CITY OF TULARE

MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

TECHNICAL MEMORANDUM NO. 1

February 4, 2016

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CITY OF TULARE

MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

TECHNICAL MEMORANDUM
NO. 1

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MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

1.0 PROJECT SCOPE

The objective of this Technical Memorandum (TM) is to document the development and evaluation of system improvements that address supply, storage, and capacity deficiencies within the City of Tulare's (City) water supply and distribution system. The specific objectives include:

- Update the hydraulic model and water supply data to reflect recent well operation and relevant changes to the water distribution system.
- Develop short term alternatives for supply, storage, and capacity improvements of the existing water distribution system.
- Prepare a non-cost evaluation for selected alternatives.
- Prepare opinion of probable construction cost for each alternative.
- Develop a recommendation based on each alternatives cost and benefit score.

2.0 BACKGROUND

The City has currently encountered a water supply shortage which is exacerbated by previous commitments to expand its service. The City has also received notifications from the State Water Resources Control Board (State Board) that is requiring the mandatory consolidations of two water distribution services areas outside the city limits. The areas include the Soultz and Matheny Tracks. Both, Soultz and Matheny Tract are small rural County subdivisions bordering the city limits to the west and south. The Matheny Tract's water system is under the management of Pratt Mutual Water Company (Pratt), while Soultz is served by Soultz Mutual Water Company. Furthermore, the City has approved the development of 952 housing units within the service area, of which 147 have been committed to specific developers.

Recently, the City's water distribution system has undergone changes which have influenced the overall performance. A number of wells have been upgraded or repaired to increase efficiency and pipelines have been installed to create loops.

The City contracted with Carollo Engineers (Carollo) to perform an evaluation of the distribution system with the addition of 952 housing units and the Soultz and Matheny Tracts connected. Carollo will use the City's Hydraulic model to develop a number of alternatives that will address system deficiencies, and develop a recommended approach to

increase supply capacity and improve the system's ability to provide adequate pressure during maximum demand conditions.

2.1 Previous Studies

The evaluation performed as part of this TM relies on previous studies conducted for the City, as well as the work conducted in 2015 to update the City's hydraulic model. Improvements within this study expand on recommendations provided in both, the Water System Master Plan (Master Plan) and the Water Model Update, Calibration, and System Analysis (WMUCSA).

- **2009 Water System Master Plan:** In 2007, the City contracted with Carollo to develop a Master Plan. As part of the Master Plan project, Carollo developed a water distribution system hydraulic model that was used to conduct analysis of the distribution system's ability to provide adequate supply and pressure during average day, maximum day, peak hour, and fire flow conditions.

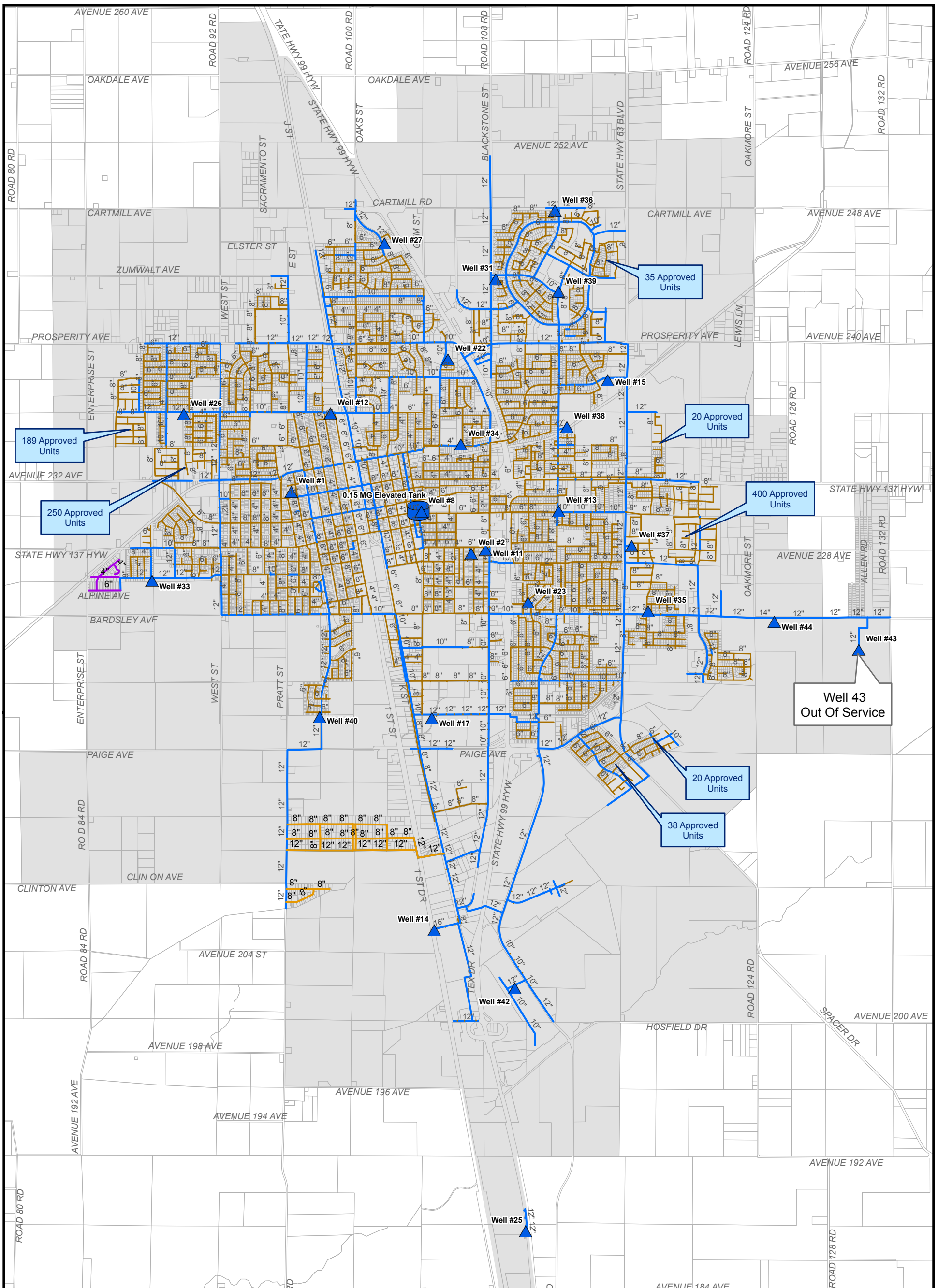
- **Water Model Update, Calibration, and System Analysis (2015):** Carollo updated the City's hydraulic model and performed an extensive model calibration process to ensure that the model simulation results match the operational conditions experienced in the field. Following model calibration, an analysis of the City's distribution system was performed using the calibrated hydraulic model to evaluate the impacts from connecting Pratt. Based on the analysis of the water distribution system, the City is currently faced with a significant supply shortfall. In addition, the City's distribution system lacks sufficient capacity to meet emergency needs.

- **Updated Report on Groundwater Conditions At and Near the City of Tulare:** A groundwater quality report conducted by Kenneth D. Schmidt and Associates (Kenneth Schmidt) was finalized on August 2015. The report summarized groundwater conditions beneath the City and provided recommendations on where additional new City wells should be constructed.

  The report considered two primary factors in determining favorable locations for new wells. They include the thickness of the subsurface layers and the quality of the groundwater. The report cites three chemicals (Nitrate, arsenic, and 1, 2, 3-TCP) as the primary constituents of concern.

3.0 DISTRIBUTION SYSTEM

The City's water distribution system is comprised of over 240 miles of pipeline ranging in size from 2-inches to 16-inches in diameter. Figure 1 illustrates the existing distribution system's pipelines, wells, and storage facility. In addition, the figure provides a general location of the Matheny Tract, Soultz Tract, and approved units.



Legend

- Modeled Water Distribution System
- Groundwater Well
- Tank
- 8" and Smaller
- 10" and Larger
- Soultz Tract
- Matheny Tract
- Parcels
- Urban Development Boundary

N

0 2,000 4,000 Feet

EXISTING WATER DISTRIBUTION SYSTEM WITH PROPOSED CONNECTIONS

FIGURE 1

CITY OF TULARE

MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

carollo

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The City's relies on groundwater as its sole supply source and is pumped by 24 active wells. The oldest well was drilled in 1925 and the most recent in 2009. An additional well (Well 43) is connected to the distribution system, but is currently offline due to excessive levels of nitrate. The City also operates three additional wells (Well 25 at Kraft and Wells 21 and 41 at the Wastewater Treatment Plant) that are not connected to the City's distribution system. Table 1 list the capacity of 24 wells. Overall, the City has a total capacity of 31.95 million gallons per day (mgd) (22,188 gallons per minute [gpm]).

Table 1 Water Supply Wells
Matheny Soultz Water System Improvements
City of Tulare, California

Well No.	Status	Date Drilled	Well Depth (ft)	Horse Power	Capacity (gpm)	Capacity (mgd)	Notes
1	AR	1950	610	125	980	1.4	
2	AR	1947	355	50	363	0.5	
8	AR	1925	460	40	189	0.3	
11	AT	1955	756	150	778	1.1	
12	AR	1960	718	150	1,265	1.8	
13	AR	1964	740	60	695	1.0	
14	AT	1970	720	125	954	1.4	
15	AT	1972	700	100	730	1.1	
17	AR	1974	696	200	1,329	1.9	
22	AT	1976	715	125	929	1.3	
23	AR	1961	430	50	365	0.5	
26	AT	1991	735	200	1,106	1.6	
27	AT	1992	720	200	1,430	2.1	
31	AR	1996	720	50	343	0.5	
33	AT	2001	770	200	859	1.2	
34	AT	2001	766	200	1,131	1.6	
35	AT	2004	780	200	1,150	1.7	
36	AT	2004	620	200	991	1.4	
37	AT	2005	710	200	1,217	1.8	
38	AT	2005	680	200	1,329	1.9	
39	AT	2005	620	125	628	0.9	
40	IT	2009	745	200	1,250	1.8	
42	AT	2008	720	200	1,194	1.7	
44	AT	2009	570	200	983	1.4	
43	AT	2009	550	200	1,398	2.1	Offline - Nitrates
Total Capacity w/o Well 43					**22,188**	**31.95**	
Firm Capacity w/o Well 43 (Total Capacity minus leakage and reserve)					**15,520**	**22.35**	

Notes: AR = Active Ray; AT = Active Treated; IT = Inactive Treated

The City has recently adopted a new firm capacity standard, which is defined as the total capacity minus the combined loss due to leakage and reserve capacity. Based on proxy data received from the City, leakage within the system varies by month and averages 1.14 mgd, which equates to 3.5-percent of total capacity. As a conservative approach, this study assumes a 5-percent loss (1.6 mgd) due to leakage. Reserved capacity is defined as 25-percent of the total supply (8.0 mgd) and is consider a safe guard against capacity loss due to maintenance or unexpected events. The City's firm capacity is estimated at 22.4 mgd.

Due to the relatively minor variations in ground elevation throughout the City limits, the City's water distribution system consists of only one pressure zone. The City's water distribution system also includes a small 150,000 gallon elevated storage tank.

Since the completion of the WMUCSA report, eight wells (Wells 11, 12, 13, 33, 34, 35, 36, and 40) have undergone improvements. With the upgrades and repairs, well capacities have increased and Well 40 is now operational. Overall, the City-wide capacity has increased from 28.5 mgd to 31.95 mgd.

4.0 DEMAND SUMMARY

The WMUCSA report developed City wide demands which were based on the City's Master Plan and five years of historical water consumption data. In addition, it was estimated that a typical single family residential unit would consume approximately 480 gallons per day per dwelling unit (gpd/DU) on an annual basis. This unit factor was utilized to estimate the water demand for 35 dwelling units within Soultz Tract. Demands associated with the Matheny Tract were developed by Provost and Prichard Consulting Group, (Provost and Prichard) and are shown in Table 2.

Currently, the City's Average Day Demand (ADD) is estimated at 10,758 gpm, or 15.5 mgd. The City's maximum day demand (MDD) is estimated to be 20,118 gpm (29.0 mgd), or 1.87 times the ADD. The City's peak hour demand (PHD) is estimated to be 28,165 gpm (40.6 mgd), or 2.62 times the ADD.

Table 2 summarizes the City's water demands under existing conditions and with the incorporation of Matheny Tract, Soultz Tract and additional development. The City-wide demands exclude Kraft plant because it's not connected to the main distribution system. As shown, the additional connections will increase the ADD by 4.6-percent.

Table 2	Water Demand Summary Matheny Soultz Water System Improvements City of Tulare, California					
	Average Day Demand		**Max Day Demand**		**Peak Hour Demand**	
	(gpm)	**(mgd)**	**(gpm)**	**(mgd)**	**(gpm)**	**(mgd)**
Existing System(1)	10,758	15.49	20,118	28.97	28,165	40.56
Matheny Tract(2)	168	0.24	420	0.60	588	0.85
Soultz Tract(3)	12	0.02	22	0.03	31	0.04
952 Approved Units(3)	317	0.46	593	0.85	831	1.20
Total	**11,255**	**16.21**	**21,152**	**30.46**	**29,615**	**42.65**

Notes:

1. Excludes demands associated with the Kraft Plant, which is not connected to the City's main water distribution system.
2. Source: Provost and Pritchard estimates.
3. Based on a unit demand factor of 480 gpd/DU, a MDD/ADD factor of 1.87, and a PHD/ADD factor of 2.62.

5.0 HYDRAULIC MODEL

Hydraulic network analysis is a powerful tool used in all aspects of water distribution system analysis. 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.

Carollo developed the systems hydraulic model as part of the 2009 Mater Plan using the H2OMAP Water Hydraulic Modeling software. In 2015 Carollo recalibrated the hydraulic model to ensure simulated results correspond to conditions within the distribution system.

For this study, the hydraulic model was utilized to evaluate the existing distribution system under various alternatives. The model was updated to include proposed connections and recent pump station upgrades.

6.0 EVALUATION AND PLANNING CRITERIA

The City's water system will be evaluated under a range of normal and emergency operating conditions which are consistent with the Master Plan and WMUCSA report. The evaluation criterion for this report is summarized in Table 3.

Table 3 Distribution System Evaluation Criteria Matheny Soultz Water System Improvements City of Tulare, California		
Description	**Value**	**Units**
Maximum Pressure		
Average Day Demand (ADD)	80	psi
Minimum Pressure		
Maximum Day Demand (MDD)	40	psi
Peak Hour Demand (PHD)	35	psi
Maximum Day Demand + Fire Flow	20	psi
Pipeline Criteria		
Maximum Pipeline Velocity	8	fps
Maximum head loss	10 feet/1,000 feet	-
Per Capita Water Consumption		
Unit Demand Factor	480	gpd/DU
Peaking Factors		
Maximum Day Demand	1.87 x ADD	
Peak Hour Demand	2.62 x ADD	
Supply Capacity		
Firm Capacity(1)	Meet the MDD	
Fire Flows		
Residential	1,500	gpm for 2 hours
Commercial	2,500	gpm for 2 hours
Industrial	3,500	gpm for 3 hours
Storage Volume		
Fire	0.63	MG

Notes:
(1) Firm capacity is defined as the City's total capacity minus the 25 percent reserve capacity.

6.1 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 routine maintenance and emergency situations. The adequate source of supply will consist of groundwater wells with a firm capacity capable of meeting the MDD. As previously discussed, the firm capacity is defined as the total capacity minus the combined loss due to leakage (5 percent) and reserve capacity (25 percent). Upon discussion with City Staff and

for planning purposes, the output of new wells is assumed to be 1.2 mgd. This rate is consistent with the average output of existing active wells within the city.

6.2 Storage Capacity

The storage criteria established by the Master Plan stated the City only required a fire flow storage of 0.63 MG. Operational and emergency storage was deemed unnecessary, given that the City relies on groundwater wells and has the capability of providing back-up generators.

Criteria from the Master Plan was reviewed and compared with typical planning criteria used in similar studies. Upon discussion with City Staff, an agreement to evaluate multiple storage criteria was concluded. The criteria are further discussed in Section 7.2.

6.3 Recommended Well Locations

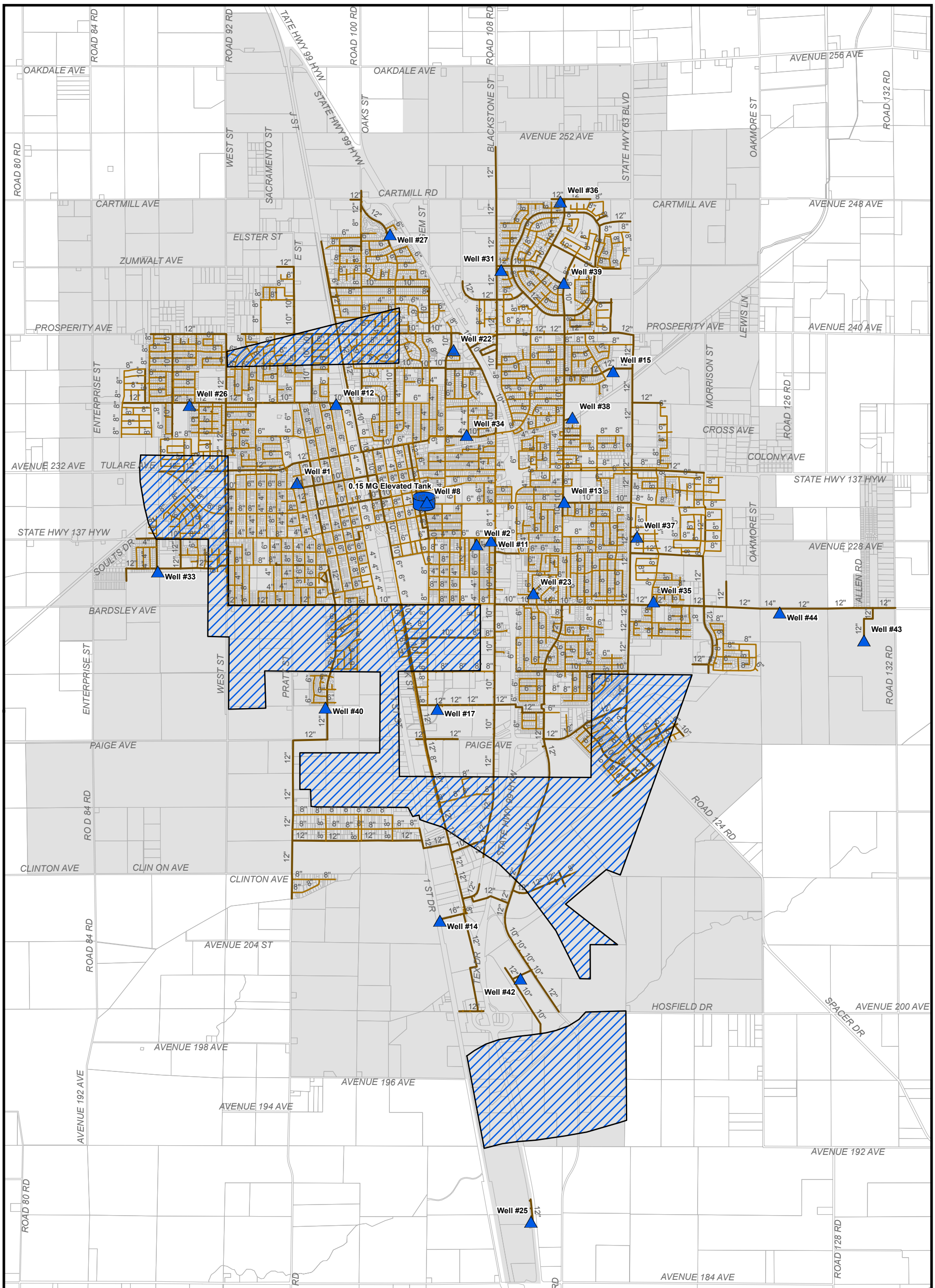
Figure 2 illustrates the general location of areas considered most favorable for construction of new wells and is based on the report provided by Kenneth Schmidt (Schmidt Report). Some areas of the City are within areas that the classified by the Schmidt report as lacking data In addition, the report recommends well placement of at least one half of a mile from existing large capacity wells to avoid drawdown interference. Well locations are not restricted to the areas considered favorable and well locations may be considered for priority growth areas outside of the recommended zones, particularly in the north.

7.0 SYSTEM EVALUATION

This section presents the evaluation results of the system's supply, storage, and distribution infrastructure with the proposed connections.

7.1 Supply Evaluation

The additional water supply requirements for the City under existing demands and with the addition of the approved connections were determined by comparing the available supply with the estimated demands. As shown in Table 4, the deficiency with approved connections is 8.1 mgd, which equates to approximately seven wells at a capacity of 1.2 mgd each.



Legend

- Modeled Water Distribution System
- Groundwater Well
- Tank
- 8" and Smaller
- 10" and Larger
- Favorable Area For New Wells
- Parcels
- Urban Development Boundary

N

0 2,000 4,000 Feet

AREAS CONSIDERED FAVORABLE FOR NEW CITY WELLS

FIGURE 2

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

carollo

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Table 4	Supply and Demand Comparison Matheny Soultz Water System Improvements City of Tulare, California								
	MDD		Firm Capacity(2)		Total Capacity		Deficiency(3)		# of Wells(4)(5)
	gpm	mgd	gpm	mgd	gpm	mgd	gpm	mgd	
Existing System	20,118	29.0	15,520	22.4	22,188	32.0	4,598	6.6	5.5
Existing System + Connections(1)	21,153	30.5	15,520	22.4	22,188	32.0	5,633	8.1	6.75

Notes:

(1) Connections include Matheny, Soultz, and 952 approved units.
(2) Firm capacity is defined as total capacity minus system losses and the 25 percent capacity reserve.
(3) Difference between the MDD and firm capacity.
(4) Number of additional wells to meet the firm capacity.
(5) Well capacity is assumed at 1.2 mgd per well.

Based on the analysis of supply and demand conditions within Table 4, it is recommended that the City install new groundwater wells to increase the total capacity and firm capacity to 40.1 mgd and 30.5 mgd. This increase of approximately 8.1 mgd is equivalent to seven (7) new groundwater wells at 1.2 mgd each.

7.2 Storage Evaluation

The City recently made the decision to move away from using the groundwater basin as operational and emergency storage. As part of this study, Carollo worked with the City to evaluate three separate storage alternatives. The three storage alternatives were developed based on criteria that have been used by other municipalities in California, as well as criteria established by the State Water Resources Control Board's Division of Drinking Water. The three alternatives include:

1. Storage Alternative 1 – 25 percent of MDD for Operational, 0.63 million gallons for fire storage and 50 percent of MDD for Emergency
2. Storage Alternative 2 – 25 percent of MDD for Operational, 0.63 million gallons for fire storage and no emergency storage.
3. Storage Alternative 3 - SWRCB Criteria - System shall meet four hours of peak hourly demand (PHD) with source capacity (wells), storage capacity, and/or emergency source connections

As shown in the following sections, all alternatives present various degrees of storage capacity. The alternatives are summarized below.

7.2.1 Operational, Emergency and Fire Flow Storage

Under this criteria, storage requirements include operational equalization (25 percent of MDD), Emergency (50 percent of ADD), and Fire (0.63 MG). As shown in Table 5, a significant amount of storage is required to maintain operational equalization and emergency storage. An additional 16.21 million gallons of storage would be required to meet this criteria.

Table 5 Storage Capacity with Operational, Emergency and Fire Flow
Matheny Soultz Water System Improvements
City of Tulare, California

			Storage Criteria				
	ADD (mgd)	MDD (mgd)	25 percent of MDD (MG)	50 percent of ADD (MG)	Fire Flow (MG)	Total Required storage (MG)	Capacity Increase (MG)(2)
Existing	15.5	29.0	7.25	7.75	0.63	15.63	15.48
Existing + Connections(1)	16.2	30.5	7.63	8.10	0.63	16.36	16.21

Notes:
(1) Connections include Matheny and Soultz Tracts and 952 approved units.
(2) Capacity increase is determined by subtracting Total Required Storage by 0.15 MG

7.2.2 Operational and Fire Flow Storage

Under this criteria, storage requirements include operational equalization (25 percent of MDD) and Fire (0.63 MG). As shown in Table 6, this option would require the construction of over 8 million gallons of storage.

Table 6 Storage Capacity with Operational and Fire Flow
Matheny Soultz Water System Improvements
City of Tulare, California

		Storage Criteria			
	MDD (mgd)	25 percent of MDD (MG)	Fire Flow (MG)	Total Required storage (MG)	Capacity Increase (MG)(2)
Existing	29.0	7.25	0.63	7.88	7.33
Existing + Connections(1)	30.5	7.63	0.63	8.26	8.11

Notes:
(1) Connections include Matheny and Soultz Tracts and 952 approved units.
(2) Capacity increase is determined by subtracting Total Required Storage by 0.15 MG.

7.2.3 State Required Storage

This criteria would include a storage capacity in compliance with California Code of Regulations (CCRs), California Regulations Related to Drinking Water. According to CCRs Title 22 Chapter 16 Article 64554, New and Existing Source Capacity, “For systems with 1,000 or more service connections, the system shall be able to meet four hours of peak hourly demand (PHD) with source capacity, storage capacity, and/or emergency source connections”.

As shown in Table 7, the storage capacity increase would be approximately 2.5 MGs. This estimate is under the assumption that additional wells would be constructed and increase the existing supply firm capacity from 22.4 mgd to 29.0 mgd for existing and 30.5 mgd with additional connections. As shown, this option would require the construction of 2.5 million gallons of water storage.

Table 7 Storage Capacity under State Requirements Matheny Soultz Water System Improvements City of Tulare, California

	Storage Criteria					
	PHD (mgd)	Firm Capacity(2) (mgd)	Deficient (mgd)	Fire Flow (MG)	Total Required storage(3) (MG)	Capacity Increase (MG)(4)
Existing	40.6	29.0	11.6	0.63	2.56	2.41
Existing + Connections(1)	42.6	30.5	12.1	0.63	2.65	2.50

Notes:
(1) Connections include Matheny and Soultz Tracts and 952 approved units.
(2) Firm capacity is assumed to equal MDD.
(3) Calculated by multiplying 4 hours x deficient (million gallons per hour) + FF.
(4) Capacity increase is the difference between Total Required Storage and 0.15 MG.

7.2.4 Recommended Storage Capacity

Three storage capacity alternatives were developed as part of the evaluation process. Based on the results, it was concluded that Alternative 3 (State criteria) is recommended. This alternatives provides the City with adequate storage capacity to meet demand conditions as a part of a reasonable capital program that can be implemented in a relatively quick time frame. Alternatives 1, and 2 would require significant capital commitments that would require a significantly longer period to implement with no significant decrease in risk to the City's customers. Therefore, a storage capacity of 2.5 MG is recommended.

7.3 Distribution System Analysis

This section presents the results of the system analysis under Maximum Day, Peak Hour Demand (PHD) and fire flow conditions for the existing distribution system. The analysis was conducted with the connection of Matheny Tract, Soultz Tract and the approved units.

7.3.1 Peak Hour Demand

Figure 3 shows the minimum system pressure during the PHD condition. Based on the hydraulic modeling results of the distribution system, there are a number of areas which exceed the minimum pressure criteria. Model results indicate the lowest pressure within the system was 30.62 psi. Previous studies have shown that the addition of Matheny Tract will increase PHD deficiencies.

7.3.2 Max Day Demand + Fire Flow

Hydraulic modeling results indicate that 196 hydrant nodes had residual pressures less than the minimum pressure criteria of 20 psi. Many of these deficiencies are mainly caused by small diameter pipelines that are incapable of providing the required fire flow. Figure 4 highlights the magnitude of deficient hydrants and their general location. As shown, a majority of the deficiencies are located in the central area of the City.

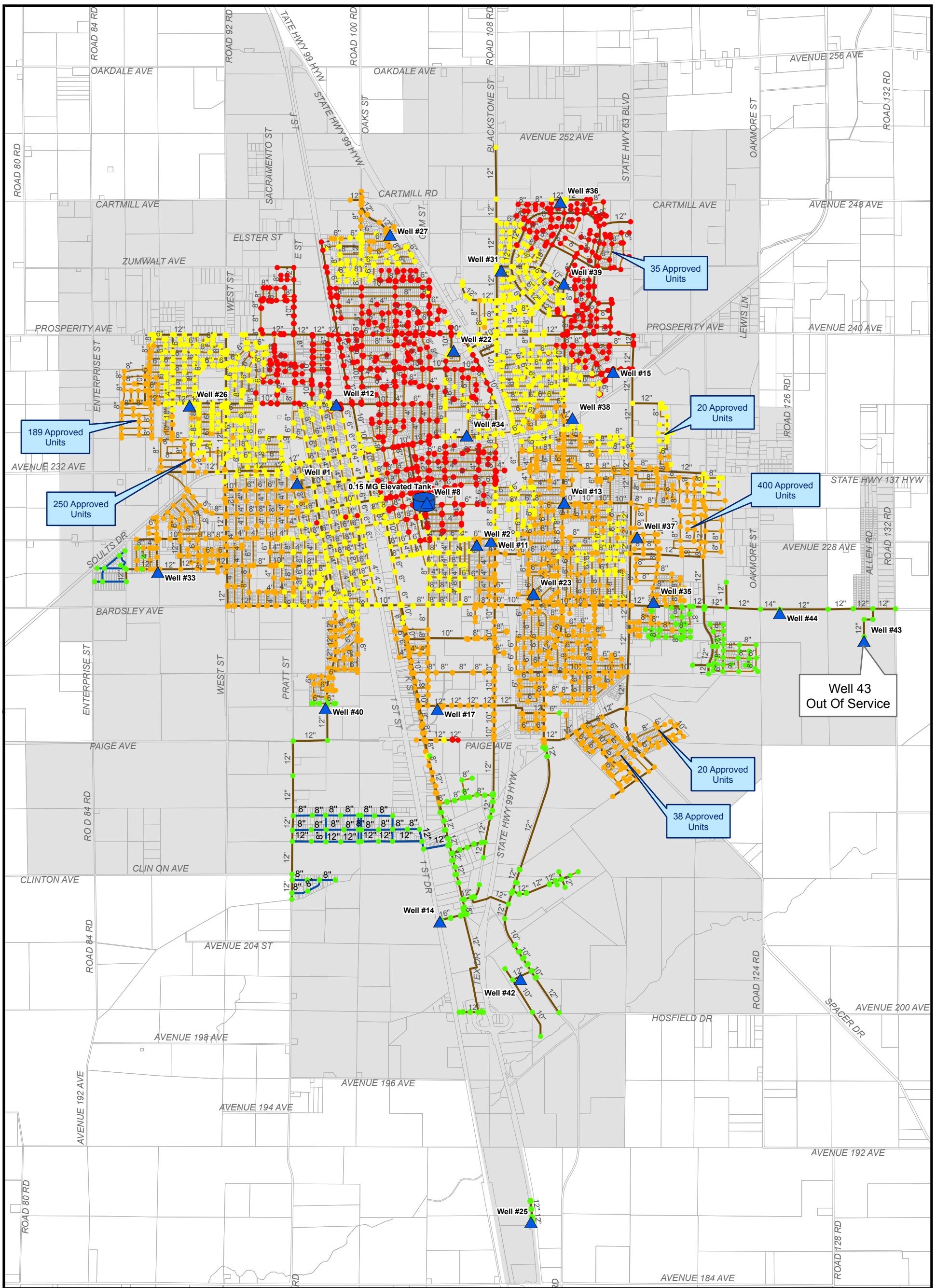
With the implementation of supply and storage improvements, a majority of the fire flow deficiencies remain. The fire flow analysis does not include recommended improvements and associate cost to mitigate the deficiencies.

8.0 IMPROVEMENT ALTERNATIVES

Based on the analysis of the existing system, the distribution system cannot deliver supply at adequate pressure under PHD and MDD plus fire flow conditions. Carollo developed alternatives to mitigate the existing deficiencies based on a review of existing information, previous studies, and hydraulic modeling results. The four alternatives presented within this section are proposed to remedy deficiencies associated with supply, storage, and pipeline capacity.

8.1 Alternative 1 – Northern 2.5 MG Storage Tank

Alternative 1 involves the construction of one storage tank with a capacity of 2.5 million gallons (MGs) and seven wells with a capacity of approximately 1.2 mgd each. The storage tanks will maintain a reserve supply to meet PHD and fire flow storage requirements. The tank will require a booster pump station with a firm capacity of 12.1 mgd and a total capacity of 21.2 mgd. The booster pump station was sized to have a firm capacity capable of pumping the difference between the MDD and the PHD. The new wells are necessary to mitigate the supply deficiency and are located throughout the City. Figure 5 illustrates improvements to mitigate capacity deficiencies and Table 8 summarizes the major infrastructure under this alternative.



Legend

Modeled Water Distribution System

- Groundwater Well
- Tank
- 8" and Smaller
- 10" and Larger

Min. Pressure - PHD

- Less Than 33 psi
- 33 psi to 35 psi
- 35 psi to 40 psi
- Greater Than 40 psi

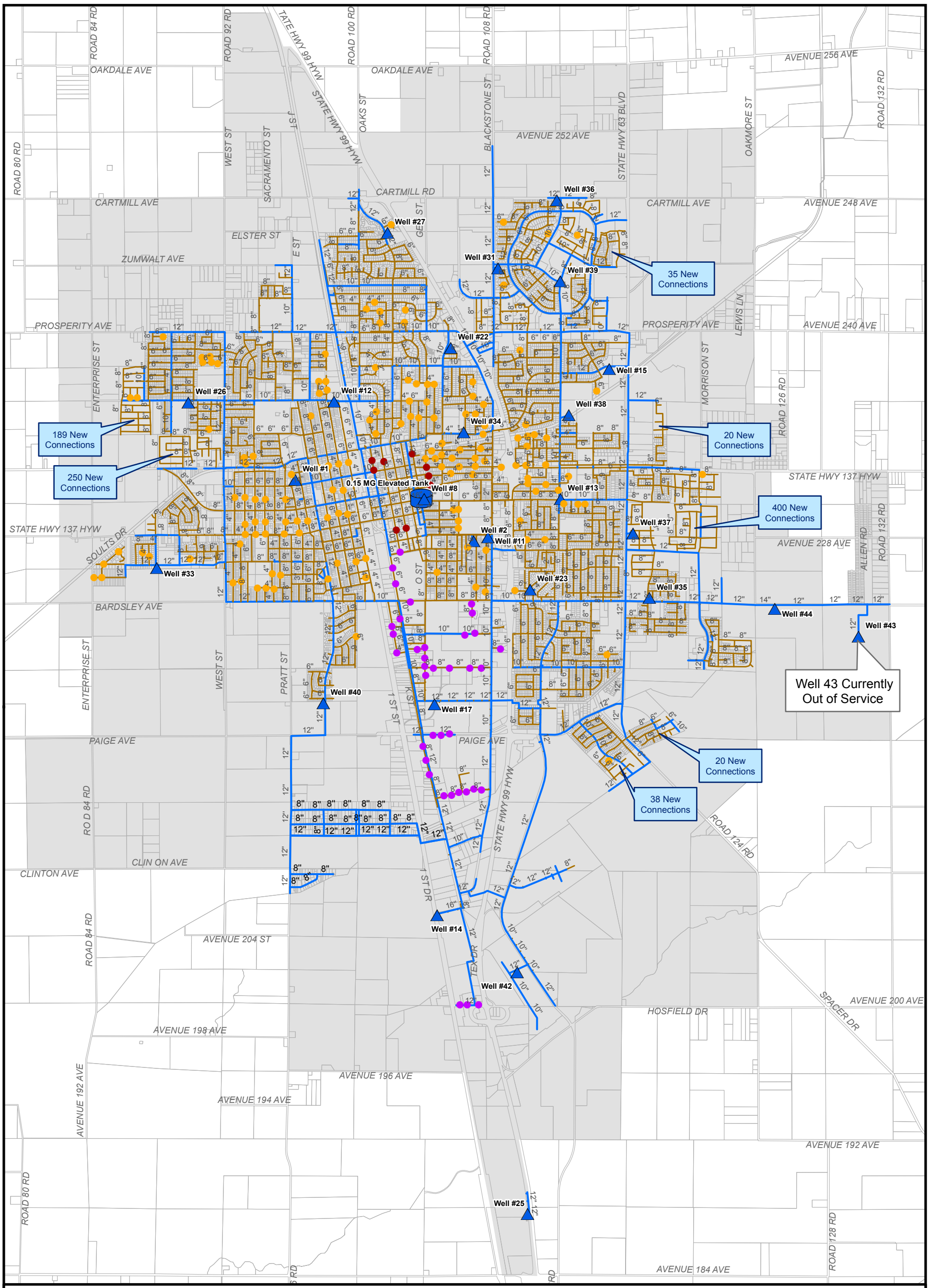
- Matheny/Soultz (Connected)
- Parcels
- Urban Development Boundary

0 2,000 4,000 Feet

PHD PRESSURE DEFICIENCIES WITH APPROVED CONNECTIONS

FIGURE 3

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM RELIABILITY STUDY



MDD + FIRE FLOW DEFICIENCIES W/ APPROVED CONNECTIONS

FIGURE 4

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM RELIABILITY STUDY

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Table 8 Proposed Alternative Summary
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/ Street	Description / Limits[1]	Improvement Category	Project Length/Size and Cost: Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)
Alternative 1								
Pipelines								
P-1-1	Pipe	Prosperity Avenue	E street to West Street	Capacity	12	20	Replace	2,800
P-1-2	Pipe	A Street	Danville Avenue to Prosperity	Capacity	8	10	Replace	700
P-1-3	Pipe	Prosperity Avenue	Sacramento Street to West Street	Capacity	-	20	New	600
P-1-4A	Pipe	East of Zumwalt Street	Cross an open field	Capacity	-	12	New	900
P-1-4B	Pipe/Casing	East of Zumwalt Street	Crosses a railroad track and canal	Capacity	-	12/24	New	300
P-1-5	Pipe	Prosperity Avenue	Intersection of Prosperity and Oaks Street	Capacity	-	12	New	30
P-1-6	Pipe	Tulare Avenue	West of Tulare Avenue and West Street	Capacity	-	12	New	300
P-1-7	Pipe	J Street	Cartmill Avenue to Ester Street	New Service	-	12	New	1,800
P-1-8	Pipe	Cartmill Avenue	J Street to west of Oaks Street	New Service	-	12	New	1,400
P-1-9	Pipe	Cartmill Avenue	Blackstone Street to west of De La Vina Street	New Service	-	12	New	2,200
P-1-10	Pipe	Undeveloped land	Cartmill Avenue to Pacific Avenue	New Service	-	12	New	2,700
P-1-11	Pipe	Pacific Avenue	Near Liberty Elementary to Mooney Boulevard	New Service	-	12	New	2,600
P-1-12	Pipe	Mooney Boulevard	Pacific Avenue to Cartmill avenue	New Service	-	12	New	2,600
P-1-13	Pipe	Cartmill Avenue	Mooney Boulevard to east of De La Vina Street	New Service	-	12	New	1,600
P-1-14A	Pipe	Prosperity Avenue	Mooney Boulevard to west of Morrison Street	New Service	-	12	New	2,000
P-1-14B	Pipe/Casing	Prosperity Avenue	Crossing of Canal	New Service	-	12/24	New	300
P-1-15	Pipe	Morrison Street	Prosperity Avenue to Cross Avenue	New Service	-	12	New	2,800
P-1-16	Pipe	Pleasant Avenue	Morrison Street to west of West Street	New Service	-	12	New	1,700
Storage Tanks and Booster Pumps								
T-1-1	Storage Tank	Prosperity Avenue	Near intersection of Prosperity and A Street	Capacity	-	2.5 MG	New	-
	Booster Pump	Prosperity Avenue	Firm capacity 12.1 mgd, standby 4.0 mgd, FF 5.0 mgd	Capacity	-	640	New	-

Table 8 Proposed Alternative Summary
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/ Street	Description / Limits[1]	Improvement Category	Project Length/Size and Cost: Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)
Groundwater Wells								
W-1-1	Supply Well	J Street	will connect to 12" pipeline in J Street	Capacity	-	1.2 mgd	New	-
W-1-2	Supply Well	Mooney Boulevard	Will connect to 12" pipeline in Mooney Boulevard	Capacity		1.2 mgd	New	-
W-1-3	Supply Well	Bardsley Avenue	Will connect to 12" pipeline in Bardsley Avenue	Capacity		1.2 mgd	New	-
W-1-4	Supply Well	Tulare Avenue	Will connect to 12" pipeline Tulare Avenue	Capacity		1.2 mgd	New	-
W-1-5	Supply Well	Oaks Street	Will connect to 12" pipeline in Oaks Street	Capacity		1.2 mgd	New	-
W-1-6	Supply Well	Pacific Avenue	Will Connect to proposed 12" improvement	Capacity		1.2 mgd	New	-
W-1-7	Supply Well	Morrison street	Will Connect to proposed 12" improvement	Capacity		1.2 mgd	New	-
Alternative 2								
Pipelines								
P-2-1	Pipe	Bardsley Avenue	Mooney Boulevard to Irwin Street	Capacity	12	20	Replace	1,400
P-2-2	Pipe	Bardsley Avenue	Irwin Street to Laspina Street	Capacity	10	20	Replace	1,300
P-2-3	Pipe	Moraine Street	Bardsley Avenue to Ash Avenue	Capacity	4 & 8	10	Replace	300
P-2-4	Pipe	Tulare Avenue	West of Tulare Avenue and West Street	Capacity	-	12	New	295
P-2-5	Pipe	J Street	Cartmill Avenue to Ester Street	New Service	-	12	New	1,800
P-2-6	Pipe	Cartmill Avenue	J Street to west of Oaks Street	New Service	-	12	New	1,400
P-2-7	Pipe	Cartmill Avenue	Blackstone Street to west of De La Vina Street	New Service	-	12	New	2,200
P-2-8	Pipe	Undeveloped land	Cartmill Avenue to Pacific Avenue	New Service	-	12	New	2,700
P-2-9	Pipe	Pacific Avenue	Near Liberty Elementary to Mooney Boulevard	New Service	-	12	New	2,600
P-2-10	Pipe	Mooney Boulevard	Pacific Avenue to Cartmill avenue	New Service	-	12	New	2,600
P-2-11	Pipe	Cartmill Avenue	Mooney Boulevard to east of De La Vina Street	New Service	-	12	New	1,600
P-2-12A	Pipe	Prosperity Avenue	Mooney Boulevard to west of Morrison Street	New Service	-	12	New	2,000
P-2-12B	Pipe/Casing	Prosperity Avenue	Crossing of Canal	New Service	-	12/24	New	300
P-2-13	Pipe	Morrison Street	Prosperity Avenue to Cross Avenue	New Service	-	12	New	2,800
P-2-14	Pipe	Pleasant Avenue	Morrison Street to west of West Street	New Service	-	12	New	1,700

Table 8 Proposed Alternative Summary
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/ Street	Description / Limits[1]	Improvement Category	Project Length/Size and Cost: Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)
Storage Tanks and Booster Pumps								
T-2-1	Storage Tank	Bardsley Avenue	West of Bardsley and Mooney Boulevard	Capacity	-	2.50 MG	New	-
	Booster Pump	Bardsley Avenue	Firm capacity 12.1 mgd, standby 4.0 mgd, FF 5.0 mgd	Capacity	-	603	New	-
Groundwater Wells								
W-2-1	Supply Well	J Street	will connect to 12" pipeline in J Street	Capacity	-	1.2 mgd	New	-
W-2-2	Supply Well	Mooney Boulevard	Will connect to 12" pipeline in Mooney Boulevard	Capacity		1.2 mgd	New	-
W-2-3	Supply Well	Bardsley Avenue	Will connect to 12" pipeline in Bardsley Avenue	Capacity		1.2 mgd	New	-
W-2-4	Supply Well	Tulare Avenue	Will connect to 12" pipeline Tulare Avenue	Capacity		1.2 mgd	New	-
W-2-5	Supply Well	Oaks Street	Will connect to 12" pipeline in Oaks Street	Capacity		1.2 mgd	New	-
W-2-6	Supply Well	Pacific Avenue	Will Connect to proposed 12" improvement	Capacity		1.2 mgd	New	-
W-2-7	Supply Well	Morrison street	Will Connect to proposed 12" improvement	Capacity		1.2 mgd	New	-
Alternative 3								
Pipelines								
P-3-1	Pipe	Prosperity Avenue	E Street to Northridge Street	Capacity	12	16	Replace	1,300
P-3-2	Pipe	Bardsley Avenue	Mooney Boulevard to Irwin Street	Capacity	12	16	Replace	1,400
P-3-3	Pipe	Bardsley Avenue	Irwin Street to Peggy Street	Capacity	10	12	Replace	400
P-3-4	Pipe	Prosperity Avenue	Sacramento Street to West Street	Capacity	-	12	New	600
P-3-5	Pipe	Tulare Avenue	West of Tulare Avenue and West Street	Capacity	-	12	New	295
P-3-6	Pipe	J Street	Cartmill Avenue to Ester Street	New Service	-	12	New	1,800
P-3-7	Pipe	Cartmill Avenue	J Street to west of Oaks Street	New Service	-	12	New	1,400
P-3-8	Pipe	Cartmill Avenue	Blackstone Street to west of De La Vina Street	New Service	-	12	New	2,200
P-3-9	Pipe	Undeveloped land	Cartmill Avenue to Pacific Avenue	New Service	-	12	New	2,700
P-3-10	Pipe	Pacific Avenue	Near Liberty Elementary to Mooney Boulevard	New Service	-	12	New	2,600
P-3-11	Pipe	Mooney Boulevard	Pacific Avenue to Cartmill avenue	New Service	-	12	New	2,600
P-3-12	Pipe	Cartmill Avenue	Mooney Boulevard to east of De La Vina Street	New Service	-	12	New	1,600
P-3-13A	Pipe	Prosperity Avenue	Mooney Boulevard to west of Morrison Street	New Service	-	12	New	2,000
P-3-13B	Pipe/Casing	Prosperity Avenue	Crossing of Canal	New Service	-	12/24	New	300

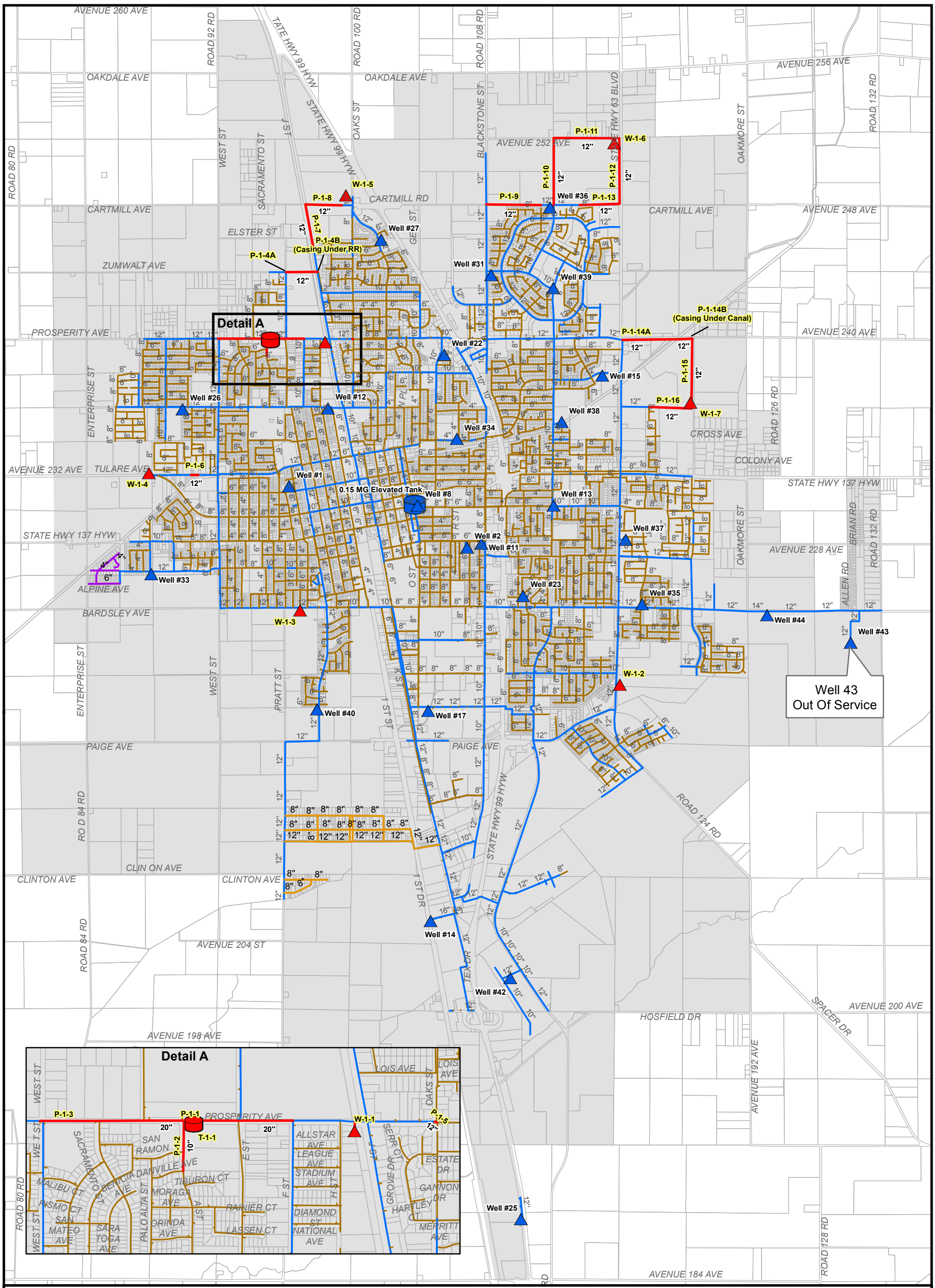
Table 8 Proposed Alternative Summary
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/ Street	Description / Limits[1]	Improvement Category	Project Length/Size and Cost: Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)
P-3-14	Pipe	Morrison Street	Prosperity Avenue to Cross Avenue	New Service	-	12	New	2,800
P-3-15	Pipe	Pleasant Avenue	Morrison Street to west of West Street	New Service	-	12	New	1,700
Storage Tanks and Booster Pumps								
T-3-1	Storage Tank	Prosperity Avenue	Near intersection of Prosperity and A Street	Capacity	-	1.25 MG	New	-
	Booster Pump	Prosperity Avenue	Firm capacity 6.0 mgd, standby 3.0 mgd mgd, FF 2.5 mgd	Capacity	-	292	New	-
T-3-2	Storage Tank	Bardsley Avenue	West of Bardsley and Mooney Boulevard	Capacity	-	1.25 MG	New	-
	Booster Pump		Firm capacity 6.0 mgd, standby 3.0 mgd mgd, FF 2.5 mgd	Capacity	-	280	New	-
Groundwater Wells								
W-3-1	Supply Well	J Street	will connect to 12" pipeline in J Street	Capacity	-	1.2 mgd	New	-
W-3-2	Supply Well	Mooney Boulevard	Will connect to 12" pipeline in Mooney Boulevard	Capacity		1.2 mgd	New	-
W-3-3	Supply Well	Bardsley Avenue	Will connect to 12" pipeline in Bardsley Avenue	Capacity		1.2 mgd	New	-
W-3-4	Supply Well	Tulare Avenue	Will connect to 12" pipeline Tulare Avenue	Capacity		1.2 mgd	New	-
W-3-5	Supply Well	Oaks Street	Will connect to 12" pipeline in Oaks Street	Capacity		1.2 mgd	New	-
W-3-6	Supply Well	Pacific Avenue	Will Connect to proposed 12" improvement	Capacity		1.2 mgd	New	-
W-3-7	Supply Well	Morrison street	Will Connect to proposed 12" improvement	Capacity		1.2 mgd	New	-
Alternative 4								
Pipelines								
P-4-1	Pipe	Prosperity Avenue	Sacramento Street to West Street	Capacity	-	12	New	600
P-4-2	Pipe	Tulare Avenue	West of Tulare Avenue and West Street	Capacity	-	12	New	300
P-4-3	Pipe	J Street	Cartmill Avenue to Ester Street	New Service	-	12	New	1,800
P-4-4	Pipe	Cartmill Avenue	J Street to west of Oaks Street	New Service	-	12	New	1,400
P-4-5	Pipe	Cartmill Avenue	Blackstone Street to west of De La Vina Street	New Service	-	12	New	2,200
P-4-6	Pipe	Undeveloped land	Cartmill Avenue to Pacific Avenue	New Service	-	12	New	2,700
P-4-7	Pipe	Pacific Avenue	Near Liberty Elementary to Mooney Boulevard	New Service	-	12	New	2,600
P-4-8	Pipe	Mooney Boulevard	Pacific Avenue to Cartmill avenue	New Service	-	12	New	2,600
P-4-9	Pipe	Cartmill Avenue	Mooney Boulevard to east of De La Vina Street	New Service	-	12	New	1,600
P-4-10A	Pipe	Prosperity Avenue	Mooney Boulevard to west of Morrison Street	New Service	-	12	New	2,000

Table 8 Proposed Alternative Summary
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/ Street	Description / Limits[1]	Improvement Category	Project Length/Size and Cost			
					Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)
P-4-10B	Pipe/Casing	Prosperity Avenue	Crossing of Canal	New Service	-	12/24	New	300
P-4-11	Pipe	Morrison Street	Prosperity Avenue to Cross Avenue	New Service	-	12	New	2,800
P-4-12	Pipe	Pleasant Avenue	Morrison Street to west of West Street	New Service	-	12	New	1,700
Storage Tanks and Booster Pumps								
T-4-1	Storage Tank	Prosperity Avenue	Near intersection of Prosperity and A Street	Capacity	-	0.83 MG	New	-
	Booster Pump	Prosperity Avenue	Firm capacity 4.0 mgd, standby 2.0 mgd, FF 1.67 mgd	Capacity	-	169	New	-
T-4-2	Storage Tank	Bardsley Avenue	West of Bardsley and Mooney Boulevard	Capacity	-	0.83 MG	New	-
	Booster Pump	Bardsley Avenue	Firm capacity 4.0 mgd, standby 2.0 mgd, FF 1.67 mgd	Capacity	-	184	New	-
T-4-3	Storage Tank	K Street	South of Paige Street	Capacity	-	0.83 MG	New	-
	Booster Pump	K Street	Firm capacity 4.0 mgd, standby 2.0 mgd, FF 1.67 mgd	Capacity	-	194	New	-
Groundwater Wells								
W-4-1	Supply Well	J Street	will connect to 12" pipeline in J Street	Capacity	-	1.2 mgd	New	-
W-4-2	Supply Well	Mooney Boulevard	Will connect to 12" pipeline in Mooney Boulevard	Capacity	-	1.2 mgd	New	-
W-4-3	Supply Well	Bardsley Avenue	Will connect to 12" pipeline in Bardsley Avenue	Capacity	-	1.2 mgd	New	-
W-4-4	Supply Well	Tulare Avenue	Will connect to 12" pipeline Tulare Avenue	Capacity	-	1.2 mgd	New	-
W-4-5	Supply Well	Oaks Street	Will connect to 12" pipeline in Oaks Street	Capacity	-	1.2 mgd	New	-
W-4-6	Supply Well	Pacific Avenue	Will Connect to proposed 12" improvement	Capacity	-	1.2 mgd	New	-
W-4-7	Supply Well	Morrison street	Will Connect to proposed 12" improvement	Capacity	-	1.2 mgd	New	-

1. Final location for groundwater wells and storage may vary.



Legend

Proposed Improvements
- Groundwater Wells
- Tank
- Pipelines

Modeled Water Distribution System
- Groundwater Well
- Tank
- 8" and Smaller
- 10" and Larger

- Soultz Tract
- Matheny Tract
- Parcels
- Urban Development Boundary

N

0 2,000 4,000 Feet

ALTERNATIVE 1
NORTHERN 2.5 MG STORAGE TANK

FIGURE 5

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

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As shown, approximately 2,800 feet of 12-inch diameter transmission line in Prosperity Avenue will be replaced with 20-inch diameter pipelines due to excessive headloss and high pressures around the storage tank during peak hour demand. Along Tulare Avenue, a 12-inch diameter pipeline will be installed to connect a proposed well to the distribution system. Additionally, new pipelines will be installed along Prosperity Avenue and east of Zumwalt Avenue to create loops and minimize pressure fluctuations due to the tanks cycle.

Under each alternative, four of the proposed wells are located in areas considerable favorable and three are located outside of the zone. The purpose of placing the three wells outside of the preferred zone is to address priority growth.

Pipelines have been recommended to provide new service to the proposed wells W-1-5, W-1-6, and W-1-7. These pipelines will provide loops and connect the proposed wells to the existing system.

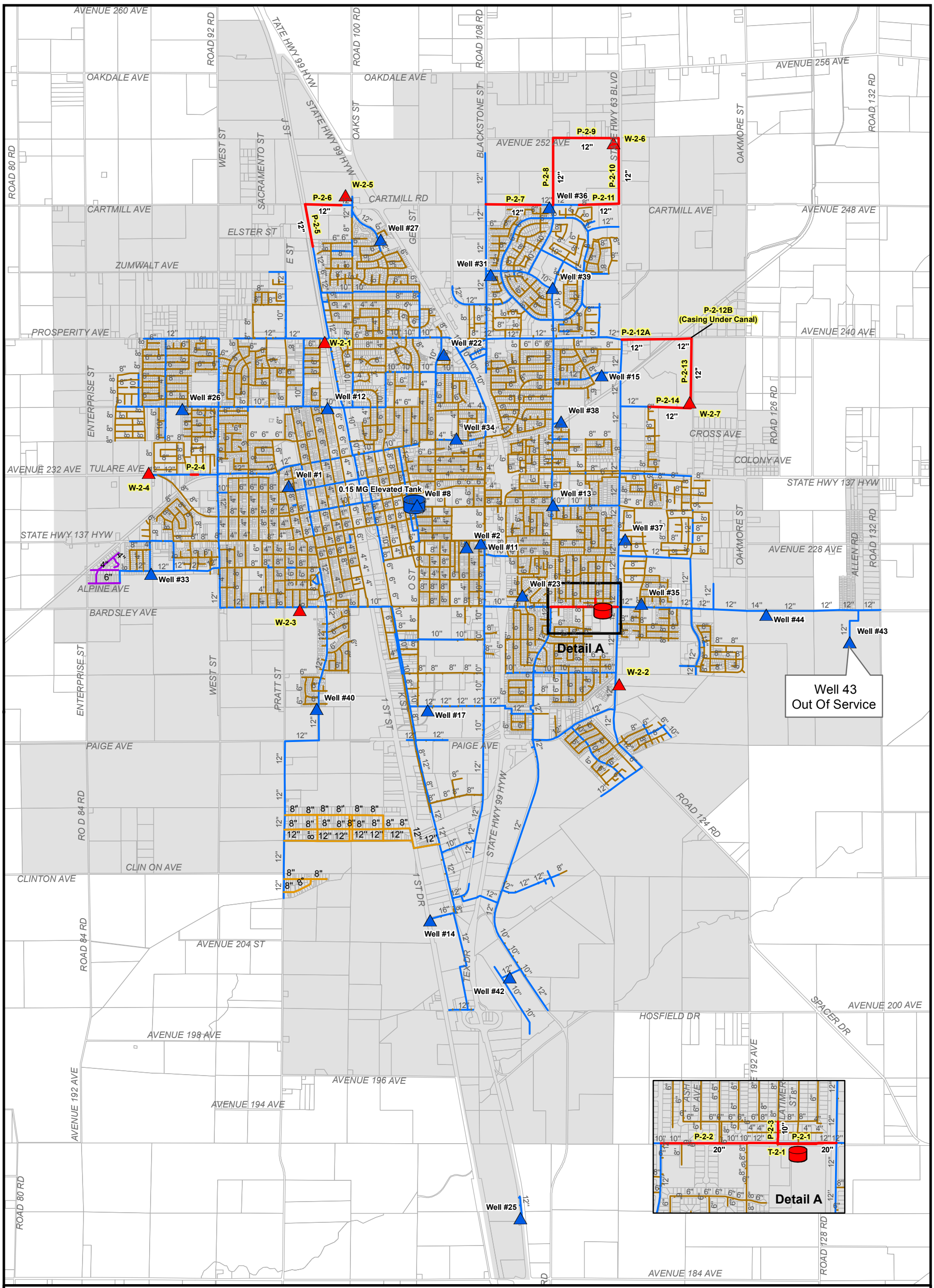
8.2 Alternative 2 – Southern 2.5 MG Storage Tank

This option is similar to Alternative 1 and entails the construction of one storage tank with a capacity of 2.5 MG and seven wells with a capacity of 1.2 mgd each. The storage facility would be located near the intersection of Mooney Boulevard and Bardsley Avenue. Figure 6 illustrates the location of the proposed facilities and Table 8 summarizes the major infrastructure under this alternative.

This project will replace approximately 1,400 feet of 12-inch diameter and 1,300 feet of 10-inch diameter pipeline in Bardsley Avenue with 20-inch diameter pipelines. The exiting 8-inch and 4-inch diameter pipeline in Moraine Street, from Bardsley Avenue to Ash Avenue, will be replaced with a 10-inch diameter pipeline. These projects are needed due to excessive headloss and high pressures near the storage tank. Twelve (12)-inch diameter pipelines are recommended to connect the proposed wells (W-2-5, W-2-6, and W-2-7) to the distribution system.

8.3 Alternative 3 – Two 1.25 MG Storage Tanks

Alternative 3 includes two separate storage facilities with a capacity of 1.25 MG per tank and seven wells at a capacity of approximately 1.2 mgd each. The storage tanks will be utilized similar to the previous alternatives and maintain a reserve supply to meet PHD and fire flow storage requirements. Each storage facility will require a booster pump station with a firm capacity of 6.0 mgd and a total capacity of 11.6 mgd. Figure 7 illustrates the location of the proposed facilities and Table 8 summarizes the major infrastructure under this alternative.



Legend

Proposed Improvements
- Well
- Tank
- Pipelines

Modeled Water Distribution System
- Groundwater Well
- Tank
- 8" and Smaller
- 10" and Larger

- Soultz Tract
- Matheny Tract
- Parcels
- Urban Development Boundary

N

0 2,000 4,000 Feet

ALTERNATIVE 2
SOUTHERN 2.5 MG STORAGE TANK

FIGURE 6

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

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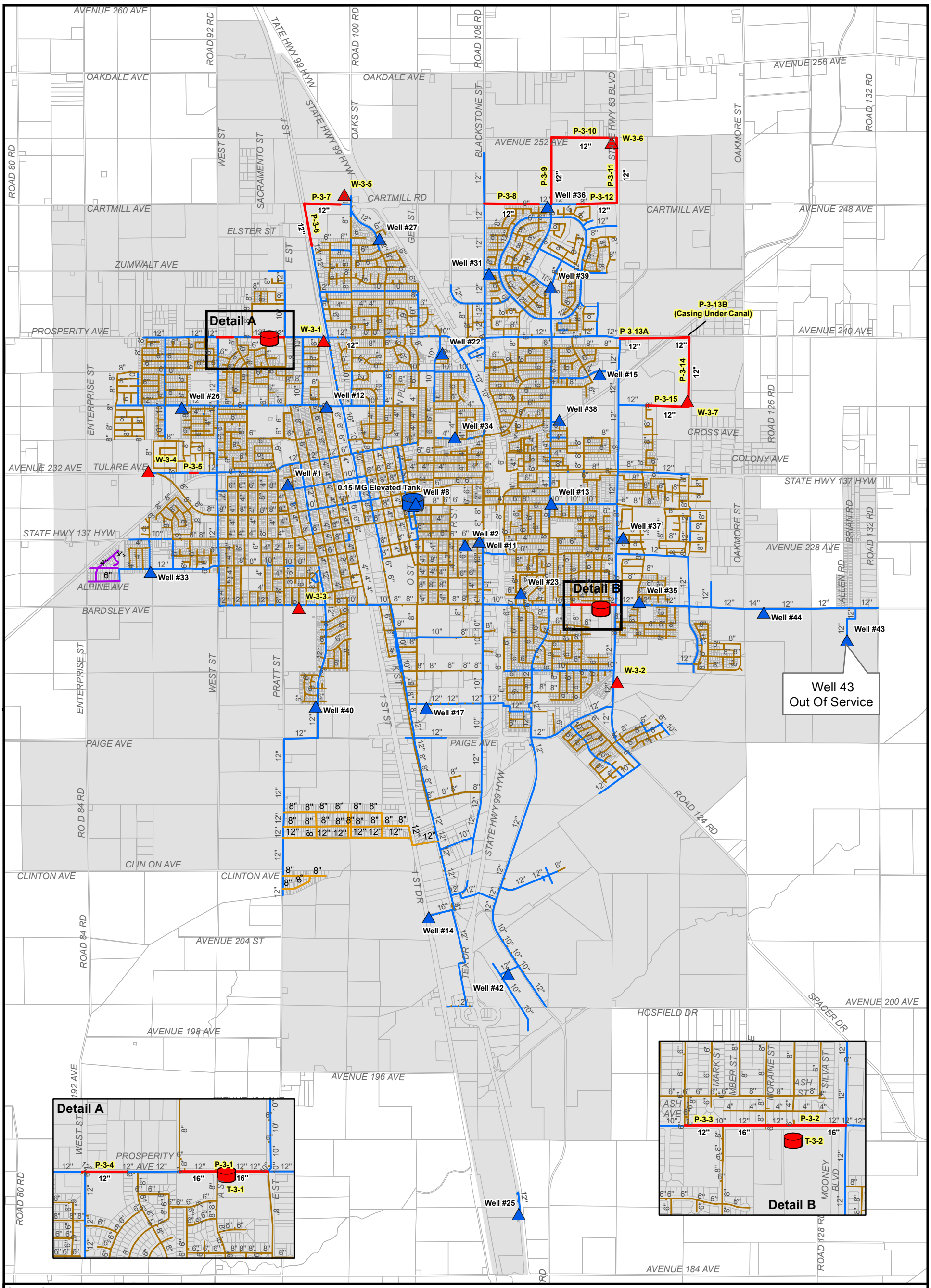

Legend

Proposed Improvements
- Wells
- Tanks
- Pipelines

Modeled Water Distribution System
- Groundwater Well
- Tank
- 8" and Smaller
- 10" and Larger

- Soultz Tract
- Matheny Tract
- Parcels
- Urban Development Boundary

N

0 2,000 4,000 Feet

ALTERNATIVE 3
TWO 1.25 MG STORAGE TANKS

FIGURE 7

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

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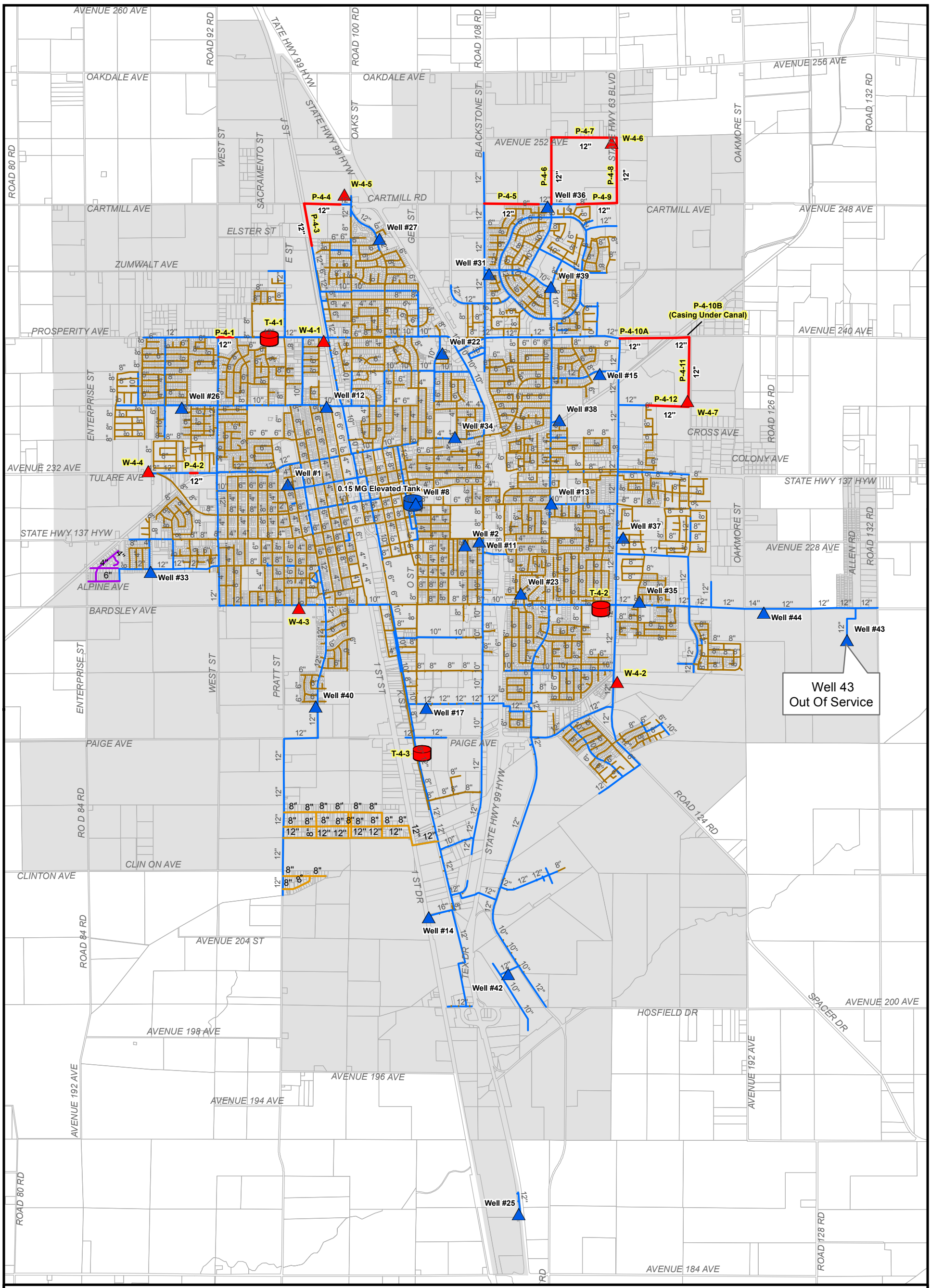

Legend

Proposed Improvements
- Wells
- Tank
- Pipelines

Modeled Water Distribution System
- Groundwater Well
- Tank
- 8" and Smaller
- 10" and Larger

- Soultz Tract
- Matheny Tract
- Parcels
- Urban Development Boundary

N

0 2,000 4,000 Feet

ALTERNATIVE 4
THREE 0.83 MG STORAGE TANKS

FIGURE 8

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

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As shown, approximately 1,300 feet of 12-inch diameter pipeline in Prosperity Avenue will be replaced with 16-inch diameter pipeline. To the southeast, approximately 1,400 feet of 12-inch diameter pipeline in Bardsley Avenue will be replaced with 16-inch diameter pipeline and 400 feet of 10-inch diameter pipeline will need upsizing to a 12-inch diameter. These projects are needed due to excessive headloss and high pressures near the storage tank. Additionally, new pipelines will be installed along Prosperity Avenue and Tulare Avenue to extend the respective transmission lines. 12-inch diameter pipelines are recommended to connect the proposed wells (W-3-5, W-3-6, and W-3-7) to the distribution system.

8.4 Alternative 4 – Three 0.84 MG Storage Tanks

This alternative entails the construction of three storage facilities with a capacity of 0.83 MG per tank and seven wells with a capacity of 1.2 mgd each. The storage tanks will maintain a reserve supply to meet PHD and fire flow storage requirements. Each storage facility will require a booster pump station with a firm capacity of 4.0 mgd and a total capacity of 7.7 mgd. Figure 8 illustrates the location of the proposed facilities and Table 8 summarizes the major infrastructure under this alternative.

This project recommends the construction of new pipelines along Prosperity Avenue and Tulare Avenue to extend the respective transmission lines. 12-inch diameter pipelines are recommended to connect the proposed wells (W-4-5, W-4-6, and W-4-7) to the distribution system.

9.0 EVALUATION OF IMPROVEMENT ALTERNATIVES

Determining a recommended alternative involves conducting a non-cost based evaluation as well as developing cost estimates. The non-cost evaluation and the cost estimates will be used to calculate a Benefit Cost Ratio to determine the recommended alternative.

9.1 Non-Cost Evaluation Criteria

The non-cost criteria used to evaluate each alternative includes: (1) constructability, (2) system performance, (3) operation and maintenance (O&M), (4) operational flexibility, (5) community disruption, and (6) project scheduling. Each alternative was assigned a score from 1 to 5, with 1 being the least desirable and 5 being the most desirable. Each criteria is designated a weighted factor based on the level of importance. These factors are then multiplied by each alternatives performance score and used as a ranking.

9.2 Non-Cost Evaluation

Table 9 shows the weighted score for each alternative and briefly explains the advantages and disadvantages of each alternative. Figure 9 depicts a summary of each alternatives

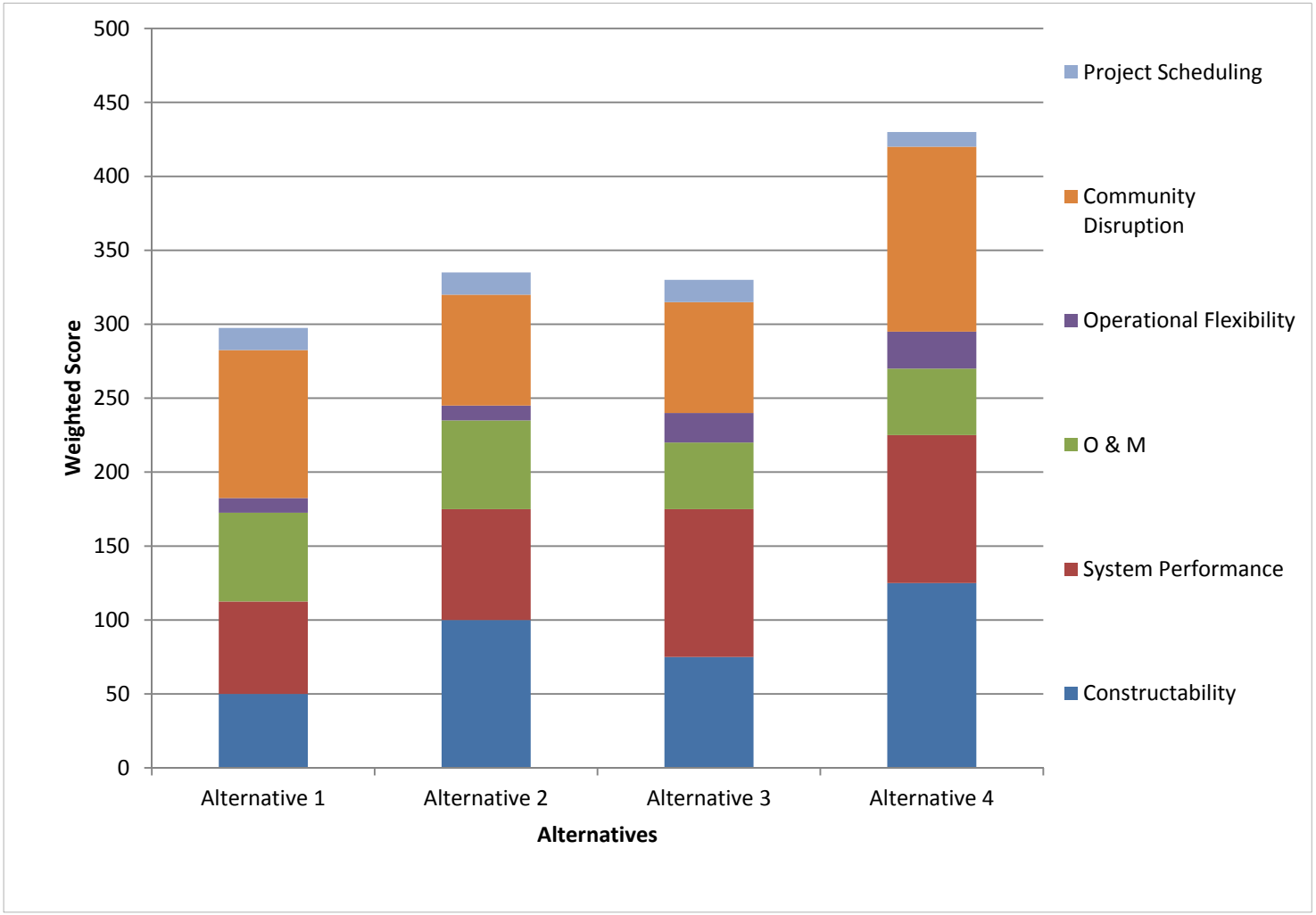
weighted score. The weighted scores ranged from a low of 298 for Alternative 1 to a high of 430 for Alternative 4. The bars illustrate which criterion had the greatest influence towards the total score.

9.3 Cost Comparison of Alternatives

The cost estimates were prepared for general planning purposes and guidance in project evaluation and implementation. Final project costs will depend on actual labor and material costs, competitive market conditions, final project scope, implementation schedule, and other variable factors such as detailed utility and topography surveys. The cost estimates presented herein were developed from bid tabulations, cost curves, and unit costs obtained from previous studies.

Cost estimates within this report are considered “Order-of-Magnitude” (Class 5) level estimates, as defined by the Association for the Advancement of Cost Engineering (AACE). Estimates of this type are normally used for concept screening of project feasibility, or to evaluate alternatives. Typical accuracy ranges for Class 5 estimates are -20 to -50 percent on the low side, and +30 to +100 percent on the high side.

Construction costs were estimated by increasing the total base cost by 25 percent (Contingency Cost) to account for unexpected construction conditions. The total project cost was estimated as the construction cost plus 30 percent for engineering, legal, and administration costs. The estimated capital cost for each alternative is 162.5 percent of the baseline construction cost.



NON-COST EVALUATION RESULTS

FIGURE 9

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

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Table 9 Alternative Evaluation Matrix Table
Matheny Soultz Water System Improvements
City of Tulare, California

Criteria	Ranking Weight	Alternative 1	Unweighted Score	Weighted Score	Alternative 2	Unweighted Score	Weighted Score	Alternative 3	Unweighted Score	Weighted Score	Alternative 4	Unweighted Score	Weighted Score
Constructability	25	**Advantages:** • None **Disadvantages:** • Pipeline Crosses a Canal and Railroad. Will require trenchless construction and encasement. • Large facility required.	2	50	**Advantages:** • All of the pipeline improvements follow existing alignment. **Disadvantages:** • Large facility required. • Pipeline construction in Bardsley.	4	100	**Advantages:** • All of the pipeline improvements follow existing alignment. **Disadvantages:** • Multiple construction sites. • Pipeline construction in Bardsley and Prosperity.	3	75	**Advantages:** • Requires least amount of pipeline improvements. • All of the pipeline improvements follow existing alignment. **Disadvantages:** • Multiple construction sites.	5	125
System Performance	25	**Advantages:** • None **Disadvantages:** • Requires new pipelines to loop system. • Pressure fluctuation as tank cycles. • Larger tank could create water quality issues. • Requires new pipelines to reduce transmission headlosses.	2.5	62.5	**Advantages:** • None **Disadvantages:** • Pressure fluctuation as tank cycles. • Larger tank could create water quality issues. • Requires new pipelines to reduce transmission headlosses.	3	75	**Advantages:** • Distributed tanks reduce transmission requirements. **Disadvantages:** • Requires new pipelines to reduce transmission headlosses.	4	100	**Advantages:** • Distributed tanks reduce transmission requirements. **Disadvantages:** • System Coordination.	4	100
O & M	15	**Advantages:** • One site to maintain. **Disadvantages:** • Larger facility to maintain.	4	60	**Advantages:** • One site to maintain. **Disadvantages:** • Size of facility to maintain.	4	60	**Advantages:** • Multiple tanks allow one to be out of service without severely comprising system performance. **Disadvantages:** • Total number of pumps to maintain. • Operational coordination between sites.	3	45	**Advantages:** • Multiple tanks allow one to be out of service without severely comprising system performance. **Disadvantages:** • Total number of pumps to maintain. • Operational coordination between sites.	3	45
Operational Flexibility	5	**Advantages:** • None **Disadvantages:** • One storage facility.	2	10	**Advantages:** • None **Disadvantages:** • One storage facility.	2	10	**Advantages:** • two storage facilities. **Disadvantages:** • None	4	20	**Advantages:** • Maximizes flexibility with 3 storage facilities. **Disadvantages:** • None	5	25

Table 9 Alternative Evaluation Matrix Table
Matheny Soultz Water System Improvements
City of Tulare, California

Criteria	Ranking Weight	Alternative 1	Unweighted Score	Weighted Score	Alternative 2	Unweighted Score	Weighted Score	Alternative 3	Unweighted Score	Weighted Score	Alternative 4	Unweighted Score	Weighted Score
Community Disruption	25	**Advantages:** • None **Disadvantages:** • located near residential housing. • Traffic control required. • Newly constructed road on Prosperity.	4	100	**Advantages:** • None **Disadvantages:** • located near residential housing. • Traffic control required along Bardsley.	3	75	**Advantages:** • None **Disadvantages:** • located near residential housing. • Traffic control required along Bardsley. • Newly constructed road on Prosperity.	3	75	**Advantages:** • Minimal work in public right-of-way. **Disadvantages:** • Reduced traffic control.	5	125
Project Scheduling	5	**Advantages:** • Requires acquisition of one location for storage tank. **Disadvantages:** • Requires acquisition of land for pipeline near Gail Avenue. • No phasing flexibility.	3	15	**Advantages:** • Requires acquisition of one location for storage tank. **Disadvantages:** • No phasing flexibility.	3	15	**Advantages:** • Project can be phased. **Disadvantages:** • Requires acquisition of two separate parcels for storage tanks.	3	15	**Advantages:** • Project can be phased. **Disadvantages:** • Requires acquisition of three separate parcels for storage tanks.	2	10
Final Score	**100**		**18**	**298**		**19**	**335**		**20**	**330**		**24**	**430**

Table 10 provides an overall estimated capital cost for each alternative. These cost estimates range from a low of $21.4 million for Alternative 4 to a high of $22.76 million for Alternative 1. The cost estimate details for each alternative are provided in Appendix A of this TM.

Table 10 Alternative Cost Comparison
Matheny Soultz Water System Improvements
City of Tulare, California

Alternative	Description	Est. Capital Cost ($,Millions)
Alternative 1	Northern 2.5 MG Storage Tank	22.76
Alternative 2	Southern 2.5 MG Storage Tank	21.79
Alternative 3	Two 1.25 MG Storage Tanks	22.35
Alternative 4	Three 0.83 Storage Tanks	21.40

Figure 10 shows the cost distribution for each alternative and illustrates which infrastructure has the greatest impact to the cost. Overall, the storage and wells have relatively similar costs.

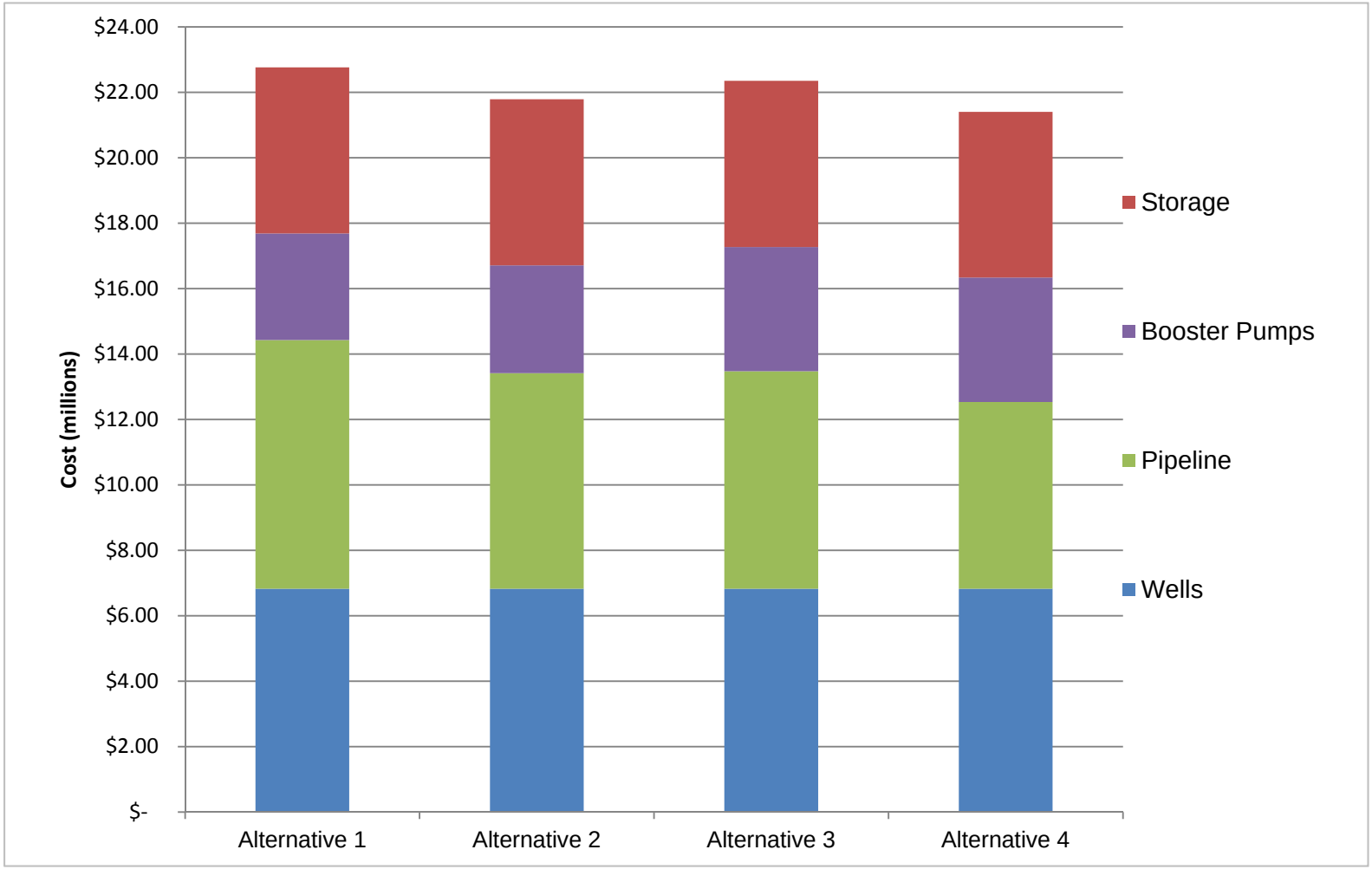
10.0 BENEFIT COST ANALYSIS

Four project alternatives were developed as a part of this analysis and include a non-cost scoring matrix (Table 9) and a cost summary (Table 10). For each alternative, the weighted performance score was divided by the estimated capital cost to determine the Benefit/Cost (B/C) Ratio. The alternative with the highest B/C ratio was considered the most favorable alternative. Table 11 provides a summary of non-cost scores, estimated capital cost, and the B/C ratio for each alternative.

Based on the results of the analysis, Alternative 4 has the highest B/C ratio at 20.1. As shown, Alternative 4 has the highest weighted score and lowest estimated capital cost.

Table 11 Benefit Cost Comparison
Matheny Soultz Water System Improvements
City of Tulare, California

Alternative	Weighted Non-Cost Score	Est. Capital Cost ($, Millions)	Benefit/Cost Ratio
Alternative 1	298	22.76	13.1
Alternative 2	335	21.79	15.4
Alternative 3	330	22.35	14.8
Alternative 4	430	21.40	20.1



COST COMPARISONS

FIGURE 10

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

carollo

pw:\\Carollo/Documents\Client/CA/Tulare City of/10098A00/Deliverables\Figure 10

11.0 RECOMMENDED ALTERNATIVE

The alternatives identified in section 10.0 were reviewed by City staff with the intent of:

- Reviewing the study's findings for each alternative;
- Confirming the best alternative; and,
- Identifying alternative refinements to incorporate into the recommended alternative.

As shown in Table 11, Alternative 4 has the highest B/C rating and is considered the preferred alternative. City staff has incorporated refinements considered strategic to increasing existing well supply. Table 12 summarizes the major infrastructure for the recommended alternative and Figure 11 illustrates the overall recommended projects. In comparison, the only variation between Alternative 4 and the recommended project is the inclusion of a short term project.

11.1 Short Term Project

Until supply deficiencies are completely addressed, City staff has indicated the need for a new 12-inch diameter pipeline in Prosperity Avenue. This project (STP-1) will maximize supply from Well 14 during high demand periods and provides needed capacity in the short term until the City can add new supply wells to the system. As illustrated in Figure 11, this project will provide a direct connection between Well 14 and the Matheny Tract.

12.0 RECOMMENDED PROPORTIONAL COST SHARE

Table 13 summarizes the revised estimated cost associated with the recommended alternative. As shown, with the short term project costs included, the cost has increased for Alternative 4 from $21.4 million to $22.1 million. Also provided in the table is a cost share allocation. The development of the cost share allocation is based on a ratio between Matheny-Soultz demands and city-wide demand. The Matheny-Soultz cost share will account for 1.6-percent of the estimated capital cost which equates to approximately $353,000.

The cost share analysis provides a tool to assess the proportion of cost associated with connecting the Matheny and Soultz Tracts. Detail cost estimates are provided in Appendix A.

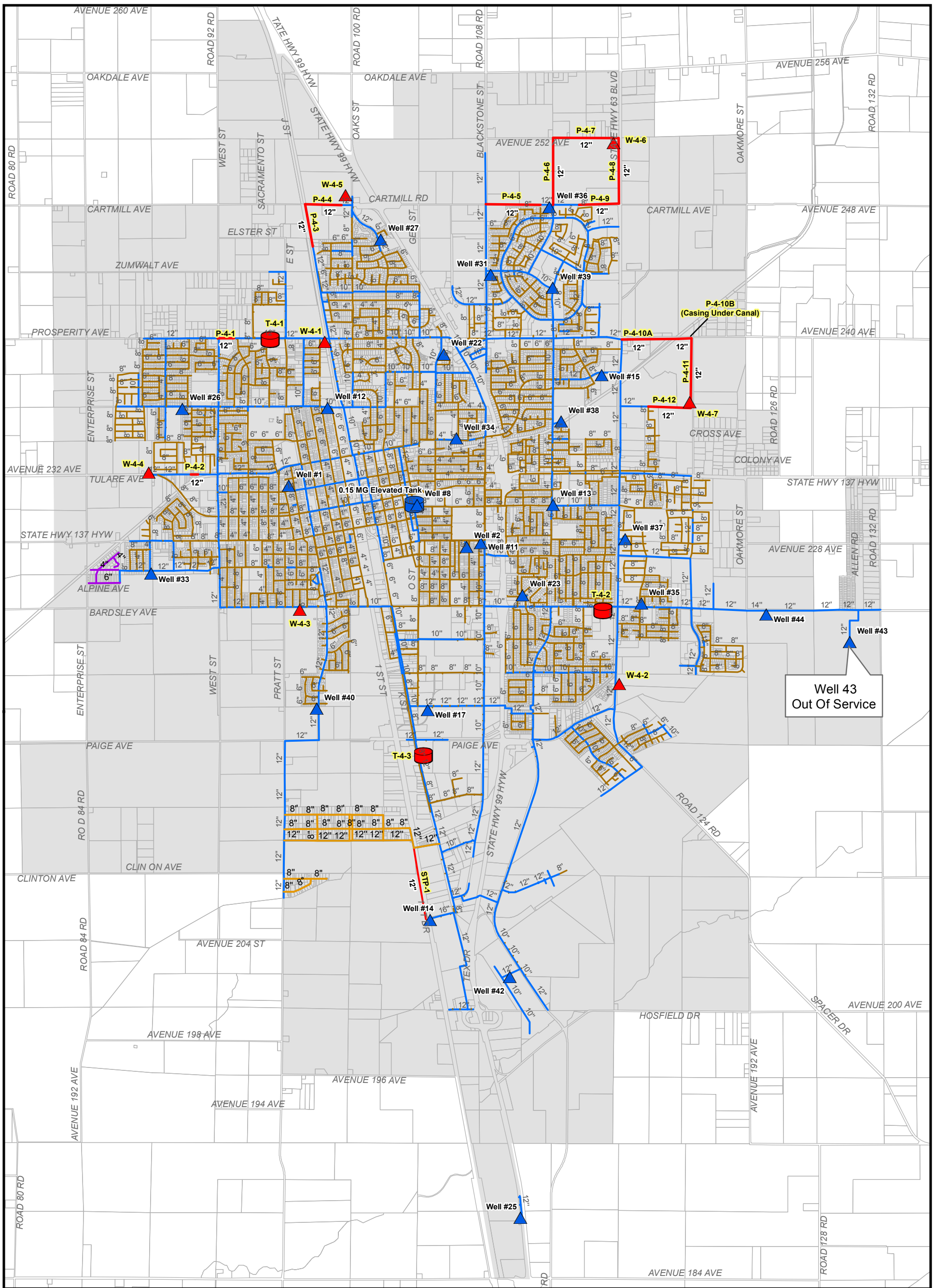
Table 12 Recommended Alternative Major Infrastructure
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/Street	Ex. Size/ Diam. (in)	New Size/Diam. (5)	Replace/ New	Length (ft)
Recommended Alternative Improvements						
Pipelines						
P-4-1	Pipe	Prosperity Avenue	-	12	New	600
P-4-2	Pipe	Tulare Avenue	-	12	New	300
P-4-3	Pipe	J Street	-	12	New	1,800
P-4-4	Pipe	Cartmill Avenue	-	12	New	1,400
P-4-5	Pipe	Cartmill Avenue	-	12	New	2,200
P-4-6	Pipe	Undeveloped land	-	12	New	2,700
P-4-7	Pipe	Pacific Avenue	-	12	New	2,600
P-4-8	Pipe	Mooney Boulevard	-	12	New	2,600
P-4-9	Pipe	Cartmill Avenue	-	12	New	1,600
P-4-10A	Pipe	Prosperity Avenue	-	12	New	2,000
P-4-10B	Pipe/Casing	Prosperity Avenue	-	12/24	New	300
P-4-11	Pipe	Morrison Street	-	12	New	2,800
P-4-12	Pipe	Pleasant Avenue	-	12	New	1,700

Table 12 Recommended Alternative Major Infrastructure
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/Street	Ex. Size/ Diam. (in)	New Size/Diam. (5)	Replace/ New	Length (ft)
Storage Tanks and Booster Pumps						
T-4-1	Storage Tank	Prosperity Avenue	-	0.83 MG	New	-
	Booster Pump	Prosperity Avenue	-	169 hp	New	-
T-4-2	Storage Tank	Bardsley Avenue	-	0.83 MG	New	-
	Booster Pump	Bardsley Avenue	-	184 hp	New	-
T-4-3	Storage Tank	K Street	-	0.83 MG	New	-
	Booster Pump	K Street	-	194 hp	New	-
Groundwater Wells						
W-4-1	Supply Well	J Street	-	1.2 mgd	New	-
W-4-2	Supply Well	Mooney Boulevard	-	1.2 mgd	New	-
W-4-3	Supply Well	Bardsley Avenue	-	1.2 mgd	New	-
W-4-4	Supply Well	Tulare Avenue	-	1.2 mgd	New	-
W-4-5	Supply Well	Oaks Street	-	1.2 mgd	New	-
W-4-6	Supply Well	Pacific Avenue	-	1.2 mgd	New	-
W-4-7	Supply Well	Morrison Street	-	1.2 mgd	New	-
Short Term Project						
STP-1	Pipe	1st Drive	-	12	New	3,000

Notes:
(1) Final location of groundwater wells and storage may vary.



Legend

Proposed Improvements
- Wells
- Tank
- Pipelines

Modeled Water Distribution System
- Groundwater Well
- Tank
- 8" and Smaller
- 10" and Larger

- Soultz Tract
- Matheny Tract
- Parcels
- Urban Development Boundary

N

0 2,000 4,000 Feet

RECOMMENDED ALTERNATIVE

FIGURE 11

CITY OF TULARE
MATHENY SOULTZ WATER SYSTEM IMPROVEMENTS

carollo

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Table 13 Recommended Alternative Cost Estimate
Matheny Soultz Water System Improvements
City of Tulare, California

Type of Improvement	Estimated Cost ($)	Proportional Cost Share	
		City of Tulare ($)	Matheny/Soultz ($)
Pipelines	5,709,000	5,617,000	91,000
Storage Tanks	5,061,000	4,980,000	81,000
Booster Pumps	3,807,000	3,747,000	61,000
Groundwater Wells	6,825,000	6,713,000	109,000
Short Term Project	705,000	694,000	11,000
Total	**22,107,000**	**21,751,000**	**356,000**

APPENDIX A – COST ESTIMATE

Table A-1 Capital Improvement Plan
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/ Street	Description / Limits[1]	Project Length/Size and Cost: Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Unit Cost[2] ($)	Cost[2] ($)	Baseline Construction Cost[2] ($)	Estimated Construction Cost[2] ($)	Capital Improvement Cost[2] ($)	Proportional Cost Share: City of Tulare Cost[2] ($)	Matheny/Soultz Cost[2] ($)
Alternative 1														
Pipelines														
P-1-1	Pipe	Prosperity Avenue	E street to West Street	12	20	Replace	2,800	$ 219	$ 613,145	$ 613,000	$ 766,250	$ 996,000	$ 980,000	$ 16,000
P-1-2	Pipe	A Street	Danville Avenue to Prosperity	8	10	Replace	700	$ 120	$ 84,307	$ 84,000	$ 105,000	$ 137,000	$ 135,000	$ 2,000
P-1-3	Pipe	Prosperity Avenue	Sacramento Street to West Street	-	20	New	600	$ 219	$ 131,388	$ 131,000	$ 163,750	$ 213,000	$ 210,000	$ 3,000
P-1-4A	Pipe	East of Zumwalt Street	Cross an open field	-	12	New	900	$ 145	$ 130,074	$ 130,000	$ 162,500	$ 211,000	$ 208,000	$ 3,000
P-1-4B	Pipe/Casing	East of Zumwalt Street	Crosses a railroad track and canal	-	12/24	New	300	$ 968	$ 290,437	$ 290,000	$ 362,500	$ 471,000	$ 463,000	$ 8,000
P-1-5	Pipe	Prosperity Avenue	Intersection of Prosperity and Oaks Street	-	12	New	30	$ 145	$ 4,336	$ 4,000	$ 5,000	$ 7,000	$ 7,000	$ 100
P-1-6	Pipe	Tulare Avenue	West of Tulare Avenue and West Street	-	12	New	300	$ 145	$ 43,358	$ 43,000	$ 53,750	$ 70,000	$ 69,000	$ 1,000
P-1-7	Pipe	J Street	Cartmill Avenue to Ester Street	-	12	New	1,800	$ 145	$ 260,148	$ 260,000	$ 325,000	$ 423,000	$ 416,000	$ 7,000
P-1-8	Pipe	Cartmill Avenue	J Street to west of Oaks Street	-	12	New	1,400	$ 145	$ 202,338	$ 202,000	$ 252,500	$ 328,000	$ 323,000	$ 5,000
P-1-9	Pipe	Cartmill Avenue	Blackstone Street to west of De La Vina Street	-	12	New	2,200	$ 145	$ 317,959	$ 318,000	$ 397,500	$ 517,000	$ 509,000	$ 8,000
P-1-10	Pipe	Undeveloped land	Cartmill Avenue to Pacific Avenue	-	12	New	2,700	$ 145	$ 390,223	$ 390,000	$ 487,500	$ 634,000	$ 624,000	$ 10,000
P-1-11	Pipe	Pacific Avenue	Near Liberty Elementary to Mooney Boulevard	-	12	New	2,600	$ 145	$ 375,770	$ 376,000	$ 470,000	$ 611,000	$ 601,000	$ 10,000
P-1-12	Pipe	Mooney Boulevard	Pacific Avenue to Cartmill avenue	-	12	New	2,600	$ 145	$ 375,770	$ 376,000	$ 470,000	$ 611,000	$ 601,000	$ 10,000
P-1-13	Pipe	Cartmill Avenue	Mooney Boulevard to east of De La Vina Street	-	12	New	1,600	$ 145	$ 231,243	$ 231,000	$ 288,750	$ 375,000	$ 369,000	$ 6,000
P-1-14A	Pipe	Prosperity Avenue	Mooney Boulevard to west of Morrison Street	-	12	New	2,000	$ 145	$ 289,054	$ 289,000	$ 361,250	$ 470,000	$ 462,000	$ 8,000
P-1-14B	Pipe/Casing	Prosperity Avenue	Crossing of Canal	-	12/24	New	300	$ 968	$ 290,437	$ 290,000	$ 362,500	$ 471,000	$ 463,000	$ 8,000
P-1-15	Pipe	Morrison Street	Prosperity Avenue to Cross Avenue	-	12	New	2,800	$ 145	$ 404,675	$ 405,000	$ 506,250	$ 658,000	$ 647,000	$ 11,000
P-1-16	Pipe	Pleasant Avenue	Morrison Street to west of West Street	-	12	New	1,700	$ 145	$ 245,696	$ 246,000	$ 307,500	$ 400,000	$ 394,000	$ 6,000
Storage Tanks and Booster Pumps														
T-1-1	Storage Tank	Prosperity Avenue	Near intersection of Prosperity and A Street	-	2.5 MG	New	-	$ 1.25	$ 3,125,000	$ 3,125,000	$ 3,906,250	$ 5,078,000	$ 4,997,000	$ 81,000
	Booster Pump	Prosperity Avenue	Firm capacity 12.1 mgd, standby 4.0 mgd, FF 5.0 mgd	-	640	New	-	hp	$ 2,005,015	$ 2,005,000	$ 2,506,250	$ 3,258,000	$ 3,206,000	$ 52,000
Groundwater Wells														
W-1-1	Supply Well	J Street	will connect to 12" pipeline in J Street	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-1-2	Supply Well	Mooney Boulevard	Will connect to 12" pipeline in Mooney Boulevard		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-1-3	Supply Well	Bardsley Avenue	Will connect to 12" pipeline in Bardsley Avenue		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-1-4	Supply Well	Tulare Avenue	Will connect to 12" pipeline Tulare Avenue		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-1-5	Supply Well	Oaks Street	Will connect to 12" pipeline in Oaks Street		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-1-6	Supply Well	Pacific Avenue	Will Connect to proposed 12" improvement		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-1-7	Supply Well	Morrison street	Will Connect to proposed 12" improvement		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
Alternative 1 Total									**Total:**	**$ 14,008,000**	**$ 17,510,000**	**$ 22,764,000**	**$ 22,397,000**	**$ 367,100**
Alternative 2														
Pipelines														
P-2-1	Pipe	Bardsley Avenue	Mooney Boulevard to Irwin Street	12	20	Replace	1,400	$ 219	$ 306,572	$ 307,000	$ 383,750	$ 499,000	$ 491,000	$ 8,000
P-2-2	Pipe	Bardsley Avenue	Irwin Street to Laspina Street	10	20	Replace	1,300	$ 219	$ 284,674	$ 285,000	$ 356,250	$ 463,000	$ 456,000	$ 7,000
P-2-3	Pipe	Moraine Street	Bardsley Avenue to Ash Avenue	4 & 8	10	Replace	300	$ 120	$ 36,132	$ 36,000	$ 45,000	$ 59,000	$ 58,000	$ 1,000
P-2-4	Pipe	Tulare Avenue	West of Tulare Avenue and West Street	-	12	New	295	$ 145	$ 42,635	$ 43,000	$ 53,750	$ 70,000	$ 69,000	$ 1,000
P-2-5	Pipe	J Street	Cartmill Avenue to Ester Street	-	12	New	1,800	$ 145	$ 260,148	$ 260,000	$ 325,000	$ 423,000	$ 416,000	$ 7,000
P-2-6	Pipe	Cartmill Avenue	J Street to west of Oaks Street	-	12	New	1,400	$ 145	$ 202,338	$ 202,000	$ 252,500	$ 328,000	$ 323,000	$ 5,000
P-2-7	Pipe	Cartmill Avenue	Blackstone Street to west of De La Vina Street	-	12	New	2,200	$ 145	$ 317,959	$ 318,000	$ 397,500	$ 517,000	$ 509,000	$ 8,000
P-2-8	Pipe	Undeveloped land	Cartmill Avenue to Pacific Avenue	-	12	New	2,700	$ 145	$ 390,223	$ 390,000	$ 487,500	$ 634,000	$ 624,000	$ 10,000
P-2-9	Pipe	Pacific Avenue	Near Liberty Elementary to Mooney Boulevard	-	12	New	2,600	$ 145	$ 375,770	$ 376,000	$ 470,000	$ 611,000	$ 601,000	$ 10,000
P-2-10	Pipe	Mooney Boulevard	Pacific Avenue to Cartmill avenue	-	12	New	2,600	$ 145	$ 375,770	$ 376,000	$ 470,000	$ 611,000	$ 601,000	$ 10,000
P-2-11	Pipe	Cartmill Avenue	Mooney Boulevard to east of De La Vina Street	-	12	New	1,600	$ 145	$ 231,243	$ 231,000	$ 288,750	$ 375,000	$ 369,000	$ 6,000
P-2-12A	Pipe	Prosperity Avenue	Mooney Boulevard to west of Morrison Street	-	12	New	2,000	$ 145	$ 289,054	$ 289,000	$ 361,250	$ 470,000	$ 462,000	$ 8,000
P-2-12B	Pipe/Casing	Prosperity Avenue	Crossing of Canal	-	12/24	New	300	$ 968	$ 290,437	$ 290,000	$ 362,500	$ 471,000	$ 463,000	$ 8,000
P-2-13	Pipe	Morrison Street	Prosperity Avenue to Cross Avenue	-	12	New	2,800	$ 145	$ 404,675	$ 405,000	$ 506,250	$ 658,000	$ 647,000	$ 11,000
P-2-14	Pipe	Pleasant Avenue	Morrison Street to west of West Street	-	12	New	1,700	$ 145	$ 245,696	$ 246,000	$ 307,500	$ 400,000	$ 394,000	$ 6,000

Table A-1 Capital Improvement Plan
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/ Street	Description / Limits[1]	Project Length/Size and Cost: Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Unit Cost[2] ($)	Cost[2] ($)	Baseline Construction Cost[2] ($)	Estimated Construction Cost[2] ($)	Capital Improvement Cost[2] ($)	Proportional Cost Share: City of Tulare Cost[2] ($)	Matheny/Soultz Cost[2] ($)
Storage Tanks and Booster Pumps														
T-2-1	Storage Tank	Bardsley Avenue	West of Bardsley and Mooney Boulevard	-	2.50 MG	New	-	$ 1.25	$ 3,125,000	$ 3,125,000	$ 3,906,250	$ 5,078,000	$ 4,997,000	$ 81,000
	Booster Pump	Bardsley Avenue	Firm capacity 12.1 mgd, standby 4.0 mgd, FF 5.0 mgd	-	603	New	-	hp	$ 2,028,577	$ 2,029,000	$ 2,536,250	$ 3,297,000	$ 3,244,000	$ 53,000
Groundwater Wells														
W-2-1	Supply Well	J Street	will connect to 12" pipeline in J Street	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-2-2	Supply Well	Mooney Boulevard	Will connect to 12" pipeline in Mooney Boulevard		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-2-3	Supply Well	Bardsley Avenue	Will connect to 12" pipeline in Bardsley Avenue		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-2-4	Supply Well	Tulare Avenue	Will connect to 12" pipeline Tulare Avenue		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-2-5	Supply Well	Oaks Street	Will connect to 12" pipeline in Oaks Street		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-2-6	Supply Well	Pacific Avenue	Will Connect to proposed 12" improvement		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-2-7	Supply Well	Morrison street	Will Connect to proposed 12" improvement		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
Alternative 2 Total									**Total:**	**$ 13,408,000**	**$ 16,760,000**	**$ 21,789,000**	**$ 21,437,000**	**$ 352,000**
Alternative 3														
Pipelines														
P-3-1	Pipe	Prosperity Avenue	E Street to Northridge Street	12	16	Replace	1,300	$ 193	$ 250,513	$ 251,000	$ 313,750	$ 408,000	$ 401,000	$ 7,000
P-3-2	Pipe	Bardsley Avenue	Mooney Boulevard to Irwin Street	12	16	Replace	1,400	$ 193	$ 269,784	$ 270,000	$ 337,500	$ 439,000	$ 432,000	$ 7,000
P-3-3	Pipe	Bardsley Avenue	Irwin Street to Peggy Street	10	12	Replace	400	$ 145	$ 57,811	$ 58,000	$ 72,500	$ 94,000	$ 92,000	$ 2,000
P-3-4	Pipe	Prosperity Avenue	Sacramento Street to West Street	-	12	New	600	$ 145	$ 86,716	$ 87,000	$ 108,750	$ 141,000	$ 139,000	$ 2,000
P-3-5	Pipe	Tulare Avenue	West of Tulare Avenue and West Street	-	12	New	295	$ 145	$ 42,635	$ 43,000	$ 53,750	$ 70,000	$ 69,000	$ 1,000
P-3-6	Pipe	J Street	Cartmill Avenue to Ester Street	-	12	New	1,800	$ 145	$ 260,148	$ 260,000	$ 325,000	$ 423,000	$ 416,000	$ 7,000
P-3-7	Pipe	Cartmill Avenue	J Street to west of Oaks Street	-	12	New	1,400	$ 145	$ 202,338	$ 202,000	$ 252,500	$ 328,000	$ 323,000	$ 5,000
P-3-8	Pipe	Cartmill Avenue	Blackstone Street to west of De La Vina Street	-	12	New	2,200	$ 145	$ 317,959	$ 318,000	$ 397,500	$ 517,000	$ 509,000	$ 8,000
P-3-9	Pipe	Undeveloped land	Cartmill Avenue to Pacific Avenue	-	12	New	2,700	$ 145	$ 390,223	$ 390,000	$ 487,500	$ 634,000	$ 624,000	$ 10,000
P-3-10	Pipe	Pacific Avenue	Near Liberty Elementary to Mooney Boulevard	-	12	New	2,600	$ 145	$ 375,770	$ 376,000	$ 470,000	$ 611,000	$ 601,000	$ 10,000
P-3-11	Pipe	Mooney Boulevard	Pacific Avenue to Cartmill avenue	-	12	New	2,600	$ 145	$ 375,770	$ 376,000	$ 470,000	$ 611,000	$ 601,000	$ 10,000
P-3-12	Pipe	Cartmill Avenue	Mooney Boulevard to east of De La Vina Street	-	12	New	1,600	$ 145	$ 231,243	$ 231,000	$ 288,750	$ 375,000	$ 369,000	$ 6,000
P-3-13A	Pipe	Prosperity Avenue	Mooney Boulevard to west of Morrison Street	-	12	New	2,000	$ 145	$ 289,054	$ 289,000	$ 361,250	$ 470,000	$ 462,000	$ 8,000
P-3-13B	Pipe/Casing	Prosperity Avenue	Crossing of Canal	-	12/24	New	300	$ 968	$ 290,437	$ 290,000	$ 362,500	$ 471,000	$ 463,000	$ 8,000
P-3-14	Pipe	Morrison Street	Prosperity Avenue to Cross Avenue	-	12	New	2,800	$ 145	$ 404,675	$ 405,000	$ 506,250	$ 658,000	$ 647,000	$ 11,000
P-3-15	Pipe	Pleasant Avenue	Morrison Street to west of West Street	-	12	New	1,700	$ 145	$ 245,696	$ 246,000	$ 307,500	$ 400,000	$ 394,000	$ 6,000
Storage Tanks and Booster Pumps														
T-3-1	Storage Tank	Prosperity Avenue	Near intersection of Prosperity and A Street	-	1.25 MG	New	-	$ 1.25	$ 1,562,500	$ 1,563,000	$ 1,953,750	$ 2,540,000	$ 2,499,000	$ 41,000
	Booster Pump	Prosperity Avenue	Firm capacity 6.0 mgd, standby 3.0 mgd mgd, FF 2.5 mgd	-	292	New	-	hp	$ 1,192,939	$ 1,193,000	$ 1,491,250	$ 1,939,000	$ 1,908,000	$ 31,000
T-3-2	Storage Tank	Bardsley Avenue	West of Bardsley and Mooney Boulevard	-	1.25 MG	New	-	$ 1.25	$ 1,562,500	$ 1,563,000	$ 1,953,750	$ 2,540,000	$ 2,499,000	$ 41,000
	Booster Pump		Firm capacity 6.0 mgd, standby 3.0 mgd mgd, FF 2.5 mgd	-	280	New	-	hp	$ 1,143,556	$ 1,144,000	$ 1,430,000	$ 1,859,000	$ 1,829,000	$ 30,000
Groundwater Wells														
W-3-1	Supply Well	J Street	will connect to 12" pipeline in J Street	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-3-2	Supply Well	Mooney Boulevard	Will connect to 12" pipeline in Mooney Boulevard		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-3-3	Supply Well	Bardsley Avenue	Will connect to 12" pipeline in Bardsley Avenue		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-3-4	Supply Well	Tulare Avenue	Will connect to 12" pipeline Tulare Avenue		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-3-5	Supply Well	Oaks Street	Will connect to 12" pipeline in Oaks Street		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-3-6	Supply Well	Pacific Avenue	Will Connect to proposed 12" improvement		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-3-7	Supply Well	Morrison street	Will Connect to proposed 12" improvement		1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
Alternative 3 Total									**Total:**	**$ 13,755,000**	**$ 17,193,750**	**$ 22,353,000**	**$ 21,990,000**	**$ 363,000**

Table A-1 Capital Improvement Plan
Matheny Soultz Water System Improvements
City of Tulare, California

Figure No.	Type of Improvement	Description/ Street	Description / Limits[1]	Project Length/Size and Cost: Ex. Size/ Diam. (in)	New Size/ Diam. (in)	Replace/ New	Length (ft)	Unit Cost[2] ($)	Cost[2] ($)	Baseline Construction Cost[2] ($)	Estimated Construction Cost[2] ($)	Capital Improvement Cost[2] ($)	Proportional Cost Share: City of Tulare Cost[2] ($)	Matheny/Soultz Cost[2] ($)
Alternative 4														
Pipelines														
P-4-1	Pipe	Prosperity Avenue	Sacramento Street to West Street	-	12	New	600	$ 145	$ 86,716	$ 87,000	$ 108,750	$ 141,000	$ 139,000	$ 2,000
P-4-2	Pipe	Tulare Avenue	West of Tulare Avenue and West Street	-	12	New	300	$ 145	$ 43,358	$ 43,000	$ 53,750	$ 70,000	$ 69,000	$ 1,000
P-4-3	Pipe	J Street	Cartmill Avenue to Ester Street	-	12	New	1,800	$ 145	$ 260,148	$ 260,000	$ 325,000	$ 423,000	$ 416,000	$ 7,000
P-4-4	Pipe	Cartmill Avenue	J Street to west of Oaks Street	-	12	New	1,400	$ 145	$ 202,338	$ 202,000	$ 252,500	$ 328,000	$ 323,000	$ 5,000
P-4-5	Pipe	Cartmill Avenue	Blackstone Street to west of De La Vina Street	-	12	New	2,200	$ 145	$ 317,959	$ 318,000	$ 397,500	$ 517,000	$ 509,000	$ 8,000
P-4-6	Pipe	Undeveloped land	Cartmill Avenue to Pacific Avenue	-	12	New	2,700	$ 145	$ 390,223	$ 390,000	$ 487,500	$ 634,000	$ 624,000	$ 10,000
P-4-7	Pipe	Pacific Avenue	Near Liberty Elementary to Mooney Boulevard	-	12	New	2,600	$ 145	$ 375,770	$ 376,000	$ 470,000	$ 611,000	$ 601,000	$ 10,000
P-4-8	Pipe	Mooney Boulevard	Pacific Avenue to Cartmill avenue	-	12	New	2,600	$ 145	$ 375,770	$ 376,000	$ 470,000	$ 611,000	$ 601,000	$ 10,000
P-4-9	Pipe	Cartmill Avenue	Mooney Boulevard to east of De La Vina Street	-	12	New	1,600	$ 145	$ 231,243	$ 231,000	$ 288,750	$ 375,000	$ 369,000	$ 6,000
P-4-10A	Pipe	Prosperity Avenue	Mooney Boulevard to west of Morrison Street	-	12	New	2,000	$ 145	$ 289,054	$ 289,000	$ 361,250	$ 470,000	$ 462,000	$ 8,000
P-4-10B	Pipe/Casing	Prosperity Avenue	Crossing of Canal	-	12/24	New	300	$ 968	$ 290,437	$ 290,000	$ 362,500	$ 471,000	$ 463,000	$ 8,000
P-4-11	Pipe	Morrison Street	Prosperity Avenue to Cross Avenue	-	12	New	2,800	$ 145	$ 404,675	$ 405,000	$ 506,250	$ 658,000	$ 647,000	$ 11,000
P-4-12	Pipe	Pleasant Avenue	Morrison Street to west of West Street	-	12	New	1,700	$ 145	$ 245,696	$ 246,000	$ 307,500	$ 400,000	$ 394,000	$ 6,000
Storage Tanks and Booster Pumps														
T-4-1	Storage Tank	Prosperity Avenue	Near intersection of Prosperity and A Street	-	0.83 MG	New	-	$ 1.25	$ 1,037,500	$ 1,038,000	$ 1,297,500	$ 1,687,000	$ 1,660,000	$ 27,000
	Booster Pump	Prosperity Avenue	Firm capacity 4.0 mgd, standby 2.0 mgd, FF 1.67 mgd	-	169	New	-	hp	$ 818,209	$ 818,000	$ 1,022,500	$ 1,329,000	$ 1,308,000	$ 21,000
T-4-2	Storage Tank	Bardsley Avenue	West of Bardsley and Mooney Boulevard	-	0.83 MG	New	-	$ 1.25	$ 1,037,500	$ 1,038,000	$ 1,297,500	$ 1,687,000	$ 1,660,000	$ 27,000
	Booster Pump	Bardsley Avenue	Firm capacity 4.0 mgd, standby 2.0 mgd, FF 1.67 mgd	-	184	New	-	hp	$ 742,682	$ 743,000	$ 928,750	$ 1,207,000	$ 1,188,000	$ 19,000
T-4-3	Storage Tank	K Street	South of Paige Street	-	0.83 MG	New	-	$ 1.25	$ 1,037,500	$ 1,038,000	$ 1,297,500	$ 1,687,000	$ 1,660,000	$ 27,000
	Booster Pump	K Street	Firm capacity 4.0 mgd, standby 2.0 mgd, FF 1.67 mgd	-	194	New	-	hp	$ 782,382	$ 782,000	$ 977,500	$ 1,271,000	$ 1,251,000	$ 20,000
Groundwater Wells														
W-4-1	Supply Well	J Street	will connect to 12" pipeline in J Street	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-4-2	Supply Well	Mooney Boulevard	Will connect to 12" pipeline in Mooney Boulevard	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-4-3	Supply Well	Bardsley Avenue	Will connect to 12" pipeline in Bardsley Avenue	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-4-4	Supply Well	Tulare Avenue	Will connect to 12" pipeline Tulare Avenue	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-4-5	Supply Well	Oaks Street	Will connect to 12" pipeline in Oaks Street	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-4-6	Supply Well	Pacific Avenue	Will Connect to proposed 12" improvement	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
W-4-7	Supply Well	Morrison street	Will Connect to proposed 12" improvement	-	1.2 mgd	New	-	$ 500,000.00	$ 600,000	$ 600,000	$ 750,000	$ 975,000	$ 959,000	$ 16,000
Alternative 4 Total									**Total:**	**$ 13,170,000**	**$ 16,462,500**	**$ 21,402,000**	**$ 21,057,000**	**$ 345,000**
Short Term Project														
STP-1	Pipe	1st Drive	Goodin Avenue to Olsen Drive	-	12	New	3,000	$ 145	$ 433,581	$ 434,000	$ 542,500	$ 705,000	$ 694,000	$ 11,000
Short Term Project Total									**Total:**	**$ 434,000**	**$ 542,500**	**$ 705,000**	**$ 694,000**	**$ 11,000**

1. Final location for groundwater wells and storage may vary.
2. Costs are based on the Engineering News Record Construction Cost Index 20-city average of 10128 (October 2015).