Superintendent, and other City Staff whose courtesy and cooperation were valuable components in completing and producing this report.

Sincerely,

CAROLLO ENGINEERS, P.C.

David L. Stringfield, P.E.
Partner

Tim Loper, P.E.
Project Manager

DLS/TJL:asw

Enclosures: Water System Master Plan (10)

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WATER SYSTEM MASTER PLAN

FINAL

July 2009

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City of Tulare

WATER SYSTEM MASTER PLAN

TABLE OF CONTENTS

Page No.

EXECUTIVE SUMMARY

ES.1 STUDY OBJECTIVE ES-1
ES.2 STUDY AREA ES-1
ES.3 WATER SYSTEM OVERVIEW ES-3
ES.4 WATER REQUIREMENTS ES-3
ES.5 EVALUATION AND PROPOSED IMPROVEMENTS ES-3
ES.5.1 Supply Capacity ES-11
ES.5.2 Storage Capacity ES-11
ES.5.3 Project Prioritization ES-11
ES.6 CAPITAL IMPROVEMENT PROGRAM ES-13

CHAPTER 1 – INTRODUCTION

1.1 BACKGROUND 1-1
1.2 SCOPE AND AUTHORIZATION 1-1
1.3 REPORT ORGANIZATION 1-3
1.4 ACKNOWLEDGMENTS 1-4
1.5 ABBREVIATIONS AND DEFINITIONS 1-4
1.6 REFERENCES 1-5

CHAPTER 2 - PLANNING AREA CHARACTERISTICS

2.1 STUDY AREA 2-1
2.2 SOIL AND TOPOGRAPHY 2-1
2.3 CLIMATE 2-1
2.4 LAND USE 2-3
2.5 POPULATION 2-9

CHAPTER 3 - PLANNING AND EVALUATION CRITERIA

3.1 WATER SUPPLY CAPACITY 3-1
3.1.1 Normal Supply Capacity 3-1
3.1.2 Standby Supply Capacity 3-1
3.1.3 Recommended Supply Capacity 3-2
3.2 STORAGE REQUIREMENTS 3-2
3.2.1 Operational Storage 3-2
3.2.2 Fire Storage 3-2
3.2.3 Emergency Storage 3-3
3.2.4 Total Storage 3-3
3.3 SERVICE PRESSURES 3-3
3.4 DISTRIBUTION MAINS 3-4
3.5 FIRE FLOWS 3-4
3.6 HISTORICAL WATER USE 3-5
3.6.1 Per-Capita Consumption 3-5
3.6.2 Seasonal Demands and Peaking Factors 3-6
3.7 AVERAGE DAY WATER DEMAND COEFFICIENTS 3-11

3.8 PROJECTED WATER DEMANDS 3-11
3.9 PLANNING AND EVALUATION CRITERIA SUMMARY 3-11

CHAPTER 4 - EXISTING SYSTEM AND HYDRAULIC MODEL

4.1 SYSTEM OVERVIEW 4-1
4.1.1 Distribution System 4-1
4.1.2 Pressure Zones 4-1
4.1.3 Supply Sources 4-1
4.1.4 Storage Reservoirs 4-4
4.1.5 Booster Pump Stations 4-4
4.2 HYDRAULIC MODEL 4-4
4.2.1 Selected Hydraulic Model 4-4
4.2.2 Data Collection and Validation 4-4
4.2.3 Elements of the Hydraulic Model 4-5
4.3 HYDRAULIC MODEL CALIBRATION 4-6
4.3.1 Fire Flow Field Testing 4-6

CHAPTER 5 - EVALUATION AND PROPOSED IMPROVEMENTS

5.1 CAPACITY EVALUATION 5-1
5.1.1 Supply Capacity 5-1
5.1.2 Storage Capacity 5-4
5.1.3 Booster Pump Stations 5-4
5.1.4 Pipelines 5-4
5.2 PROPOSED IMPROVEMENTS 5-7
5.3 PROJECT PRIORITIZATION 5-7
5.3.1 Highest Priority Improvements 5-11

CHAPTER 6 - CAPITAL IMPROVEMENT PROGRAM

6.1 COST ESTIMATING ACCURACY 6-1
6.2 COST ESTIMATING CRITERIA 6-1
6.2.1 Pipeline Unit Costs 6-2
6.2.2 Wells, Tanks, and Booster Pumps Stations 6-2
6.2.3 Land Acquisition 6-3
6.2.4 Construction Cost Adjustments 6-3
6.3 CAPITAL IMPROVEMENT PROGRAM 6-3
6.3.1 Baseline Construction Cost 6-3
6.3.2 Estimated Construction Cost 6-9
6.3.3 Capital Improvement Cost 6-9
6.3.4 Capital Improvement Schedule 6-9
6.4 USER BENEFIT AND COST ALLOCATION 6-10

LIST OF APPENDICES

APPENDIX A - April 2008 Fire Hydrant Test Data

LIST OF TABLES

Table ES.1 Projected Future Water Demands ES-5
Table ES.2 Proposed Improvements (3 pages) ES-8
Table ES.3 Project Prioritization ES-12
Table ES.4 Capital Improvement Program Summary ES-13
Table 2.1 Land Use and Vacant Area 2-5

Table 2.2 Historical and Projected Population 2-9
Table 3.1 Pipe Roughness Design Criteria 3-5
Table 3.2 Historical Water Production and Per Capita Consumption (1990-2005) 3-7
Table 3.3 Historical Monthly Water Production (2003-2005) 3-8
Table 3.4 Daily Diurnal Water Demand Pattern 3-10
Table 3.5 Existing Water Demand Balance 3-12
Table 3.6 Projected Future Water Demands Based on Population 3-13
Table 3.7 Projected Water Demands Based on Land Use 3-14
Table 3.8 Planning and Evaluation Criteria Summary 3-15
Table 4.1 Water Supply Wells 4-3
Table 4.2 Fire Flow Calibration Results 4-9
Table 5.1 Supply and Storage Requirements 5-2
Table 5.2 Proposed Improvements (3 pages) 5-8
Table 5.3 Project Prioritization 5-11
Table 6.1 Pipeline Costs 6-2
Table 6.2 Facility Construction Unit Costs 6-3
Table 6.3 Capital Improvement Program (5 pages) 6-4
Table 6.4 Capital Improvement Schedule 6-10
Table 6.5 Capital Improvement Program – Existing and Future Users 6-11

LIST OF FIGURES

Figure ES.1 Study Area ES-2
Figure ES.2 Existing Water Distribution System ES-4
Figure ES.3 Proposed Improvements (2 pages) ES-6
Figure 1.1 Regional Location Map 1-2
Figure 2.1 Study Area 2-2
Figure 2.2 General Plan Land Use 2-4
Figure 2.3 Historical and Projected Population 2-10
Figure 3.1 Daily Dirunal Water Demand Pattern 3-10
Figure 4.1 Existing Water Distribution System 4-2
Figure 4.2 Hydrant Test Locations 4-7
Figure 5.1 Projected Supply and Demand Increase 5-3
Figure 5.2 Proposed Improvements (2 pages) 5-5

WATER SYSTEM MASTER PLAN

This executive summary presents a brief background of the City of Tulare's (City) water distribution system, the need for this master plan, proposed improvements to mitigate existing deficiencies, and proposed improvements for anticipated future growth. A summary of capital improvement program costs, through the planning year 2030, is included at the end of this chapter.

ES.1 STUDY OBJECTIVE

On September 21, 2006, the City authorized Carollo Engineers, P.C. (Carollo) to prepare this Water System Master Plan study, which included the following tasks:

- Establish water system planning and evaluation criteria.
- Evaluate the existing water distribution system.
- Perform a demand analysis and review supply capacity.
- Perform a system-wide storage analysis.
- Review existing system and propose improvements to enhance system capacity.
- Recommend improvements needed to service anticipated future growth.
- Develop a Capital Improvement Program (CIP) with a planning horizon of 2030.

ES.2 STUDY AREA

The City is located along Highway 99 in Tulare County within the Central San Joaquin Valley of California, approximately 45 miles south of Fresno and 60 miles north of Bakersfield.

Tulare was founded in 1872 by the Southern Pacific Railroad, and incorporated in 1888. Agriculture is a major component of the City's economy, due to its highly productive farmland. Tulare is attractive to food processors and distributors because of its central location and abundance of locally grown products.

The City recently updated its General Plan. The City limits and Urban Development Boundary (UDB), as established from the City's Land Use Diagram, are 19 square miles (12,281 acres) and 37 square miles (23,608 acres), respectively. The current City limits and UDB are shown on Figure ES.1. The study area boundary for this master plan is the UDB.

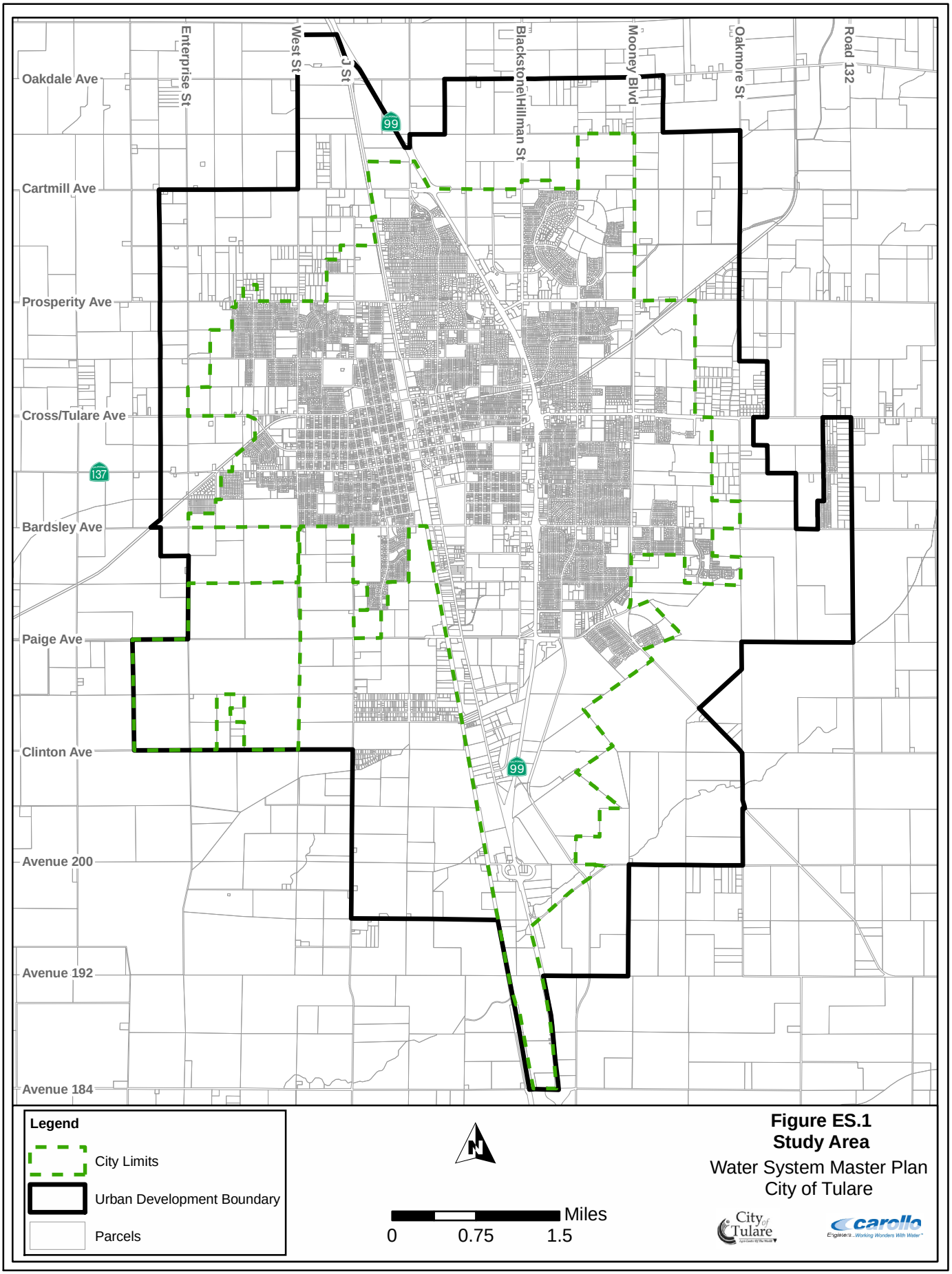


Figure ES.1
Study Area
Water System Master Plan
City of Tulare

ES.3 WATER SYSTEM OVERVIEW

The City provides potable water service to its residential, commercial, industrial, and institutional customers within the City limits.

The City's municipal water system extracts water from the underground aquifers via a series of 27 active groundwater wells distributed throughout the City (Figure ES.2). Water is transmitted from the wells to customers via a distribution system with pipe sizes that range from 2-inches to 16-inches in diameter. The City's water distribution system also includes a 150,000 gallon elevated storage tank.

ES.4 WATER REQUIREMENTS

The per-capita consumption rate is used to estimate the City's future water requirements, the evaluation of the adequacy of the supply source, and the determination of storage needs. The consumption rate, expressed in gallons per capita per day (gpcd), is applied to the projected population to yield future water requirements.

Tulare's historical city-wide per-capita consumption rate, based on dividing the City's total water use by the total population, generally ranged between 235 gpcd in 1993 and 311 gpcd in 2005.

For planning purposes, a residential per-capita water use of 300 gpcd was applied to calculate the future residential and commercial water use for the planning horizon of 2030. This value is greater than the average from 1990 to the present, however it is approximately equal to the average over the last five years.

Based on the future trends in population provided in the body of this report, and the estimated per capita water consumption rate of 300 gpcd, the City's future water demands were estimated and summarized in Table ES.1. In addition to the projected average demands, Table ES.1 includes annual estimates for the maximum day and peak hour demands (PHD), through the planning horizon year of 2030. Based on these projections, it is anticipated that the City's average day and maximum day requirements for 2030 could approach 39.3 mgd (27,300 gpm) and 98.2 mgd (68,200 gpm), respectively.

ES.5 EVALUATION AND PROPOSED IMPROVEMENTS

The additional water supply and storage facilities required to meet existing and projected water demands were determined by comparing the available water supplies with the projected water demands. A hydraulic computer model was assembled and used in the evaluation of the City's existing distribution system and for planning future facilities.

The proposed improvements to mitigate existing deficiencies and to serve future growth are shown Figure ES.3. Details of each improvement are also provided in Table ES.2.

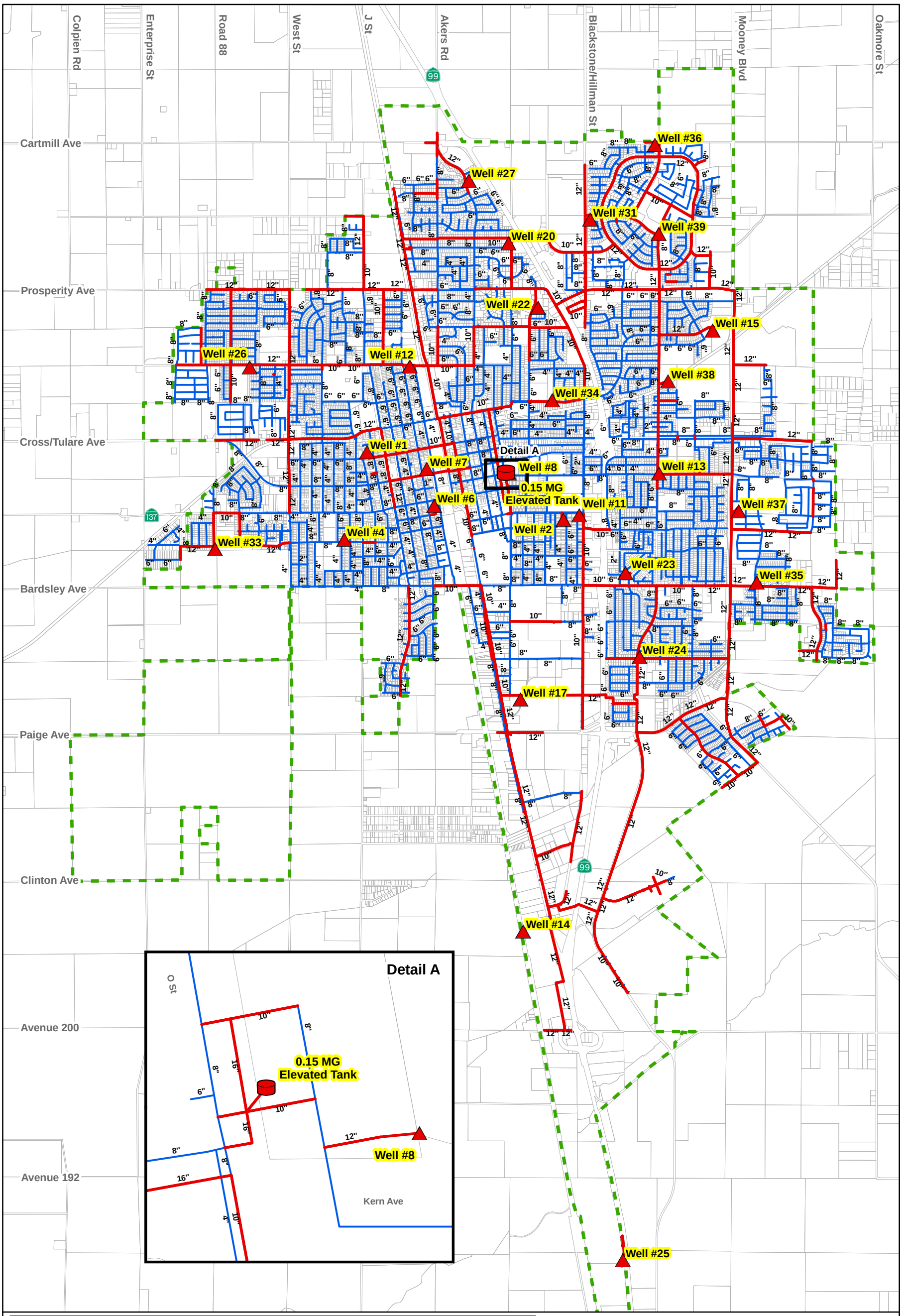


Figure ES.2
Existing Water
Distribution System

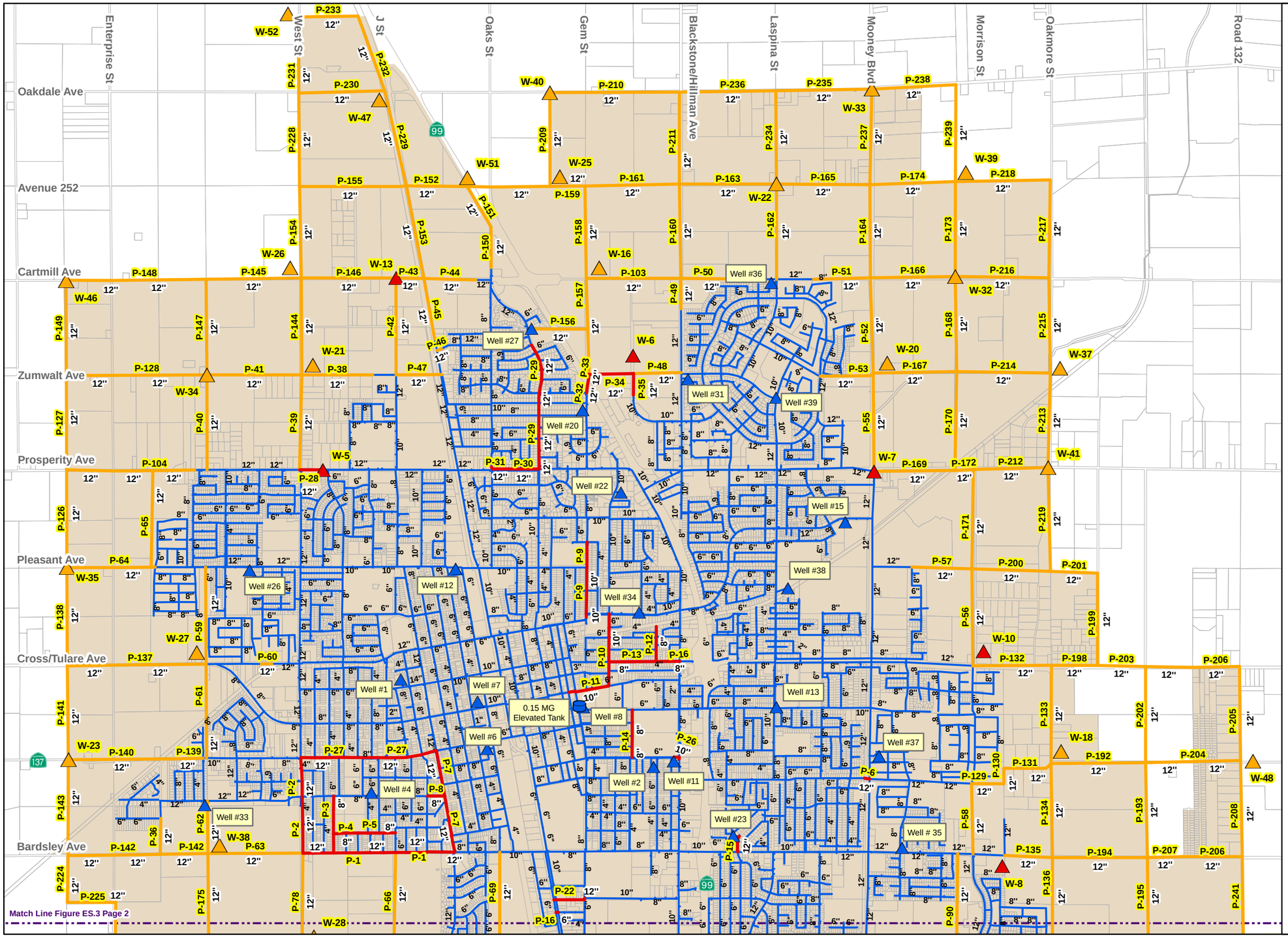
Water System Master Plan
City of Tulare

*As of January 2009

Table ES.1 Projected Future Water Demands
Water System Master Plan
City of Tulare

Year	Population	Projected Water Requirements								
		Annual	Avg. Month	Max. Month (3)	Average Day (2)		Maximum Day (4)		Peak Hour (5)	
		(MG)	(MGM)	(MGM)	(MGD)	(gpm)	(MGD)	(gpm)	(MGD)	(gpm)
2008	56,000	6,092	508	830	**16.7**	11,591	41.7	28,976	58.4	40,567
2009	58,000	6,333	528	863	**17.4**	12,050	43.4	30,124	60.7	42,173
2010	60,000	6,584	549	897	**18.0**	12,527	45.1	31,317	63.1	43,843
2011	63,000	6,845	570	932	**18.8**	13,023	46.9	32,557	65.6	45,580
2012	65,000	7,116	593	969	**19.5**	13,538	48.7	33,846	68.2	47,385
2013	68,000	7,398	616	1,008	**20.3**	14,075	50.7	35,186	70.9	49,261
2014	70,000	7,691	641	1,048	**21.1**	14,632	52.7	36,580	73.7	51,212
2015	73,000	7,995	666	1,089	**21.9**	15,211	54.8	38,028	76.7	53,240
2016	76,000	8,312	693	1,132	**22.8**	15,814	56.9	39,534	79.7	55,348
2017	79,000	8,641	720	1,177	**23.7**	16,440	59.2	41,100	82.9	57,540
2018	82,000	8,983	749	1,224	**24.6**	17,091	61.5	42,727	86.1	59,818
2019	85,000	9,339	778	1,272	**25.6**	17,768	64.0	44,419	89.5	62,187
2020	89,000	9,709	809	1,322	**26.6**	18,471	66.5	46,178	93.1	64,650
2021	92,000	10,093	841	1,375	**27.7**	19,203	69.1	48,007	96.8	67,210
2022	96,000	10,493	874	1,429	**28.7**	19,963	71.9	49,908	100.6	69,872
2023	100,000	10,908	909	1,486	**29.9**	20,754	74.7	51,885	104.6	72,638
2024	104,000	11,340	945	1,545	**31.1**	21,576	77.7	53,939	108.7	75,515
2025	108,000	11,789	982	1,606	**32.3**	22,430	80.7	56,075	113.0	78,505
2026	112,000	12,256	1,021	1,669	**33.6**	23,318	83.9	58,296	117.5	81,614
2027	116,000	12,741	1,062	1,735	**34.9**	24,242	87.3	60,604	122.2	84,846
2028	121,000	13,246	1,104	1,804	**36.3**	25,202	90.7	63,004	127.0	88,206
2029	126,000	13,771	1,148	1,876	**37.7**	26,200	94.3	65,499	132.0	91,699
2030	131,000	14,342	1,195	1,953	**39.3**	27,286	98.2	68,216	137.5	95,503

Notes:
1. Projected Per Capita Consumption is estimated at 300 gpdc.
2. Average Day Demand is based on the Annual Demand, expressed in daily units.
3. Maximum Month Demand (highest monthly demand), is calculated by applying a multiplier of 1.63 to the Average Day Demand.
4. Maximum Day Demand (highest daily demand), is calculated by applying a multiplier of 2.6 to the Average Day Demand.
5. Peak Hour Demand (highest hourly demand), is calculated by applying a multiplier of 3.5 to the Average Day Demand.



Legend

Existing Water Distribution System

- Storage Tank
- Groundwater Supply Well
- Pipelines

Proposed Improvements

Existing System

- Storage Tank
- Groundwater Supply Well
- Pipelines

Future System

- Groundwater Supply Well
- Pipelines
- Urban Development Boundary
- Parcels
- P-20 Proposed Improvement ID
- 12" Proposed Pipe Diameter
- 8" Existing Pipe Diameter

Feet

0 2,500 5,000

Figure ES.3
Proposed Improvements
(1 of 2)

Water System Master Plan
City of Tulare

City of Tulare

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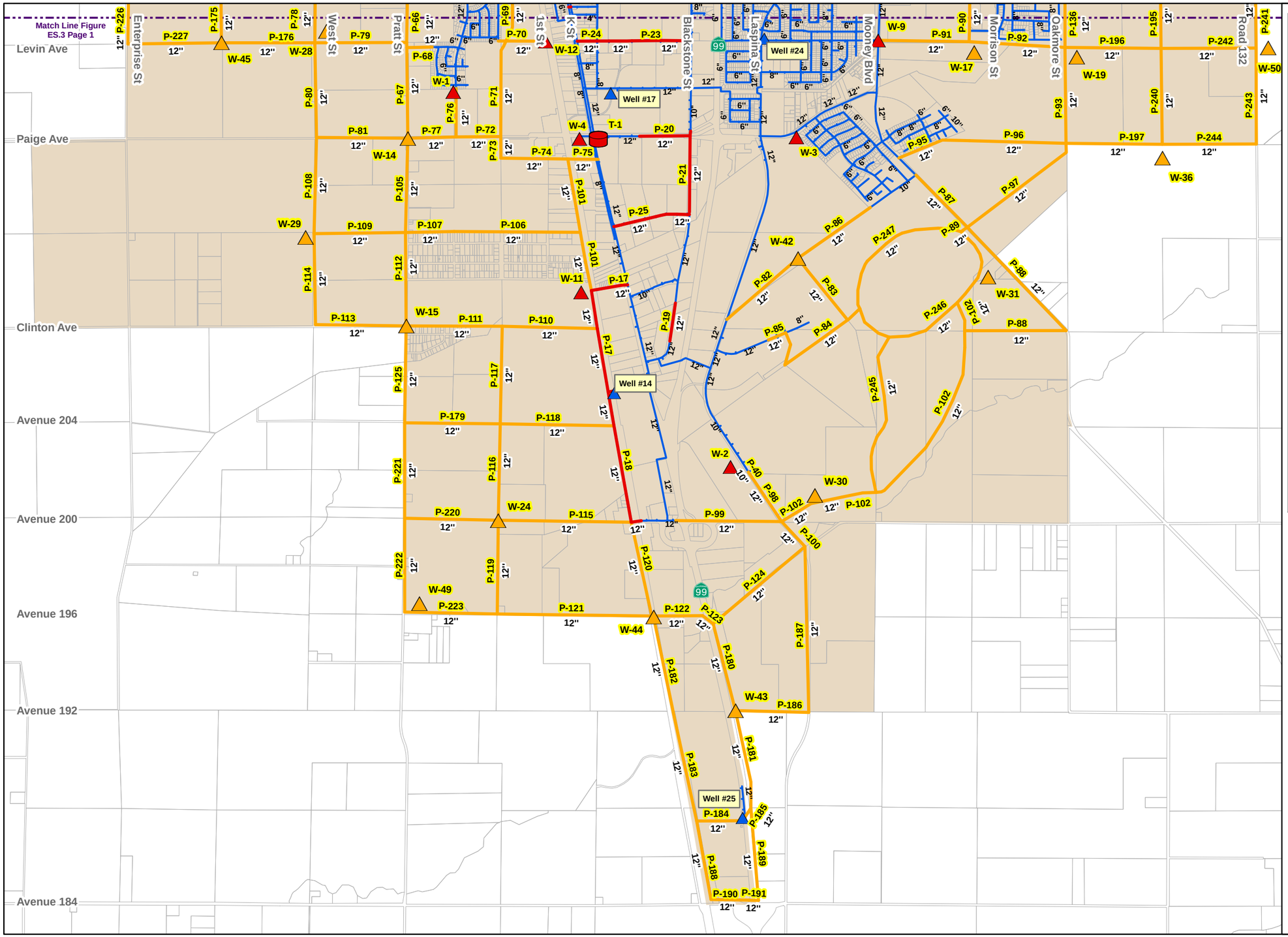

Legend

Existing Water Distribution System

- Storage Tank
- Groundwater Supply Well
- Pipelines

Proposed Improvements

Existing System

- Storage Tank
- Groundwater Supply Well
- Pipelines

Future System

- Groundwater Supply Well
- Pipelines
- Urban Development Boundary
- Parcels
- P-20 Proposed Improvement ID
- 12" Proposed Pipe Diameter
- 8" Existing Pipe Diameter

Feet
0 2,500 5,000

Figure ES.3
Proposed Improvements
(2 of 2)

Water System Master Plan
City of Tulare

City of Tulare
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Table ES.2 Proposed Improvements
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)
Existing System Improvements							
Pipeline Improvements							
P-1	Pipe	Bardsley Avenue	West St to E St	4,8	12	Replace	4,200
P-2	Pipe	West Street	Inyo Ave to Bardsley Ave	4,8	12	Replace	2650
P-3	Pipe	Sacramento Street	Sonora Ave to Bardsley Ave	4	8	Replace	1,600
P-4	Pipe	Elm Street	Sacramento St to Walter St	--	8	New	350
P-5	Pipe	Elm Street	Walter St to Pratt St	4	8	Replace	1,400
P-6	Pipe	Alpine Avenue	Mooney Blvd to connection e/o Mooney Blvd	--	12	New	150
P-7	Pipe	E Street	Bardsley Ave to Inyo Ave	4, 6, 8	12	Replace	2,900
P-8	Pipe	Sonora Avenue	E St to D St	4	8	Replace	500
P-9	Pipe	Gem Street	Terrace Ave to Cross Ave	4	10	Replace	2,100
P-10	Pipe	Cherry Street	Cross Ave to Tulare Ave	4	10	Replace	2,000
P-11	Pipe	Tulare Avenue	Cherry St to Alleyway w/o O St	4,6,8	10	Replace	1,150
P-12	Pipe	Highland Street	Pine Dr to San Joaquin Ave	4	8	Replace	950
P-13	Pipe	San Joaquin Avenue	Blackstone St to Cherry St	4	8	Replace	1,950
P-14	Pipe	R Street	Kern Ave to Sonora Ave	4	8	Replace	1,300
P-15	Pipe	Cardoza Drive	Bardsley Ave to n/o Bardsley Ave	6	12	Replace	450
P-16	Pipe	Almond Avenue	K St to e/o K St	--	12	New	70
P-17	Pipe	Goodin Avenue, County Road 112	K St to County Road 112, then south to Olson Ave	--	12	New	1,200
P-17A	Casing (1)	County Road 112	Crossing under Railroad	--	12/24	New	300
P-18	Pipe	County Road 112	Olson Ave to Rankin Ave	4	12	Replace	2,000
P-19	Pipe	Blackstone Street	Commercial Ave to n/o Commercial Ave	--	12	New	1,100
P-20	Pipe	Paige Avenue	Blackstone St to w/o Blackstone St	--	12	New	1,400
P-21	Pipe	Blackstone Street	Paige Ave to s/o Paige Ave	--	12	New	2,250
P-22	Pipe	Walnut Avenue	O St to K St	6	12	Replace	900
P-23	Pipe	Levin Avenue	Blackstone St to O St	8	12	Replace	2,650
P-24	Pipe	Levin Avenue	O St to K St	6	12	Replace	550
P-25	Pipe	s/o Paige Avenue	K St to Blackstone St	8,10	12	Replace	2,150
P-26	Pipe	Sonora Avenue	Blackstone St to w/o Blackstone St	6,8	10	Replace	200
P-27	Pipe	Inyo Avenue	Los Angeles St to E St	2, 4, 8	8	Replace	3,000
P-28	Pipe	Prosperity Avenue	West St to Sacramento St	--	12	New	650
P-29	Pipe	M Street	Prosperity Ave to Garfield Ave	8	12	Replace	3,550
P-30	Pipe	Prosperity Avenue	M St to w/o Williams St	8	12	Replace	1,000
P-31	Pipe	Prosperity Avenue	Oaks St to w/o Williams St	--	12	New	500
P-32	Pipe	Gem Street	Washington Ave to Sandra Ave	6	10	Replace	300
P-33	Pipe	w/o Blackstone Avenue	Zumwalt Ave to Washington Ave	--	12	New	500
P-33A	Casing (1)	w/o Blackstone Avenue	Crossing across Highway 99	--	12/24	New	400
P-34	Pipe	Zumwalt Avenue	Gem St to Retherford St	--	12	New	1,250
P-35	Pipe	Retherford Street	Leland Ave to n/o Leland Ave	--	12	New	600
Well Improvements							
W-1	Supply Well (2)	E Street	E St and Lemonwood Ave	--	1400 gpm	New	--
W-2	Supply Well (2)	Laspina Street	ne/o Laspina St and Ave 200	--	1400 gpm	New	--
W-3	Supply Well (2)	se/o Modac Avenue	sw/o Foster Dr and Turner Dr	--	1400 gpm	New	--
W-4	Supply Well (2)	Paige Avenue	w/o K St	--	1400 gpm	New	--
Tank Improvements							
T-1	Tank (2)	Paige Avenue	Paige Ave and K St	--	1.0 MG	New	--
T-2	Tank (2)	Bardsley Avenue	Bardsley Ave and Morrison St	--	6.0 MG	New	--
T-3	Tank (2)	e/o Highway 99	e/o Highway 99 and s/o Cartmill Ave	--	5.0 MG	New	--
Future System Improvements							
Pipeline Improvements							
P-36	Pipe	Haven Street	Alpline Ave to Bardsley Ave	--	12	New	1,000
P-37	Pipe	Mooney Boulevard	s/o Prosperity Ave to Cross Ave	--	12	New	950
P-38	Pipe	Zumwalt Avenue	West St to e/o West St	--	12	New	2,000
P-39	Pipe	West Street	Zumwalt Ave to Prosperity Ave	--	12	New	2,650
P-40	Pipe	w/o West Street	Zumwalt Ave to Prosperity Ave	--	12	New	2,650
P-41	Pipe	Zumwalt Avenue	w/o West St to West St	--	12	New	2,650
P-42	Pipe	E Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,700
P-43	Pipe	Cartmill Avenue	E St to J St	--	12	New	850
P-44	Pipe	Cartmill Avenue	J St to w/o Oaks St	--	12	New	1,400
P-45	Pipe	J Street	Cartmill Ave to ne/o Zumwalt Ave	--	12	New	1,750
P-46	Pipe	Mitchell Avenue	Alcott St to J St	--	12	New	150
P-47	Pipe	Zumwalt Avenue	E St to J St	--	12	New	1,300
P-48	Pipe	Zumwalt Avenue	Retherford St to Blackstone St	--	12	New	1,350
P-49	Pipe	Blackstone Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,600
P-50	Pipe	Cartmill Avenue	Blackstone St to e/o Blackstone St	--	12	New	2,150
P-51	Pipe	Cartmill Avenue	Mooney Blvd to w/o Mooney Blvd	--	12	New	1,600
P-52	Pipe	Mooney Boulevard	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-53	Pipe	Zumwalt Avenue	Mooney Blvd to w/o Mooney Blvd	--	12	New	1,500
P-54	Pipe	Prosperity Avenue	Mooney Blvd to w/o Mooney Blvd	--	12	New	600
P-55	Pipe	Mooney Boulevard	Zumwalt Ave to Prosperity Ave	--	12	New	2,750
P-56	Pipe	Morrison Street	Cross Ave to Tulare Ave	--	12	New	2,700
P-57	Pipe	Pleasant Avenue	Morrison St to w/o Morrison St	--	12	New	1,700
P-58	Pipe	e/o Mooney Boulevard	Bardsley Ave to n/o Bardsley Ave	--	12	New	1,950
P-59	Pipe	w/o West Street	Pleasant Ave to Tulare Ave	--	12	New	2,700
P-60	Pipe	Tulare Avenue	e/o Enterprise St to w/o West St	--	12	New	1,000
P-61	Pipe	w/o West Street	Tulare Ave to Inyo Ave	--	12	New	2,600
P-62	Pipe	w/o West Street	Sonora Ave to Bardsley Ave	--	12	New	1,450
P-63	Pipe	Bardsley Avenue	e/o Enterprise St to West St	--	12	New	2,650
P-64	Pipe	Pleasant Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	2,450
P-65	Pipe	e/o Enterprise Street	Prosperity Ave to Pleasant Ave	--	12	New	2,700
P-66	Pipe	Pratt Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-67	Pipe	Pratt Street	s/o Bardsley Ave to Paige Ave	--	12	New	2,650
P-68	Pipe	s/o Bardsley Avenue	Pratt St to e/o Pratt St	--	12	New	700
P-69	Pipe	w/o I St	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,700
P-70	Pipe	s/o Bardsley Avenue	I St to w/o I St	--	12	New	1,300
P-71	Pipe	w/o I St	s/o Bardsley Ave to Paige Ave	--	12	New	2,700
P-72	Pipe	Paige Avenue	E St to w/o I St	--	12	New	1,250
P-73	Pipe	w/o I St	Paige Ave to 600' s/o Paige Ave	--	12	New	650
P-74	Pipe	600 ft s/o Paige Avenue	w/o I St to County Road 112	--	12	New	1,900
P-75	Pipe	600 ft s/o Paige Avenue	County Road 112 to K St	--	12	New	800
P-76	Pipe	E Street	Ave 216 to proposed well s/o Lemonwood Ave	--	12	New	1,350
P-77	Pipe	Paige Avenue	Pratt St to E St	--	12	New	1,350
P-78	Pipe	West Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-79	Pipe	s/o Bardsley Avenue	West St to Pratt St	--	12	New	2,550
P-80	Pipe	West Street	s/o Bardsley Ave to Paige Ave	--	12	New	2,650
P-81	Pipe	Paige Avenue	West St to Pratt St	--	12	New	2,550
P-82	Pipe	se/o Laspina St	Laspina St to e/o Laspina St	--	12	New	2,600
P-83	Pipe	e/o Laspina Street & Tex Drive	Proposed Well (W-28) to TMSC Property Line	--	12	New	450
P-84	Pipe	se/o Laspina St	Golf Course to TMSC Property Line	--	12	New	1,850
P-85	Pipe	n/o Tex Drive	1,600' e/o Laspina St to 2,400' e/o Laspina St	10	12	Replace	850
P-86	Pipe	se/o Laspina St	e/o Laspina St to w/o Turner Dr	--	12	New	2,450
P-87	Pipe	Turner Drive	900' se/o Foster Dr to 2,900' se/o Foster Dr	--	12	New	2,050
P-88	Pipe	Turner Drive	Stub se/o P-87	--	12	New	200
P-89	Pipe	Turner Drive	Stub sw/o P-87	--	12	New	200
P-90	Pipe	e/o Mooney Boulevard	Levin Ave to Bardsley Ave	--	12	New	2,600
P-91	Pipe	s/o Bardsley Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,500
P-92	Pipe	s/o Bardsley Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,650
P-93	Pipe	Oakmore Street	Levin Ave to Paige Ave	--	12	New	2,650
P-94	Pipe	Mooney Boulevard/Turner Drive	s/o Mooney Blvd to Turner Dr	--	12	New	1,950
P-95	Pipe	se/o Foster Drive	Turner Dr to w/o Oakmore St	--	12	New	2,100

Table ES.2 Proposed Improvements
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)
P-96	Pipe	s/o Levin Avenue	w/o Oakmore St to Oakmore St	--	12	New	2,700
P-97	Pipe	se/o Foster Drive	Turner Dr to ne/o Turner Dr	--	12	New	3,700
P-98	Pipe	Laspina Street	Rankin Ave to n/o Rankin Ave	--	12	New	1,650
P-99	Pipe	Rankin Avenue	Laspina St to w/o Highway 99	--	12	New	4,600
P-99A	Casing (1)	Rankin Avenue	Crossing across Highway 99	--	12/24	New	250
P-100	Pipe	Laspina Street	Hosfield Dr to 1,000' nw/o Hosfield Dr	--	12	New	950
P-101	Pipe	J Street	Paige Ave to Goodin Ave	--	12	New	3,400
P-102	Pipe	ne/o Rankin Ave	Proposed Tank (T-6) to TMSC Property Line	--	12	New	1,350
P-103	Pipe	Cartmill Avenue	Gem St to Blackstone St	--	12	New	2,650
P-104	Pipe	Prosperity Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	3,550
P-105	Pipe	Pratt Street	n/o Wade Ave to Paige Ave	--	12	New	2,650
P-106	Pipe	n/o Wade Avenue	e/o Pratt St to County Road 112	--	12	New	3,500
P-107	Pipe	n/o Wade Avenue	Pratt St to E St	--	12	New	1,350
P-108	Pipe	West Street	Paige Ave to s/o Paige Ave	--	12	New	2,700
P-109	Pipe	s/o Paige Avenue	West St to Pratt St	--	12	New	2,550
P-110	Pipe	Avenue 208	County Road 112 to w/o County Road 112	--	12	New	2,650
P-111	Pipe	Avenue 208	Pratt St to w/o County Road 112	--	12	New	2,650
P-112	Pipe	Pratt Street	n/o Wade Ave to Ave 208	--	12	New	2,600
P-113	Pipe	Avenue 208	West St to Pratt St	--	12	New	2,500
P-114	Pipe	West Street	s/o Paige Ave to Ave 208	--	12	New	2,500
P-115	Pipe	Avenue 200	County Road 112 to e/o Pratt St	--	12	New	3,700
P-116	Pipe	e/o Pratt Street	Ave 200 to n/o Ave 200	--	12	New	2,700
P-117	Pipe	e/o Pratt Street	Clinton Ave to s/o Clinton Ave	--	12	New	2,700
P-118	Pipe	Lopes Avenue	County Road 112 to e/o Pratt St	--	12	New	3,150
P-119	Pipe	e/o Pratt Street	Ave 200 to s/o Ave 200	--	12	New	2,600
P-120	Pipe	County Road 112	Rankin Ave to Ave 196	--	12	New	2,650
P-121	Pipe	Avenue 196	County Road 112 to e/o Pratt St	--	12	New	4,300
P-122	Pipe	Avenue 196	County Road 112 to Highway 99	--	12	New	1,400
P-123	Pipe	Avenue 196	Pipeline across Highway 99	--	12	New	400
P-123A	Casing (1)	Avenue 196	Crossing across Highway 99	--	12/24	New	250
P-124	Pipe	Hosfield Drive	Highway 99 to Laspina St	--	12	New	3,350
P-125	Pipe	Pratt Street	Clinton Ave to s/o Clinton Ave	--	12	New	2,700
P-126	Pipe	w/o Enterprise Street	Prosperity Ave to Pleasant Ave	--	12	New	2,700
P-127	Pipe	w/o Enterprise Street	Zumwalt Ave to Prosperity Ave	--	12	New	2,600
P-128	Pipe	Zumwalt Avenue	w/o Enterprise St to w/o West St	--	12	New	3,900
P-129	Pipe	Alpine Avenue	Morrison St to e/o Morrison St	--	12	New	900
P-130	Pipe	e/o Morrison Street	Alpine Ave to Ave 228	--	12	New	450
P-131	Pipe	Avenue 228	e/o Morrison St to Oakmore St	--	12	New	1,350
P-132	Pipe	Tulare Avenue	Morrison St to Oakmore St	--	12	New	2,200
P-133	Pipe	Oakmore Street	Tulare Ave to Ave 228	--	12	New	2,750
P-134	Pipe	Oakmore Street	Ave 228 to Bardsley Ave	--	12	New	2,600
P-135	Pipe	Bardsley Avenue	Oakmore St to w/o Oakmore St	--	12	New	2,200
P-136	Pipe	Oakmore Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-137	Pipe	Tulare Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	3,850
P-138	Pipe	w/o Enterprise Street	Pleasant Ave to Tulare Ave	--	12	New	2,700
P-139	Pipe	Inyo Avenue	Road 88 to w/o Road 88	6	12	Replace	800
P-140	Pipe	Inyo Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	2,950
P-141	Pipe	w/o Enterprise Street	Tulare Ave to Inyo Ave	--	12	New	2,600
P-142	Pipe	Bardsley Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	3,900
P-143	Pipe	w/o Enterprise Street	Inyo Ave to Bardsley Ave	--	12	New	2,600
P-144	Pipe	West Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,700
P-145	Pipe	Cartmill Avenue	w/o West St to West St	--	12	New	2,650
P-146	Pipe	Cartmill Avenue	West St to E St	--	12	New	2,650
P-147	Pipe	w/o West Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-148	Pipe	Cartmill Avenue	w/o Enterprise St to w/o West St	--	12	New	3,900
P-149	Pipe	w/o Enterprise Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-150	Pipe	Oaks Avenue	n/o Cartmill Ave to n/o Cartmill Ave	--	12	New	1,100
P-151	Pipe	w/o Highway 99	Pacific Ave to Oaks Ave	--	12	New	1,300
P-152	Pipe	Pacific Avenue	J St to w/o Gem St	--	12	New	3,950
P-152A	Casing (1)	Pacific Avenue	Crossing across Highway 99	--	12/24	New	250
P-153	Pipe	J Street	nw/o Cartmill Ave to Cartmill Ave	--	12	New	2,650
P-154	Pipe	West Street	Cartmill Ave to Pacific Ave	--	12	New	2,550
P-155	Pipe	Pacific Avenue	West St to J St	--	12	New	28,250
P-156	Pipe	Cartmill Avenue	Oaks St to Gem St	--	12	New	3,100
P-156A	Casing (1)	Cartmill Avenue	Crossing across Highway 99	--	12/24	New	300
P-157	Pipe	w/o Blackstone Avenue	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-158	Pipe	w/o Blackstone Avenue	Pacific Ave to Cartmill Ave	--	12	New	2,550
P-159	Pipe	Pacific Avenue	w/o Gem St to Gem St	--	12	New	1,000
P-160	Pipe	Blackstone Street	Pacific Ave to Cartmill Ave	--	12	New	2,600
P-161	Pipe	Pacific Avenue	Gem St to Blackstone St	--	12	New	2,650
P-162	Pipe	e/o Blackstone Street	Pacific Ave to Cartmill Ave	--	12	New	2,650
P-163	Pipe	Pacific Avenue	Blackstone St to 2,600' w/o Mooney Blvd	--	12	New	2,700
P-164	Pipe	Mooney Boulevard	Pacific Ave to Cartmill Ave	--	12	New	2,600
P-165	Pipe	Pacific Avenue	w/o Mooney Blvd to Mooney Blvd	--	12	New	2,600
P-166	Pipe	Cartmill Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,350
P-167	Pipe	Zumwalt Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,300
P-168	Pipe	e/o Mooney Boulevard	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-169	Pipe	Prosperity Avenue	Mooney Blvd to w/o Morrison St	--	12	New	2,250
P-170	Pipe	e/o Mooney Boulevard	Zumwalt Ave to Prosperity Ave	--	12	New	2,750
P-171	Pipe	Morrison Street	Prosperity Ave to Cross Ave	--	12	New	2,750
P-172	Pipe	Prosperity Avenue	w/o Morrison St to Morrison St	--	12	New	500
P-173	Pipe	e/o Mooney Boulevard	Pacific Ave to Cartmill Ave	--	12	New	2,650
P-174	Pipe	Pacific Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,400
P-175	Pipe	w/o West Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-176	Pipe	s/o Bardsley Avenue	e/o Enterprise St to West St	--	12	New	2,600
P-177	Pipe	w/o West Street	s/o Bardsley Ave to Paige Ave	--	12	New	2,650
P-178	Pipe	Paige Avenue	w/o West St to West St	--	12	New	2,600
P-179	Pipe	Lopes Avenue	Pratt St to e/o Pratt St	--	12	New	2,650
P-180	Pipe	e/o Highway 99	Hosfield Dr to se/o Hosfield Dr	--	12	New	2,500
P-181	Pipe	e/o Highway 99	se/o Hosfield Dr to n/o Ave 184	--	12	New	2,750
P-182	Pipe	County Road 112	Ave 196 to se/o Ave 196	--	12	New	2,750
P-183	Pipe	County Road 112	se/o Ave 196 to nw/o Ave 184	--	12	New	3,100
P-184	Pipe	n/o Avenue 184	County Road 112 to Highway 99	--	12	New	1,300
P-185	Pipe	n/o Avenue 184	Pipeline across Highway 99	--	12	New	550
P-185A	Casing (1)	n/o Avenue 184	Crossing across Highway 99	--	12/24	New	300
P-186	Pipe	Avenue 192	Highway 99 to Road 112	--	12	New	2,050
P-187	Pipe	Road 112	n/o Ave 184 to Hosfield Dr	--	12	New	4,600
P-188	Pipe	County Road 112	nw/o Ave 184 to Ave 184	--	12	New	2,200
P-189	Pipe	e/o Highway 99	Ave 184 to n/o Ave 184	--	12	New	2,600
P-190	Pipe	Avenue 184	County Road 112 to Highway 99	--	12	New	1,050
P-191	Pipe	Avenue 184	Pipeline across Highway 99	--	12	New	250
P-191A	Casing (1)	Avenue 184	Crossing across Highway 99	--	12/24	New	300
P-192	Pipe	Avenue 228	Oakmore St to e/o Road 126	--	12	New	2,650
P-193	Pipe	e/o Road 132	Ave 228 to Bardsley Ave	--	12	New	2,650
P-194	Pipe	Bardsley Avenue	Oakmore St to e/o Road 126	--	12	New	2,650
P-195	Pipe	e/o Road 132	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-196	Pipe	s/o Bardsley Avenue	Oakmore St to e/o Road 126	--	12	New	2,650
P-197	Pipe	Paige Avenue	Oakmore St to e/o Road 126	--	12	New	2,650
P-198	Pipe	Tulare Avenue	Oakmore St to Road 126	--	12	New	1,300
P-199	Pipe	e/o Oakmore Street	Tulare Ave to n/o Tulare Ave	--	12	New	2,550

Table ES.2 Proposed Improvements
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)
P-200	Pipe	Pleasant Avenue	Morrison St to Oakmore St	--	12	New	2,200
P-201	Pipe	Pleasant Avenue	Oakmore St to Road 126	--	12	New	1,300
P-202	Pipe	w/o Road 132	Tulare Ave to Ave 228	--	12	New	2,650
P-203	Pipe	Tulare Avenue	Road 126 to w/o Road 126	--	12	New	1,350
P-204	Pipe	Avenue 229	e/o Road 126 to Road 132	--	12	New	2,600
P-205	Pipe	Road 132	Tulare Ave to Ave 228	--	12	New	2,600
P-206	Pipe	Tulare Avenue	w/o Road 126 to Road 132	--	12	New	2,600
P-207	Pipe	Bardsley Avenue	e/o Road 126 to Road 132	--	12	New	2,600
P-208	Pipe	Road 132	Ave 228 to Bardsley Ave	--	12	New	2,700
P-209	Pipe	e/o Akers Road	Oakdale Ave to Pacific Ave	--	12	New	2,600
P-210	Pipe	Oakdale Avenue	e/o Akers Rd to Blackstone St	--	12	New	3,600
P-211	Pipe	Blackstone Street	Oakdale Ave to Pacific Ave	--	12	New	2,550
P-212	Pipe	Prosperity Avenue	Morrison St to Oakmore St	--	12	New	2,100
P-213	Pipe	Oakmore Street	Prosperity Ave to Zumwalt Ave	--	12	New	2,600
P-214	Pipe	Zumwalt Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,600
P-215	Pipe	Oakmore Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-216	Pipe	Cartmill Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,600
P-217	Pipe	Oakmore Street	Pacific Ave to Cartmill Ave	--	12	New	2,700
P-218	Pipe	Pacific Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,650
P-219	Pipe	Oakmore Street	Prosperity Ave to Cross Ave	--	12	New	2,900
P-220	Pipe	Avenue 200	Pratt St to e/o Pratt St	--	12	New	2,600
P-221	Pipe	Pratt Street	Ave 200 to n/o Ave 200	--	12	New	2,650
P-222	Pipe	Pratt Street	Ave 200 to s/o Ave 200	--	12	New	2,600
P-223	Pipe	Avenue 196	Pratt St to e/o Pratt St	--	12	New	2,600
P-224	Pipe	w/o Enterprise Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	1,300
P-225	Pipe	s/o Bardsley Avenue	w/o Enterprise St to Enterprise St	--	12	New	1,300
P-226	Pipe	Enterprise Street	s/o Bardsley Ave to n/o Paige Ave	--	12	New	1,300
P-227	Pipe	s/o Bardsley Avenue	Enterprise St to e/o Enterprise St	--	12	New	2,600
P-228	Pipe	West Street	Pacific Ave to Oakdale Ave	--	12	New	2,600
P-229	Pipe	J Street	Pacific Ave to Oakdale Ave	--	12	New	2,700
P-230	Pipe	Oakdale Avenue	West St to J St	--	12	New	2,400
P-231	Pipe	West Street	Oakdale Ave to s/o Ave 260	--	12	New	2,100
P-232	Pipe	J Street	Oakdale Ave to s/o Ave 260	--	12	New	2,200
P-233	Pipe	s/o Avenue 260	West St to J St	--	12	New	1,650
P-234	Pipe	e/o Blackstone Street	Oakdale Ave to Pacific Ave	--	12	New	2,600
P-235	Pipe	Oakdale Avenue	w/o Mooney Blvd to Mooney Blvd	--	12	New	2,700
P-236	Pipe	Oakdale Avenue	Blackstone St to w/o Mooney Blvd	--	12	New	2,700
P-237	Pipe	Mooney Boulevard	Oakdale Ave to Pacific Ave	--	12	New	2,650
P-238	Pipe	Oakdale Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,350
P-239	Pipe	e/o Mooney Boulevard	Oakdale Ave to Pacific Ave	--	12	New	2,700
P-240	Pipe	w/o Road 132	s/o Bardsley Ave to n/o Paige Ave	--	12	New	2,650
P-241	Pipe	Road 132	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,700
P-242	Pipe	s/o Bardsley Avenue	e/o Road 126 to Road 132	--	12	New	2,600
P-243	Pipe	Road 132	s/o Bardsley Ave to Paige Ave	--	12	New	2,650
P-244	Pipe	Paige Avenue	e/o Road 126 to Road 132	--	12	New	2,600
Well Improvements							
W-5	Supply Well (2)	Oakdale Avenue	w/o Gem St	--	1400 gpm	New	--
W-6	Supply Well (2)	Oakdale Avenue	Mooney Blvd	--	1400 gpm	New	--
W-7	Supply Well (2)	Avenue 252	Laspina St	--	1400 gpm	New	--
W-8	Supply Well (2)	Cartmill Avenue	Morrison St	--	1400 gpm	New	--
W-9	Supply Well (2)	Zumwalt Avenue	e/o Gem St	--	1400 gpm	New	--
W-10	Supply Well (2)	Cartmill Avenue	w/o J St	--	1400 gpm	New	--
W-11	Supply Well (2)	Cartmill Avenue	w/o Enterprise St	--	1400 gpm	New	--
W-12	Supply Well (2)	Zumwalt Avenue	w/o West St	--	1400 gpm	New	--
W-13	Supply Well (2)	Prosperity Avenue	Sacramento St	--	1400 gpm	New	--
W-14	Supply Well (2)	Prosperity Avenue	Mooney Blvd	--	1400 gpm	New	--
W-15	Supply Well (2)	Prosperity Avenue	Oakmore St	--	1400 gpm	New	--
W-16	Supply Well (2)	w/o Enterprise Street	Pleasant Ave	--	1400 gpm	New	--
W-17	Supply Well (2)	Oakmore Street	State Highway 137	--	1400 gpm	New	--
W-18	Supply Well (2)	n/o Bardsley Avenue	e/o Oakmore St	--	1400 gpm	New	--
W-19	Supply Well (2)	State Highway 137	w/o Enterprise Ave	--	1400 gpm	New	--
W-20	Supply Well (2)	s/o Bardsley Avenue	e/o Enterprise Ave	--	1400 gpm	New	--
W-21	Supply Well (2)	1st Street	w/o K St	--	1400 gpm	New	--
W-22	Supply Well (2)	Levin Avenue	Foster Dr	--	1400 gpm	New	--
W-23	Supply Well (2)	Bardsley Avenue	Morrison St	--	1400 gpm	New	--
W-24	Supply Well (2)	e/o Oakmore Street	Levin Ave	--	1400 gpm	New	--
W-25	Supply Well (2)	Pratt Street	Paige Ave	--	1400 gpm	New	--
W-26	Supply Well (2)	County Road 112	s/o Paige Ave	--	1400 gpm	New	--
W-27	Supply Well (2)	Oakmore Street	Paige Ave	--	1400 gpm	New	--
W-28	Supply Well (2)	e/o Laspina St	sw/o Turner Dr	--	1400 gpm	New	--
W-29	Supply Well (2)	Pratt Street	Clinton Ave	--	1400 gpm	New	--
W-30	Supply Well (2)	e/o Laspina Street	n/o Hosfield Dr	--	1400 gpm	New	--
W-31	Supply Well (2)	e/o Pratt Street	Ave 200	--	1400 gpm	New	--
W-32	Supply Well (2)	Avenue 196	County Road 112	--	1400 gpm	New	--
W-33	Supply Well (2)	e/o Highway 99	s/o Hosfield Dr	--	1400 gpm	New	--
Tank Improvements							
T-4	Tank (2)	Prosperity Avenue	Prosperity Ave and Sacramento St	--	5.0 MG	New	--
T-5	Tank (2)	Pratt Street	Clinton Ave and Pratt St	--	4.0 MG	New	--
T-6	Tank (2)	e/o Laspina Street	n/o Hosfield Dr	--	4.0 MG	New	--

Notes:
1. Proposed casings size and carrier pipe size.
2. Final location of future tanks and groundwater wells to be determined.

ES.5.1 Supply Capacity

The City's total and firm supply capacity from the 27 existing groundwater wells is estimated at 38.6 mgd and 33.4 mgd, respectively. The city-wide supply analysis indicates that the 2008 peak hour demand (PHD) is about 20 mgd greater than the total capacity of the existing wells. The City's firm capacity, therefore, is well below the 2008 PHD, and does not meet the supply criteria.

Assuming the existing wells will remain in service at their current capacities, the total recommended increase in the source of supply is 26.0 mgd to satisfy 2008 PHD conditions. It is recommended that the City construct 13 new wells, with an approximate capacity of 2.0 mgd (approximately 1,400 gpm) each. This increase will provide enough capacity to meet 2008 PHDs with two of the largest well out of service. The total recommended increase in supply capacity through 2030 is 104 mgd (total recommended supply less the 2008 available total supply). It is recommended that the City install 52 new wells by 2030, 13 of which are needed to mitigate existing deficiencies.

ES.5.2 Storage Capacity

The City's current storage capacity totals 150,000 gallons (0.15 MG), which is provided by an elevated tank located near the intersection of Kern Avenue and O Street. A city-wide analysis of the storage needs was conducted as part of this study. The storage requirements are based on providing the fire flow storage of 0.63 million gallons (MG) only. No operational or emergency storage is required since the City relies on groundwater and some wells have backup power. It is recommended that the City construct an above-ground storage tank with 1.0 MG to meet the fire flow requirement.

ES.5.3 Project Prioritization

The master plan CIP provides a breakdown of recommended improvement projects over five phases. Improvement projects to correct existing deficiencies should be implemented by the City as soon as possible. Due to budget and time constraints, however, it may not be feasible for the City to implement all existing system improvement projects within the first or second CIP phase. In order to provide guidance to the City in identifying the most critical improvements, the recommended improvement projects were prioritized based on the severity of the existing or expected deficiency. Projects given highest priority should be implemented as soon as possible, whereas projects given a lower priority can likely be pushed back to later CIP phases.

Improvement projects needed to service future growth will be constructed at the time a specific development comes on line. Therefore, the phasing of future improvements is dependant upon the pace of development.

The priorities are described below:

- **Existing Higher Priority** - Facility is required to maintain adequate pressures in a large tributary area.
- **Existing Lower Priority** - Low pressure conditions existing in an isolated area.
- **Future Development Related** - Facilities necessary to serve future growth, or facility is required to extend potable water service to a new development area.

Table ES.3 provides a summary of the proposed improvement by project prioritization.

Table ES.3 Project Prioritization
Water System Master Plan
City of Tulare

Priority	Improvement Number
Existing Higher Priority - Facility is required to maintain adequate pressures in a large tributary area.	P-1, P-2, P-7, P-17 through P-21, P-23 through P-25, P-27 through P-35, W-1 through W-13, T-1 through T-3
Existing Lower Priority - Low pressure conditions in an isolated area.	P-3 through P-6, P-8 through P-16, P-22, P-26
Future Development Related - Facilities necessary to serve future growth, or facility is required to extend potable water service to a new development area.	P-36 through P-247, W-14 through W-52, T-4 through T-6

ES.5.3.1 *Highest Priority Improvements*

Selected improvement projects were identified out of the higher priority improvements as the most critical and are summarized below:

- **Supply Wells (W-1 through W-13**). The construction of four new wells is recommended to maintain a supply capacity that is sufficient to reliably meet existing MDDs with the two largest wells serving as standby.
- **Storage Tank (T-1)**. In order to supply adequate pressure during fireflows, it is recommended that a 1 MG elevated tank be constructed in the industrial region of the City.
- **Pipelines P-1, P-2, P-7, and P-27**. These improvements are necessary to create a large diameter water main loop on Bardsley Avenue, West Street, Inyo Avenue, and E Street. This loop will alleviate low pressures in the area under PHD and fire flow conditions.

ES.6 CAPITAL IMPROVEMENT PROGRAM

The cost estimates presented in the CIP have been prepared for general master planning purposes and for guidance in project evaluation and implementation. Final costs of a project

will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as: preliminary alignments, alternative routings, and detailed utility and topography surveys.

Knowledge about site-specific conditions for each proposed project is limited at the master planning stage; therefore the Estimated Construction Costs include a 30 percent contingency to account for unforeseen events and unknown field conditions. The Capital Improvement Costs also include an additional 20 percent (applied to the Estimated Construction costs) for project-related costs, comprised of engineering, administration, construction inspection, and legal costs. Table ES.4 summarizes the master plan CIP.

As shown in Table ES.4, the majority of improvements and capital costs are associated with growth and are therefore allocated to future customers ($113.8 million). The total CIP is estimated to cost approximately $146.0 million, of which 22 percent ($32.2 million) is allocated to existing customers.

Table ES.4 Capital Improvement Program Summary
Water System Master Plan
City of Tulare

Customer Type	Cost (million dollars)					
	Phase I (2009-2011)	**Phase II (2012-2015)**	**Phase III (2016-2020)**	**Phase IV (2021-2025)**	**Phase V (2026-2030)**	**Total**
Existing	29.1	3.1	0.0	0.0	0.0	**32.2**
Future	0.0	21.8	26.2	24.6	41.2	**113.8**
Total	**29.1**	**24.9**	**26.2**	**24.6**	**41.2**	**146.0**

Chapter 1

INTRODUCTION

This chapter presents the need for this Water System Master Plan and the objectives of the study. A list of abbreviations is also provided to assist the reader in understanding the information presented.

1.1 BACKGROUND

The City of Tulare (City) (Figure 1.1) operates its own groundwater wells and associated infrastructure facilities, and serves customers within the City limits. The previous Water System Master Plan was completed in May 1994 (1994 Master Plan) and included a capacity evaluation of the water system, recommended improvements to mitigate deficiencies, and a summary of the capital costs associated with the improvements. The 1994 Master Plan was based on planning assumptions and operational conditions that have since changed.

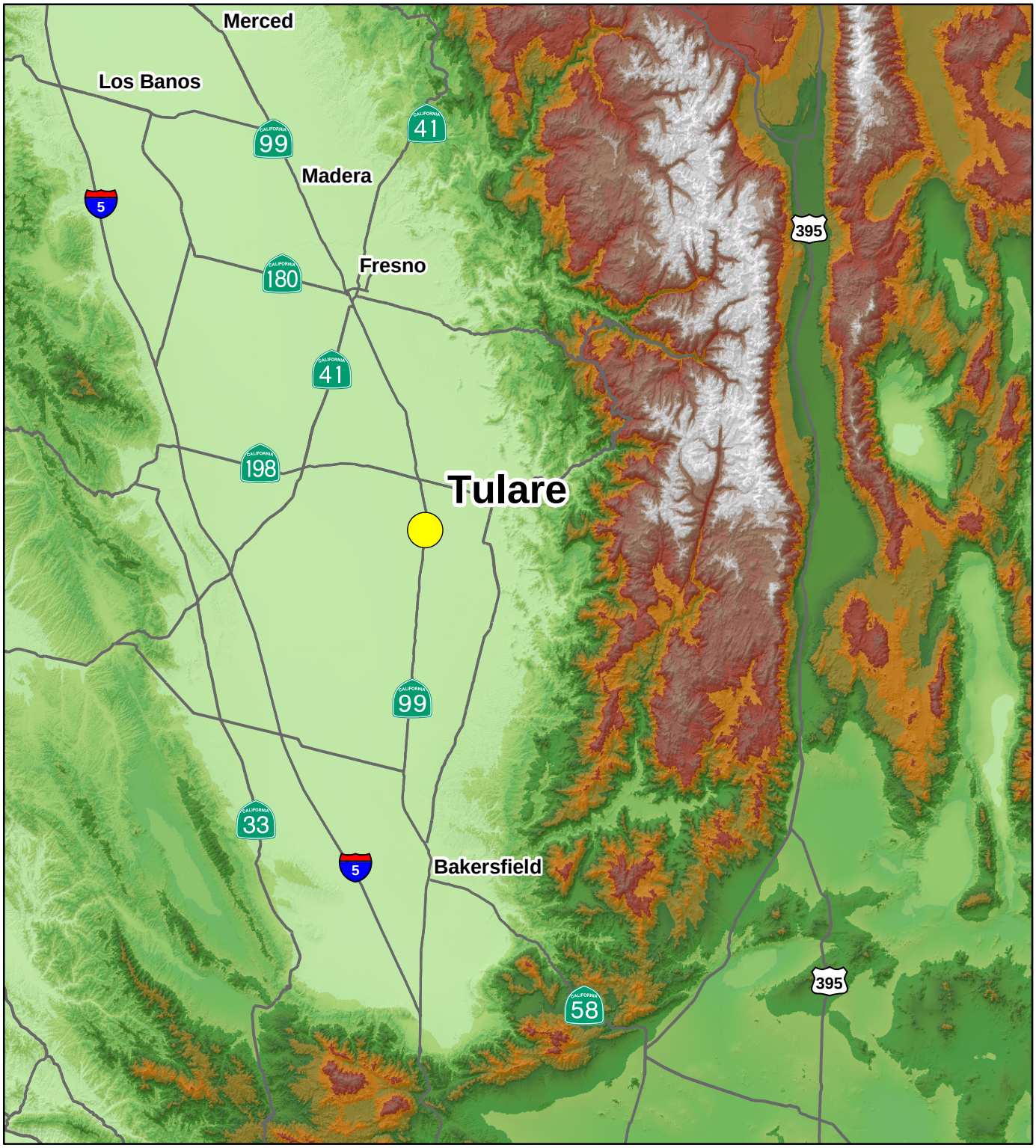
The City is recently updated its general plan to the planning horizon of 2030. The land use assumptions and development assumptions used in this master plan are consistent with those provided in the General Plan Update (April 2008). This master plan recommends projects that will serve existing and future customers as development extends to the Urban Development Boundary (UDB) of the General Plan Update.

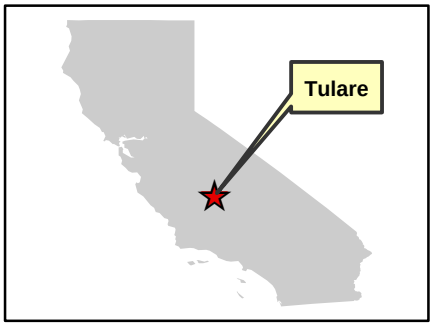
1.2 SCOPE AND AUTHORIZATION

The purpose of this Water System Master Plan is to identify capacity deficiencies in the water distribution system, develop feasible alternatives to correct these deficiencies, and plan the infrastructure that will serve future development.

On September 21, 2006, the City authorized Carollo Engineers, P.C. (Carollo) to prepare this Water System Master Plan study, which included the following tasks:

- Establish water system planning and evaluation criteria.
- Evaluate the existing water distribution system.
- Perform a demand analysis and review supply capacity.
- Perform a system-wide storage analysis.
- Review existing system and propose improvements to enhance system capacity.
- Recommend improvements needed to service anticipated future growth.
- Develop a Capital Improvement Program (CIP) with a planning horizon of 2030.





Legend

Elevation

High : 12,000 Feet

Low : 0 Feet

Major Roads

Miles

0 15 30

Figure 1.1
Regional Location Map
Water System Master Plan
City of Tulare

The study includes several planning assumptions that are documented in this report. Should future planning conditions deviate from the assumptions stated in this master plan (i.e., accelerated growth, more developments with higher densities, supply source modifications, etc.), revisions and adjustments to the master plan recommendations would be necessary. The scope of work for this project does not include a review of water quality conditions.

1.3 REPORT ORGANIZATION

The water system master plan report contains six chapters, followed by appendices that provide supporting documentation for the information presented in the report. The chapters are briefly described below:

Chapter 1 - Introduction. This chapter presents the need for this water system master plan and the objectives of the study. A list of abbreviations is also provided to assist the reader in understanding the information presented.

Chapter 2 - Planning Area Characteristics. This chapter presents a discussion of this study's planning area characteristics, defining the land use classifications and summarizing the historical population trends. Population projections, used to estimate the City's future water requirements, are also presented.

Chapter 3 - Planning and Evaluation Criteria. The City's water supply, storage, and distribution facilities were evaluated based on the planning and evaluation criteria defined in this chapter. Historical water consumption and production records were reviewed to determine the daily, monthly, and seasonal fluctuations experienced by the water system. The developed criteria address the water supply capacity, storage capacity, acceptable service pressures, distribution main performance, average annual water demand coefficients, and daily and hourly peaking factors.

Chapter 4 - Existing System and Hydraulic Model. This chapter presents an overview of the City's water supply, distribution, and storage facilities. The chapter also describes the development of the City's water distribution system hydraulic model. This model was used for identifying existing system deficiencies and for recommending enhancements.

Chapter 5 - Evaluation and Proposed Improvements. This chapter presents the results of the capacity evaluation of the water supply, distribution, and storage facilities. The chapter also presents improvements to mitigate existing system deficiencies and for servicing future growth. These improvements are recommended based on the system's technical requirements, cost effectiveness, and operational reliability.

Chapter 6 - Capital Improvement Program. This chapter presents the recommended CIP for the City's water distribution system. The program is based on the evaluation of the City's

water distribution system, and on the recommended improvements described in the previous chapters. The CIP has been staged to the planning horizon of 2030.

1.4 ACKNOWLEDGEMENTS

Carollo wishes to acknowledge and thank Mr. Darrel Pyle, City Manager; Mr. Ken Ramage, City Engineer; Mr. Lew Nelson, Public Works Director; Mr. Mike Whitlock, Senior Civil Engineer; and Mr. Dan Boggs, Water Superintendent. Their own and their staff's cooperation and courtesy in obtaining a variety of necessary information were valuable components in completing and producing this report.

1.5 ABBREVIATIONS AND DEFINITIONS

To conserve space and to improve readability, the following abbreviations are used in this report.

Abbreviation	Description
$/LF	Dollars per Linear Foot
^{o}F	Degrees Fahrenheit
1994 Master Plan	1994 Water System Master Plan
AACE	Association for the Advancement of Cost Engineering
ADD	Average Day Demand
AFY	Acre Feet Per Year
AT	Active Treated
AU	Active Untreated
AWWA	American Water Works Association
C	Hazen Williams Friction Coefficient
City	City of Tulare
Carollo	Carollo Engineers, P.C.
CDPH	California Department of Public Health
CIP	Capital Improvement Program
DOF	Department of Finance
ENR CCI	Engineering News Record Construction Cost Index
FAR	Floor Area Ratio
fps	Feet Per Second
ft	Feet
GIS	Geographic Information System
gpda	Gallons Per Day Per Acre
gpcd	Gallons Per Capita Per Day
gpm	Gallons Per Minute
gr. ac.	Gross Acres
ISO	Insurance Service Office
MDD	Maximum Day Demand
MG	Million Gallons
mgd	Million Gallons Per Day
mgm	Million Gallons Per Month
msl	Mean Sea Level
NRCS	Natural Resources Conservation Service

Abbreviation	Description
PHD	Peak Hour Demand
psi	Pounds Per Square Inch
ROW	Right of Way
sq ft	Square Feet
UDB	Urban Development Boundary
USDA	United States Department of Agriculture

1.6 REFERENCES

The following documents were referenced in the preparation of this master plan report.

- City of Tulare Engineering General Design Standards, April 2002.
- City of Tulare Draft Environmental Impact Report for the Tulare Motor Sports Park Complex, May 2008.
- City of Tulare General Plan, April 2008.
- City of Tulare Water System Master Plan, Montgomery Watson, May 1994.
- Soil Survey of Tulare County, California, Western Part, United States Department of Agriculture Natural Resources Conservation Service, 1999.

Chapter 2

PLANNING AREA CHARACTERISTICS

This chapter presents a discussion of this study's planning area characteristics, defining the land use classifications and summarizing the historical population trends. Population projections, used to estimate the City's future water requirements, are based on the City of Tulare's (City) General Plan Update.

2.1 STUDY AREA

The City is located along Highway 99 in Tulare County within the Central San Joaquin Valley of California, approximately 45 miles south of Fresno and 60 miles north of Bakersfield.

Tulare was founded in 1872 by the Southern Pacific Railroad, and incorporated in 1888. Agriculture is a major component of the City's economy, due to its highly productive farmland. Tulare is attractive to food processors and distributors because of its central location and abundance of locally grown products.

The City recently updated its General Plan. The City limits and Urban Development Boundary (UDB), as established from the City's Land Use Diagram (Updated December 2007), are 19 square miles (12,281 acres) and 37 square miles (23,608 acres), respectively. The current City limits and UDB are shown on Figure 2.1. The study area boundary for this master plan is the UDB.

2.2 SOIL AND TOPOGRAPHY

According to the Soil Survey of Tulare County, California, Western Part from the United States Department of Agriculture (USDA) Natural Resources Conservation Service (NRCS) (http://www.ca.nrcs.usda.gov/), the dominant soil types within City limits include Colpien, Nord, Yettem, Crosscreek, and Flamen soils. Additional soils within City limits include Hanford, Biggriz, and Tagus soils.

The topography of the San Joaquin Valley is generally flat. The City's UDB ground elevations range from approximately 255 feet (ft) to 310 ft above mean sea level.

2.3 CLIMATE

According to the City's website, the average maximum and minimum temperatures in January are 54 degrees Fahrenheit (°F) and 34 °F, respectively. In July, the average maximum and minimum temperatures are 96 °F and 65 °F, respectively. The City's average annual rainfall is 10.15 inches.

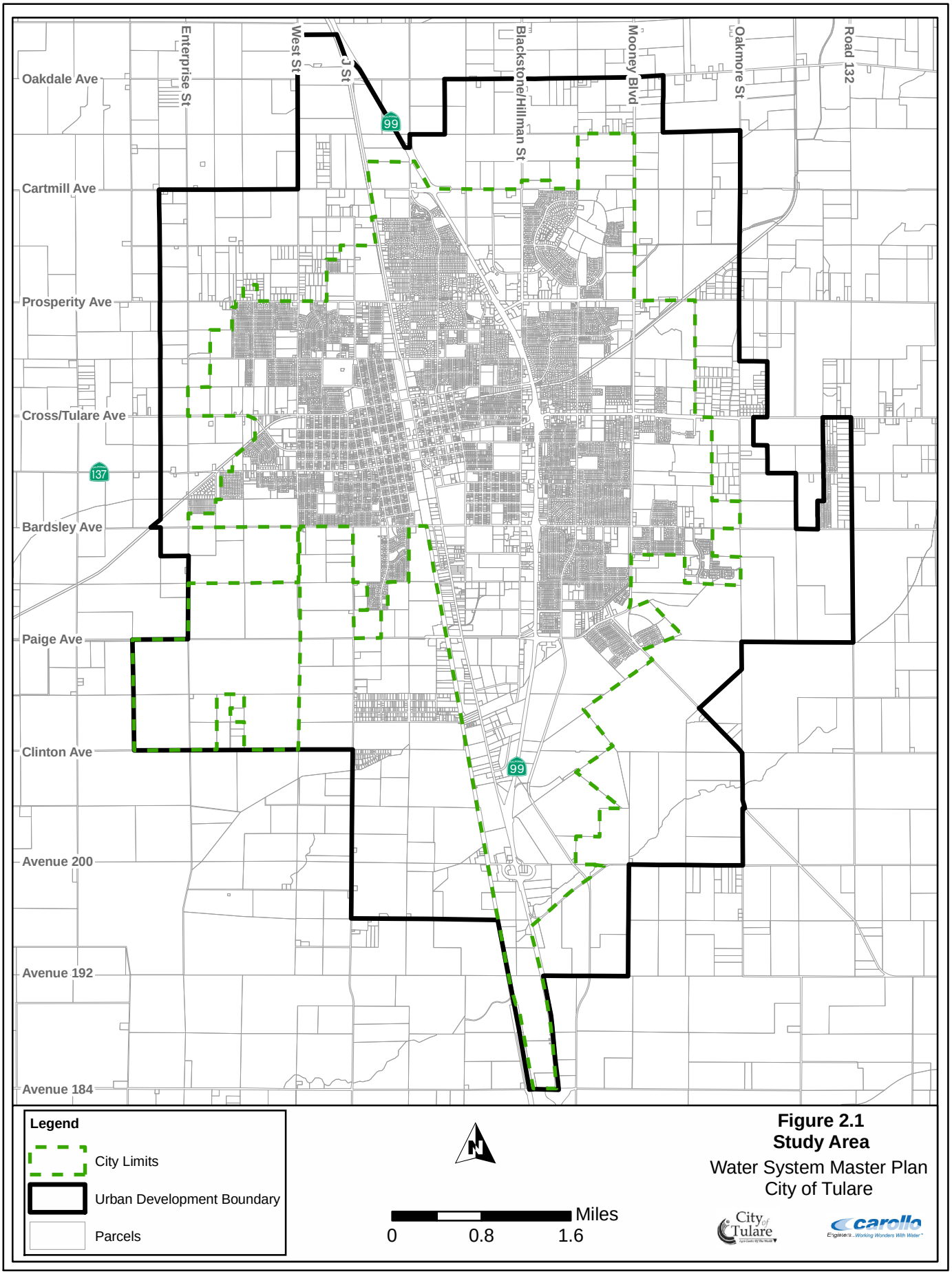


Figure 2.1
Study Area
Water System Master Plan
City of Tulare

2.4 LAND USE

The land use classifications used in this master plan are consistent with the Land Use Diagram and Standards described in the City's General Plan Update, as shown on Figure 2.2. Table 2.1 summarizes the land use designations, along with gross acreages, for the current City limits and UDB. Not all land within the City is developed. Table 2.1 also tabulates the existing developed land within the current City limits.

The current City limits encompass approximately 12,281 acres. The existing land uses include 5,056 acres of residential, 1,598 acres of commercial, 1,781 acres of industrial, 340 acres of Parks and Recreation, and 1,625 acres of Public facilities.

Rural Residential (0-2.0 dwelling units/gross acre). This designation established areas for single-family dwellings and mini-farms or ranchettes where agricultural activity is secondary to the residential land use. Lots within this designation are typically large enough to support independent wastewater disposal (septic) systems. The minimum lot size for this designation is 20,000 square feet (sq. ft.).

Rural Estate (2.1-3.0 dwelling units per gross acre). This designation establishes areas for large lot single-family estate dwellings. Uses typically allowed include detached single-family homes, secondary dwellings, and support uses (i.e., servant quarters and/or pool houses). The minimum lot size for this designation is 12,500 sq. ft.

Low Density Residential (3.1-7.0 dwelling units per gross acre). This designation establishes areas for single-family residences in a suburban configuration. Uses typically allowed include detached single-family homes, secondary dwellings, and residential support uses such as churches, schools, and other necessary public utilities and safety facilities. The minimum lot size for this designation is 6,000 sq. ft.

Medium Density Residential (7.1-14.0 dwelling units per gross acre). This land designation establishes areas for single-family and low-density multi-family dwellings located near neighborhood serving uses such as, grocery stores, schools, parks, and other public services. Uses typically allowed include single-family dwellings, second units, town homes, duplexes, triplexes, and mobile park homes. The minimum lot size for this designation is 3,000 sq. ft.

High Density Residential (14.1-29.0 dwelling units per gross acre). This designation establishes areas for multi-family dwellings in urbanized areas with access to public transportation and residential serving uses (i.e., grocers and drug stores). Uses typically allowed include duplexes, triplexes, townhomes, and apartments near schools, parks, and other public services. The minimum lot size for this designation is 1,500 sq. ft.

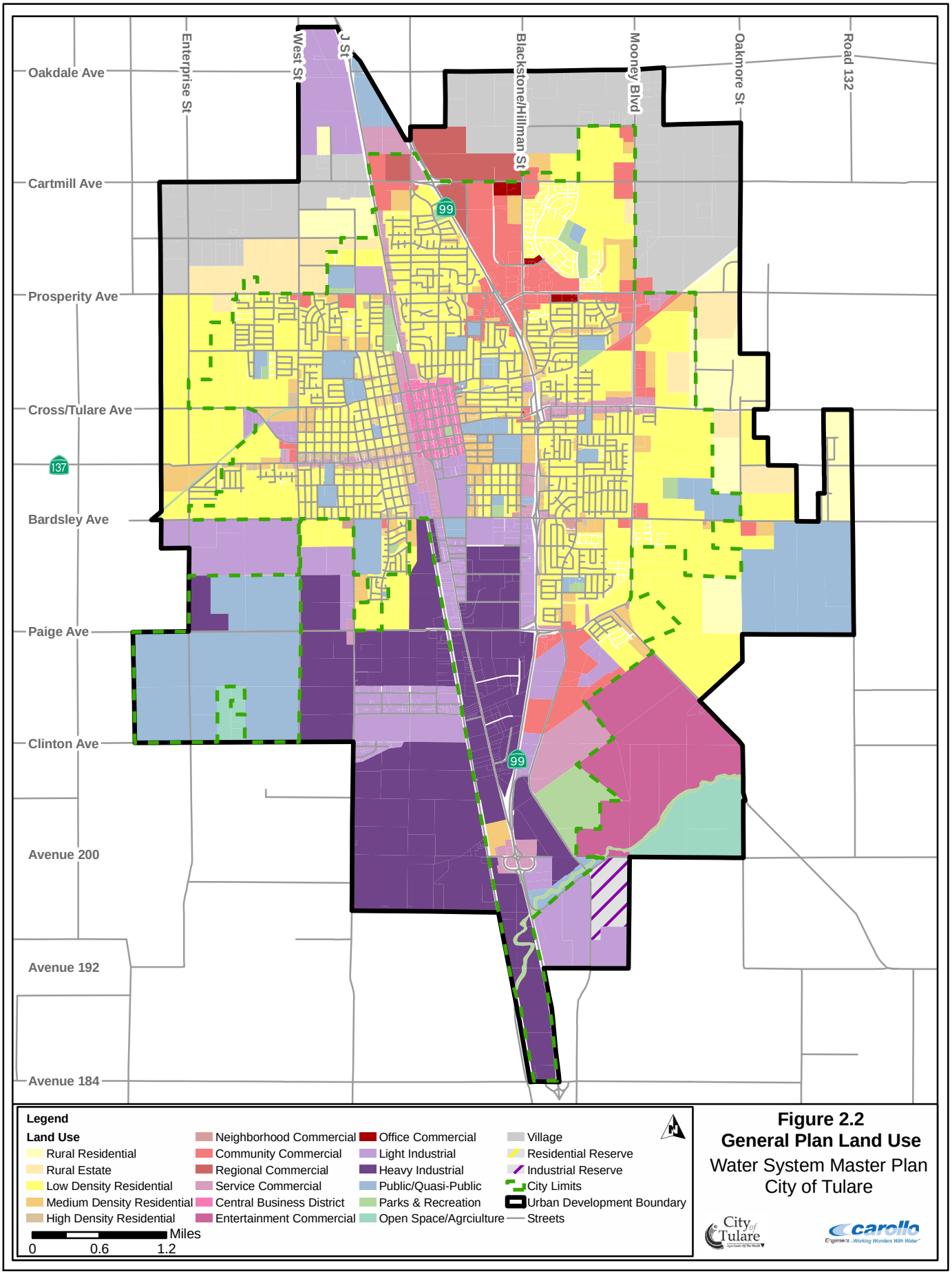


Figure 2.2
General Plan Land Use
Water System Master Plan
City of Tulare

Table 2.1 Land Use and Vacant Area
Water System Master Plan
City of Tulare

Land Use Designation	Code	City Limits				Urban Development Boundary
		2006 Total (gr. Ac.)	2006 Vacant (gr. Ac.)	2006 Developed (gr. Ac.)	% Vacant (%)	2030 Total (gr. Ac.)
Residential Designations						
Rural Residential	R-RR	30	29	1	0%	813
Rural Estate	R-RE	90	79	11	1%	623
Low Density Residential	R-LDR	4,257	1,739	2,518	14%	5,612
Medium Density Residential	R-MDR	614	206	408	2%	735
High Density Residential	R-HDR	66	19	47	0%	66
Commercial Designations						
Neighborhood Commercial	C-NC	13	6	7	0%	18
Community Commercial	C-CC	856	610	246	5%	894
Regional Commercial	C-RC	76	76	0	1%	280
Service Commercial	C-SC	506	103	403	1%	577
Central Business District	CBD	130	10	120	0%	130
Entertainment Commercial	C-EC	0	0	0	0%	937
Office Commercial	C-OC	16	14	2	0%	35
Industrial Designations						
Light Industrial	I-LI	561	202	359	2%	1,966
Heavy Industrial	I-HI	1,219	501	719	4%	3,106
Other Designations						
Public/Quasi-Public	PUB	1,625	149	1,476	1%	2,306

Table 2.1 Land Use and Vacant Area
Water System Master Plan
City of Tulare

Land Use Designation	Code	City Limits				Urban Development Boundary
		2006 Total (gr. Ac.)	2006 Vacant (gr. Ac.)	2006 Developed (gr. Ac.)	% Vacant (%)	2030 Total (gr. Ac.)
Parks and Recreation	PRK	340	47	293	0%	394
Open Space	OS/AG	13	0	13	0%	386
Roadways and Railroads	--	1,864	0	1,864	0%	2,322
Reserve Designations						
Village	NC	5	0	5	0%	2,272
Residential Reserve	UR-R	0	0	0	0%	0
Commercial Reserve	UR-C	0	0	0	0%	0
Industrial	UR-I	0	0	0	0%	136
Total						
Total		**12,281**	**3,788**	**8,492**	**31%**	**23,608**

Source: Draft General Plan Update (Matrix Design Group)

Neighborhood Commercial. This designation establishes areas for daily convenience shopping services adjacent to residential neighborhoods. Uses typically allowed include supermarkets, drug stores, and other residential serving uses that are convenient to vehicular access and highly accessible for pedestrians and bicyclists. These centers typically contain 30,000 to 100,000 square feet of floor area on approximately 2 to 5 acres. Neighborhood centers usually include a grocery store as a leading tenant, and generally require a support population or 3,000 to 40,000 people. The maximum intensity of this designation is 0.60 FAR, and the minimum development size is 2 acres.

Community Commercial. This designation establishes areas for community oriented uses with a community wide market base. Uses typically allowed include community commercial centers, shopping plazas, and shopping centers that include a junior department store, or a large variety, discount or department store with direct and convenient arterial access and access for pedestrians, bicyclists, and public transit. These centers typically contain 100,000 to 300,000 square feet of floor area on 7 to 20 acres. The maximum intensity of this designation is 0.27 FAR, and the minimum development size is 7 acres.

Regional Commercial. This designation establishes areas for regional retail centers capable of drawing consumers from outside the Planning Area. Uses typically allowed include regional malls and outlet centers that contain department stores, comparison, and specialty retail uses with direct and visual arterial and highway access. Developments in this designation typically contain 500,000 or more square feet of commercial space on approximately 20 to 50 acres. The maximum intensity of this designation is 0.27 FAR, and the minimum development size is 20 acres.

Service Commercial. This designation establishes areas for neighborhood, business, and industrial serving uses. Uses typically allowed include automotive related or heavy equipment sales and services, building maintenance services, construction sales and services, and mini storage. The maximum intensity of this designation is 0.60 FAR, and the minimum development size is 20,000 sq. ft.

Office Commercial. This designation establishes areas for the development of offices and office parks. Uses typically allowed include professional offices (including but not limited to finance, insurance, and real estate), large administrative centers, medical and dental clinics, research and development, and other similar compatible activities. The maximum intensity of this designation is 0.80 FAR, and the minimum development size is 4,000 sq. ft.

Central Business District (0-29.0 dwelling units per gross acre). This designation establishes the Downtown as the predominant urban area of the city to provide a central gathering place for commerce and living. Uses typically allowed include eating and drinking establishments, personal, medical, and professional services, retail sales, medium-high and high-density residential dwellings, and mixed-use development. The maximum intensity of this designation is 3.0 FAR.

Entertainment Commercial. This designation establishes areas for regional entertainment centers capable of drawing consumers from outside the Planning Area. Uses typically allowed include fairgrounds, racetracks, amusement parks, golf courses, and recreation/entertainment facilities with visual arterial and highway access. The maximum intensity of this designation is 0.20 FAR, and the minimum development size is 50 acres.

Light Industrial. This designation establishes areas for a range of non-intensive business park, industrial park, and warehouse uses that do not have detrimental noise or odor impacts on surrounding urban uses. Uses typically allowed include warehousing, welding and fabrication shops, and business support uses such as retail or eating establishments that serve adjacent light industrial uses and employees. The minimum lot size for this designation is 20,000 sq. ft.

Heavy Industrial. This designation establishes areas for the full range of industrial uses, which may cause noise or odor impacts on surrounding urban uses. Uses typically allowed include manufacturing, processing, fabrication, trucking terminals, ethanol plants, warehouses, asphalt batch plants, mills, lumber yards, and aggregate mining operations and support uses such as retail or eating establishments that support adjacent industrial uses and employees. The minimum lot size for this designation is 40,000 sq. ft.

Public. This designation establishes areas for public and institutional uses that serve the local community. Uses typically allowed include government facilities, schools, libraries, municipal corporation yards, sewer and water facilities, police and fire stations, and hospitals located throughout the community to serve neighborhoods and businesses and promote public safety. The maximum intensity of this designation is 0.60 FAR.

Parks and Recreation. This designation establishes areas for outdoor recreation facilities that serve local and regional users. Uses typically allowed in this designation include pocket, neighborhood, community, regional, natural parks, and other outdoor recreation facilities, such as, golf courses, trails, and open space/habitat preserves. Recreation facilities should be connected with accessibility to pedestrians and bicyclists.

Village. This designation establishes areas for planning new residential growth areas within the Planning Area. Key features of a village include a mix of single-family and multi-family development, a neighborhood center, and a range of public uses such as schools and parks. The village center is comprised of neighborhood commercial, higher density residential, schools, public and open space uses.

The Village (V) designation is intended to promote a mixed-use village concept, incorporating the principles of smart growth and also recognizing the environmental and physical constraints of each village area. Each of the villages is assigned a particular land use mix, which will set the general parameters of urban development.

The V designation is considered a “holding” category. The purpose of the V designation is to promote the development of a detailed specific plan that will provide the details needed

to ensure a comprehensive mixed-use area is developed. A specific plan is required to be submitted and approved to ensure a mixed-use concept, and an approved specific plan is required prior to approval of an annexation request.

2.5 POPULATION

According to data collected from the California Department of Finance (DOF), the City's population for the year 2006 was approximately 51,477. This corresponds to an increase in population of approximately 18,000 from 1990 to 2006.

The draft General Plan Update projects a population of 130,975 people by the year 2030. In order for this to happen, the City's population would need to increase by 4 percent per year. This growth rate corresponds with a projected population of approximately 60,000 in 2010, 89,000 in 2020, and 130,975 in 2030, as shown in Table 2.2. Figure 2.3 shows the historical and projected population trends from 1990 to 2030.

Table 2.2 Historical and Projected Population
Water System Master Plan
City of Tulare

Master Plan Projected Years	2010	2015	2020	2025	2030[1]
Projected Population[2]	60,000	73,000	89,000	108,000	**130,975**
Annual Increase over 5-Year Period		4.0%	4.0%	4.0%	4.0%

Notes:
1. Source: General Plan Update (Matrix Design Group).
2. A 4.0% annual growth rate through 2030 was used based on projections provided in the draft General Plan Update.

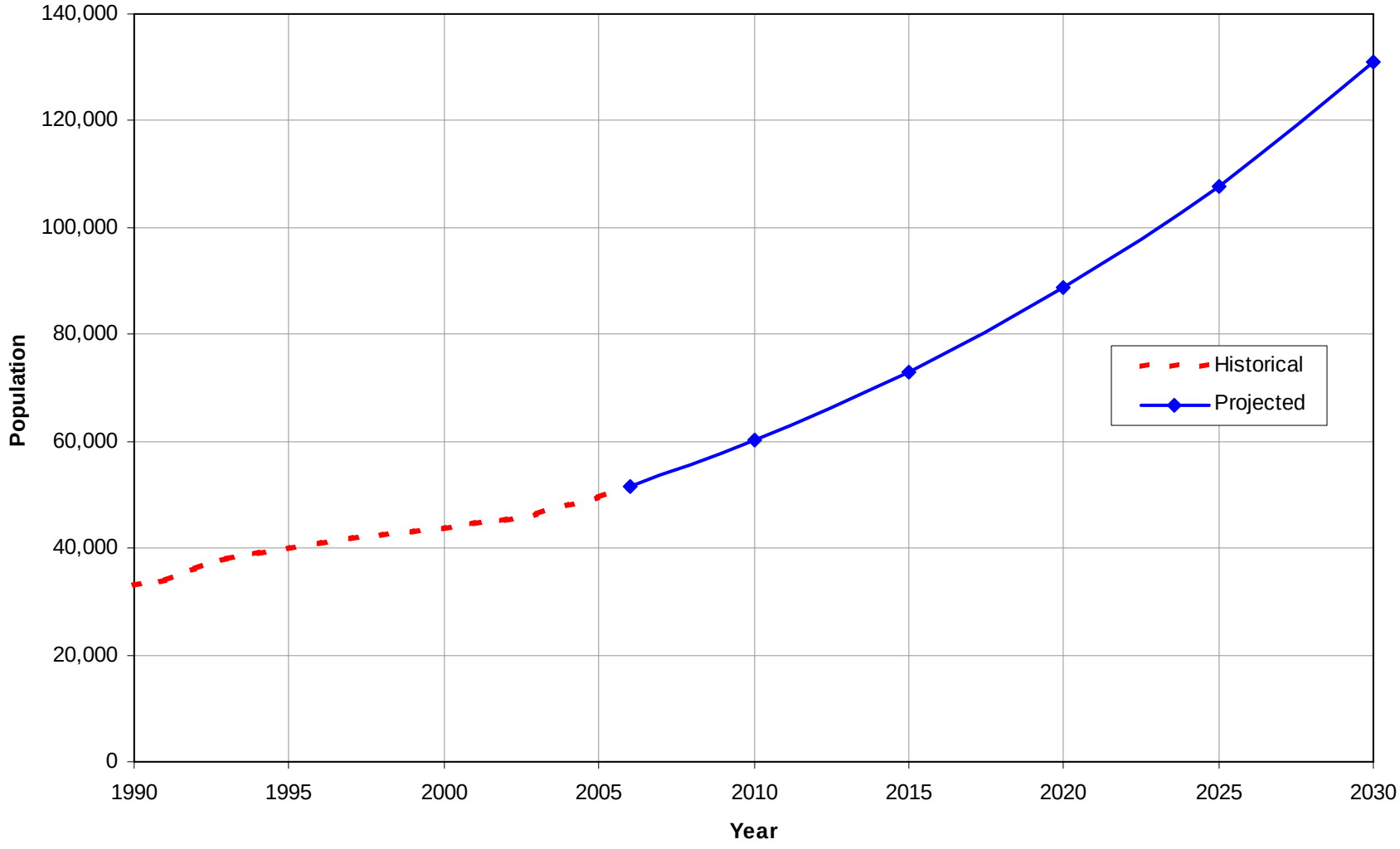


Figure 2.3
Historical and Projected Population
Water System Master Plan
City of Tulare

Engineers...Working Wonders With Water™

The City of Tulare (City) water supply, storage, and distribution facilities were evaluated based on the planning and evaluation criteria defined in this chapter. Historical water consumption and production records were reviewed to determine the daily, monthly, and seasonal fluctuations experienced by the water system. The planning criteria address the water supply capacity, storage capacity, acceptable service pressures, distribution main performance, average annual water demand coefficients, and daily and hourly peaking factors.

3.1 WATER SUPPLY CAPACITY

In determining the adequacy of the water supply facilities, the source must be large enough to meet the varying water demand conditions, as well as provide sufficient water during potential emergencies such as power outages and natural or created disasters.

This study does not include an analysis of the groundwater aquifer yield and assumes that future water supply capacity will continue to be extracted from groundwater wells.

3.1.1 Normal Supply Capacity

Typically, a public water system's water source should have the capacity to meet the system's maximum day demand (MDD). Water required for peak hour demand (PHD) or for fire flows would be provided through storage.

However, in the absence of above ground storage, the City's supply capacity shall be sufficient to meet the PHD. For reliability purposes, it is desirable to maintain a firm water supply capacity equal to the PHD. Firm capacity is equal to the total capacity, minus the standby supply capacity. Water required for fireflows would be provided through storage.

Additionally, it is recommended that City wells be equipped with backup power in the event of a power outage (see Section 3.2.3).

3.1.2 Standby Supply Capacity

Standby production capacity is required for system reliability. Under normal operating conditions, it is possible that one or two of the City's wells can be placed out of service during MDD or PHD conditions due to equipment malfunction, for servicing, or for water quality concerns. It is common industry practice to set the standby supply capacity as the capacity of the largest well. However, the 1994 Master Plan recommended a standby capacity equivalent to two large wells. Therefore, this study used a standby capacity requirement of 3,596 gallons per minute (gpm), which is the capacity of the City's two largest wells (Well No. 33 and Well No. 37).

3.1.3 Recommended Supply Capacity

The adequate source of supply for the City will consist of groundwater wells with a combined production capacity sufficient to meet the PHD, in addition to a standby well production capacity of 5.2 million gallons per day (mgd) (3,596 gpm). This criteria results in a recommended existing total production capacity of 63.6 mgd, which assumes fire flow and demands will be supplied by storage tanks.

This master plan does not consider the loss of existing supply wells due to water quality issues or lowering groundwater levels. Should existing wells be taken out of service, the City should add pumping capacity (i.e. additional wells) to offset the loss of the existing wells.

3.2 STORAGE REQUIREMENTS

The principle function of storage is to provide reserve supply of water for: 1) operational equalization, 2) fire reserve, and 3) emergency needs. Operational storage is directly related to the amount of water necessary to meet peak demands. The intent of operational storage is to provide the difference in quantity between the customer's PHDs and the system's reliable supply source. The volume of water allocated for emergency uses is decided based on the historical record of emergencies experienced, and on the amount of time which is expected to elapse before a hypothetical emergency can be corrected.

3.2.1 Operational Storage

This storage is the amount of desirable stored water in a system to regulate fluctuations in demand so that extreme variations will not be imposed on the source of supply. Operational storage typically serves the peak demands exerted during the MDD. With operational storage, system pressures are improved and stabilized to better serve customers throughout the service area. Operational storage is commonly estimated between 25 percent and 50 percent of the MDD. Because the City plans to meet the PHD through well capacity, this study recommends an operational storage equal to zero percent of the City’s MDD.

3.2.2 Fire Storage

This storage is the amount required when the capacity of the production facilities is insufficient to meet the necessary MDD plus fire flow demands for certain durations of time. The Insurance Service Office (ISO), a non-profit association of insurers, classifies a city’s insurance rating based on a maximum fire flow rate of 3,500 gpm for a duration of three hours. This provision equates to a storage requirement of 0.63 million gallons (MG) and will allow the water system to respond to hypothetical fires in residential, commercial, or industrial areas.

3.2.3 Emergency Storage

This storage is the volume recommended to meet demands during emergency situations such as pipeline failures, major main failures, pump failures, electrical power outages, or natural disasters. The amount of emergency storage included within a particular water distribution system is an owner option, based on an assessment of risk, the desired degree of system dependability, economic considerations, and water quality concerns. In California, emergency storage is usually estimated at 50 to 100 percent of the MDD.

It is normally desired that an emergency storage volume equal to 50 percent of the City's MDD be available. However, in Central California, emergency supply has often come from the availability of water from underground aquifers, provided groundwater wells are constructed with emergency generators. Currently, only five of the City's wells have auxiliary power sources, which could supply 8.0 mgd during a citywide power failure. In order for the City to rely on groundwater for emergency storage, additional emergency generators will need to be installed to provide sufficient supply during a power failure.

3.2.4 Total Storage

The recommended operational storage capacity for the City is equal to zero percent of the maximum day water demand. Additionally, the recommended fire storage capacity will be equivalent to 0.63 MG. The emergency storage is equal to zero percent of the MDD. Again, this assumes that the City's firm water supply will be sufficient to meet the PHD. This criteria is further summarized with the following equation.

$$Vs = \text{Fire Flow} = 0.63 \text{ MG}$$

Where, Vs is the Total Required Storage, in gallons

The City currently operates one storage tank with a capacity of 150,000 gallons.

3.3 SERVICE PRESSURES

Pressures maintained within distribution systems vary depending on distribution system operations and pressure zone topography. It is essential that the water pressure in a consumer's residence or place of business be neither too high nor too low. Low pressures, below 30 pounds per square inch (psi), cause annoying flow reductions when more than one water-using appliance is used. High pressures may cause faucets to leak and valve seats to wear out quickly. Additionally, high service pressures usually result in wasted water and high water utility bills. The Uniform Plumbing Code (UPC) requires water pressures not exceed 80 psi at service connections, unless the service is provided with a pressure-reducing device.

The American Water Works Association (AWWA) Manual on Distribution Network Analysis of Water Utilities (AWWA M-32), indicates that pressures between 30 psi and 90 psi are

generally expected during the range of system water demands including: average day demand (ADD), MDD, maximum storage replenishment rate, and PHD. Based on Carollo experience with water system planning, it is recommended that a minimum pressure of 35 psi be maintained during the PHD, while a pressure of 40 psi be maintained during the MDD. The maximum recommended pressure is 80 psi.

Another service pressure criteria is related to fire flows and was devised to ensure adequate positive pressure head for the booster pumps in the fire trucks. The fire pressure criteria requires a minimum acceptable residual pressure of 20 psi at the connecting hydrant used for fighting the fire.

3.4 DISTRIBUTION MAINS

Transmission grid mains are generally sized to carry the greater of 1) the PHD, or 2) the MDD plus fire flow. Other criteria related to the distribution piping include the maximum and minimum velocities and the maximum allowable friction losses.

High velocities may cause damage to the pipes and to their appurtenances. Normally, velocities of 10 feet per second (fps) (AWWA M-32), or higher, do not cause ill effects if they occur for a limited duration. It is normally good practice to become concerned when pipe velocities exceed 8 fps on a continuous basis.

As long as the maximum velocity criteria and the pressure criteria are not violated, high head loss by itself is not an important factor. However, it may be a warning that the pipe is nearing the limit of its carrying capacity, and may not have sufficient capacity to perform under stringent conditions. It is normally good practice to monitor pipes that have a head loss in excess of 10 feet per 1,000 feet of pipe (AWWA M-32).

The roughness coefficients for calculating head loss in pipes were based on industry standards for similar pipe materials and service age (Table 3.1).

3.5 FIRE FLOWS

Fire flows stress a water system in a specific area of the fire and often show existing deficiencies, if any, within the general area of the simulated fire. The deficiencies are generally associated with pipe sizes (diameter) or age (roughness) that result in high headloss and lower pressures. The fire flow criteria measures a system's ability to deliver a high rate of water while maintaining a minimum pressure.

To evaluate the effect of fire flows throughout the distribution system, large point demands are applied at selected areas. The fire flow demands are run concurrent with the maximum day demand. Simulating maximum day demand plus fire flows also demonstrates the performance of supply sources, booster pumps, and storage tanks operating under very high demand conditions.

Table 3.1 Pipe Roughness Design Criteria
Water System Master Plan
City of Tulare

	Age (Years)					
Pipe Material	**0**	**10**	**20**	**30**	**40**	**50**
Asbestos Cement	125	125	125	125	125	125
Cast Iron	120	110	100	90	80	70
Ductile Iron	130	125	120	115	110	105
Plastic (PVC)	140	140	140	140	140	140
Steel	130	120	110	100	90	80

Note:
At age = 0, the roughness coefficients are commonly used values for new pipes. Roughness coefficients decrease with age at a rate that depends on pipe material. For planning purposes, roughness of Asbestos Cement and PVC pipes are assumed constant, while the remaining pipe materials decrease by age.

Below are the recommended fire flow criteria for the different land uses:

- Residential fire flows: 1,500 gpm for a duration of two hours
- Commercial fire flows: 2,500 gpm for a duration of two hours
- Industrial fire flows: 3,500 gpm for a duration of three hours

3.6 HISTORICAL WATER USE

Groundwater is currently the only source of supply for Tulare. The City's municipal water system extracts its water supply from underground aquifers via 27 groundwater wells scattered throughout the City.

Table 3.2 lists the historical production from 1990 to 2005. The City's current total supply capacity is approximately 26,777 gpm (38.6 mgd).

3.6.1 Per-Capita Consumption

The per-capita consumption rate is used to estimate the City's future water requirements, the evaluation of the adequacy of the supply source, and the determination of storage

needs. The consumption rate, expressed in gallons per capita per day (gpcd), is applied to the projected population to yield future water requirements.

Tulare's historical city-wide per-capita consumption rate, based on dividing the City's total water use by the total population, generally ranged between 235 gpcd in 1993 and 311 gpcd in 2005 (Table 3.2).

For planning purposes, a residential per-capita water use of 300 gpcd was applied to calculate the future residential and commercial water use for the planning horizon of 2030. This value is greater than the average from 1990 to the present, however it is approximately equal to the average over the last five years.

3.6.2 Seasonal Demands and Peaking Factors

Peaking factors represent the water use seasonal and daily variations, above or below the average annual water demand. The various peaking conditions are either statistical concepts or numerical values established through a review of historical data and are, at times, adjusted to reflect a level of conservatism.

Peaking conditions that are of particular significance to hydraulic analysis of the water system include the maximum month demand (MMD), MDD, and the PHD. Peaking factors are expressed as a function of the ADD. Monthly water production data for four years (2003-2006) were obtained from City Operations Staff, and are summarized in Table 3.3.

3.6.2.1 Maximum Month Demand

The MMD is the highest water demand during a calendar month of the year, usually occurring in July or August for the City. The MMD peaking factor is expressed as a multiplier applied to the ADD, and is used primarily in the evaluation of supply capabilities.

Based on historical water use data, this study used a MMD peaking factor of 1.6. This value is consistent with the 1994 Master Plan.

Maximum Month Demand = 1.6 x Average Day Demand

Table 3.2 Historical Water Production and Per Capita Consumption (1990-2005)
Water System Master Plan
City of Tulare

		Historical Water Production										
		Annual Production[2]			Monthly Production				Daily Production			Historical Per Capita Consumption (gpcd)
Year	Population[1]	(AF)	(mgy)	(gpm)	Average[3] (mgm)	Max. (mgm)	Month of Occur.	Max-to-Avg Ration	Average (mgd)	Maximum (mgd)	Max-to Avg. Ration	
1990	**33,249**	**10,208**	**3,326**	**6,328**	**277**	**471**	**July**	**1.70**	**9.1**	**n/a**	**n/a**	**274**
1991[4]	34,150	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a	n/a
1992	36,450	10,393	3,386	6,443	282	458	July	1.62	9.3	n/a	n/a	255
1993	38,050	10,011	3,262	6,206	272	437	August	1.61	8.9	n/a	n/a	235
1994	39,100	11,452	3,731	7,099	311	558	July	1.79	10.2	n/a	n/a	261
1995	**33,249**	**11,975**	**3,902**	**7,424**	**325**	**548**	**July**	**1.68**	**10.7**	**n/a**	**n/a**	**322**
1996	41,100	12,616	4,111	7,821	343	601	July	1.75	11.3	n/a	n/a	274
1997	41,800	12,995	4,234	8,056	353	540	July	1.53	11.6	n/a	n/a	278
1998(5)	42,450	9,644	3,142	5,979	262	373	August	1.43	8.6	n/a	n/a	203
1999	43,150	12,349	4,024	7,656	335	564	August	1.68	11.0	n/a	n/a	256
2000	**43,850**	**12,441**	**4,054**	**7,713**	**338**	**601**	**July**	**1.78**	**11.1**	**n/a**	**n/a**	**253**
2001	44,621	14,551	4,741	9,021	395	616	July	1.56	13.0	n/a	n/a	291
2002	45,439	15,829	5,158	9,813	430	663	July	1.54	14.1	n/a	n/a	311
2003	46,672	16,319	5,318	10,117	443	686	July	1.55	14.6	n/a	n/a	312
2004	48,160	17,819	5,806	11,047	484	720	July	1.49	15.9	n/a	n/a	330
2005	**49,703**	**17,313**	**5,641**	**10,733**	**470**	**745**	**July**	**1.58**	**15.5**	**n/a**	**n/a**	**311**
Average (1990 to 2005)		--	--	--	--	--	--	--	**1.62**	--	--	278
Average (2000 to 2005)		--	--	--	--	--	--	--	**1.58**	--	--	301

Notes:
1. Historical Population Source: California Department of Finance.
2. Annual production records for 1995 to 2005 provided by City staff.
3. Average production is based on the total annual production for that year.
4. Data provided by City staff is incomplete for the year 1991.
5. The total production for the year 1998 is assumed to be incomplete.

Table 3.3 Historical Monthly Water Production (2003-2005)
Water System Master Plan
City of Tulare

Month	Days	Daily Production	Monthly Production		Peaking Factor
		Average Day (mgd)	Monthly Production (mgm)	Percent of Annual (%)	Month to Avg Month Factor
2003					
January	31	8.37	260	7%	0.59
February	28	8.53	239	6%	0.54
March	31	11.02	342	9%	0.77
April	30	12.44	373	10%	0.84
May	31	15.15	470	13%	1.06
June	30	21.14	634	17%	1.43
July	31	22.14	686	19%	**1.55**
August	31	20.82	645	17%	1.46
September	30	19.34	580	16%	1.31
October	31	15.96	495	13%	1.12
November	30	10.30	309	8%	0.70
December	31	9.18	285	8%	0.64
2004					
January	31	8.89	276	7%	0.57
February	28	9.60	269	7%	0.56
March	31	12.00	372	9%	0.77
April	30	16.75	502	12%	1.04
May	31	20.45	634	16%	1.31
June	30	22.24	667	17%	1.38
July	31	23.23	720	18%	**1.49**
August	31	22.32	692	17%	1.43
September	30	20.23	607	15%	1.25
October	31	14.58	452	11%	0.93
November	30	10.36	311	8%	0.64
December	31	9.83	305	8%	0.63
2005					
January	31	9.13	283	7%	0.60
February	28	7.32	205	5%	0.44
March	31	10.05	311	8%	0.66
April	30	13.19	396	10%	0.84
May	31	16.50	511	13%	1.09
June	30	21.85	656	17%	1.39
July	31	24.04	745	19%	**1.58**
August	31	22.80	707	18%	1.50
September	30	20.08	602	15%	1.28
October	31	16.31	505	13%	1.08
November	30	13.15	395	10%	0.84
December	31	10.48	325	8%	0.69
2006 (2)					
January	31	9.72	301	7%	0.59
February	28	10.66	299	7%	0.59
March	31	9.90	307	7%	0.60
April	30	10.80	324	8%	0.64
May	31	18.34	568	13%	1.12
June	30	22.77	683	16%	1.35
July	31	24.49	759	18%	**1.50**
August	31	22.97	712	17%	1.40
September	30	20.43	613	14%	1.21
October	31	N/A	N/A	N/A	N/A
November	30	N/A	N/A	N/A	N/A
December	31	N/A	N/A	N/A	N/A

4-Year Summary (2003-2005)

Year	Days	Daily Production	Monthly Production		Peaking Factor
		Average Day (mgd)	Average Month (mgm)	Max Month (mgm)	Max Month to-AvgDay Factor
2003	365	14.6	443	686	1.55
2004	365	15.9	484	720	1.49
2005	365	15.5	470	745	1.58
2006	273	16.7	507	759	1.50

Notes:
1. Source: City of Tulare historical water production records.
2. Data was not available for October through December, 2006.

3.6.2.2 Maximum Day Demand

The MDD is the highest water demand during a 24-hour period. The MDD peaking factor is expressed as a multiplier applied to the ADD. Water system sources are typically sized to meet the anticipated MDD of a water system. Maximum day plus fire flows stress the water system in the specific area of the fire and often show existing deficiencies. To evaluate the effect of maximum day plus fire flow throughout a system, the fire flow is simulated at selected critical areas of the distribution system. Simulating maximum day plus fire flows also demonstrates the performance of supply sources, booster pumps, and storage tanks operating under stressful conditions.

In general, the MDD is 2.0 to 2.5 times greater than the average annual demand. This study recommends a peaking factor of 2.5.

Maximum Day Demand = 2.5 x Average Day Demand

3.6.2.3 Peak Hour Demand

The PHD is the highest water demand during any one-hour period. The PHD is expressed as a multiplier applied to the average annual demand. PHDs simulate high water use throughout the system during peak demands and identifies areas of the distribution system that experience low pressures.

This condition is similar to applying maximum day plus fire flow; only in this case, the entire system is exposed to stressful conditions. In general, the PHD ranges between 2.5 and 3.5 times greater than the average annual demand system wide. This study recommends a peaking factor of 3.5.

Peak Hour Demand = 3.5 x Average Day Demand

3.6.2.4 Daily Diurnal Pattern

In the absence of hourly production records, an hourly diurnal pattern was developed for this study using the recommended peaking factors. These peaking factors are shown in Table 3.4 and on Figure 3.1. Table 3.5 includes values for hourly demands during existing and projected MDD conditions. These diurnal patterns were used in the hydraulic computer model to perform 24-hour simulations for evaluating the capacity of the City's existing distribution system and for designing improvement facilities.

Table 3.4 **Daily Diurnal Water Demand Pattern**
Water System Master Plan
City of Tulare

Demand Condition	Time (Hours) 1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	24-Hour Average	
Peaking Factors																										
Average Day Demand (ADD)	0.75	0.80	0.85	0.85	1.20	1.35	1.40	1.20	1.10	1.05	0.95	1.05	0.90	0.85	0.95	1.00	1.13	1.20	1.13	1.00	0.90	0.85	0.80	0.75	1.0	
Max. Day Demand (MDD)	1.88	2.00	2.13	2.13	3.00	3.38	**3.50**	3.00	2.75	2.63	2.38	2.63	2.25	2.13	2.38	2.50	2.81	3.00	2.81	2.50	2.25	2.13	2.00	1.88	2.5	
Max. Month Demand (MMD)	1.23	1.31	1.39	1.39	1.96	2.21	2.29	1.96	1.80	1.72	1.55	1.72	1.47	1.39	1.55	1.63	1.84	1.96	1.84	1.63	1.47	1.39	1.31	1.23	1.6	
Existing Water Demands (gpm)																									**(gpm)**	**(mgd)**
Average Day Demand (ADD)	8,050	8,587	9,123	9,123	12,880	14,490	15,027	12,880	11,807	11,270	10,197	11,270	9,660	9,123	10,197	10,733	12,075	12,880	12,075	10,733	9,660	9,123	8,587	8,050	10,733	15.5
Max. Day Demand (MDD)	20,125	21,467	22,808	22,808	32,200	36,225	37,566	32,200	29,517	28,175	25,492	28,175	24,150	22,808	25,492	26,833	30,187	32,200	30,187	26,833	24,150	22,808	21,467	20,125	26,833	38.6
Projected Demands: Urban Development Boundary (gpm)																									**(gpm)**	**(mgd)**
Average Day Demand (ADD)	20,465	21,829	23,193	23,193	32,744	36,837	38,201	32,744	30,015	28,651	25,922	28,651	24,558	23,193	25,922	27,286	30,697	32,744	30,697	27,286	24,558	23,193	21,829	20,465	27,286	39.3
Max. Day Demand (MDD)	51,162	54,573	57,984	57,984	81,859	92,092	95,503	81,859	75,038	71,627	64,805	71,627	61,395	57,984	64,805	68,216	76,743	81,859	76,743	68,216	61,395	57,984	54,573	51,162	68,216	98.2

Note: (1) Peaking Factors are multipliers applied to the average day demands

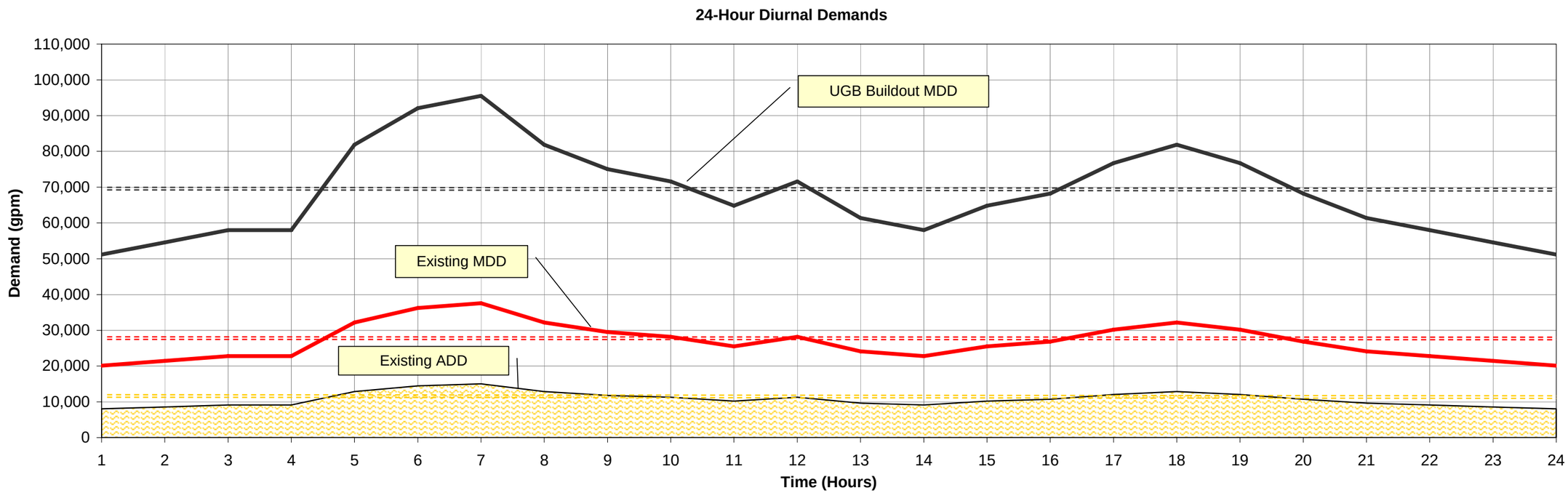


Figure 3.1
Daily Diurnal Water Demand Pattern
Water System Master Plan
City of Tulare

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3.7 AVERAGE DAY WATER DEMAND COEFFICIENTS

The average day water demand coefficients are factors, usually expressed in gallons per day per acre (gpda), applied to either gross or net acres for calculating the average water demands generated from a particular land use designation. Since some land uses require larger amounts of water than others do, an assessment of water consumption by land use category provides a more accurate representation of water demands. The developed factors (Table 3.5) are based on a City-wide water balance for the developed land use acreages.

The water balance of 10,850 gpm (15.6 mgd) represents the existing water production for the City. Residential water use accounted for approximately 48 percent of the total water use throughout the City in 2005, whereas commercial, industrial and community designations accounted for about 6 percent, 38 percent, and 8 percent, respectively.

3.8 PROJECTED WATER DEMANDS

Based on the future trends in population provided in Chapter 2, and the estimated per capita water consumption rate of 300 gpcd, the City's future water demands were estimated and summarized in Table 3.6. In addition to the projected average demands, Table 3.6 includes annual estimates for the maximum day and PHDs, through the planning horizon year of 2030. Based on these projections, it is anticipated that the City's average day and maximum day requirements for 2030 could approach 39.3 mgd (27,300 gpm) and 98.2 mgd (68,200 gpm), respectively.

The Projected Future Water Demand Balance (Table 3.7) presents the projected water demand for the year 2030 based on land use. This projected ADD presented in Table 3.7 is consistent with the ADD projection provided in Table 3.6. The 2030 water requirements indicate that residential customers are expected to account for approximately 46 percent of the water demands, whereas commercial, industrial, and community facilities are projected to account for 9 percent, 29 percent, and 5 percent, respectively. Additionally, the reserve designation is projected to account for 11 percent of future water demands.

3.9 PLANNING AND EVALUATION CRITERIA SUMMARY

The City’s water distribution system was evaluated based on the planning and evaluation criteria described in this chapter. These criteria are summarized in Table 3.8.

Table 3.5 Existing Water Demand Balance
Water System Master Plan
City of Tulare

Land Use Designation	Land Use Code	Urban Development Boundary [1] (acres)	Existing City Limits[1] (acres)	Existing Water Service Area [2] (acres)	% of Total Service Area (%)	Demand Coefficient (gpd/acre)	ADD Balance (gpd)	% of Total Demand (%)
Residential								
Rural Residential	R-RR	813	30	1	0%	1,200	1,400	0%
Rural Estate	R-RE	623	90	11	0%	2,000	22,000	0%
Low Density Residential	R-LDR	5,612	4,257	2,518	30%	2,400	6,042,300	39%
Medium Density Residential	R-MDR	735	614	408	5%	3,000	1,223,800	8%
High Density Residential	R-HDR	66	66	47	1%	4,000	187,600	1%
Residential Subtotal		**7,848**	**5,056**	**2,985**	**35%**		**7,477,100**	**48%**
Commercial								
Neighborhood Commercial	C-NC	18	13	7	0%	1,300	8,900	0%
Community Commericial	C-CC	894	856	246	3%	1,300	320,400	2%
Regional Commercial	C-RC	280	76	0	0%	1,300	0	0%
Service Commericial	C-SC	577	506	403	5%	1,300	524,300	3%
Central Business District	CBD	130	130	120	1%	1,300	156,400	1%
Entertainment Commercial	C-EC	937	0	0	0%	1,300	0	0%
Office Commercial	C-OC	35	16	2	0%	1,300	3,200	0%
Commercial Subtotal		**2,871**	**1,598**	**779**	**9%**		**1,013,100**	**6%**
Industrial								
Light Industrial	I-LI	1,966	561	359	4%	2,000	718,900	5%
Heavy Industrial	I-HI	3,106	1,219	719	8%	7,250	5,209,500	33%
Industrial Subtotal		**5,072**		**1,078**	**13%**		**5,928,400**	**38%**
Community Facilities								
Public/Quasi-Public	PUB	2,306	1,625	1,476	17%	800	1,181,000	8%
Parks and Recreation	PRK	394	340	293	3%	0	0	0%
Open Space	OS/AG	386	13	13	0%	0	0	0%
Roadways and Railroads	--	2,322	1,864	1,864	22%	0	0	0%
Community Facilities Subtotal		**5,409**	**3,842**	**3,646**	**43%**		**1,181,000**	**8%**
Reserve Designations								
Village	NC	2,272	5	5	0%	1,748	8,500	0%
Residential Reserve	UR-R	0	0	0	0%	2,505	0	0%
Commercial Reserve	UR-C	0	0	0	0%	1,300	0	0%
Industrial Reserve	UR-I	136	0	0	0%	2,000	0	0%
Reserve Designations Subtotal		**2,408**	**5**	**5**	**0%**		**8,500**	**0%**
Totals								
Totals		**23,608**	**12,281**	**8,492**	**100%**		**15,608,000**	**100%**

Notes:
1. Based on the City of Tulare Draft Land Use Diagram (Updated November 2006).
2. Includes all developed land within the City limits.

Table 3.6 Projected Future Water Demands Based on Population
Water System Master Plan
City of Tulare

Year	Population	Projected Water Requirements								
		Annual	Avg. Month	Max. Month (3)	Average Day (2)		Maximum Day (4)		Peak Hour (5)	
		(MG)	(MGM)	(MGM)	(MGD)	(gpm)	(MGD)	(gpm)	(MGD)	(gpm)
2008	56,000	6,092	508	830	**16.7**	11,591	41.7	28,976	58.4	40,567
2009	58,000	6,333	528	863	**17.4**	12,050	43.4	30,124	60.7	42,173
2010	60,000	6,584	549	897	**18.0**	12,527	45.1	31,317	63.1	43,843
2011	63,000	6,845	570	932	**18.8**	13,023	46.9	32,557	65.6	45,580
2012	65,000	7,116	593	969	**19.5**	13,538	48.7	33,846	68.2	47,385
2013	68,000	7,398	616	1,008	**20.3**	14,075	50.7	35,186	70.9	49,261
2014	70,000	7,691	641	1,048	**21.1**	14,632	52.7	36,580	73.7	51,212
2015	73,000	7,995	666	1,089	**21.9**	15,211	54.8	38,028	76.7	53,240
2016	76,000	8,312	693	1,132	**22.8**	15,814	56.9	39,534	79.7	55,348
2017	79,000	8,641	720	1,177	**23.7**	16,440	59.2	41,100	82.9	57,540
2018	82,000	8,983	749	1,224	**24.6**	17,091	61.5	42,727	86.1	59,818
2019	85,000	9,339	778	1,272	**25.6**	17,768	64.0	44,419	89.5	62,187
2020	89,000	9,709	809	1,322	**26.6**	18,471	66.5	46,178	93.1	64,650
2021	92,000	10,093	841	1,375	**27.7**	19,203	69.1	48,007	96.8	67,210
2022	96,000	10,493	874	1,429	**28.7**	19,963	71.9	49,908	100.6	69,872
2023	100,000	10,908	909	1,486	**29.9**	20,754	74.7	51,885	104.6	72,638
2024	104,000	11,340	945	1,545	**31.1**	21,576	77.7	53,939	108.7	75,515
2025	108,000	11,789	982	1,606	**32.3**	22,430	80.7	56,075	113.0	78,505
2026	112,000	12,256	1,021	1,669	**33.6**	23,318	83.9	58,296	117.5	81,614
2027	116,000	12,741	1,062	1,735	**34.9**	24,242	87.3	60,604	122.2	84,846
2028	121,000	13,246	1,104	1,804	**36.3**	25,202	90.7	63,004	127.0	88,206
2029	126,000	13,771	1,148	1,876	**37.7**	26,200	94.3	65,499	132.0	91,699
2030	131,000	14,342	1,195	1,953	**39.3**	27,286	98.2	68,216	137.5	95,503

Notes:
1. Projected Per Capita Consumption is estimated at 300 gpdc.
2. Average Day Demand is based on the Annual Demand, expressed in daily units.
3. Maximum Month Demand (highest monthly demand), is calculated by applying a multiplier of 1.63 to the Average Day Demand.
4. Maximum Day Demand (highest daily demand), is calculated by applying a multiplier of 2.6 to the Average Day Demand.
5. Peak Hour Demand (highest hourly demand), is calculated by applying a multiplier of 3.5 to the Average Day Demand.

Table 3.7 Projected Water Demands Based on Land Use
Water System Master Plan
City of Tulare

Land Use Designation	Land Use Code	Existing City Limits[1] (acres)	Urban Development Boundary [1] (acres)	% of Total Service Area [2] (%)	Demand Coefficient (gpd/acre)	2030 ADD Balance (gpd)	% of Total Demand (%)
Residential							
Rural Residential	R-RR	30	813	3%	1,200	975,500	2%
Rural Estate	R-RE	90	623	3%	2,000	1,246,000	3%
Low Density Residential	R-LDR	4,257	5,612	24%	2,400	13,467,800	34%
Medium Density Residential	R-MDR	614	735	3%	3,000	2,205,400	6%
High Density Residential	R-HDR	66	66	0%	4,000	263,200	1%
Residential Subtotal		**5,056**	**7,848**	**33%**		**18,158,000**	**46%**
Commercial							
Neighborhood Commercial	C-NC	13	18	0%	1,300	23,700	0%
Community Commericial	C-CC	856	894	4%	1,300	1,161,900	3%
Regional Commercial	C-RC	76	280	1%	1,300	363,700	1%
Service Commericial	C-SC	506	577	2%	1,300	750,400	2%
Central Business District	CBD	130	130	1%	1,300	169,200	0%
Entertainment Commercial	C-EC	0	937	4%	1,300	1,217,900	3%
Office Commercial	C-OC	16	35	0%	1,300	46,100	0%
Commercial Subtotal		**1,598**	**2,871**	**12%**		**3,732,800**	**9%**
Industrial							
Light Industrial	I-LI	561	1,966	8%	2,000	3,931,400	10%
Heavy Industrial [3]	I-HI	1,219	3,106	13%	2,408	7,479,100	19%
Industrial Subtotal			**5,072**	**21%**		**11,410,500**	**29%**
Community Facilities							
Public/Quasi-Public	PUB	1,625	2,306	10%	800	1,845,000	5%
Parks and Recreation	PRK	340	394	2%	0	0	0%
Open Space	OS/AG	13	386	2%	0	0	0%
Roadways and Railroads	--	1,864	2,322	10%	0	0	0%
Community Facilities Subtotal		**3,842**	**5,409**	**23%**		**1,845,000**	**5%**
Reserve Designations							
Village	NC	5	2,272	10%	1,748	3,971,000	10%
Residential Reserve	UR-R	0	0	0%	2,505	300	0%
Commercial Reserve	UR-C	0	0	0%	1,300	0	0%
Industrial Reserve	UR-I	0	136	1%	2,000	271,100	1%
Reserve Designations Subtotal		**5**	**2,408**	**10%**		**4,242,300**	**11%**
Totals							
Totals		**12,281**	**23,608**	**100%**		**39,388,700**	**100%**

Notes:
1. Based on the City of Tulare Draft Land Use Diagram (Updated November 2006).
2. Includes all land within the UDB.
3. It is anticipated that Heavy Industrial demands per acre will decrease through build out of the Urban Development Boundary.

Table 3.8 Planning and Evaluation Criteria Summary
Water System Master Plan
City of Tulare

Source of Supply

The adequate source of supply is required to meet: Maximum Day Demand + 3,596 gpm.

Storage

The adequate Pressure Zone 1 storage shall meet:
Operational Storage = 25% of Maximum Day Demand
Fire Storage = 0.63 MG
Emergency Storage = 0% Maximum Day Demand

Distribution Mains

The distribution system should be sized to meet the greater of:
Peak Hour Demand, or
Maximum Day Demand + Fire Flow.

Criteria for judging the adequacy of existing pipelines:
Maximum desirable pipeline velocity: 8 feet per second
Maximum desirable head loss: 10 feet/1,000 feet

Headloss in Existing Pipes

Headloss in pipes shall be calculated based on the following table:

	Age (Years)					
Pipe Material	**0**	**10**	**20**	**30**	**40**	**50**
Asbestos Cement	125	125	125	125	125	125
Cast Iron	120	110	100	90	80	70
Ductile Iron	130	125	120	115	110	105
Plastic (PVC)	140	140	140	140	140	140
Steel	130	120	110	100	90	80

Service Pressures

The recommended high/low pressures are as follows:

Maximum Pressure =	80 psi
Minimum Pressure (during Maximum Day) =	40 psi
Minimum Pressure (during Peak Hour) =	35 psi
Minimum Residual Pressure (during Fires) =	20 psi

Water Use Peaking Factors

Fluctuations in water demands shall be based on:

Maximum Month Demand =	1.6 x Average Day Demand
Maximum Day Demand =	2.5 x Average Day Demand
Peak Hour Demand =	3.5 x Average Day Demand

Per Capita Water Consumption

Demand forecasting shall be based on: City-Wide = 300 gpdc

Average Annual Demand Coefficients

These demand coefficients are applied to the gross land use acreages to yield average day water demands:

Land Use Category	Code	Coefficients (gpd/acre)	Coefficients (gpm/acre)
Rural Residential	R-RR	1200	0.83
Rural Estate	R-RE	2,000	1.39
Low Density Residential	R-LDR	2,400	1.67
Medium Density Residential	R-MDR	3,000	2.08
High Density Residential	R-HDR	4,000	2.78
Neighborhood Commercial	C-NC	1,300	0.90
Community Commericial	C-CC	1,300	0.90
Regional Commercial	C-RC	1,300	0.90
Service Commericial	C-SC	1,300	0.90
Central Business District	CBD	1,300	0.90
Entertainment Commercial	C-EC	1,300	0.90
Office Commercial	C-OC	1,300	0.90
Light Industrial	I-LI	2,000	1.39
Heavy Industrial	I-HI	7,250	5.03
Public/Quasi-Public	PUB	800	0.56
Parks and Recreation	PRK	0	0.00
Open Space	OS/AG	0	0.00
Roadways and Railroads	--	0	0.00
Village	NC	1,748	1.21
Residential Reserve	UR-R	2,505	1.74
Commercial Reserve	UR-C	1,300	0.90
Industrial Reserve	UR-I	2,000	1.39

Fire Flows

In this study, water system response is adequate when it provides the following flows:

Residential fire flow =	1,500 gpm for a duration of 2 hours
Commercial fire flow =	2,500 gpm for a duration of 2 hours
Industrial fire flow =	3,500 gpm for a duration of 3 hours.

EXISTING SYSTEM AND HYDRAULIC MODEL

This chapter presents an overview of the City of Tulare (City) water supply, distribution, and storage facilities. The chapter also describes the development of the City's water distribution hydraulic model. This model was used for identifying existing system deficiencies and for recommending enhancements.

4.1 SYSTEM OVERVIEW

The City provides potable water service to its residential, commercial, industrial, and institutional customers within the City limits. The City's municipal water system extracts water from the underground aquifers via a series of 27 groundwater wells distributed throughout the City (Figure 5.1). Water is transmitted from the wells to customers via a distribution system with pipe sizes that range from 2-inches to 16-inches in diameter. The City's water distribution system also includes a 150,000 gallon elevated storage tank.

4.1.1 Distribution System

The City's current water distribution system consists of over 200 miles of pipelines ranging from 2-inches to 16-inches in diameter. Figure 5.1 shows a map of the existing distribution system, pipe diameters, and alignments. The figure also shows the well and tank locations. As shown on Figure 5.1, the majority of the City's water distribution system pipelines (approximately 159 miles) are 8-inches in diameter and smaller. The remaining (approximately 47 miles) range from 10-inches to 16-inches in diameter.

4.1.2 Pressure Zones

The topography of the City is generally flat. The ground elevations within the Urban Development Boundary (UDB) range from approximately 255 feet (ft) to 310 ft above mean sea level (msl). Due to the relatively minor variations in ground elevation throughout the UDB, the City's water distribution system consists of only one pressure zone.

4.1.3 Supply Sources

The City relies on groundwater only to meet its supply needs. Table 4.1 lists the capacities of the 27 existing groundwater supply wells, as provided by City staff. The active wells have a current supply capacity of approximately 38.6 million gallons per day (mgd) (26,777 gpm). The firm capacity, which is defined as the total capacity less the City's two largest wells out of service, is 33.4 mgd (23,181 gpm). Table 4.1 also indicates the current status of each well, as well as a listing of which wells are equipped with auxiliary power. Several of the City's groundwater wells are also equipped with hydropneumatic tanks.

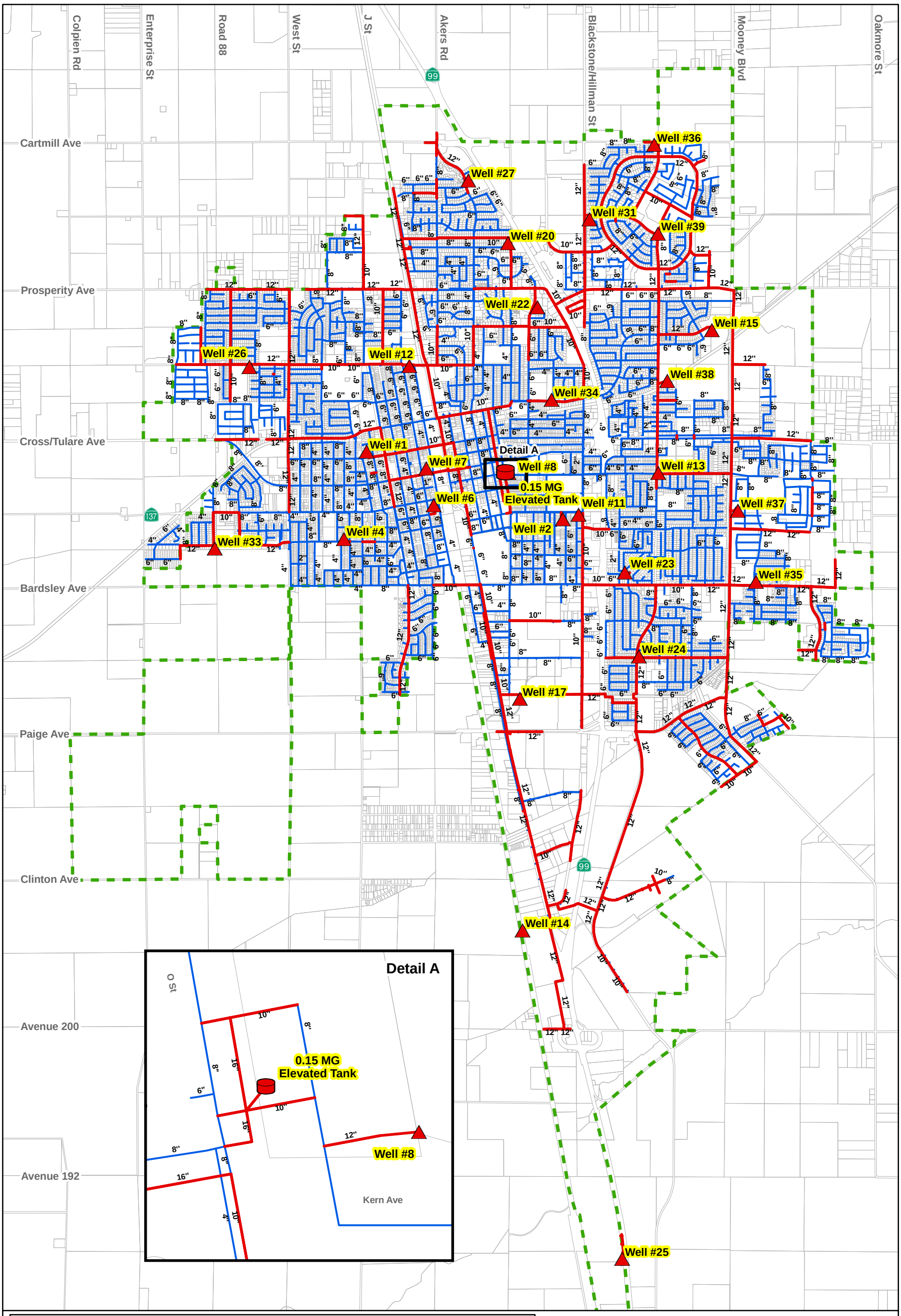


Figure 4.1
Existing Water
Distribution System

Water System Master Plan
City of Tulare

*As of January 2009

Table 4.1 Water Supply Wells
Water System Master Plan
City of Tulare

	Capacity[1]			
Well No.	**(gpm)**	**(mgd)**	**Auxilary Power**	**Status[2]**
1	1,111	1.6		AU
2	414	0.6		AU
4	734	1.1	Yes	AU
6	1,125	1.6		AT
7	347	0.5		AU
8	351	0.5		AU
11	902	1.3		AT
12	1,522	2.2		AT
13	587	0.8		AT
14	431	0.6		AT
15	915	1.3		AT
17	1,699	2.4	Yes	AU
20	204	0.3		AU
22	1,042	1.5	Yes	AU
23	427	0.6		AT
24	700	1.0	Yes	AU
25	1,006	1.4		AU
26	1,395	2.0	Yes	AT
27	1,205	1.7		AT
31	473	0.7		AU
33	1,742	2.5		AU
34	1,524	2.2		AT
35	1,353	1.9		AT
36	1,208	1.7		AT
37	1,854	2.7		AT
38	1,551	2.2		AT
39	955	1.4		AT
Total	**26,777**	**38.6**		
Firm[3]	**23,181**	**33.4**		

Notes:
1. Data provided by City staff, July 2007.
2. AT=Active Treated; AU=Active Untreated.
3. Firm capacity is the total capacity minus the capacity of the two largest wells.

4.1.4 Storage Reservoirs

The City currently operates one elevated water storage tank with a capacity of approximately 150,000 gallons. This tank is located near Tulare Union High School between East Tulare Avenue and East Kern Avenue on South O Street.

4.1.5 Booster Pump Stations

There are currently no booster pump stations located within the City.

4.2 HYDRAULIC MODEL

Hydraulic network analysis is a powerful tool used in all aspects of water distribution system planning, design, operation, management, emergency response, system reliability analysis, fire flow capacity evaluation, as well as water quality simulations. The City's hydraulic model is a critical element used in evaluating the City's existing water distribution system and in planning the City's future facilities.

4.2.1 Selected Hydraulic Model

There is an abundance of network analysis software in the marketplace today with a variety of features and capabilities. The selection of a particular model generally depends on user preferences, the operational requirements of the water system, and cost.

It was agreed that H_2OMAP Water Version 8.0, by MWH Soft, would be used by Carollo to assemble the City's hydraulic model. H_2OMAP Water consists of multiple products that work together to bring a graphical approach to the analysis and design of water distribution systems. The program includes seamless integration with the City's GIS data.

This software was also selected because its user interface and capabilities are very similar to H_2OMAP SWMM, which is the selected modeling software package for the Sewer and Storm Drainage System Master Plans.

4.2.2 Data Collection and Validation

Data necessary for the development of the hydraulic model were collected from City engineering and operational staff. The data included GIS shapefiles of the City's water distribution system, which were used as the basis for the hydraulic model.

The data validation process included a review by City engineering, operation, and field maintenance staff of the City's existing water plat maps. City staff comments were compared and used to update the developed computer hydraulic model. System operational data were collected from City staff familiar with the day-to-day operation of the water system.

Historical water production data were obtained and summarized. Current land use information was based on a map obtained from the City's Draft General Plan Update.

4.2.3 Elements of the Hydraulic Model

The City's hydraulic model combines information on the physical and operational characteristics of the water system, and performs calculations to solve a series of mathematical equations to simulate flows in pipes and pressures at nodes. Elements comprising the computer modeling process are: skeletonizing the water system, defining pipes and nodes, and allocating water demands.

4.2.3.1 Skeletonizing

Skeletonizing is the process by which water networks are stripped of pipelines not considered essential for the intended analysis purpose. The purpose of skeletonizing a system is to develop a model that accurately simulates the hydraulics of the pipelines delivering water through the system. At the same time, skeletonizing should reduce the complexity of the large model, minimizing the time of analysis, and comply with the limitations imposed by the computer program.

In Tulare's case, an effort was made to digitize a majority of the existing distribution pipes, including pipes that are 4-inches in diameter.

4.2.3.2 Pipes and Nodes

Computer modeling requires gathering detailed numerical information on the physical characteristic of the modeled water system, such as pipe sizes (diameters), lengths, and general system geometry.

Pipes and nodes represent the physical elements describing the water network. A node represents a location in the network where a demand can be applied or water supplied to the system, while a pipe segment represents the actual transmission or distribution pipe itself. Pump performance curve data, defining the operation of the existing pumps and booster stations, were also incorporated in the computer model.

4.2.3.3 Demand Allocation

Allocating water demands to appropriate nodes in the hydraulic model was accomplished in several steps that included an analysis of city-wide land use distribution and review of historical water production records. Water demands tributary to nodes were delineated and the resulting demand was calculated by multiplying the land use water coefficients by the area. The resulting total demands matched the total existing average day demand. Variations to the average demand (maximum day demand and peak hour demand) were applied to the model for simulating high demand conditions.

Future water demands through the planning horizon of 2030 were calculated and distributed throughout the UDB based on the land use projections defined in a previous chapter.

4.3 HYDRAULIC MODEL CALIBRATION

The model calibration consisted primarily of a fire flow (hydrant) test calibration, as described in the following section.

4.3.1 Fire Flow Field Testing

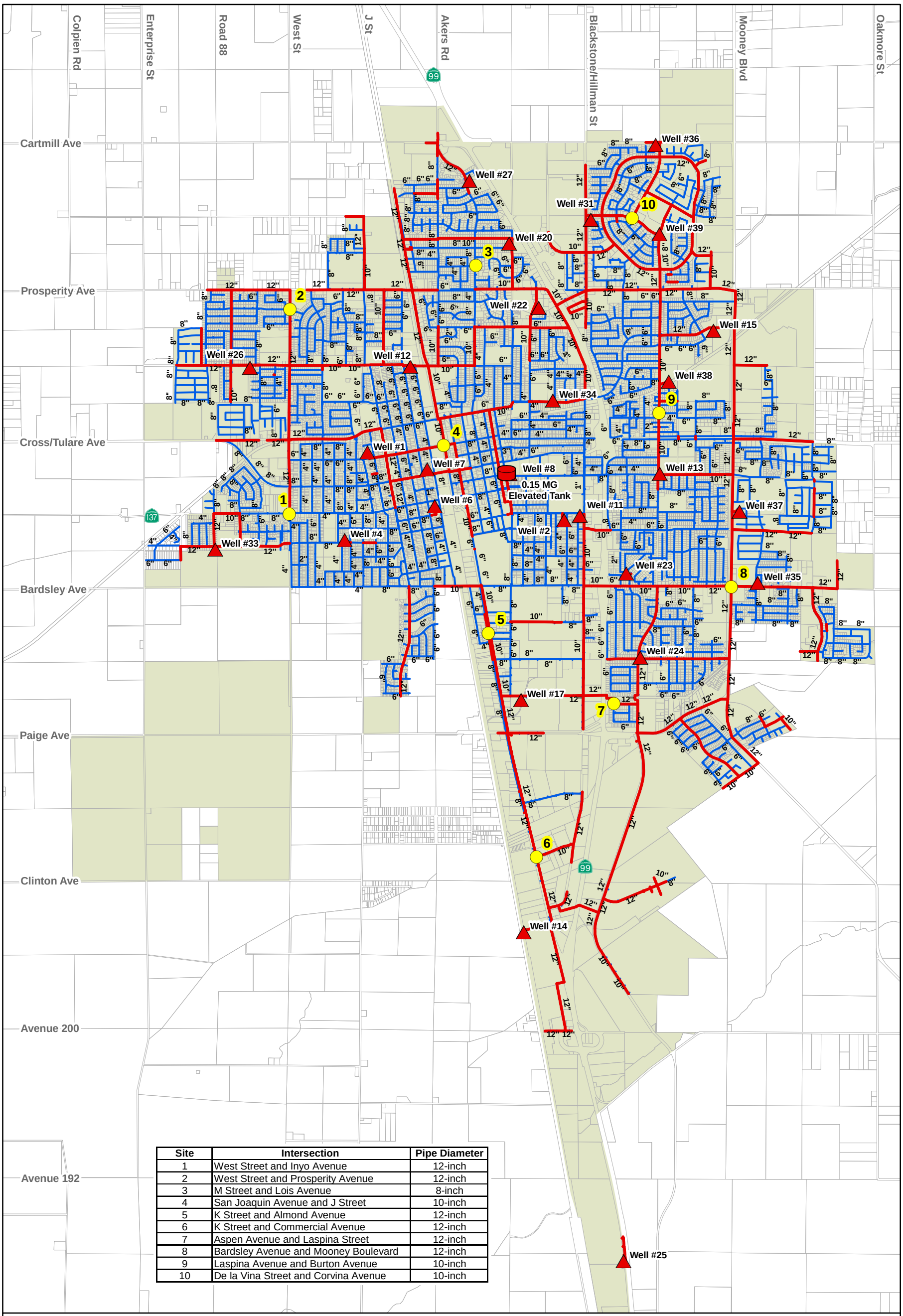
City Staff performed fire flow field tests at ten selected sites throughout the City in April 2008. Figure 4.2 shows the location of the tests, and provides the City fire hydrant work sheets related to the tests.

The primary purpose of fire flow field-testing is to calibrate the model, estimate roughness coefficients, and verify the model's ability to accurately represent the distribution system. The fire flow tests were used to develop a calibrated hydraulic model by closely matching water model pressures to field pressures under similar demand and system boundary conditions. Model calibration is typically achieved by modifying a pipeline's roughness coefficient, although other parameters may be adjusted as calibration results are generated.

Hazen-Williams roughness coefficients, or C-factors, have industry accepted values based on pipeline material, diameter, and age. Characteristics specific to the City's distribution system such as water quality, temperature, construction methodologies, and material suppliers may result in roughness coefficients that differ from the typical range. Fire flow calibration is used to refine the initial roughness coefficient estimate and reflects the conditions of the City's distribution system. Older pipes tend to experience tuberculation, which increases headloss and reduces pressure.

During average demand conditions, flows are low and the roughness of a pipe causes a relatively small impact on the pressures of a distribution system. However, as the flows increase during high demand days, velocities within pipelines increase and the roughness of a pipe contributes to more head loss and lower pressures. Fire flow tests are useful for assessing a pipelines roughness coefficient because they generate a high velocity in the pipe. The high velocity causes a significant drop in pressure, which can be used to estimate a pipeline's roughness coefficient.

Typically, static pressure measurements are collected under normal demand conditions. Next, a hydrant is opened to release a large amount of flow and to cause a significant headloss or pressure drop. City Staff conducted several hydrant tests that stressed the City's distribution system by creating a difference in pressure between the point of hydrant flow and neighboring hydrants. Adjustments to a pipeline's roughness coefficient were made until the model's predicted pressures reasonably matched field measured pressures within an acceptable tolerance. The roughness coefficients were adjusted only within an



Site	Intersection	Pipe Diameter
1	West Street and Inyo Avenue	12-inch
2	West Street and Prosperity Avenue	12-inch
3	M Street and Lois Avenue	8-inch
4	San Joaquin Avenue and J Street	10-inch
5	K Street and Almond Avenue	12-inch
6	K Street and Commercial Avenue	12-inch
7	Aspen Avenue and Laspina Street	12-inch
8	Bardsley Avenue and Mooney Boulevard	12-inch
9	Laspina Avenue and Burton Avenue	10-inch
10	De la Vina Street and Corvina Avenue	10-inch

Legend

Hydrant Test Location

Existing Water Distribution System*

Groundwater Supply Well

Storage Tank

Pipelines

8" and Smaller

10" and Larger

City Limits

Parcels

0 0.4 0.8 Miles

Figure 4.2
Hydrant Test Locations

Water System Master Plan
City of Tulare

*As of January 2009

acceptable range for a given pipe material and age. If a modeled pipe was unable to match the calibration results without deviation from the acceptable range of roughness coefficients, then there may be cause for further investigation of a previously unknown field condition. Examples of such conditions that typically arise during hydraulic model calibration include closed, partially closed or malfunctioning valves, extreme corrosion within pipelines, pipeline connectivity and size. These conditions were not found in the City's hydraulic model and the model predicted results match the field measured pressures well, as summarized in Table 4.2.

Table 4.2 Fire Flow Calibration Results
Water System Master Plan
City of Tulare

Test No.	Static Pressure			Residual Pressure			Pressure Drop[1]		
	Field Pressure (psi)	Modeled Pressure (psi)	Percent Error (%)	Field Pressure (psi)	Modeled Pressure (psi)	Percent Error (%)	Field (psi)	Modeled (psi)	Difference (psi)
1	60	60	0%	50	50	0%	10	10	0
2	59	59	0%	50	52	4%	9	7	2
3	61	58	5%	53	52	2%	8	6	2
4	54	54	0%	48	51	6%	6	3	-3
5	61	60	2%	58	56	4%	3	4	-1
6	52	52	0%	47	48	2%	5	4	-1
7	62	62	0%	58	56	4%	4	6	-2
8	42	45	7%	40	43	7%	2	2	0
9	62	62	0%	55	55	0%	7	7	0
10	50	50	0%	49	49	0%	1	1	0

Note:
1. Pressure Drop = Static Pressure - Residual Pressure

EVALUATION AND PROPOSED IMPROVEMENTS

This chapter presents the results of the capacity evaluation of the City of Tulare (City) water supply, distribution, and storage facilities. The chapter also presents improvements to mitigate existing system deficiencies and to serve future growth. These improvements are recommended based on the system's technical requirements, cost effectiveness, and operational reliability.

5.1 CAPACITY EVALUATION

The additional water supply and storage facilities required to meet existing and projected water demands were determined by comparing the available water supplies with the projected water demands.

5.1.1 Supply Capacity

The City's total and firm supply capacity from the 27 existing groundwater wells is estimated at 38.6 million gallons per day (mgd) and 33.4 mgd, respectively. The city-wide supply analysis, summarized in Table 5.1, indicates that the 2008 peak hour demand (PHD) is about 20 mgd greater than the total capacity of the existing wells. The City's firm capacity, therefore, is well below the 2008 PHD, and does not meet the supply criteria.

Assuming the existing wells will remain in service at their current capacities, the total recommended increase in the source of supply is 26.0 mgd to satisfy 2008 PHD conditions. It is recommended that the City construct 13 new wells, with an approximate capacity of 2.0 mgd (approximately 1,400 gpm) each. This increase will provide enough capacity to meet 2008 PHDs with two of the largest well out of service.

The analysis (Table 5.1) also estimates future demands based on future population projections. The population increases are projected to approach 130,975 by 2030. For each staged planning period, the table summarizes the corresponding supply capacity, which is the PHD plus a standby capacity of 5.2 mgd.

Assuming the existing wells will remain in service at their current capacities, the total recommended increase in supply capacity through 2030 is 104 mgd (total recommended supply less the 2008 available total supply). It is recommended that the City install 52 new wells by 2030, 13 of which are needed to mitigate existing deficiencies.

Figure 5.1 illustrates the possible range of years in which future supply wells will come on-line. A range is provided since it is difficult to predict the specific year a new well is required. The actual installation rate of new supply wells will depend on the actual rate of growth in the City.

Table 5.1 Supply and Storage Requirements
Water System Master Plan
City of Tulare

Supply and Storage	Criteria	Year					
		2008	**2010**	**2015**	**2020**	**2025**	**2030**
1. Population Forecasting							
City and Urban Development Boundary		56,000	60,000	73,000	89,000	108,000	131,000
2. Projected Demands		**(MGD)**	**(MGD)**	**(MGD)**	**(MGD)**	**(MGD)**	**(MGD)**
a. City Wide Average Day Demands (ADD)	Per Capita Consumption: 300 gpcd	16.7	18.0	21.9	26.6	32.3	39.3
b. City Wide Maximum Day Demands (MDD)	MDD = 2.5 x ADD	41.7	45.1	54.8	66.5	80.7	98.2
c. City Wide Peak Hour Demands (PHD)	PHD = 3.5 x ADD	58.4	63.1	76.7	93.1	113.0	137.5
3. Supply Requirements		**(MGD)**	**(MGD)**	**(MGD)**	**(MGD)**	**(MGD)**	**(MGD)**
a. Required Supply	Supply to meet Max. Day Demands plus Standby 5.2 mgd	46.9	50.3	60.0	71.7	85.9	103.4
b. Available Supply (Wells Capacity)	Peak Hour Demands will be supplied through Storage	38.6	46.6	50.6	60.6	72.6	86.6
c. Recommended Upgrade		8.0	4.0	10.0	12.0	14.0	18.0
d. Number of New Wells (2)	Assume 2.0 mgd per new supply well	**4.0**	**2.0**	**5.0**	**6.0**	**7.0**	**9.0**
e. Proposed Total Supply (Well Capacity)		46.6	50.6	60.6	72.6	86.6	104.6
4. Storage Requirements		**(MG)**	**(MG)**	**(MG)**	**(MG)**	**(MG)**	**(MG)**
a. Required Storage							
Operational Storage	**25%** of Maximum Day Demand	10.4	11.3	13.7	16.6	20.2	24.6
Fire Flow Storage	3,500 gpm for 3 hours	0.63	0.63	0.63	0.63	0.63	0.63
Emergency Storage	**0%** of Maximum Day Demand	0.0	0.0	0.0	0.0	0.0	0.0
Total		**11.1**	**11.9**	**14.3**	**17.3**	**20.8**	**25.2**
b. Available Storage		0.2	5.2	12.2	17.2	21.2	25.2
c. Recommended New Storage Capacity (1), (2)		**5.0**	**7.0**	**5.0**	**4.0**	**4.0**	**0.0**
d. Proposed Total Storage Capacity		5.2	12.2	17.2	21.2	25.2	25.2

Notes:
1. The 2008 new storage recommendation is less than the total required storage because it is recognized that the installation of total required storage between 2008 and 2010 is not practical.
2. The number of new wells or storage capacity reflects the increase required by the given year. In other words, two wells are required between 2008 and 2010, and 7 MG of storage is required.

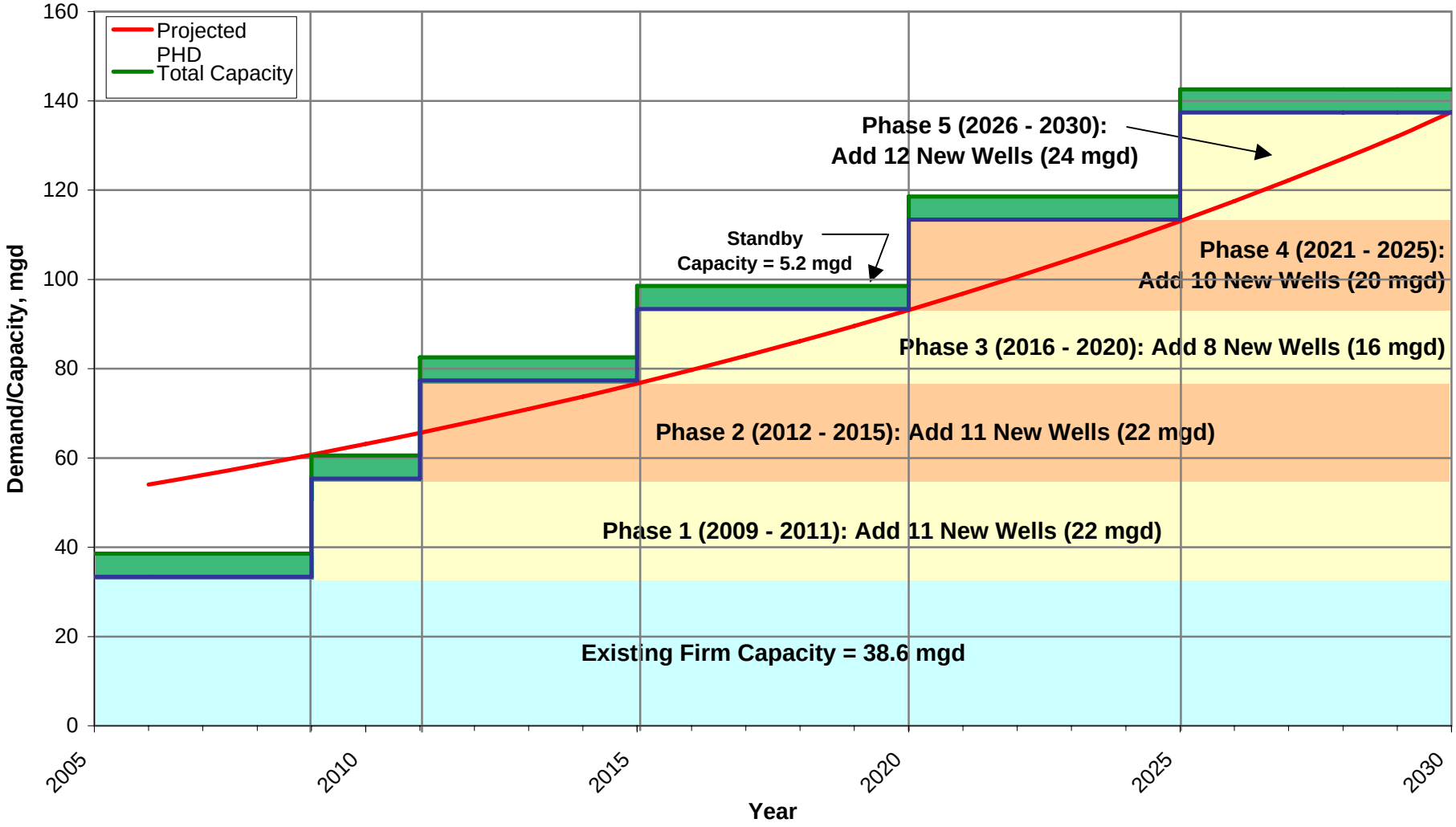


Figure 5.1
Porjected Supply and Demand Increase
Water System Master Plan
City of Tulare

carollo
Engineers...Working Wonders With Water™

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Table 5.2 also provides an estimate for the required supply capacity if the City chooses to provide storage. This would reduce the required firm supply capacity to the maximum day demand (MDD).

The water supply recommendations in this master plan do not account for the loss of any existing groundwater wells due to water quality issues or lowering groundwater levels. If an existing well is taken out of service, the City should provide additional groundwater pumping capacity (i.e. an additional well) to offset the loss.

5.1.2 Storage Capacity

The City's current storage capacity totals 150,000 gallons (0.15 MG), which is provided by an elevated tank located near the intersection of Kern Avenue and O Street. A city-wide analysis of the storage needs was conducted as part of this study. The storage requirements are based on providing the fire flow storage of 0.63 million gallons (MG) only. No operational or emergency storage is required since the City relies on groundwater and some wells have backup power. It is recommended that the City construct an above-ground storage tank with 1.0 MG storage capacity to meet the fireflow requirement.

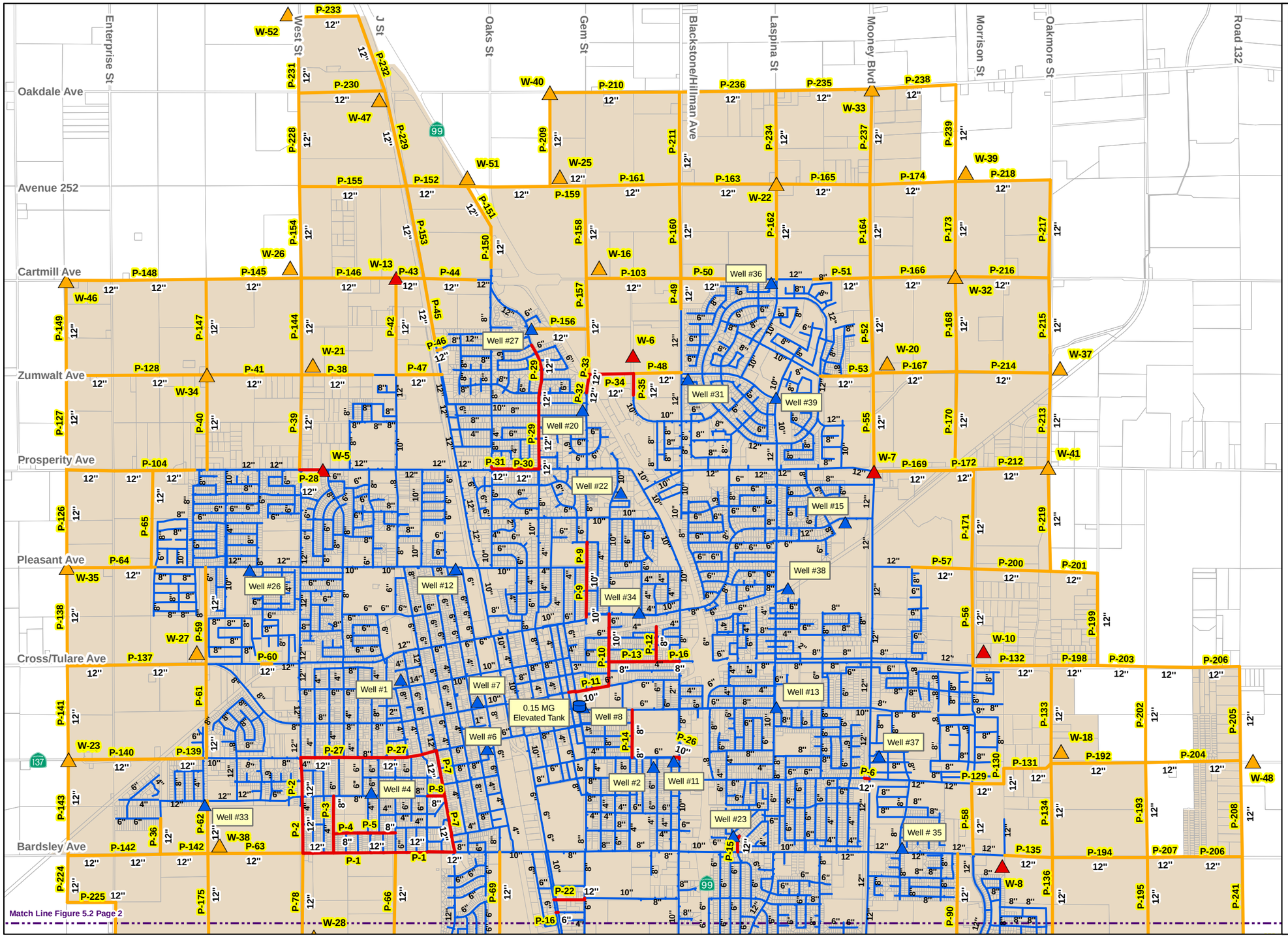
5.1.3 Booster Pump Stations

Each storage tank will require the installation of a pump station. Hence, new booster pump stations are recommended in this Master Plan. Although the booster pumps are not shown on Figure 5.3, the reader should assume their presence. It is assumed that the booster pumps would have sufficient capacity to drain the tank in six hours, to provide the operational storage in the distribution system. The final pump station design capacity will be determined during the planning and design phase.

5.1.4 Pipelines

In certain areas of the City's water distribution system, small diameter pipelines are present that should be replaced. These pipes are unable to deliver water at high rates and meet fire flow pressure requirements. Fire flows were simulated in conjunction with MDD to identify the capability of the distribution system to respond to hypothetical fires. Only one hypothetical fire was applied during a staged single model simulation, and the magnitude of the fire flow varied depending on the predominant land use density or intensity. For example, 3,500 gpm was simulated in industrial areas and 2,500 gpm in commercial areas. The fire flow was reduced to 1,500 gpm in the residential areas.

Undersized water mains can either be upgraded (i.e. replaced with a larger diameter main) or a parallel water main can be constructed. Because this study did not include a condition assessment, it was assumed, unless otherwise specified, that all deficient pipelines will be replaced. The ultimate decision of whether to replace or parallel a given water main should be made during the preliminary design phase.



Legend

Existing Water Distribution System

- Storage Tank
- Groundwater Supply Well
- Pipelines

Proposed Improvements

Existing System

- Storage Tank
- Groundwater Supply Well
- Pipelines

Future System

- Groundwater Supply Well
- Pipelines
- Parcels
- Urban Development Boundary
- P-20 Proposed Improvement ID
- 12" Proposed Pipe Diameter
- 8" Existing Pipe Diameter

Feet

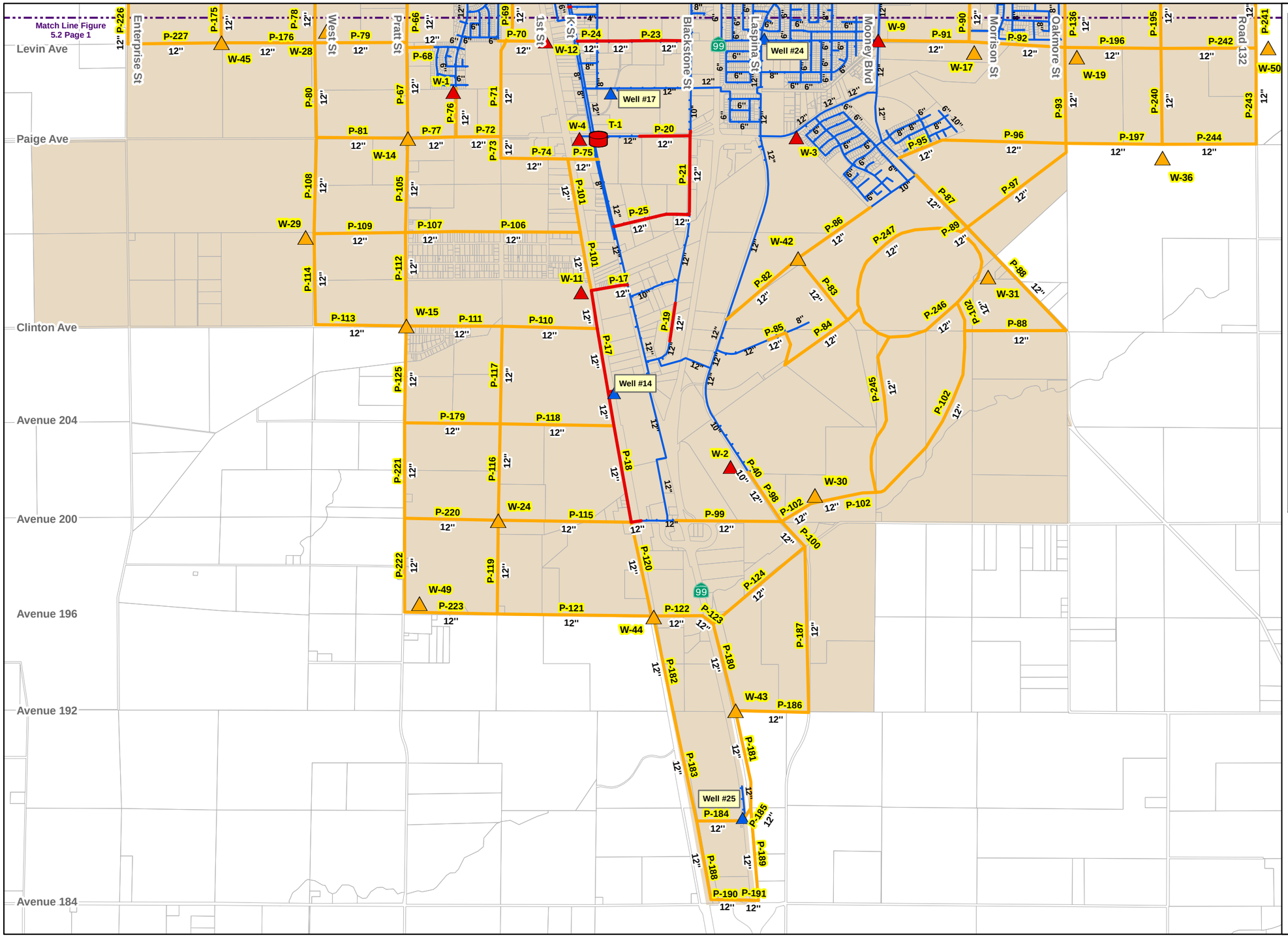
0 2,500 5,000

Figure 5.2
Proposed Improvements
(1 of 2)

Water System Master Plan
City of Tulare

City of Tulare

carollo



Legend

Existing Water Distribution System

- Storage Tank
- Groundwater Supply Well
- Pipelines

Proposed Improvements

Existing System

- Storage Tank
- Groundwater Supply Well
- Pipelines

Future System

- Groundwater Supply Well
- Pipelines
- Urban Development Boundary
- Parcels
- P-20 Proposed Improvement ID
- 12" Proposed Pipe Diameter
- 8" Existing Pipe Diameter

Feet

0 2,500 5,000

Figure 5.2
Proposed Improvements
(2 of 2)

Water System Master Plan
City of Tulare

City of Tulare

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5.2 PROPOSED IMPROVEMENTS

The recommended improvements discussed in this section are needed to mitigate existing system deficiencies and provide capacity for future development. The improvements are quantified in the Capital Improvement Program (CIP), presented in the following chapter, and are shown on Figure 5.3 and listed in Table 5.2. It should be noted that developers are responsible for paying an equitable cost allocation for the infrastructures needed to extend service from their developments to the master plan facilities.

The hydraulic model evaluation consisted of 24-hour simulations during normal operations of a MDD condition. The MDD, the highest daily demand in the year, also includes the peak hour demand (PHD).

5.3 PROJECT PRIORITIZATION

The master plan CIP provides a breakdown of recommended improvement projects by phase. The CIP phases are:

- Phase I: 2009-2011;
- Phase II: 2012-2015;
- Phase III: 2016-2020;
- Phase IV: 2021-2025;
- Phase V: 2026-2030.

Improvement projects to correct existing deficiencies should be implemented by the City as soon as possible. Due to budget and time constraints, however, it may not be feasible for the City to implement all existing system improvement projects within the first or second CIP phase. In order to provide guidance to the City in identifying the most critical improvements, the recommended improvement projects were prioritized based on the severity of the existing or expected deficiency. Projects given highest priority should be implemented as soon as possible, whereas projects given a lower priority can likely be pushed back to later CIP phases.

Improvement projects needed to service future growth will be constructed at the time a specific development comes on line. Therefore, the phasing of future improvements is dependant upon the pace of development.

The priorities are described below:

- **Existing Higher Priority** - Facility is required to maintain adequate pressures in a large tributary area.
- **Existing Lower Priority** - Low pressure conditions existing in an isolated area.

Table 5.2 Proposed Improvements
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)
Existing System Improvements							
Pipeline Improvements							
P-1	Pipe	Bardsley Avenue	West St to E St	4,8	12	Replace	4,200
P-2	Pipe	West Street	Inyo Ave to Bardsley Ave	4,8	12	Replace	2650
P-3	Pipe	Sacramento Street	Sonora Ave to Bardsley Ave	4	8	Replace	1,600
P-4	Pipe	Elm Street	Sacramento St to Walter St	--	8	New	350
P-5	Pipe	Elm Street	Walter St to Pratt St	4	8	Replace	1,400
P-6	Pipe	Alpine Avenue	Mooney Blvd to connection e/o Mooney Blvd	--	12	New	150
P-7	Pipe	E Street	Bardsley Ave to Inyo Ave	4, 6, 8	12	Replace	2,900
P-8	Pipe	Sonora Avenue	E St to D St	4	8	Replace	500
P-9	Pipe	Gem Street	Terrace Ave to Cross Ave	4	10	Replace	2,100
P-10	Pipe	Cherry Street	Cross Ave to Tulare Ave	4	10	Replace	2,000
P-11	Pipe	Tulare Avenue	Cherry St to Alleyway w/o O St	4,6,8	10	Replace	1,150
P-12	Pipe	Highland Street	Pine Dr to San Joaquin Ave	4	8	Replace	950
P-13	Pipe	San Joaquin Avenue	Blackstone St to Cherry St	4	8	Replace	1,950
P-14	Pipe	R Street	Kern Ave to Sonora Ave	4	8	Replace	1,300
P-15	Pipe	Cardoza Drive	Bardsley Ave to n/o Bardsley Ave	6	12	Replace	450
P-16	Pipe	Almond Avenue	K St to e/o K St	--	12	New	70
P-17	Pipe	Goodin Avenue, County Road 112	K St to County Road 112, then south to Olson Ave	--	12	New	1,200
P-17A	Casing (1)	County Road 112	Crossing under Railroad	--	12/24	New	300
P-18	Pipe	County Road 112	Olson Ave to Rankin Ave	4	12	Replace	2,000
P-19	Pipe	Blackstone Street	Commercial Ave to n/o Commercial Ave	--	12	New	1,100
P-20	Pipe	Paige Avenue	Blackstone St to w/o Blackstone St	--	12	New	1,400
P-21	Pipe	Blackstone Street	Paige Ave to s/o Paige Ave	--	12	New	2,250
P-22	Pipe	Walnut Avenue	O St to K St	6	12	Replace	900
P-23	Pipe	Levin Avenue	Blackstone St to O St	8	12	Replace	2,650
P-24	Pipe	Levin Avenue	O St to K St	6	12	Replace	550
P-25	Pipe	s/o Paige Avenue	K St to Blackstone St	8,10	12	Replace	2,150
P-26	Pipe	Sonora Avenue	Blackstone St to w/o Blackstone St	6,8	10	Replace	200
P-27	Pipe	Inyo Avenue	Los Angeles St to E St	2, 4, 8	8	Replace	3,000
P-28	Pipe	Prosperity Avenue	West St to Sacramento St	--	12	New	650
P-29	Pipe	M Street	Prosperity Ave to Garfield Ave	8	12	Replace	3,550
P-30	Pipe	Prosperity Avenue	M St to w/o Williams St	8	12	Replace	1,000
P-31	Pipe	Prosperity Avenue	Oaks St to w/o Williams St	--	12	New	500
P-32	Pipe	Gem Street	Washington Ave to Sandra Ave	6	10	Replace	300
P-33	Pipe	w/o Blackstone Avenue	Zumwalt Ave to Washington Ave	--	12	New	500
P-33A	Casing (1)	w/o Blackstone Avenue	Crossing across Highway 99	--	12/24	New	400
P-34	Pipe	Zumwalt Avenue	Gem St to Retherford St	--	12	New	1,250
P-35	Pipe	Retherford Street	Leland Ave to n/o Leland Ave	--	12	New	600
Well Improvements							
W-1	Supply Well (2)	E Street	E St and Lemonwood Ave	--	1400 gpm	New	--
W-2	Supply Well (2)	Laspina Street	ne/o Laspina St and Ave 200	--	1400 gpm	New	--
W-3	Supply Well (2)	se/o Modac Avenue	sw/o Foster Dr and Turner Dr	--	1400 gpm	New	--
W-4	Supply Well (2)	Paige Avenue	w/o K St	--	1400 gpm	New	--
Tank Improvements							
T-1	Tank (2)	Paige Avenue	Paige Ave and K St	--	1.0 MG	New	--
T-2	Tank (2)	Bardsley Avenue	Bardsley Ave and Morrison St	--	6.0 MG	New	--
T-3	Tank (2)	e/o Highway 99	e/o Highway 99 and s/o Cartmill Ave	--	5.0 MG	New	--
Future System Improvements							
Pipeline Improvements							
P-36	Pipe	Haven Street	Alpline Ave to Bardsley Ave	--	12	New	1,000
P-37	Pipe	Mooney Boulevard	s/o Prosperity Ave to Cross Ave	--	12	New	950
P-38	Pipe	Zumwalt Avenue	West St to e/o West St	--	12	New	2,000
P-39	Pipe	West Street	Zumwalt Ave to Prosperity Ave	--	12	New	2,650
P-40	Pipe	w/o West Street	Zumwalt Ave to Prosperity Ave	--	12	New	2,650
P-41	Pipe	Zumwalt Avenue	w/o West St to West St	--	12	New	2,650
P-42	Pipe	E Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,700
P-43	Pipe	Cartmill Avenue	E St to J St	--	12	New	850
P-44	Pipe	Cartmill Avenue	J St to w/o Oaks St	--	12	New	1,400
P-45	Pipe	J Street	Cartmill Ave to ne/o Zumwalt Ave	--	12	New	1,750
P-46	Pipe	Mitchell Avenue	Alcott St to J St	--	12	New	150
P-47	Pipe	Zumwalt Avenue	E St to J St	--	12	New	1,300
P-48	Pipe	Zumwalt Avenue	Retherford St to Blackstone St	--	12	New	1,350
P-49	Pipe	Blackstone Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,600
P-50	Pipe	Cartmill Avenue	Blackstone St to e/o Blackstone St	--	12	New	2,150
P-51	Pipe	Cartmill Avenue	Mooney Blvd to w/o Mooney Blvd	--	12	New	1,600
P-52	Pipe	Mooney Boulevard	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-53	Pipe	Zumwalt Avenue	Mooney Blvd to w/o Mooney Blvd	--	12	New	1,500
P-54	Pipe	Prosperity Avenue	Mooney Blvd to w/o Mooney Blvd	--	12	New	600
P-55	Pipe	Mooney Boulevard	Zumwalt Ave to Prosperity Ave	--	12	New	2,750
P-56	Pipe	Morrison Street	Cross Ave to Tulare Ave	--	12	New	2,700
P-57	Pipe	Pleasant Avenue	Morrison St to w/o Morrison St	--	12	New	1,700
P-58	Pipe	e/o Mooney Boulevard	Bardsley Ave to n/o Bardsley Ave	--	12	New	1,950
P-59	Pipe	w/o West Street	Pleasant Ave to Tulare Ave	--	12	New	2,700
P-60	Pipe	Tulare Avenue	e/o Enterprise St to w/o West St	--	12	New	1,000
P-61	Pipe	w/o West Street	Tulare Ave to Inyo Ave	--	12	New	2,600
P-62	Pipe	w/o West Street	Sonora Ave to Bardsley Ave	--	12	New	1,450
P-63	Pipe	Bardsley Avenue	e/o Enterprise St to West St	--	12	New	2,650
P-64	Pipe	Pleasant Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	2,450
P-65	Pipe	e/o Enterprise Street	Prosperity Ave to Pleasant Ave	--	12	New	2,700
P-66	Pipe	Pratt Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-67	Pipe	Pratt Street	s/o Bardsley Ave to Paige Ave	--	12	New	2,650
P-68	Pipe	s/o Bardsley Avenue	Pratt St to e/o Pratt St	--	12	New	700
P-69	Pipe	w/o I St	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,700
P-70	Pipe	s/o Bardsley Avenue	I St to w/o I St	--	12	New	1,300
P-71	Pipe	w/o I St	s/o Bardsley Ave to Paige Ave	--	12	New	2,700
P-72	Pipe	Paige Avenue	E St to w/o I St	--	12	New	1,250
P-73	Pipe	w/o I St	Paige Ave to 600' s/o Paige Ave	--	12	New	650
P-74	Pipe	600 ft s/o Paige Avenue	w/o I St to County Road 112	--	12	New	1,900
P-75	Pipe	600 ft s/o Paige Avenue	County Road 112 to K St	--	12	New	800
P-76	Pipe	E Street	Ave 216 to proposed well s/o Lemonwood Ave	--	12	New	1,350
P-77	Pipe	Paige Avenue	Pratt St to E St	--	12	New	1,350
P-78	Pipe	West Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-79	Pipe	s/o Bardsley Avenue	West St to Pratt St	--	12	New	2,550
P-80	Pipe	West Street	s/o Bardsley Ave to Paige Ave	--	12	New	2,650
P-81	Pipe	Paige Avenue	West St to Pratt St	--	12	New	2,550
P-82	Pipe	se/o Laspina St	Laspina St to e/o Laspina St	--	12	New	2,600
P-83	Pipe	e/o Laspina Street & Tex Drive	Proposed Well (W-28) to TMSC Property Line	--	12	New	450
P-84	Pipe	se/o Laspina St	Golf Course to TMSC Property Line	--	12	New	1,850
P-85	Pipe	n/o Tex Drive	1,600' e/o Laspina St to 2,400' e/o Laspina St	10	12	Replace	850
P-86	Pipe	se/o Laspina St	e/o Laspina St to w/o Turner Dr	--	12	New	2,450
P-87	Pipe	Turner Drive	900' se/o Foster Dr to 2,900' se/o Foster Dr	--	12	New	2,050
P-88	Pipe	Turner Drive	Stub se/o P-87	--	12	New	200
P-89	Pipe	Turner Drive	Stub sw/o P-87	--	12	New	200
P-90	Pipe	e/o Mooney Boulevard	Levin Ave to Bardsley Ave	--	12	New	2,600
P-91	Pipe	s/o Bardsley Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,500
P-92	Pipe	s/o Bardsley Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,650
P-93	Pipe	Oakmore Street	Levin Ave to Paige Ave	--	12	New	2,650
P-94	Pipe	Mooney Boulevard/Turner Drive	s/o Mooney Blvd to Turner Dr	--	12	New	1,950
P-95	Pipe	se/o Foster Drive	Turner Dr to w/o Oakmore St	--	12	New	2,100

Table 5.2 Proposed Improvements
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)
P-96	Pipe	s/o Levin Avenue	w/o Oakmore St to Oakmore St	--	12	New	2,700
P-97	Pipe	se/o Foster Drive	Turner Dr to ne/o Turner Dr	--	12	New	3,700
P-98	Pipe	Laspina Street	Rankin Ave to n/o Rankin Ave	--	12	New	1,650
P-99	Pipe	Rankin Avenue	Laspina St to w/o Highway 99	--	12	New	4,600
P-99A	Casing (1)	Rankin Avenue	Crossing across Highway 99	--	12/24	New	250
P-100	Pipe	Laspina Street	Hosfield Dr to 1,000' nw/o Hosfield Dr	--	12	New	950
P-101	Pipe	J Street	Paige Ave to Goodin Ave	--	12	New	3,400
P-102	Pipe	ne/o Rankin Ave	Proposed Tank (T-6) to TMSC Property Line	--	12	New	1,350
P-103	Pipe	Cartmill Avenue	Gem St to Blackstone St	--	12	New	2,650
P-104	Pipe	Prosperity Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	3,550
P-105	Pipe	Pratt Street	n/o Wade Ave to Paige Ave	--	12	New	2,650
P-106	Pipe	n/o Wade Avenue	e/o Pratt St to County Road 112	--	12	New	3,500
P-107	Pipe	n/o Wade Avenue	Pratt St to E St	--	12	New	1,350
P-108	Pipe	West Street	Paige Ave to s/o Paige Ave	--	12	New	2,700
P-109	Pipe	s/o Paige Avenue	West St to Pratt St	--	12	New	2,550
P-110	Pipe	Avenue 208	County Road 112 to w/o County Road 112	--	12	New	2,650
P-111	Pipe	Avenue 208	Pratt St to w/o County Road 112	--	12	New	2,650
P-112	Pipe	Pratt Street	n/o Wade Ave to Ave 208	--	12	New	2,600
P-113	Pipe	Avenue 208	West St to Pratt St	--	12	New	2,500
P-114	Pipe	West Street	s/o Paige Ave to Ave 208	--	12	New	2,500
P-115	Pipe	Avenue 200	County Road 112 to e/o Pratt St	--	12	New	3,700
P-116	Pipe	e/o Pratt Street	Ave 200 to n/o Ave 200	--	12	New	2,700
P-117	Pipe	e/o Pratt Street	Clinton Ave to s/o Clinton Ave	--	12	New	2,700
P-118	Pipe	Lopes Avenue	County Road 112 to e/o Pratt St	--	12	New	3,150
P-119	Pipe	e/o Pratt Street	Ave 200 to s/o Ave 200	--	12	New	2,600
P-120	Pipe	County Road 112	Rankin Ave to Ave 196	--	12	New	2,650
P-121	Pipe	Avenue 196	County Road 112 to e/o Pratt St	--	12	New	4,300
P-122	Pipe	Avenue 196	County Road 112 to Highway 99	--	12	New	1,400
P-123	Pipe	Avenue 196	Pipeline across Highway 99	--	12	New	400
P-123A	Casing (1)	Avenue 196	Crossing across Highway 99	--	12/24	New	250
P-124	Pipe	Hosfield Drive	Highway 99 to Laspina St	--	12	New	3,350
P-125	Pipe	Pratt Street	Clinton Ave to s/o Clinton Ave	--	12	New	2,700
P-126	Pipe	w/o Enterprise Street	Prosperity Ave to Pleasant Ave	--	12	New	2,700
P-127	Pipe	w/o Enterprise Street	Zumwalt Ave to Prosperity Ave	--	12	New	2,600
P-128	Pipe	Zumwalt Avenue	w/o Enterprise St to w/o West St	--	12	New	3,900
P-129	Pipe	Alpine Avenue	Morrison St to e/o Morrison St	--	12	New	900
P-130	Pipe	e/o Morrison Street	Alpine Ave to Ave 228	--	12	New	450
P-131	Pipe	Avenue 228	e/o Morrison St to Oakmore St	--	12	New	1,350
P-132	Pipe	Tulare Avenue	Morrison St to Oakmore St	--	12	New	2,200
P-133	Pipe	Oakmore Street	Tulare Ave to Ave 228	--	12	New	2,750
P-134	Pipe	Oakmore Street	Ave 228 to Bardsley Ave	--	12	New	2,600
P-135	Pipe	Bardsley Avenue	Oakmore St to w/o Oakmore St	--	12	New	2,200
P-136	Pipe	Oakmore Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-137	Pipe	Tulare Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	3,850
P-138	Pipe	w/o Enterprise Street	Pleasant Ave to Tulare Ave	--	12	New	2,700
P-139	Pipe	Inyo Avenue	Road 88 to w/o Road 88	6	12	Replace	800
P-140	Pipe	Inyo Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	2,950
P-141	Pipe	w/o Enterprise Street	Tulare Ave to Inyo Ave	--	12	New	2,600
P-142	Pipe	Bardsley Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	3,900
P-143	Pipe	w/o Enterprise Street	Inyo Ave to Bardsley Ave	--	12	New	2,600
P-144	Pipe	West Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,700
P-145	Pipe	Cartmill Avenue	w/o West St to West St	--	12	New	2,650
P-146	Pipe	Cartmill Avenue	West St to E St	--	12	New	2,650
P-147	Pipe	w/o West Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-148	Pipe	Cartmill Avenue	w/o Enterprise St to w/o West St	--	12	New	3,900
P-149	Pipe	w/o Enterprise Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-150	Pipe	Oaks Avenue	n/o Cartmill Ave to n/o Cartmill Ave	--	12	New	1,100
P-151	Pipe	w/o Highway 99	Pacific Ave to Oaks Ave	--	12	New	1,300
P-152	Pipe	Pacific Avenue	J St to w/o Gem St	--	12	New	3,950
P-152A	Casing (1)	Pacific Avenue	Crossing across Highway 99	--	12/24	New	250
P-153	Pipe	J Street	nw/o Cartmill Ave to Cartmill Ave	--	12	New	2,650
P-154	Pipe	West Street	Cartmill Ave to Pacific Ave	--	12	New	2,550
P-155	Pipe	Pacific Avenue	West St to J St	--	12	New	28,250
P-156	Pipe	Cartmill Avenue	Oaks St to Gem St	--	12	New	3,100
P-156A	Casing (1)	Cartmill Avenue	Crossing across Highway 99	--	12/24	New	300
P-157	Pipe	w/o Blackstone Avenue	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-158	Pipe	w/o Blackstone Avenue	Pacific Ave to Cartmill Ave	--	12	New	2,550
P-159	Pipe	Pacific Avenue	w/o Gem St to Gem St	--	12	New	1,000
P-160	Pipe	Blackstone Street	Pacific Ave to Cartmill Ave	--	12	New	2,600
P-161	Pipe	Pacific Avenue	Gem St to Blackstone St	--	12	New	2,650
P-162	Pipe	e/o Blackstone Street	Pacific Ave to Cartmill Ave	--	12	New	2,650
P-163	Pipe	Pacific Avenue	Blackstone St to 2,600' w/o Mooney Blvd	--	12	New	2,700
P-164	Pipe	Mooney Boulevard	Pacific Ave to Cartmill Ave	--	12	New	2,600
P-165	Pipe	Pacific Avenue	w/o Mooney Blvd to Mooney Blvd	--	12	New	2,600
P-166	Pipe	Cartmill Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,350
P-167	Pipe	Zumwalt Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,300
P-168	Pipe	e/o Mooney Boulevard	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-169	Pipe	Prosperity Avenue	Mooney Blvd to w/o Morrison St	--	12	New	2,250
P-170	Pipe	e/o Mooney Boulevard	Zumwalt Ave to Prosperity Ave	--	12	New	2,750
P-171	Pipe	Morrison Street	Prosperity Ave to Cross Ave	--	12	New	2,750
P-172	Pipe	Prosperity Avenue	w/o Morrison St to Morrison St	--	12	New	500
P-173	Pipe	e/o Mooney Boulevard	Pacific Ave to Cartmill Ave	--	12	New	2,650
P-174	Pipe	Pacific Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,400
P-175	Pipe	w/o West Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-176	Pipe	s/o Bardsley Avenue	e/o Enterprise St to West St	--	12	New	2,600
P-177	Pipe	w/o West Street	s/o Bardsley Ave to Paige Ave	--	12	New	2,650
P-178	Pipe	Paige Avenue	w/o West St to West St	--	12	New	2,600
P-179	Pipe	Lopes Avenue	Pratt St to e/o Pratt St	--	12	New	2,650
P-180	Pipe	e/o Highway 99	Hosfield Dr to se/o Hosfield Dr	--	12	New	2,500
P-181	Pipe	e/o Highway 99	se/o Hosfield Dr to n/o Ave 184	--	12	New	2,750
P-182	Pipe	County Road 112	Ave 196 to se/o Ave 196	--	12	New	2,750
P-183	Pipe	County Road 112	se/o Ave 196 to nw/o Ave 184	--	12	New	3,100
P-184	Pipe	n/o Avenue 184	County Road 112 to Highway 99	--	12	New	1,300
P-185	Pipe	n/o Avenue 184	Pipeline across Highway 99	--	12	New	550
P-185A	Casing (1)	n/o Avenue 184	Crossing across Highway 99	--	12/24	New	300
P-186	Pipe	Avenue 192	Highway 99 to Road 112	--	12	New	2,050
P-187	Pipe	Road 112	n/o Ave 184 to Hosfield Dr	--	12	New	4,600
P-188	Pipe	County Road 112	nw/o Ave 184 to Ave 184	--	12	New	2,200
P-189	Pipe	e/o Highway 99	Ave 184 to n/o Ave 184	--	12	New	2,600
P-190	Pipe	Avenue 184	County Road 112 to Highway 99	--	12	New	1,050
P-191	Pipe	Avenue 184	Pipeline across Highway 99	--	12	New	250
P-191A	Casing (1)	Avenue 184	Crossing across Highway 99	--	12/24	New	300
P-192	Pipe	Avenue 228	Oakmore St to e/o Road 126	--	12	New	2,650
P-193	Pipe	e/o Road 132	Ave 228 to Bardsley Ave	--	12	New	2,650
P-194	Pipe	Bardsley Avenue	Oakmore St to e/o Road 126	--	12	New	2,650
P-195	Pipe	e/o Road 132	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650
P-196	Pipe	s/o Bardsley Avenue	Oakmore St to e/o Road 126	--	12	New	2,650
P-197	Pipe	Paige Avenue	Oakmore St to e/o Road 126	--	12	New	2,650
P-198	Pipe	Tulare Avenue	Oakmore St to Road 126	--	12	New	1,300
P-199	Pipe	e/o Oakmore Street	Tulare Ave to n/o Tulare Ave	--	12	New	2,550

Table 5.2 Proposed Improvements
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)
P-200	Pipe	Pleasant Avenue	Morrison St to Oakmore St	--	12	New	2,200
P-201	Pipe	Pleasant Avenue	Oakmore St to Road 126	--	12	New	1,300
P-202	Pipe	w/o Road 132	Tulare Ave to Ave 228	--	12	New	2,650
P-203	Pipe	Tulare Avenue	Road 126 to w/o Road 126	--	12	New	1,350
P-204	Pipe	Avenue 229	e/o Road 126 to Road 132	--	12	New	2,600
P-205	Pipe	Road 132	Tulare Ave to Ave 228	--	12	New	2,600
P-206	Pipe	Tulare Avenue	w/o Road 126 to Road 132	--	12	New	2,600
P-207	Pipe	Bardsley Avenue	e/o Road 126 to Road 132	--	12	New	2,600
P-208	Pipe	Road 132	Ave 228 to Bardsley Ave	--	12	New	2,700
P-209	Pipe	e/o Akers Road	Oakdale Ave to Pacific Ave	--	12	New	2,600
P-210	Pipe	Oakdale Avenue	e/o Akers Rd to Blackstone St	--	12	New	3,600
P-211	Pipe	Blackstone Street	Oakdale Ave to Pacific Ave	--	12	New	2,550
P-212	Pipe	Prosperity Avenue	Morrison St to Oakmore St	--	12	New	2,100
P-213	Pipe	Oakmore Street	Prosperity Ave to Zumwalt Ave	--	12	New	2,600
P-214	Pipe	Zumwalt Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,600
P-215	Pipe	Oakmore Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,650
P-216	Pipe	Cartmill Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,600
P-217	Pipe	Oakmore Street	Pacific Ave to Cartmill Ave	--	12	New	2,700
P-218	Pipe	Pacific Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,650
P-219	Pipe	Oakmore Street	Prosperity Ave to Cross Ave	--	12	New	2,900
P-220	Pipe	Avenue 200	Pratt St to e/o Pratt St	--	12	New	2,600
P-221	Pipe	Pratt Street	Ave 200 to n/o Ave 200	--	12	New	2,650
P-222	Pipe	Pratt Street	Ave 200 to s/o Ave 200	--	12	New	2,600
P-223	Pipe	Avenue 196	Pratt St to e/o Pratt St	--	12	New	2,600
P-224	Pipe	w/o Enterprise Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	1,300
P-225	Pipe	s/o Bardsley Avenue	w/o Enterprise St to Enterprise St	--	12	New	1,300
P-226	Pipe	Enterprise Street	s/o Bardsley Ave to n/o Paige Ave	--	12	New	1,300
P-227	Pipe	s/o Bardsley Avenue	Enterprise St to e/o Enterprise St	--	12	New	2,600
P-228	Pipe	West Street	Pacific Ave to Oakdale Ave	--	12	New	2,600
P-229	Pipe	J Street	Pacific Ave to Oakdale Ave	--	12	New	2,700
P-230	Pipe	Oakdale Avenue	West St to J St	--	12	New	2,400
P-231	Pipe	West Street	Oakdale Ave to s/o Ave 260	--	12	New	2,100
P-232	Pipe	J Street	Oakdale Ave to s/o Ave 260	--	12	New	2,200
P-233	Pipe	s/o Avenue 260	West St to J St	--	12	New	1,650
P-234	Pipe	e/o Blackstone Street	Oakdale Ave to Pacific Ave	--	12	New	2,600
P-235	Pipe	Oakdale Avenue	w/o Mooney Blvd to Mooney Blvd	--	12	New	2,700
P-236	Pipe	Oakdale Avenue	Blackstone St to w/o Mooney Blvd	--	12	New	2,700
P-237	Pipe	Mooney Boulevard	Oakdale Ave to Pacific Ave	--	12	New	2,650
P-238	Pipe	Oakdale Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,350
P-239	Pipe	e/o Mooney Boulevard	Oakdale Ave to Pacific Ave	--	12	New	2,700
P-240	Pipe	w/o Road 132	s/o Bardsley Ave to n/o Paige Ave	--	12	New	2,650
P-241	Pipe	Road 132	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,700
P-242	Pipe	s/o Bardsley Avenue	e/o Road 126 to Road 132	--	12	New	2,600
P-243	Pipe	Road 132	s/o Bardsley Ave to Paige Ave	--	12	New	2,650
P-244	Pipe	Paige Avenue	e/o Road 126 to Road 132	--	12	New	2,600
Well Improvements							
W-5	Supply Well (2)	Oakdale Avenue	w/o Gem St	--	1400 gpm	New	--
W-6	Supply Well (2)	Oakdale Avenue	Mooney Blvd	--	1400 gpm	New	--
W-7	Supply Well (2)	Avenue 252	Laspina St	--	1400 gpm	New	--
W-8	Supply Well (2)	Cartmill Avenue	Morrison St	--	1400 gpm	New	--
W-9	Supply Well (2)	Zumwalt Avenue	e/o Gem St	--	1400 gpm	New	--
W-10	Supply Well (2)	Cartmill Avenue	w/o J St	--	1400 gpm	New	--
W-11	Supply Well (2)	Cartmill Avenue	w/o Enterprise St	--	1400 gpm	New	--
W-12	Supply Well (2)	Zumwalt Avenue	w/o West St	--	1400 gpm	New	--
W-13	Supply Well (2)	Prosperity Avenue	Sacramento St	--	1400 gpm	New	--
W-14	Supply Well (2)	Prosperity Avenue	Mooney Blvd	--	1400 gpm	New	--
W-15	Supply Well (2)	Prosperity Avenue	Oakmore St	--	1400 gpm	New	--
W-16	Supply Well (2)	w/o Enterprise Street	Pleasant Ave	--	1400 gpm	New	--
W-17	Supply Well (2)	Oakmore Street	State Highway 137	--	1400 gpm	New	--
W-18	Supply Well (2)	n/o Bardsley Avenue	e/o Oakmore St	--	1400 gpm	New	--
W-19	Supply Well (2)	State Highway 137	w/o Enterprise Ave	--	1400 gpm	New	--
W-20	Supply Well (2)	s/o Bardsley Avenue	e/o Enterprise Ave	--	1400 gpm	New	--
W-21	Supply Well (2)	1st Street	w/o K St	--	1400 gpm	New	--
W-22	Supply Well (2)	Levin Avenue	Foster Dr	--	1400 gpm	New	--
W-23	Supply Well (2)	Bardsley Avenue	Morrison St	--	1400 gpm	New	--
W-24	Supply Well (2)	e/o Oakmore Street	Levin Ave	--	1400 gpm	New	--
W-25	Supply Well (2)	Pratt Street	Paige Ave	--	1400 gpm	New	--
W-26	Supply Well (2)	County Road 112	s/o Paige Ave	--	1400 gpm	New	--
W-27	Supply Well (2)	Oakmore Street	Paige Ave	--	1400 gpm	New	--
W-28	Supply Well (2)	e/o Laspina St	sw/o Turner Dr	--	1400 gpm	New	--
W-29	Supply Well (2)	Pratt Street	Clinton Ave	--	1400 gpm	New	--
W-30	Supply Well (2)	e/o Laspina Street	n/o Hosfield Dr	--	1400 gpm	New	--
W-31	Supply Well (2)	e/o Pratt Street	Ave 200	--	1400 gpm	New	--
W-32	Supply Well (2)	Avenue 196	County Road 112	--	1400 gpm	New	--
W-33	Supply Well (2)	e/o Highway 99	s/o Hosfield Dr	--	1400 gpm	New	--
Tank Improvements							
T-4	Tank (2)	Prosperity Avenue	Prosperity Ave and Sacramento St	--	5.0 MG	New	--
T-5	Tank (2)	Pratt Street	Clinton Ave and Pratt St	--	4.0 MG	New	--
T-6	Tank (2)	e/o Laspina Street	n/o Hosfield Dr	--	4.0 MG	New	--

Notes:
1. Proposed casings size and carrier pipe size.
2. Final location of future tanks and groundwater wells to be determined.

- **Future Development Related** - Facilities necessary to serve future growth, or facility is required to extend potable water service to a new development area.

Table 5.3 provides a summary of the proposed improvement by project prioritization.

Table 5.3 Project Prioritization
Water System Master Plan
City of Tulare

Priority	Improvement Number
Existing Higher Priority - Facility is required to maintain adequate pressures in a large tributary area.	P-1, P-2, P-7, P-17 through P-21, P-23 through P-25, P-27 through P-35, W-1 through W-13, T-1 through T-3
Existing Lower Priority - Low pressure conditions in an isolated area.	P-3 through P-6, P-8 through P-16, P-22, P-26
Future Development Related - Facilities necessary to serve future growth, or facility is required to extend potable water service to a new development area.	P-36 through P-247, W-14 through W-52, T-4 through T-6

5.3.1 Highest Priority Improvements

Selected improvement projects were identified out of the higher priority improvements as the most critical and are summarized below:

- **Supply Wells (W-1 through W-13)**. The construction of four new wells is recommended to maintain a supply capacity that is sufficient to reliably meet existing MDDs with the two largest wells serving as standby.
- **Storage Tank (T-1)**. In order to supply adequate pressure during fireflows, it is recommended that a one MG elevated tank be constructed in the industrial region of the City.
- **Pipelines P-1, P-2, P-7, and P-27**. These improvements are necessary to create a large diameter water main loop on Bardsley Avenue, West Street, Inyo Avenue, and E Street. This loop will alleviate low pressures in the area under PHD and fire flow conditions.

CAPITAL IMPROVEMENT PROGRAM

This chapter presents the recommended Capital Improvement Program (CIP) for the City of Tulare (City) water distribution system. The projects are based on the evaluation of the City's water distribution system, and on the recommended projects described in the previous chapters. The CIP has been prepared to assist the City in planning and constructing the water system improvements through the planning year 2030.

6.1 COST ESTIMATING ACCURACY

The cost estimates presented in the CIP have been prepared for general master planning purposes and for guidance in project evaluation and implementation. Final costs of a project will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as: preliminary alignments, investigation of alternative routings, and detailed utility and topography surveys.

The Association for the Advancement of Cost Engineering (AACE) defines three types of cost estimates:

- **An Order of Magnitude Estimate for Master Plan Studies**. This is an approximate estimate made without detailed engineering data. It is normally expected that an estimate of this type would be accurate within +50 percent to -30 percent.
- **A Budget Estimate for Predesign Study**. A budget estimate is prepared with the use of flow sheets, layouts, and equipment details. It is normally expected that an estimate of this type would be accurate within +30 percent to -15 percent.
- **A Definite Estimate (Engineer's Estimate) for Time of Contract Bidding**. This estimate is prepared from very defined engineering data. The data includes fairly complete plot plans and elevations, soil data, and a complete set of specs. It is expected that a definite estimate would be accurate within +15 to -5 percent.

Costs developed for this study should be considered "order of magnitude" and have an expected accuracy range of +50 percent to -30 percent. The purpose of this chapter is to present the assumptions used in developing order of magnitude cost estimates for facilities recommended with this master plan. Recommended facility improvements, which will address current deficiencies and facilities required to meet future City needs, are presented within the body of the report.

6.2 COST ESTIMATING CRITERIA

The cost estimates presented in this study are developed from bid tabulations, cost curves, information obtained from previous studies, and Carollo Engineers, P.C. (Carollo)

experience on other projects. The costs estimated for each recommended facility are included in the CIP tables developed with this study. The tables are intended to be used to facilitate revisions to the City's CIP and ultimately to support determination of the user rates and connection impact fees.

6.2.1 Pipeline Unit Costs

Pipeline improvements to the City range in size from approximately 8-inches to 12-inches in diameter. Unit costs are given in Table 6.1. Construction of pipelines in undeveloped areas will likely cost less than those constructed in developed areas, such as downtown. To account for this, two separate unit cost schedules were developed. Schedule A is applied to pipeline projects in developed areas, whereas Schedule B is applied to currently undeveloped areas. Schedule B unit costs have been assumed to equal to half of the schedule A costs, based on data provided by City staff.

Table 6.1 Pipeline Costs
Water System Master Plan
City of Tulare

	Unit Cost[1] ($/linear foot)	
Pipe Size (inches)	**Schedule A (Developed)**	**Schedule B (Developed)**
8	87	43
10	109	54
12	129	65

Note:
1. ENR CCI = 8,362 (20-City Average, August 2008)

6.2.2 Wells, Tanks, and Booster Pumps Stations

Construction unit costs were developed for elevated storage tanks, ground level storage tanks and booster pumps, and groundwater wells. The unit costs associated with these facilities are included in Table 6.2.

It should be noted that the cost to construct an elevated storage tank is greater than the cost to construct a ground level storage tank. However, because ground level tanks require the construction of booster pump stations with backup generators and variable frequency drives, the total construction cost of either type of storage tank would be similar in most applications. For this reason, this master plan uses a uniform cost for both elevated and ground level storage tanks.

6.2.3 Land Acquisition

Acquisition of property, easements, and right-of-way (ROW) will be required for some new wells and tanks, but not pipelines because it was assumed that public ROW will be utilized wherever possible. Land costs in Tulare County are not easily determined, particularly in the master-planning phase, and variables affecting properties can result in widely varying land prices. Since land acquisition costs are not included in this master plan, the final capital costs may vary from the estimates presented herein.

Table 6.2 Facility Construction Unit Costs
Water System Master Plan
City of Tulare

Facility	Unit Cost
Elevated Storage Tank and Ground Level Storage Tank with Booster Pump Station =	$1.25 per gallon of storage
Groundwater Supply Wells =	$500,000 per 1 mgd of capacity

Note:
1. ENR CCI = 8,362 (20-City Average, August 2008)

6.2.4 Construction Cost Adjustments

Costs estimated for this study were adjusted utilizing the Engineering News Record (ENR) Cost Construction Index (CCI). The ENR CCI is the primary index utilized by the planning and engineering community to adjust cost estimates developed in different years. The costs estimated in this chapter are in year 2008 dollars, based on an ENR CCI of 8,362 (August 2008, 20-City Average).

6.3 CAPITAL IMPROVEMENT PROGRAM

The CIP for this master plan is presented in Table 6.3. Cost related contingencies are provided below.

6.3.1 Baseline Construction Cost

This is the total estimated construction cost, in dollars, of the proposed improvements. Baseline Construction Costs were calculated according to the following:

- **Pipe Unit Cost**: Estimated unit cost of pipeline is based on the pipe's present day cost. The cost is expressed in dollars per linear foot ($/LF) of pipe length.
- **Pipe Cost**: Estimated cost of the pipeline, calculated by multiplying the estimated length by the unit cost, in dollars.

Other Infrastructure Facilities Costs: Estimated lump sum costs. Used for tanks, wells, and other similar facilities.

Table 6.3 Capital Improvement Program
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)	Capital Improv. Cost [3] ($)	Capital Improvement Program: Phase I 2008-10 ($)	Phase II 2011-15 ($)	Phase III 2016-20 ($)	Phase IV 2021-25 ($)	Phase V 2026-2030 ($)	Financing: Future Users Benefit (%)	Total Capital Cost ($)	Future Users Cost ($)	Existing Users Cost ($)
Existing System Improvements																	
Pipeline Improvements																	
P-1	Pipe	Bardsley Avenue	West St to E St	4,8	12	Replace	4,200	847,000	847,000					0%	847,000	0	847,000
P-2	Pipe	West Street	Inyo Ave to Bardsley Ave	4,8	12	Replace	2650	534,000	534,000					0%	534,000	0	534,000
P-3	Pipe	Sacramento Street	Sonora Ave to Bardsley Ave	4	8	Replace	1,600	217,000	217,000					0%	217,000	0	217,000
P-4	Pipe	Elm Street	Sacramento St to Walter St	--	8	New	350	47,000	47,000					0%	47,000	0	47,000
P-5	Pipe	Elm Street	Walter St to Pratt St	4	8	Replace	1,400	190,000	190,000					0%	190,000	0	190,000
P-6	Pipe	Alpine Avenue	Mooney Blvd to connection e/o Mooney Blvd	--	12	New	150	30,000	30,000					0%	30,000	0	30,000
P-7	Pipe	E Street	Bardsley Ave to Inyo Ave	4, 6, 8	12	Replace	2,900	585,000	585,000					0%	585,000	0	585,000
P-8	Pipe	Sonora Avenue	E St to D St	4	8	Replace	500	67,000	67,000					0%	67,000	0	67,000
P-9	Pipe	Gem Street	Terrace Ave to Cross Ave	4	10	Replace	2,100	356,000	356,000					0%	356,000	0	356,000
P-10	Pipe	Cherry Street	Cross Ave to Tulare Ave	4	10	Replace	2,000	339,000	339,000					0%	339,000	0	339,000
P-11	Pipe	Tulare Avenue	Cherry St to Alleyway w/o O St	4,6,8	10	Replace	1,150	195,000	195,000					0%	195,000	0	195,000
P-12	Pipe	Highland Street	Pine Dr to San Joaquin Ave	4	8	Replace	950	128,000	128,000					0%	128,000	0	128,000
P-13	Pipe	San Joaquin Avenue	Blackstone St to Cherry St	4	8	Replace	1,950	264,000	264,000					0%	264,000	0	264,000
P-14	Pipe	R Street	Kern Ave to Sonora Ave	4	8	Replace	1,300	176,000	176,000					0%	176,000	0	176,000
P-15	Pipe	Cardoza Drive	Bardsley Ave to n/o Bardsley Ave	6	12	Replace	450	90,000	90,000					0%	90,000	0	90,000
P-16	Pipe	Almond Avenue	K St to e/o K St	--	12	New	70	14,000	14,000					0%	14,000	0	14,000
P-17	Pipe	Goodin Avenue, County Road 112	K St to County Road 112, then south to Olson Ave	--	12	New	1,200	242,000	242,000					0%	242,000	0	242,000
P-17A	Casing [1]	County Road 112	Crossing under Railroad	--	12/24	New	300	406,000	406,000					0%	406,000	0	406,000
P-18	Pipe	County Road 112	Olson Ave to Rankin Ave	4	12	Replace	2,000	402,000	402,000					0%	402,000	0	402,000
P-19	Pipe	Blackstone Street	Commercial Ave to n/o Commercial Ave	--	12	New	1,100	222,000	222,000					0%	222,000	0	222,000
P-20	Pipe	Paige Avenue	Blackstone St to w/o Blackstone St	--	12	New	1,400	282,000	282,000					0%	282,000	0	282,000
P-21	Pipe	Blackstone Street	Paige Ave to s/o Paige Ave	--	12	New	2,250	454,000	454,000					0%	454,000	0	454,000
P-22	Pipe	Walnut Avenue	O St to K St	6	12	Replace	900	181,000	181,000					0%	181,000	0	181,000
P-23	Pipe	Levin Avenue	Blackstone St to O St	8	12	Replace	2,650	534,000	534,000					0%	534,000	0	534,000
P-24	Pipe	Levin Avenue	O St to K St	6	12	Replace	550	111,000	111,000					0%	111,000	0	111,000
P-25	Pipe	s/o Paige Avenue	K St to Blackstone St	8,10	12	Replace	2,150	434,000	434,000					0%	434,000	0	434,000
P-26	Pipe	Sonora Avenue	Blackstone St to w/o Blackstone St	6,8	10	Replace	200	34,000	34,000					0%	34,000	0	34,000
P-27	Pipe	Inyo Avenue	Los Angeles St to E St	2, 4, 8	8	Replace	3,000	406,000	406,000					0%	406,000	0	406,000
P-28	Pipe	Prosperity Avenue	West St to Sacramento St	--	12	New	650	131,000	131,000					0%	131,000	0	131,000
P-29	Pipe	M Street	Prosperity Ave to Garfield Ave	8	12	Replace	3,550	716,000	716,000					0%	716,000	0	716,000
P-30	Pipe	Prosperity Avenue	M St to w/o Williams St	8	12	Replace	1,000	201,000	201,000					0%	201,000	0	201,000
P-31	Pipe	Prosperity Avenue	Oaks St to w/o Williams St	--	12	New	500	101,000	101,000					0%	101,000	0	101,000
P-32	Pipe	Gem Street	Washington Ave to Sandra Ave	6	10	Replace	300	51,000	51,000					0%	51,000	0	51,000
P-33	Pipe	w/o Blackstone Avenue	Zumwalt Ave to Washington Ave	--	12	New	500	101,000	101,000					0%	101,000	0	101,000
P-33A	Casing [1]	w/o Blackstone Avenue	Crossing across Highway 99	--	12/24	New	400	541,000	541,000					0%	541,000	0	541,000
P-34	Pipe	Zumwalt Avenue	Gem St to Retherford St	--	12	New	1,250	253,000	253,000					0%	253,000	0	253,000
P-35	Pipe	Retherford Street	Leland Ave to n/o Leland Ave	--	12	New	600	122,000	122,000					0%	122,000	0	122,000
Well Improvements																	
W-1	Supply Well [4]	E Street	E St and Lemonwood Ave	--	1400 gpm	New	--	1,560,000	1,560,000					0%	1,560,000	0	1,560,000
W-2	Supply Well [4]	Laspina Street	ne/o Laspina St and Ave 200	--	1400 gpm	New	--	1,560,000	1,560,000					0%	1,560,000	0	1,560,000
W-3	Supply Well [4]	se/o Modac Avenue	sw/o Foster Dr and Turner Dr	--	1400 gpm	New	--	1,560,000	1,560,000					0%	1,560,000	0	1,560,000
W-4	Supply Well [4]	Paige Avenue	w/o K St	--	1400 gpm	New	--	1,560,000	1,560,000					0%	1,560,000	0	1,560,000
Tank Improvements																	
T-1	Tank [4]	Paige Avenue	Paige Ave and K St	--	1.0 MG	New	--	1,950,000	1,950,000					0%	1,950,000	0	1,950,000
T-2	Tank [4]	Bardsley Avenue	Bardsley Ave and Morrison St	--	6.0 MG	New	--	11,700,000	11,700,000					0%	11,700,000	0	11,700,000
T-3	Tank [4]	e/o Highway 99	e/o Highway 99 and s/o Cartmill Ave	--	5.0 MG	New	--	9,750,000	9,750,000					0%	9,750,000	0	9,750,000
Existing System Improvements Subtotal																	
						Existing System Improvements Subtotal		**$39,644,000**	**$39,644,000**						**$39,644,000**	**$0**	**$39,644,000**
Future System Improvements																	
Pipeline Improvements																	
P-36	Pipe	Haven Street	Alpline Ave to Bardsley Ave	--	12	New	1,000	201,000		201,000				100%	201,000	201,000	0
P-37	Pipe	Mooney Boulevard	s/o Prosperity Ave to Cross Ave	--	12	New	950	192,000		192,000				100%	192,000	192,000	0
P-38	Pipe	Zumwalt Avenue	West St to e/o West St	--	12	New	2,000	402,000		402,000				100%	402,000	402,000	0
P-39	Pipe	West Street	Zumwalt Ave to Prosperity Ave	--	12	New	2,650	534,000		534,000				100%	534,000	534,000	0
P-40	Pipe	w/o West Street	Zumwalt Ave to Prosperity Ave	--	12	New	2,650	534,000				534,000		100%	534,000	534,000	0
P-41	Pipe	Zumwalt Avenue	w/o West St to West St	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-42	Pipe	E Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,700	544,000		544,000				100%	544,000	544,000	0
P-43	Pipe	Cartmill Avenue	E St to J St	--	12	New	850	172,000			172,000			100%	172,000	172,000	0
P-44	Pipe	Cartmill Avenue	J St to w/o Oaks St	--	12	New	1,400	282,000			282,000			100%	282,000	282,000	0

Table 6.3 Capital Improvement Program
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)	Capital Improv. Cost [3] ($)	Capital Improvement Program: Phase I 2008-10 ($)	Phase II 2011-15 ($)	Phase III 2016-20 ($)	Phase IV 2021-25 ($)	Phase V 2026-2030 ($)	Financing: Future Users Benefit (%)	Total Capital Cost ($)	Future Users Cost ($)	Existing Users Cost ($)
P-45	Pipe	J Street	Cartmill Ave to ne/o Zumwalt Ave	--	12	New	1,750	353,000			353,000			100%	353,000	353,000	0
P-46	Pipe	Mitchell Avenue	Alcott St to J St	--	12	New	150	30,000		30,000				100%	30,000	30,000	0
P-47	Pipe	Zumwalt Avenue	E St to J St	--	12	New	1,300	262,000		262,000				100%	262,000	262,000	0
P-48	Pipe	Zumwalt Avenue	Retherford St to Blackstone St	--	12	New	1,350	271,000		271,000				100%	271,000	271,000	0
P-49	Pipe	Blackstone Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,600	524,000		524,000				100%	524,000	524,000	0
P-50	Pipe	Cartmill Avenue	Blackstone St to e/o Blackstone St	--	12	New	2,150	434,000		434,000				100%	434,000	434,000	0
P-51	Pipe	Cartmill Avenue	Mooney Blvd to w/o Mooney Blvd	--	12	New	1,600	323,000		323,000				100%	323,000	323,000	0
P-52	Pipe	Mooney Boulevard	Cartmill Ave to Zumwalt Ave	--	12	New	2,650	534,000		534,000				100%	534,000	534,000	0
P-53	Pipe	Zumwalt Avenue	Mooney Blvd to w/o Mooney Blvd	--	12	New	1,500	303,000		303,000				100%	303,000	303,000	0
P-54	Pipe	Prosperity Avenue	Mooney Blvd to w/o Mooney Blvd	--	12	New	600	122,000			122,000			100%	122,000	122,000	0
P-55	Pipe	Mooney Boulevard	Zumwalt Ave to Prosperity Ave	--	12	New	2,750	554,000		554,000				100%	554,000	554,000	0
P-56	Pipe	Morrison Street	Cross Ave to Tulare Ave	--	12	New	2,700	544,000			544,000			100%	544,000	544,000	0
P-57	Pipe	Pleasant Avenue	Morrison St to w/o Morrison St	--	12	New	1,700	343,000			343,000			100%	343,000	343,000	0
P-58	Pipe	e/o Mooney Boulevard	Bardsley Ave to n/o Bardsley Ave	--	12	New	1,950	393,000		393,000				100%	393,000	393,000	0
P-59	Pipe	w/o West Street	Pleasant Ave to Tulare Ave	--	12	New	2,700	544,000			544,000			100%	544,000	544,000	0
P-60	Pipe	Tulare Avenue	e/o Enterprise St to w/o West St	--	12	New	1,000	201,000			201,000			100%	201,000	201,000	0
P-61	Pipe	w/o West Street	Tulare Ave to Inyo Ave	--	12	New	2,600	524,000			524,000			100%	524,000	524,000	0
P-62	Pipe	w/o West Street	Sonora Ave to Bardsley Ave	--	12	New	1,450	292,000				292,000		100%	292,000	292,000	0
P-63	Pipe	Bardsley Avenue	e/o Enterprise St to West St	--	12	New	2,650	534,000				534,000		100%	534,000	534,000	0
P-64	Pipe	Pleasant Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	2,450	495,000				495,000		100%	495,000	495,000	0
P-65	Pipe	e/o Enterprise Street	Prosperity Ave to Pleasant Ave	--	12	New	2,700	544,000				544,000		100%	544,000	544,000	0
P-66	Pipe	Pratt Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-67	Pipe	Pratt Street	s/o Bardsley Ave to Paige Ave	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-68	Pipe	s/o Bardsley Avenue	Pratt St to e/o Pratt St	--	12	New	700	140,000			140,000			100%	140,000	140,000	0
P-69	Pipe	w/o I St	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,700	544,000		544,000				100%	544,000	544,000	0
P-70	Pipe	s/o Bardsley Avenue	I St to w/o I St	--	12	New	1,300	262,000		262,000				100%	262,000	262,000	0
P-71	Pipe	w/o I St	s/o Bardsley Ave to Paige Ave	--	12	New	2,700	544,000		544,000				100%	544,000	544,000	0
P-72	Pipe	Paige Avenue	E St to w/o I St	--	12	New	1,250	253,000		253,000				100%	253,000	253,000	0
P-73	Pipe	w/o I St	Paige Ave to 600' s/o Paige Ave	--	12	New	650	131,000		131,000				100%	131,000	131,000	0
P-74	Pipe	600 ft s/o Paige Avenue	w/o I St to County Road 112	--	12	New	1,900	382,000		382,000				100%	382,000	382,000	0
P-75	Pipe	600 ft s/o Paige Avenue	County Road 112 to K St	--	12	New	800	161,000		161,000				100%	161,000	161,000	0
P-76	Pipe	E Street	Ave 216 to proposed well s/o Lemonwood Ave	--	12	New	1,350	271,000		271,000				100%	271,000	271,000	0
P-77	Pipe	Paige Avenue	Pratt St to E St	--	12	New	1,350	271,000		271,000				100%	271,000	271,000	0
P-78	Pipe	West Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-79	Pipe	s/o Bardsley Avenue	West St to Pratt St	--	12	New	2,550	513,000			513,000			100%	513,000	513,000	0
P-80	Pipe	West Street	s/o Bardsley Ave to Paige Ave	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-81	Pipe	Paige Avenue	West St to Pratt St	--	12	New	2,550	513,000			513,000			100%	513,000	513,000	0
P-82	Pipe	se/o Laspina St	Laspina St to e/o Laspina St	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-83	Pipe	e/o Laspina Street & Tex Drive	Proposed Well (W-28) to TMSC Property Line	--	12	New	450	90,000					90,000	100%	90,000	90,000	0
P-84	Pipe	se/o Laspina St	Golf Course to TMSC Property Line	--	12	New	1,850	373,000					373,000	100%	373,000	373,000	0
P-85	Pipe	n/o Tex Drive	1,600' e/o Laspina St to 2,400' e/o Laspina St	10	12	Replace	850	172,000					172,000	100%	172,000	172,000	0
P-86	Pipe	se/o Laspina St	e/o Laspina St to w/o Turner Dr	--	12	New	2,450	495,000					495,000	100%	495,000	495,000	0
P-87	Pipe	Turner Drive	900' se/o Foster Dr to 2,900' se/o Foster Dr	--	12	New	2,050	413,000					413,000	100%	413,000	413,000	0
P-88	Pipe	Turner Drive	Stub se/o P-87	--	12	New	200	41,000					41,000	100%	41,000	41,000	0
P-89	Pipe	Turner Drive	Stub sw/o P-87	--	12	New	200	41,000					41,000	100%	41,000	41,000	0
P-90	Pipe	e/o Mooney Boulevard	Levin Ave to Bardsley Ave	--	12	New	2,600	524,000		524,000				100%	524,000	524,000	0
P-91	Pipe	s/o Bardsley Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,500	504,000		504,000				100%	504,000	504,000	0
P-92	Pipe	s/o Bardsley Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,650	534,000		534,000				100%	534,000	534,000	0
P-93	Pipe	Oakmore Street	Levin Ave to Paige Ave	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-94	Pipe	Mooney Boulevard/Turner Drive	s/o Mooney Blvd to Turner Dr	--	12	New	1,950	393,000		393,000				100%	393,000	393,000	0
P-95	Pipe	se/o Foster Drive	Turner Dr to w/o Oakmore St	--	12	New	2,100	423,000				423,000		100%	423,000	423,000	0
P-96	Pipe	s/o Levin Avenue	w/o Oakmore St to Oakmore St	--	12	New	2,700	544,000				544,000		100%	544,000	544,000	0
P-97	Pipe	se/o Foster Drive	Turner Dr to ne/o Turner Dr	--	12	New	3,700	746,000				746,000		100%	746,000	746,000	0
P-98	Pipe	Laspina Street	Rankin Ave to n/o Rankin Ave	--	12	New	1,650	332,000				332,000		100%	332,000	332,000	0
P-99	Pipe	Rankin Avenue	Laspina St to w/o Highway 99	--	12	New	4,600	927,000				927,000		100%	927,000	927,000	0
P-99A	Casing [1]	Rankin Avenue	Crossing across Highway 99	--	12/24	New	250	339,000				339,000		100%	339,000	339,000	0
P-100	Pipe	Laspina Street	Hosfield Dr to 1,000' nw/o Hosfield Dr	--	12	New	950	192,000					192,000	100%	192,000	192,000	0
P-101	Pipe	J Street	Paige Ave to Goodin Ave	--	12	New	3,400	685,000			685,000			100%	685,000	685,000	0
P-102	Pipe	ne/o Rankin Ave	Proposed Tank (T-6) to TMSC Property Line	--	12	New	1,350	271,000				271,000		100%	271,000	271,000	0
P-103	Pipe	Cartmill Avenue	Gem St to Blackstone St	--	12	New	2,650	534,000		534,000				100%	534,000	534,000	0
P-104	Pipe	Prosperity Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	3,550	716,000				716,000		100%	716,000	716,000	0
P-105	Pipe	Pratt Street	n/o Wade Ave to Paige Ave	--	12	New	2,650	534,000		534,000				100%	534,000	534,000	0
P-106	Pipe	n/o Wade Avenue	e/o Pratt St to County Road 112	--	12	New	3,500	705,000		705,000				100%	705,000	705,000	0

Table 6.3 Capital Improvement Program
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)	Capital Improv. Cost [3] ($)	Capital Improvement Program: Phase I 2008-10 ($)	Phase II 2011-15 ($)	Phase III 2016-20 ($)	Phase IV 2021-25 ($)	Phase V 2026-2030 ($)	Financing: Future Users Benefit (%)	Total Capital Cost ($)	Future Users Cost ($)	Existing Users Cost ($)
P-107	Pipe	n/o Wade Avenue	Pratt St to E St	--	12	New	1,350	271,000		271,000				100%	271,000	271,000	0
P-108	Pipe	West Street	Paige Ave to s/o Paige Ave	--	12	New	2,700	544,000			544,000			100%	544,000	544,000	0
P-109	Pipe	s/o Paige Avenue	West St to Pratt St	--	12	New	2,550	513,000			513,000			100%	513,000	513,000	0
P-110	Pipe	Avenue 208	County Road 112 to w/o County Road 112	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-111	Pipe	Avenue 208	Pratt St to w/o County Road 112	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-112	Pipe	Pratt Street	n/o Wade Ave to Ave 208	--	12	New	2,600	524,000		524,000				100%	524,000	524,000	0
P-113	Pipe	Avenue 208	West St to Pratt St	--	12	New	2,500	504,000			504,000			100%	504,000	504,000	0
P-114	Pipe	West Street	s/o Paige Ave to Ave 208	--	12	New	2,500	504,000			504,000			100%	504,000	504,000	0
P-115	Pipe	Avenue 200	County Road 112 to e/o Pratt St	--	12	New	3,700	746,000				746,000		100%	746,000	746,000	0
P-116	Pipe	e/o Pratt Street	Ave 200 to n/o Ave 200	--	12	New	2,700	544,000			544,000			100%	544,000	544,000	0
P-117	Pipe	e/o Pratt Street	Clinton Ave to s/o Clinton Ave	--	12	New	2,700	544,000			544,000			100%	544,000	544,000	0
P-118	Pipe	Lopes Avenue	County Road 112 to e/o Pratt St	--	12	New	3,150	635,000			635,000			100%	635,000	635,000	0
P-119	Pipe	e/o Pratt Street	Ave 200 to s/o Ave 200	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-120	Pipe	County Road 112	Rankin Ave to Ave 196	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-121	Pipe	Avenue 196	County Road 112 to e/o Pratt St	--	12	New	4,300	867,000					867,000	100%	867,000	867,000	0
P-122	Pipe	Avenue 196	County Road 112 to Highway 99	--	12	New	1,400	282,000					282,000	100%	282,000	282,000	0
P-123	Pipe	Avenue 196	Pipeline across Highway 99	--	12	New	400	81,000					81,000	100%	81,000	81,000	0
P-123A	Casing [1]	Avenue 196	Crossing across Highway 99	--	12/24	New	250	339,000					339,000	100%	339,000	339,000	0
P-124	Pipe	Hosfield Drive	Highway 99 to Laspina St	--	12	New	3,350	675,000					675,000	100%	675,000	675,000	0
P-125	Pipe	Pratt Street	Clinton Ave to s/o Clinton Ave	--	12	New	2,700	544,000			544,000			100%	544,000	544,000	0
P-126	Pipe	w/o Enterprise Street	Prosperity Ave to Pleasant Ave	--	12	New	2,700	544,000				544,000		100%	544,000	544,000	0
P-127	Pipe	w/o Enterprise Street	Zumwalt Ave to Prosperity Ave	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-128	Pipe	Zumwalt Avenue	w/o Enterprise St to w/o West St	--	12	New	3,900	786,000					786,000	100%	786,000	786,000	0
P-129	Pipe	Alpine Avenue	Morrison St to e/o Morrison St	--	12	New	900	181,000		181,000				100%	181,000	181,000	0
P-130	Pipe	e/o Morrison Street	Alpine Ave to Ave 228	--	12	New	450	90,000		90,000				100%	90,000	90,000	0
P-131	Pipe	Avenue 228	e/o Morrison St to Oakmore St	--	12	New	1,350	271,000		271,000				100%	271,000	271,000	0
P-132	Pipe	Tulare Avenue	Morrison St to Oakmore St	--	12	New	2,200	443,000		443,000				100%	443,000	443,000	0
P-133	Pipe	Oakmore Street	Tulare Ave to Ave 228	--	12	New	2,750	554,000		554,000				100%	554,000	554,000	0
P-134	Pipe	Oakmore Street	Ave 228 to Bardsley Ave	--	12	New	2,600	524,000			524,000			100%	524,000	524,000	0
P-135	Pipe	Bardsley Avenue	Oakmore St to w/o Oakmore St	--	12	New	2,200	443,000			443,000			100%	443,000	443,000	0
P-136	Pipe	Oakmore Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-137	Pipe	Tulare Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	3,850	775,000			775,000			100%	775,000	775,000	0
P-138	Pipe	w/o Enterprise Street	Pleasant Ave to Tulare Ave	--	12	New	2,700	544,000				544,000		100%	544,000	544,000	0
P-139	Pipe	Inyo Avenue	Road 88 to w/o Road 88	6	12	Replace	800	161,000			161,000			100%	161,000	161,000	0
P-140	Pipe	Inyo Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	2,950	594,000			594,000			100%	594,000	594,000	0
P-141	Pipe	w/o Enterprise Street	Tulare Ave to Inyo Ave	--	12	New	2,600	524,000				524,000		100%	524,000	524,000	0
P-142	Pipe	Bardsley Avenue	w/o Enterprise St to e/o Enterprise St	--	12	New	3,900	786,000				786,000		100%	786,000	786,000	0
P-143	Pipe	w/o Enterprise Street	Inyo Ave to Bardsley Ave	--	12	New	2,600	524,000				524,000		100%	524,000	524,000	0
P-144	Pipe	West Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,700	544,000			544,000			100%	544,000	544,000	0
P-145	Pipe	Cartmill Avenue	w/o West St to West St	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-146	Pipe	Cartmill Avenue	West St to E St	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-147	Pipe	w/o West Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-148	Pipe	Cartmill Avenue	w/o Enterprise St to w/o West St	--	12	New	3,900	786,000					786,000	100%	786,000	786,000	0
P-149	Pipe	w/o Enterprise Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-150	Pipe	Oaks Avenue	n/o Cartmill Ave to n/o Cartmill Ave	--	12	New	1,100	222,000					222,000	100%	222,000	222,000	0
P-151	Pipe	w/o Highway 99	Pacific Ave to Oaks Ave	--	12	New	1,300	262,000					262,000	100%	262,000	262,000	0
P-152	Pipe	Pacific Avenue	J St to w/o Gem St	--	12	New	3,950	796,000					796,000	100%	796,000	796,000	0
P-152A	Casing [1]	Pacific Avenue	Crossing across Highway 99	--	12/24	New	250	339,000					339,000	100%	339,000	339,000	0
P-153	Pipe	J Street	nw/o Cartmill Ave to Cartmill Ave	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-154	Pipe	West Street	Cartmill Ave to Pacific Ave	--	12	New	2,550	513,000					513,000	100%	513,000	513,000	0
P-155	Pipe	Pacific Avenue	West St to J St	--	12	New	28,250	5,694,000					5,694,000	100%	5,694,000	5,694,000	0
P-156	Pipe	Cartmill Avenue	Oaks St to Gem St	--	12	New	3,100	626,000		626,000				100%	626,000	626,000	0
P-156A	Casing [1]	Cartmill Avenue	Crossing across Highway 99	--	12/24	New	300	406,000		406,000				100%	406,000	406,000	0
P-157	Pipe	w/o Blackstone Avenue	Cartmill Ave to Zumwalt Ave	--	12	New	2,650	534,000		534,000				100%	534,000	534,000	0
P-158	Pipe	w/o Blackstone Avenue	Pacific Ave to Cartmill Ave	--	12	New	2,550	513,000			513,000			100%	513,000	513,000	0
P-159	Pipe	Pacific Avenue	w/o Gem St to Gem St	--	12	New	1,000	201,000			201,000			100%	201,000	201,000	0
P-160	Pipe	Blackstone Street	Pacific Ave to Cartmill Ave	--	12	New	2,600	524,000			524,000			100%	524,000	524,000	0
P-161	Pipe	Pacific Avenue	Gem St to Blackstone St	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-162	Pipe	e/o Blackstone Street	Pacific Ave to Cartmill Ave	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-163	Pipe	Pacific Avenue	Blackstone St to 2,600' w/o Mooney Blvd	--	12	New	2,700	544,000			544,000			100%	544,000	544,000	0
P-164	Pipe	Mooney Boulevard	Pacific Ave to Cartmill Ave	--	12	New	2,600	524,000				524,000		100%	524,000	524,000	0
P-165	Pipe	Pacific Avenue	w/o Mooney Blvd to Mooney Blvd	--	12	New	2,600	524,000				524,000		100%	524,000	524,000	0
P-166	Pipe	Cartmill Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,350	474,000					474,000	100%	474,000	474,000	0

Table 6.3 Capital Improvement Program
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)	Capital Improv. Cost [3] ($)	Capital Improvement Program: Phase I 2008-10 ($)	Phase II 2011-15 ($)	Phase III 2016-20 ($)	Phase IV 2021-25 ($)	Phase V 2026-2030 ($)	Financing: Future Users Benefit (%)	Total Capital Cost ($)	Future Users Cost ($)	Existing Users Cost ($)
P-167	Pipe	Zumwalt Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,300	463,000				463,000		100%	463,000	463,000	0
P-168	Pipe	e/o Mooney Boulevard	Cartmill Ave to Zumwalt Ave	--	12	New	2,650	534,000				534,000		100%	534,000	534,000	0
P-169	Pipe	Prosperity Avenue	Mooney Blvd to w/o Morrison St	--	12	New	2,250	454,000			454,000			100%	454,000	454,000	0
P-170	Pipe	e/o Mooney Boulevard	Zumwalt Ave to Prosperity Ave	--	12	New	2,750	554,000				554,000		100%	554,000	554,000	0
P-171	Pipe	Morrison Street	Prosperity Ave to Cross Ave	--	12	New	2,750	554,000			554,000			100%	554,000	554,000	0
P-172	Pipe	Prosperity Avenue	w/o Morrison St to Morrison St	--	12	New	500	101,000			101,000			100%	101,000	101,000	0
P-173	Pipe	e/o Mooney Boulevard	Pacific Ave to Cartmill Ave	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-174	Pipe	Pacific Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,400	484,000				484,000		100%	484,000	484,000	0
P-175	Pipe	w/o West Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-176	Pipe	s/o Bardsley Avenue	e/o Enterprise St to West St	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-177	Pipe	w/o West Street	s/o Bardsley Ave to Paige Ave	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-178	Pipe	Paige Avenue	w/o West St to West St	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-179	Pipe	Lopes Avenue	Pratt St to e/o Pratt St	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-180	Pipe	e/o Highway 99	Hosfield Dr to se/o Hosfield Dr	--	12	New	2,500	504,000					504,000	100%	504,000	504,000	0
P-181	Pipe	e/o Highway 99	se/o Hosfield Dr to n/o Ave 184	--	12	New	2,750	554,000					554,000	100%	554,000	554,000	0
P-182	Pipe	County Road 112	Ave 196 to se/o Ave 196	--	12	New	2,750	554,000					554,000	100%	554,000	554,000	0
P-183	Pipe	County Road 112	se/o Ave 196 to nw/o Ave 184	--	12	New	3,100	626,000					626,000	100%	626,000	626,000	0
P-184	Pipe	n/o Avenue 184	County Road 112 to Highway 99	--	12	New	1,300	262,000					262,000	100%	262,000	262,000	0
P-185	Pipe	n/o Avenue 184	Pipeline across Highway 99	--	12	New	550	111,000					111,000	100%	111,000	111,000	0
P-185A	Casing [1]	n/o Avenue 184	Crossing across Highway 99	--	12/24	New	300	406,000					406,000	100%	406,000	406,000	0
P-186	Pipe	Avenue 192	Highway 99 to Road 112	--	12	New	2,050	413,000					413,000	100%	413,000	413,000	0
P-187	Pipe	Road 112	n/o Ave 184 to Hosfield Dr	--	12	New	4,600	927,000					927,000	100%	927,000	927,000	0
P-188	Pipe	County Road 112	nw/o Ave 184 to Ave 184	--	12	New	2,200	443,000					443,000	100%	443,000	443,000	0
P-189	Pipe	e/o Highway 99	Ave 184 to n/o Ave 184	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-190	Pipe	Avenue 184	County Road 112 to Highway 99	--	12	New	1,050	212,000					212,000	100%	212,000	212,000	0
P-191	Pipe	Avenue 184	Pipeline across Highway 99	--	12	New	250	50,000					50,000	100%	50,000	50,000	0
P-191A	Casing [1]	Avenue 184	Crossing across Highway 99	--	12/24	New	300	406,000					406,000	100%	406,000	406,000	0
P-192	Pipe	Avenue 228	Oakmore St to e/o Road 126	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-193	Pipe	e/o Road 132	Ave 228 to Bardsley Ave	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-194	Pipe	Bardsley Avenue	Oakmore St to e/o Road 126	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-195	Pipe	e/o Road 132	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-196	Pipe	s/o Bardsley Avenue	Oakmore St to e/o Road 126	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-197	Pipe	Paige Avenue	Oakmore St to e/o Road 126	--	12	New	2,650	534,000				534,000		100%	534,000	534,000	0
P-198	Pipe	Tulare Avenue	Oakmore St to Road 126	--	12	New	1,300	262,000					262,000	100%	262,000	262,000	0
P-199	Pipe	e/o Oakmore Street	Tulare Ave to n/o Tulare Ave	--	12	New	2,550	513,000					513,000	100%	513,000	513,000	0
P-200	Pipe	Pleasant Avenue	Morrison St to Oakmore St	--	12	New	2,200	443,000					443,000	100%	443,000	443,000	0
P-201	Pipe	Pleasant Avenue	Oakmore St to Road 126	--	12	New	1,300	262,000					262,000	100%	262,000	262,000	0
P-202	Pipe	w/o Road 132	Tulare Ave to Ave 228	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-203	Pipe	Tulare Avenue	Road 126 to w/o Road 126	--	12	New	1,350	271,000					271,000	100%	271,000	271,000	0
P-204	Pipe	Avenue 229	e/o Road 126 to Road 132	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-205	Pipe	Road 132	Tulare Ave to Ave 228	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-206	Pipe	Tulare Avenue	w/o Road 126 to Road 132	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-207	Pipe	Bardsley Avenue	e/o Road 126 to Road 132	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-208	Pipe	Road 132	Ave 228 to Bardsley Ave	--	12	New	2,700	544,000					544,000	100%	544,000	544,000	0
P-209	Pipe	e/o Akers Road	Oakdale Ave to Pacific Ave	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-210	Pipe	Oakdale Avenue	e/o Akers Rd to Blackstone St	--	12	New	3,600	725,000					725,000	100%	725,000	725,000	0
P-211	Pipe	Blackstone Street	Oakdale Ave to Pacific Ave	--	12	New	2,550	513,000					513,000	100%	513,000	513,000	0
P-212	Pipe	Prosperity Avenue	Morrison St to Oakmore St	--	12	New	2,100	423,000					423,000	100%	423,000	423,000	0
P-213	Pipe	Oakmore Street	Prosperity Ave to Zumwalt Ave	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-214	Pipe	Zumwalt Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,600	524,000				524,000		100%	524,000	524,000	0
P-215	Pipe	Oakmore Street	Cartmill Ave to Zumwalt Ave	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-216	Pipe	Cartmill Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-217	Pipe	Oakmore Street	Pacific Ave to Cartmill Ave	--	12	New	2,700	544,000					544,000	100%	544,000	544,000	0
P-218	Pipe	Pacific Avenue	e/o Mooney Blvd to Oakmore St	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-219	Pipe	Oakmore Street	Prosperity Ave to Cross Ave	--	12	New	2,900	585,000					585,000	100%	585,000	585,000	0
P-220	Pipe	Avenue 200	Pratt St to e/o Pratt St	--	12	New	2,600	524,000				524,000		100%	524,000	524,000	0
P-221	Pipe	Pratt Street	Ave 200 to n/o Ave 200	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-222	Pipe	Pratt Street	Ave 200 to s/o Ave 200	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-223	Pipe	Avenue 196	Pratt St to e/o Pratt St	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-224	Pipe	w/o Enterprise Street	Bardsley Ave to s/o Bardsley Ave	--	12	New	1,300	262,000					262,000	100%	262,000	262,000	0
P-225	Pipe	s/o Bardsley Avenue	w/o Enterprise St to Enterprise St	--	12	New	1,300	262,000					262,000	100%	262,000	262,000	0
P-226	Pipe	Enterprise Street	s/o Bardsley Ave to n/o Paige Ave	--	12	New	1,300	262,000					262,000	100%	262,000	262,000	0
P-227	Pipe	s/o Bardsley Avenue	Enterprise St to e/o Enterprise St	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0

Table 6.3 Capital Improvement Program
Water System Master Plan
City of Tulare

Improvement No.	Type of Improv.	Description/ Street	Description / Limits	Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Parallel/ Replace/ New	Length (ft)	Capital Improv. Cost [3] ($)	Capital Improvement Program: Phase I 2008-10 ($)	Phase II 2011-15 ($)	Phase III 2016-20 ($)	Phase IV 2021-25 ($)	Phase V 2026-2030 ($)	Financing: Future Users Benefit (%)	Total Capital Cost ($)	Future Users Cost ($)	Existing Users Cost ($)
P-228	Pipe	West Street	Pacific Ave to Oakdale Ave	--	12	New	2,600	524,000					524,000	100%	524,000	524,000	0
P-229	Pipe	J Street	Pacific Ave to Oakdale Ave	--	12	New	2,700	544,000					544,000	100%	544,000	544,000	0
P-230	Pipe	Oakdale Avenue	West St to J St	--	12	New	2,400	484,000					484,000	100%	484,000	484,000	0
P-231	Pipe	West Street	Oakdale Ave to s/o Ave 260	--	12	New	2,100	423,000					423,000	100%	423,000	423,000	0
P-232	Pipe	J Street	Oakdale Ave to s/o Ave 260	--	12	New	2,200	443,000					443,000	100%	443,000	443,000	0
P-233	Pipe	s/o Avenue 260	West St to J St	--	12	New	1,650	332,000					332,000	100%	332,000	332,000	0
P-234	Pipe	e/o Blackstone Street	Oakdale Ave to Pacific Ave	--	12	New	2,600	524,000				524,000		100%	524,000	524,000	0
P-235	Pipe	Oakdale Avenue	w/o Mooney Blvd to Mooney Blvd	--	12	New	2,700	544,000					544,000	100%	544,000	544,000	0
P-236	Pipe	Oakdale Avenue	Blackstone St to w/o Mooney Blvd	--	12	New	2,700	544,000					544,000	100%	544,000	544,000	0
P-237	Pipe	Mooney Boulevard	Oakdale Ave to Pacific Ave	--	12	New	2,650	534,000				534,000		100%	534,000	534,000	0
P-238	Pipe	Oakdale Avenue	Mooney Blvd to e/o Mooney Blvd	--	12	New	2,350	474,000					474,000	100%	474,000	474,000	0
P-239	Pipe	e/o Mooney Boulevard	Oakdale Ave to Pacific Ave	--	12	New	2,700	544,000					544,000	100%	544,000	544,000	0
P-240	Pipe	w/o Road 132	s/o Bardsley Ave to n/o Paige Ave	--	12	New	2,650	534,000			534,000			100%	534,000	534,000	0
P-241	Pipe	Road 132	Bardsley Ave to s/o Bardsley Ave	--	12	New	2,700	544,000					544,000	100%	544,000	544,000	0
P-242	Pipe	s/o Bardsley Avenue	e/o Road 126 to Road 132	--	12	New	2,600	524,000			524,000			100%	524,000	524,000	0
P-243	Pipe	Road 132	s/o Bardsley Ave to Paige Ave	--	12	New	2,650	534,000					534,000	100%	534,000	534,000	0
P-244	Pipe	Paige Avenue	e/o Road 126 to Road 132	--	12	New	2,600	524,000			524,000			100%	524,000	524,000	0
Well Improvements																	
W-5	Supply Well [4]	Oakdale Avenue	w/o Gem St	--	1400 gpm	New	--	1,560,000					1,560,000	100%	1,560,000	1,560,000	0
W-6	Supply Well [4]	Oakdale Avenue	Mooney Blvd	--	1400 gpm	New	--	1,560,000				1,560,000		100%	1,560,000	1,560,000	0
W-7	Supply Well [4]	Avenue 252	Laspina St	--	1400 gpm	New	--	1,560,000			1,560,000			100%	1,560,000	1,560,000	0
W-8	Supply Well [4]	Cartmill Avenue	Morrison St	--	1400 gpm	New	--	1,560,000				1,560,000		100%	1,560,000	1,560,000	0
W-9	Supply Well [4]	Zumwalt Avenue	e/o Gem St	--	1400 gpm	New	--	1,560,000	1,560,000					100%	1,560,000	1,560,000	0
W-10	Supply Well [4]	Cartmill Avenue	w/o J St	--	1400 gpm	New	--	1,560,000			1,560,000			100%	1,560,000	1,560,000	0
W-11	Supply Well [4]	Cartmill Avenue	w/o Enterprise St	--	1400 gpm	New	--	1,560,000					1,560,000	100%	1,560,000	1,560,000	0
W-12	Supply Well [4]	Zumwalt Avenue	w/o West St	--	1400 gpm	New	--	1,560,000				1,560,000		100%	1,560,000	1,560,000	0
W-13	Supply Well [4]	Prosperity Avenue	Sacramento St	--	1400 gpm	New	--	1,560,000		1,560,000				100%	1,560,000	1,560,000	0
W-14	Supply Well [4]	Prosperity Avenue	Mooney Blvd	--	1400 gpm	New	--	1,560,000			1,560,000			100%	1,560,000	1,560,000	0
W-15	Supply Well [4]	Prosperity Avenue	Oakmore St	--	1400 gpm	New	--	1,560,000					1,560,000	100%	1,560,000	1,560,000	0
W-16	Supply Well [4]	w/o Enterprise Street	Pleasant Ave	--	1400 gpm	New	--	1,560,000				1,560,000		100%	1,560,000	1,560,000	0
W-17	Supply Well [4]	Oakmore Street	State Highway 137	--	1400 gpm	New	--	1,560,000		1,560,000				100%	1,560,000	1,560,000	0
W-18	Supply Well [4]	n/o Bardsley Avenue	e/o Oakmore St	--	1400 gpm	New	--	1,560,000					1,560,000	100%	1,560,000	1,560,000	0
W-19	Supply Well [4]	State Highway 137	w/o Enterprise Ave	--	1400 gpm	New	--	1,560,000				1,560,000		100%	1,560,000	1,560,000	0
W-20	Supply Well [4]	s/o Bardsley Avenue	e/o Enterprise Ave	--	1400 gpm	New	--	1,560,000					1,560,000	100%	1,560,000	1,560,000	0
W-21	Supply Well [4]	1st Street	w/o K St	--	1400 gpm	New	--	1,560,000		1,560,000				100%	1,560,000	1,560,000	0
W-22	Supply Well [4]	Levin Avenue	Foster Dr	--	1400 gpm	New	--	1,560,000		1,560,000				100%	1,560,000	1,560,000	0
W-23	Supply Well [4]	Bardsley Avenue	Morrison St	--	1400 gpm	New	--	1,560,000	1,560,000					100%	1,560,000	1,560,000	0
W-24	Supply Well [4]	e/o Oakmore Street	Levin Ave	--	1400 gpm	New	--	1,560,000			1,560,000			100%	1,560,000	1,560,000	0
W-25	Supply Well [4]	Pratt Street	Paige Ave	--	1400 gpm	New	--	1,560,000			1,560,000			100%	1,560,000	1,560,000	0
W-26	Supply Well [4]	County Road 112	s/o Paige Ave	--	1400 gpm	New	--	1,560,000		1,560,000				100%	1,560,000	1,560,000	0
W-27	Supply Well [4]	Oakmore Street	Paige Ave	--	1400 gpm	New	--	1,560,000				1,560,000		100%	1,560,000	1,560,000	0
W-28	Supply Well [4]	e/o Laspina St	sw/o Turner Dr	--	1400 gpm	New	--	1,560,000					1,560,000	100%	1,560,000	1,560,000	0
W-29	Supply Well [4]	Pratt Street	Clinton Ave	--	1400 gpm	New	--	1,560,000			1,560,000			100%	1,560,000	1,560,000	0
W-30	Supply Well [4]	e/o Laspina Street	n/o Hosfield Dr	--	1400 gpm	New	--	1,560,000					1,560,000	100%	1,560,000	1,560,000	0
W-31	Supply Well [4]	e/o Pratt Street	Ave 200	--	1400 gpm	New	--	1,560,000				1,560,000		100%	1,560,000	1,560,000	0
W-32	Supply Well [4]	Avenue 196	County Road 112	--	1400 gpm	New	--	1,560,000					1,560,000	100%	1,560,000	1,560,000	0
W-33	Supply Well [4]	e/o Highway 99	s/o Hosfield Dr	--	1400 gpm	New	--	1,560,000					1,560,000	100%	1,560,000	1,560,000	0
Tank Improvements																	
T-4	Tank [4]	Prosperity Avenue	Prosperity Ave and Sacramento St	--	5.0 MG	New	--	9,750,000		9,750,000				100%	9,750,000	9,750,000	0
T-5	Tank [4]	Pratt Street	Clinton Ave and Pratt St	--	4.0 MG	New	--	7,800,000			7,800,000			100%	7,800,000	7,800,000	0
T-6	Tank [4]	e/o Laspina Street	n/o Hosfield Dr	--	4.0 MG	New	--	7,800,000				7,800,000		100%	7,800,000	7,800,000	0
Future System Improvements Subtotal																	
							Future System Improvements Subtotal		**3,120,000**	**33,498,000**	**41,952,000**	**34,808,000**	**61,640,000**		**175,018,000**	**175,018,000**	**0**
Total City of Tulare CIP																	
							Total City of Tulare CIP	**214,662,000**	**42,764,000**	**33,498,000**	**41,952,000**	**34,808,000**	**61,640,000**		**214,662,000**	**175,018,000**	**39,644,000**

Notes:
1. Proposed casings size and carrier pipe size.
2. Estimated Construction Cost is Baseline Construction Cost plus 30% to account for unforeseen events and unknown conditions.
3. Capital Improvement Cost is Estimated Construction Cost plus 20% to cover other costs including Engineering, Administation, Construction Inspection, and Legal Costs.
4. Final location of future tanks and groundwater wells to be determined.

6.3.2 Estimated Construction Cost

Since knowledge about site-specific conditions of each proposed project is limited at the master planning stage, a 30 percent contingency was applied to the Baseline Construction Cost to account for unforeseen events and unknown conditions.

The Estimated Construction Cost for the proposed improvement consists of the Baseline Construction Cost plus the construction contingency.

6.3.3 Capital Improvement Cost

Other project-related costs have been identified and estimated at 20 percent of the Estimated Construction Costs. These costs include engineering, administration, construction inspection, and legal costs.

The Capital Improvement Cost for each proposed improvement is the total of the Estimated Construction Cost (including contingency) plus the other costs discussed in the previous paragraph.

An example calculation to determine the Capital Improvement Cost is provided as follows:

Example Calculation:

Given:

Baseline Construction Cost = $1,000,000

Required:

Capital Improvement Cost

Solution:

Estimated Construction Cost = (Baseline Construction Cost) x (1 + 0.30)

Estimated Construction Cost = ($1,000,000) x (1 + 0.30)

Estimated Construction Cost = $1,300,000

Capital Improvement Cost = (Estimated Construction Cost) x (1 + 0.20)

Capital Improvement Cost = ($1,300,000) x (1+ 0.20)

Capital Improvement Cost = $1,560,000

6.3.4 Capital Improvement Schedule

The CIP costs were prioritized based on their urgency to meet existing deficiencies and for servicing anticipated growth. It is recommended that improvements to mitigate existing deficiencies be constructed as soon as possible. The recommended improvements to serve future growth have a significant total capital cost that is best distributed based on the order in which the City will develop. The master plan CIP utilizes the following phases:

- **Phase I**. This short-term phase includes improvements that are allocated between 2009 and 2011.
- **Phase II**. This intermediate phase includes improvements that are allocated between 2012 and 2015.
- **Phase III**. This intermediate phase includes improvements that are allocated 2016 and 2020.
- **Phase IV**. This long-term phase includes improvements that are 2021 and 2025.
- **Phase V**. This long-term phase includes improvements that are allocated 2026 and 2030.

Table 6.4 summarizes the master plan capital improvement costs by phase and improvement type.

Table 6.4 Capital Improvement Schedule Water System Master Plan City of Tulare

Improv. Type	Cost (million dollars)					
	Phase I (2009-2011)	**Phase II (2012-2015)**	**Phase III (2016-2020)**	**Phase IV (2021-2025)**	**Phase V (2026-2030)**	**Total**
Pipelines[1]	10.0	7.7	13.7	9.0	22.4	**62.8**
Wells	17.1	17.2	12.5	15.6	18.8	**81.2**
Tanks and Booster Pumps	2.0	0.0	0.0	0.0	0.0	**2.0**
Total	**29.1**	**24.9**	**26.2**	**24.6**	**41.2**	**146.0**

Note:
1. Includes water mains and pipeline casings.

6.4 USER BENEFIT AND COST ALLOCATION

The improvements in this master plan have been classified into two categories:

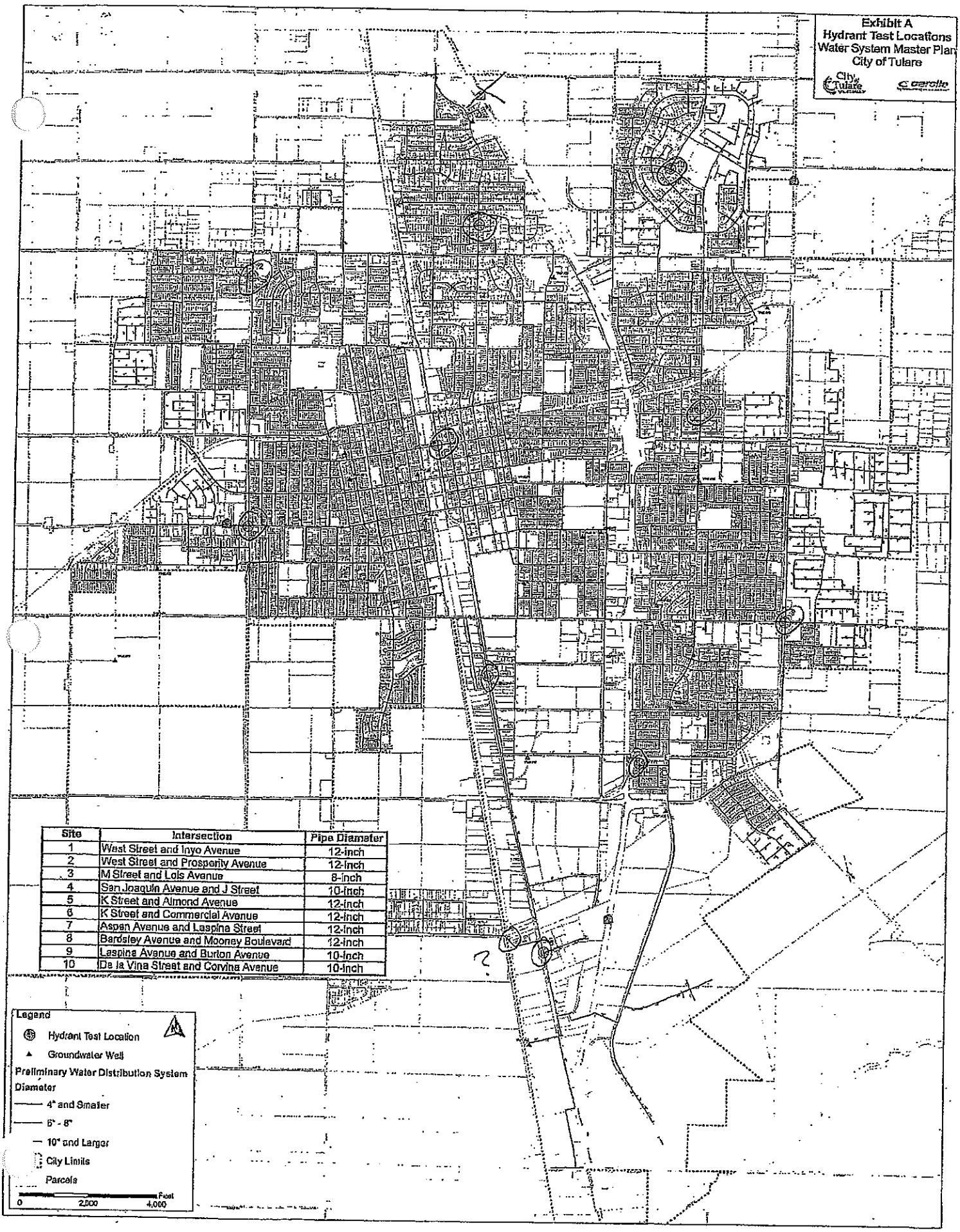
- Services benefiting existing users.
- Services necessitated by or benefiting new development.

An opinion of benefit to existing and future users, based on preliminary project information, was included in this master plan. Once estimates for specific projects are completed, a more precise allocation may be performed if required by the provisions of the California Government Code Section 66000 and AB1600.

Table 6.5 summarizes the master plan capital improvement costs by phase and user type.

Table 6.5	**Capital Improvement Program – Existing and Future Users Water System Master Plan City of Tulare**					
	Cost (million dollars)					
Customer Type	**Phase I (2009-2011)**	**Phase II (2012-2015)**	**Phase III (2016-2020)**	**Phase IV (2021-2025)**	**Phase V (2026-2030)**	**Total**
Existing	29.1	3.1	0.0	0.0	0.0	**32.2**
Future	0.0	21.8	26.2	24.6	41.2	**113.8**
Total	**29.1**	**24.9**	**26.2**	**24.6**	**41.2**	**146.0**

APPENDIX A - APRIL 2008 FIRE HYDRANT TEST DATA



Site	Intersection	Pipe Diameter
1	West Street and Inyo Avenue	12-inch
2	West Street and Prosperity Avenue	12-inch
3	M Street and Lois Avenue	8-inch
4	San Joaquin Avenue and J Street	10-inch
5	K Street and Almond Avenue	12-inch
6	K Street and Commercial Avenue	12-inch
7	Aspen Avenue and Laspina Street	12-inch
8	Bardsley Avenue and Mooney Boulevard	12-inch
9	Laspina Avenue and Burton Avenue	10-inch
10	De la Vina Street and Corvina Avenue	10-inch

Water Utility Division
FIRE HYDRANT
WORK SHEET

Site #1

DATE 4-10-8 HYDRANT # 39B-008

LOCATION WEST & INYO

MFG./ MODEL CLOW YEAR 2005 PORT SIZES #1 2½ #2 4½

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge)

FLOW TEST

STATIC 60 psi RESIDUAL 50 psi PITOT 42 psi

NOTES:

PERSONNEL PERFORMING TEST 613-614

Site #2

DATE 4-10-8 HYDRANT # 30B-041

LOCATION WEST & PROSPERITY

MFG./ MODEL CLOW YEAR 1994 PORT SIZES #1 2½ #2 4½

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge)

FLOW TEST

STATIC 59 psi RESIDUAL 50 psi PITOT 45 psi

NOTES:

PERSONNEL PERFORMING TEST 613-614

Site #3

DATE 4-10-8 HYDRANT # 23C-046

LOCATION "M" ST. & LOIS

MFG./ MODEL RICH VALVE CO YEAR 1979 PORT SIZES #1 2½ #2 4½

SHUT OFF VALVE LOCATION (If not 3' ~~from the curbs edge~~)

FLOW TEST

STATIC 61 psi RESIDUAL 53 psi PITOT 43 psi

NOTES:

PERSONNEL PERFORMING TEST 613/614

Water Utility Division
FIRE HYDRANT
WORK SHEET

Site #4

DATE 4-10-8 HYDRANT # 41A-116

LOCATION SAN JOAQUIN & J ST.

MFG./ MODEL LONG BEACH IRON WORK 611 YEAR 1989 PORT SIZES #1 2½ #2 4½

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge)

FLOW TEST

STATIC 54psi RESIDUAL 48psi PITOT 43 psi

NOTES:

PERSONNEL PERFORMING TEST 613-614

Site #5

DATE 4-10-8 HYDRANT # 50A-040

LOCATION "K" ST & ALMOND (CHESTNUT AVE.)

MFG./ MODEL LONG BEACH IRON WORKS 611 YEAR 1985 PORT SIZES #1 2½ #2 4½

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge)

FLOW TEST

STATIC 61psi RESIDUAL 58 psi PITOT 43 psi

NOTES:

PERSONNEL PERFORMING TEST 613-614

Site #6

DATE 4-10-8 HYDRANT # 59D-00D

LOCATION "K" ST & COMMERCIAL

MFG./ MODEL MUELLER YEAR 1989 PORT SIZES #1 2½ #2 4½

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge)

FLOW TEST

STATIC 52psi RESIDUAL 47 psi PITOT 47 psi

NOTES:

PERSONNEL PERFORMING TEST 613-614

Water Utility Division
FIRE HYDRANT
WORK SHEET

site # 7

DATE 4-10-8 HYDRANT # 51C-010

LOCATION Aspen Ave & Laspina

MFG./ MODEL RICH VALVE YEAR 1980 PORT SIZES #1 2½ #2 4½

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge)

FLOW TEST

STATIC 62psi RESIDUAL 58psi PITOT 48psi

NOTES:

PERSONNEL PERFORMING TEST 613/614

DATE 4-10-8 HYDRANT # 52A-000

LOCATION Bardsley Ave & Mooney Blvd.

site # 8

MFG./ MODEL Clow 5 YEAR 2001 PORT SIZES #1 2½ #2 4½

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge)

FLOW TEST

STATIC 42psi RESIDUAL 40psi PITOT 47psi

NOTES:

PERSONNEL PERFORMING TEST 613/614

DATE 4-10-8 HYDRANT # 33D-017

LOCATION Laspina Ave & Burton Ave.

MFG./ MODEL LONG BEACH IRON WORKS 611 YEAR 1983 PORT SIZES #1 2½ #2 4½

site # 9

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge)

FLOW TEST

STATIC 62psi RESIDUAL 55psi PITOT 45psi

NOTES:

PERSONNEL PERFORMING TEST 613-614

Water Utility Division
FIRE HYDRANT
WORK SHEET

DATE 4-10-8 HYDRANT # 24C-014

LOCATION De la Vina St & Cornina Ave

MFG./ MODEL CLOW 5 YEAR 1990 PORT SIZES #1 2½ #2 4½

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge) _____

Site #10

FLOW TEST

STATIC 50 psi RESIDUAL 49 psi PITOT 46 psi

NOTES: _____

PERSONNEL PERFORMING TEST 613-614

DATE _____ HYDRANT # _____

LOCATION _____

MFG./ MODEL _____ YEAR _____ PORT SIZES #1 _____ #2 _____

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge) _____

FLOW TEST

STATIC _____ RESIDUAL _____ PITOT _____

NOTES: _____

PERSONNEL PERFORMING TEST _____

DATE _____ HYDRANT # _____

LOCATION _____

MFG./ MODEL _____ YEAR _____ PORT SIZES #1 _____ #2 _____

SHUT OFF VALVE LOCATION (If not 3' from the curbs edge) _____

FLOW TEST

STATIC _____ RESIDUAL _____ PITOT _____

NOTES: _____

PERSONNEL PERFORMING TEST _____