Kennedy/Jenks Consultants

10850 Gold Center Drive, Suite 350
Rancho Cordova, California 95670
916-858-2700
916-858-2754 (Fax)

City of Manteca
2005 Water Master Plan

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REGISTERED PROFESSIONAL ENGINEER
ALEXANDER R. PETERSON
No. 046095
Exp. 12/31/06
CIVIL
STATE OF CALIFORNIA

7/24/07

Prepared for

City of Manteca
1001 W. Center Street
Manteca, CA 95337

K/J Project No. 032511.00

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Abbreviations

μg/l	Micrograms per liter
AC	Asbestos cement (pipe)
AF	Acre feet
AF/AC/YR	Acre foot per acre per year
AF/YR	Acre foot per year
CCR	California Code of Regulations
CIP	Capital Improvement Program
CT	Empirical immobilization credit associated with disinfection and contact time
City	City of Manteca
County	County of San Joaquin
D/DBPR	Disinfection/Disinfection By-Products Rule
DBCP	1,2-Dibromo 3-chloropropane
DBPP	Disinfection by-product precursor
DOHS	California Department of Health Services
DWR	California Department of Water Resources
DWSAP	Drinking water source assessment and protection
EDB	Ethylene dibromide
EIR	Environmental Impact Report
fps	Feet per second
GAC	Granular activated carbon
GPAD	Gallons per acre per day
GPCD	Gallons per capita per day
gpm	Gallons per minute
GWR	Groundwater Rule
ISO	Insurance Services Office
LCR	Lead and Copper Rule
MCL	Maximum contaminant level
MCLG	Maximum contaminant level goal

MG	Million gallons
MGD	Million gallons per day
mg/l	Milligrams per liter
mi	Mile(s)
MMM	Multimedia Mitigation
MRDL	Maximum residual disinfectant level
O&M	Operation and maintenance
PCA	Potential Contaminating Activities
PCE	Perchloroethene, tetrachloroethylene
pci/l	Picocuries per litter
PFIP	Public Facilities Implementation Plan
ppm	Parts per million
psi	Pounds per square inch
PVC	Polyvinylchloride
Reg-Neg	Regulatory negotiation
RTU	Remote telemetry unit
SCADA	Supervisory control and data acquisition
SDWA	Safe Drinking Water Act
sq	Square
SSJID	South San Joaquin Irrigation District
State	State of California
TCR	Total Coliform Rule
THM	Trihalomethane
USEPA	United States Environmental Protection Agency
WTP	Water treatment plant
WWTP	Wastewater treatment plant
YR	Year

Executive Summary

This Executive Summary provides a brief overview of the Master Plan purpose, findings and recommendations. Detailed discussion of issues and elements addressed are provided in this plan and are in part further developed through the Public Facilities Improvement Plan (PFIP) efforts addressing all major City of Manteca infrastructure.

Overview

This Master Plan evaluates the City of Manteca (City) water utility considering the existing infrastructure conditions, water supply availability, water quality requirements and planned growth. The Master Plan presents alternative approaches to meeting the ongoing demand for a safe and reliable water system based on the findings of the evaluation and ultimately provides recommendations as to how to proceed with capital improvements planning.

The Master Plan provides analysis, information, data, and technical recommendations for use by the City in planning for future investments. The conditions controlling and guiding City decisions will change over time and this document should be considered as a living document providing for reasonable flexibility in completing all elements recommended.

This Master Plan was prepared in part as a larger City effort to prepared a PFIP document and proceed with updated development fees and charges. This Master Plan combines the historic Zone 11 and Zone 12 areas of the City that previously were addressed under two fee structures. Capital improvements presented here address replacement and improvements to existing infrastructure as one element and expansion as a second element. The expansion element is associated with the PFIP work.

Water Treatment

The single largest water treatment issue facing the City is the presence of arsenic in the groundwater. Table ES-1 provides a summary of the water quality for the existing City wells. As can be seen 16 of the 18 existing wells are at or above 10 μg/l (0.010 mg/l).

Table ES-1: Average Arsenic Concentrations at Existing Well Sites

Well Number:	***5***	***8***	***9***	***10***	***12***	***13***	***14***	***15***	***16***	***17***	***18***	***19***	***20***	***21***	***22***	***23***	***24***	***25***
Arsenic Concentration (μg/l)	11	9.3	12.75	9.5	11.25	12.3	18.25	13	17.5	9.5	6.5	12	18.3	12	12	12	12	14
Arsenic Reporting for Compliance (μg/l)	11	9	13	10	11	12	18	13	18	10	7	12	18	12	12	12	12	14

Treatment options developed include a combination of blending surface water with groundwater for a reduced arsenic concentration and treatment at the well head to remove arsenic prior to delivery to the system. The estimated cost to address the existing water supply is approximately $22 million.

Future groundwater development is assumed to require treatment for arsenic, nitrate and possible volatile organic compounds. The extent of the treatment requirements will not be known until actual wells have drilled and water quality results produced. However, the Master Plan includes an estimate of treatment costs for use in projecting future PFIP liabilities for water supply.

Water Supply

The Master Plan projects water demand and supply through 2030 and through buildout. These projections are intended to provide a basis for use by the City in developing water supply determinations as required by Senate Bills 610 and 221. Based on existing water use patterns the water supply is reasonably available through 2027. City identified use of recycled water could generate sufficient water savings to extend the supply availability to support growth through 2030.

Water Distribution System

The water distribution system of the City is comprised of both the newer system area(s) less then 20 years old and the central core area much older. Included in this Master Plan are planned system maintenance projects to replace existing pipelines and facilities that are at or beyond their useful service life.

The estimated capital investment is $11.7 million over approximately 10 years.

Extension of the water distribution system for planned growth is addressed and the estimated costs provided for use with the PFIP.

Recommendations and Capital Improvement Plan

The Master Plan recommended capital improvements to the City water supply and distribution system and identifies the preferred alternative in each instance. Improvement recommendations are based on addressing existing system deficiencies and accommodating future planned growth.

This section provides recommendations in the following sequence:

1. Groundwater Treatment for Arsenic - These improvements are necessary to meet existing water demands and are cataloged separately. Recommendations include the estimated costs assigned to the existing water service accounts of the City.

2. Planned System Maintenance – These projects include replacement of deteriorating pipelines, relocation of meters from back lots to front lots to allow abandonment of existing 4-inch and smaller water mains, installation of 12-inch and larger transmission mains for hydraulic improvements, and inspection and recoating of the elevated water

tower. The costs of these improvements have been cataloged separately and are assigned to the existing water service accounts.

3. Public Facilities Improvements Plan (PFIP)– These projects include 12-inch main extensions, water storage facilities, booster pump stations, groundwater wells and groundwater treatment plants. The costs of these improvements have been estimated and cataloged separately and assigned to new growth. Phase 2 SSJID project costs are not included in the PFIP project costs.

The recommended implementation schedule is presented in the Capital Improvement Program in Section 7.

Section 1: Introduction

This Water Master Plan Report (Water Master Plan or Master Plan) presents the results of an evaluation of the water supply and distribution system for the City of Manteca (City or Manteca). This planning document intends to be used as a tool by the City for planning future improvements to its water system through the year 2035. In addition, it provides an estimate of water facility requirements at ultimate buildout of the Primary Urban Services Area defined by the 2003 General Plan. Information presented in this chapter includes project background and purpose, scope of work, and a summary of concurrent planning activities.

1.1 Purpose of the Water Master Plan

The purpose of this Water Master Plan is to provide a new comprehensive planning document to guide improvement and expansion of the City's water system to meet current and future needs for a safe, reliable water supply and distribution system. Nolte and Associates completed a Public Facilities Implementation Plan (PFIP) for the City in 1993, and Kennedy/Jenks prepared a Water Master Plan for the City in 2002. An update to the PFIP is currently being prepared with anticipated completion in late 2005. This Water Master Plan effort has been coordinated with the PFIP development and the Capital Improvement Plan (CIP) recommendations and costs are to be incorporated into the water supply element of the PFIP.

In 2003, the City updated its General Plan, resulting in approximately 4.5 square miles of additional area that will require services by City infrastructure once buildout has been completed. This Water Master Plan addresses the water requirements of the new General Plan and recommends capital improvements to support the existing infrastructure and customer demands as well as identify improvements to support infill and new development within the Primary Urban Service Area.

Historically, the City has utilized separate planning documents for Zone 11 (2002 Water Master Plan) and Zone 12 (1993 PFIP) to define the required capital improvements. Zone 11 includes heavily developed portions of Manteca and growth in this area is generally limited to infill development and redevelopment. Zone 12 can be characterized as agricultural lands with significant urban development potential. This Master Plan provides planning evaluation and recommendations for the entire combined City area and does not distinguish between Zones 11 and 12. An updated PFIP combining this Master Plan with other public facility planning recommendations is being completed to implement a single user fee to fund capital improvements and water facilities development projects.

The objectives of this Water Master Plan include the following:

1. Provide a strategic approach to compliance with the new maximum contaminant level (MCL) for arsenic which will take effect next year.

2. Evaluate alternatives and plan water system improvements to facilitate delivery of the South San Joaquin Irrigation District (SSJID) surface water supply to the combined service area.

3. Develop groundwater supply and storage plan to meet a conjunctive groundwater/surface water use approach by the City without exceeding the aquifer's safe yield.

4. Update the City's existing water distribution system hydraulic model, conduct hydraulic modeling to determine distribution system piping improvement, replacement, and expansion requirements, and provide copies of the model for ongoing use by the City.

5. Prepare a time-phased CIP for the water system that identifies projects for incorporation in a new fee analysis by the City.

This Master Plan is intended to be a living document, which will be subject to periodic and regular review of the CIP recommendations by comparing actual City growth and changes in water demand to those projected. This process will enable the City to amend improvement schedules and respond to actual growth changes during the life of this document. It is recommended that the City conduct a Master Plan update within the 10-year planning horizon to address possible changes impacting the City's water supply and distribution system not addressed or foreseen by this Master Plan.

1.2 Scope of Work

The scope of work for preparing this Water Master Plan included the following:

1. Review of existing water system data pertinent to the water master planning effort.

2. Identification of the City service area and projected water demands.

3. Evaluation of water supply sources for quantity, reliability, and quality.

4. Development of a strategic plan for compliance with the new Arsenic Rule and the anticipated revision of the California Department of Health Services (DOHS) MCL for Arsenic in the drinking water supply.

5. Completion of an extended period simulation computer model network analyses to test water supply alternatives and develop infrastructure recommendations.

6. Assessment of the existing water distribution system condition and potential repair or replacement projects based on physical conditions.

7. Review of existing documentation regarding potential seismic retrofit requirements for the elevated water storage tank.

8. Development of improvement alternatives and recommendations for a time phased CIP.

9. Preparation of estimated costs for CIP recommendations segregated into existing customer based projects and new development driven projects.

10. Preparation of this Water Master Plan Report.

11. Coordination with other consultants regarding PFIP element document preparation.

1.3 Concurrent Planning Activities

The City has undertaken completing concurrent planning efforts including this Water Master Plan, a Sewer Master Plan, Drainage Master Plan, and Traffic Plan as part of the PFIP process necessary to address the 2003 General Plan. Due to the related nature of these studies, preparation of this Water Master Plan was coordinated with City staff and others responsible for developing the concurrent planning documents.

Section 2: Planning Service Area and Growth, Water Use, Projections and Study Criteria

Section 2 documents the Water Master Plan study area that is encompassed by the Primary Urban Service Boundary as provided in the 2003 City of Manteca General Plan. This section presents water use historical records, projections for future use, system planning assumptions, and operational standards and criteria.

2.1 Planning Assumptions

The assumptions and conditions used for developing the 2005 Water Master Plan and subsequent capital improvement projects and schedules are summarized below.

2.1.1 Planning Period

This Water Master Plan evaluates and provides capital improvement recommendations through the year 2035 and includes general recommendations for water utility infrastructure improvements through City buildout. The following milestone periods are used for determining the CIP recommendations:

Table 2-1: CIP Planning Periods

CIP Planning Period	Planning Period Summary
Year 2005	The year 2005 improvement recommendations address the existing population and planned developments with sewer allotments as of June 30, 2004. These recommendations primarily address the addition of improvements to comply with the new Arsenic Rule. The corresponding CIP projects are programmed to be completed in the period from 2005 to 2010. It is assumed that a favorable determination will be received from the DOHS regarding a Compliance Schedule to complete the addition of treatment, storage and booster pumping facilities, and optimization of surface water deliveries. These improvements will be presented on a yearly basis through 2010.
Year 2010	The year 2010 improvement recommendations address new growth for those projects not included in the 2005 group and requiring service commitments through 2010. These improvements primarily address new growth, unless otherwise noted in the CIP, and include new wells, groundwater treatment, storage and booster pumping, and optimization of surface water deliveries. These improvements will be presented on a yearly basis through 2010 and include the corresponding population growth triggering each project.

Table 2-1 CIP Planning Periods (cont'd)

CIP Planning Period	Planning Period Summary
Year 2015	The year 2015 improvement recommendations address new growth for those projects not included in the 2010 group and requiring service commitments through 2015. These improvements primarily address new growth, unless otherwise noted in the CIP. These improvements will be presented as occurring between 2011 and 2015 in the CIP. Actual implementation dates will depend on growth patterns. Non-growth related projects include planned infrastructure replacement and maintenance projects and are also identified for this period but not included as PFIP projects.
Year 2025	The year 2025 improvement recommendations primarily address new growth, unless otherwise noted in the CIP. These improvements will be presented in 5-year increments through 2025. Actual implementation dates will depend on growth patterns. Non-growth related projects include planned infrastructure replacement and maintenance projects and are also identified for this period but not included as PFIP projects.
Year 2035	The year 2035 improvement recommendations primarily address new growth, unless otherwise noted in the CIP. These improvements will be presented in 5-year increments through 2035. Actual implementation dates will depend on growth patterns. Non-growth related projects include planned infrastructure replacement and maintenance projects and are also identified for this period but not included as PFIP projects.
Ultimate Buildout	This planning period addresses the full use of all lands within the Primary Urban Service Area and assumes development and redevelopment to the maximum density and highest use allowable.

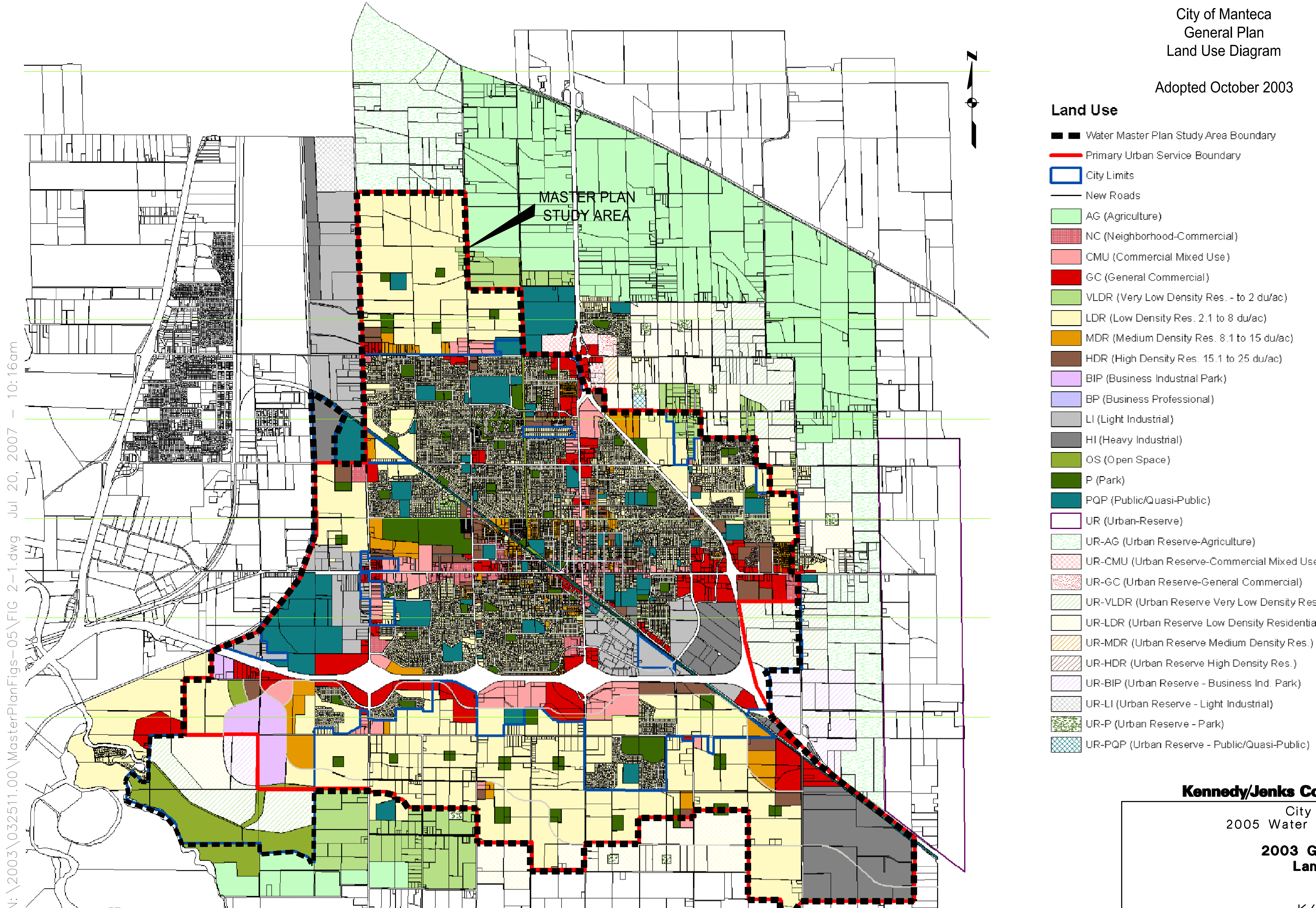
2.1.2 Water Service Area

The service area studied in the “existing” and “buildout” water demand conditions are based on information provided in Figure 2-1, City of Manteca General Plan Land Use Map, October 2003, 2003 City of Manteca General Plan Primary Urban Service Area (PUSA). Land use areas used for planning in the concurrent PFIP planning efforts may be different and include areas outside the PUSA to allow for sizing of interim facilities such as trunk sewers, regional storm water detention facilities, and arterial transportation corridors.

For the purpose of projecting total water demands and developing the CIP recommendations, the following service area assumptions were made based on planning-level information available at the time of this Water Master Plan:

1. The total gross area within the PUSA is 13,790 acres. This area was calculated based on the boundary provided in Figure 2-2. Ultimate water demand calculations will be based on the PUSA at full buildout using population projections.

2. The land use planning area associated with the larger General Plan boundary is 25,975 acres based on the General Plan study area boundary. Water supply requirements or infrastructure needs were not developed for the land area outside the 13,790-acre PUSA.



Source: City of Manteca General Plan Map, Updated 03/08/04

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City of Manteca
2005 Water Master Plan

2003 General Plan
Land Use Map

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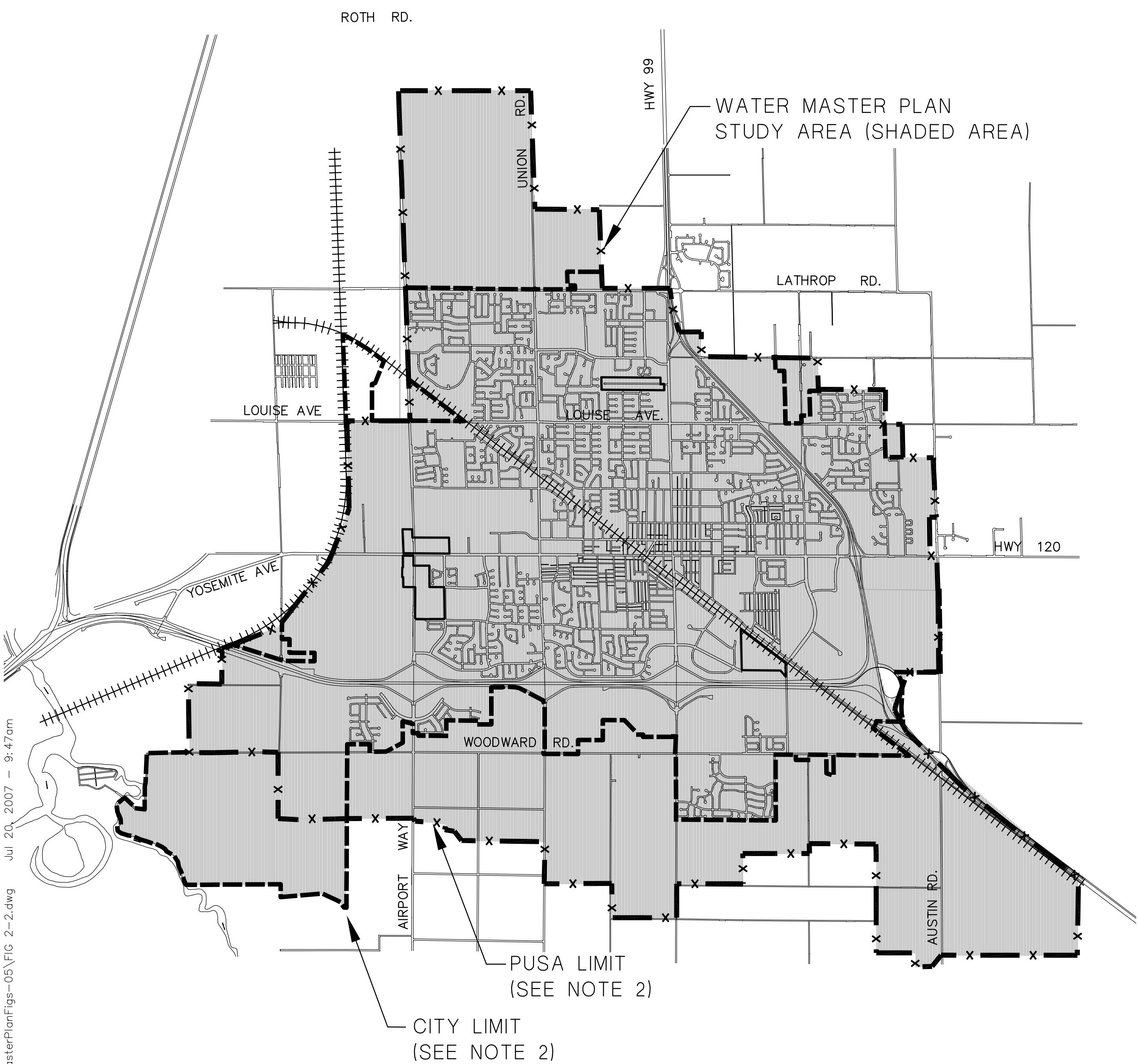
Figure 2-1



2003 CITY LIMITS

PRIMARY URBAN SERVICE AREA (PUSA)

MASTER PLAN STUDY AREA

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NOTES:

1. BOUNDARY AREAS ARE SHOWN AT THEIR APPROXIMATE LOCATIONS

2. STUDY AREA IS BOUNDED BY THE PUSA. AREAS OUTSIDE THE PUSA, INCLUDING LOCATIONS WITHIN THE 2003 CITY LIMITS, ARE NOT INCLUDED IN THIS MASTER PLAN STUDY AREA.

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City of Manteca
2005 Water Master Plan

Primary Urban Service Boundary

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Figure 2-2

3. The water supply planning area associated with the SSJID, South County Water Supply Project (SSJID Project) is 16,500 acres. The total 16,500-acre planning area of the SSJID project is within the General Plan boundary of 25,975 acres. In addition, the 16,500-acre SSJID planning area includes the 13,790 acres within the PUSA used for this Master Plan.

Existing developed land within the 2003 City limits comprises a total of 5,350 acres. The existing developed land includes approximately 3,230 acres of residential, 960 acres of commercial/industrial, and 1,160 acres of permanent agriculture, parks, and public/quasi public land uses according to the General Plan.

The buildout land area for the City incorporates additional agricultural parcels that are not considered to be within the existing City water service area. This shift will reflect a change in potable water demand patterns for the City in subsequent years. Table 2-2 below compares existing land use distribution with buildout land use distribution projections. As can be seen in Table 2-2, residential land use remains nearly constant as a percentage of the total area within the PUSA. Also, there is a shift from the Public/Parks/Open Space/Other category to commercial and industrial development. This transition is reflected in updates to water usages in this Water Master Plan.

Table 2-2: Existing and Buildout Land Use Comparison

Demand Type Description	Residential	Commercial	Industrial	Public/Parks/Open Space/Other
Existing Land Use[(a)]	60.5%	10%	7.9%	21.7%
Buildout Land Use[(a)]	60.6%	13.2%	13.4%	12.8%

(a) 2003 City of Manteca General Plan Table 2-1 for existing and buildout land use distribution.

2.2 Population Growth Projections

The population values developed for the concurrent PFIP planning efforts were reviewed and are presented below. The projected growth rate for the periods 2004 to 2020, as presented in Table 2-3 below, reflects a 2.93% average growth. The maximum allowable City-mandated growth rate is 3.9% per year. Therefore, the PFIP growth projections are within this maximum allowed under City growth limits.

Table 2-3: Population Growth Forecasts

		Growth		Total
	2004	2005-2010	2011-2020	2020
Population[(a)]	59,705	13,319	22,198	94,744
Growth Rate		3.41%	2.64%	2.93%

(a) Source: Robert E. Goldman and Associates.

The PFIP projects a growth rate of 3.4% per year between 2004 and 2010 where it tapers off to 2.6% through the end of the PFIP study period. However, this is not indicative of recent City development that has precipitated water demand and population increases on the order of the City mandated 3.9% per year growth cap. Further, actual water use data trends based on the past 15 years of historical water consumption data have recorded approximately 3.4% of additional demand per year. A comparison of the three projection methods may be seen on Figure 2-3.

Table 2-4 provides a comparison of the 3.4 percent growth projections and the 2.93 percent PFIP projections. Although the actual City growth rate may vary in any given year between 2.6% and 3.9%, this Master Plan assumes an overall annual water consumption growth rate of 3.4% per year to follow demand growth patterns and develop CIP throughout the planning period.

Table 2-4: Population Projections for Planning Period

Year	Population 3.4% Historical	Population 2.93%
2005	61,460	60,867
2010	72,644	70,220
2015	85,862	81,010
2025	119,952	107,818
Ultimate Buildout PUSA (2028 at 3.4% growth)	132,600	Not Reported
Ultimate Buildout PUSA (2032 at 2.93% growth)	Not Reported	132,600

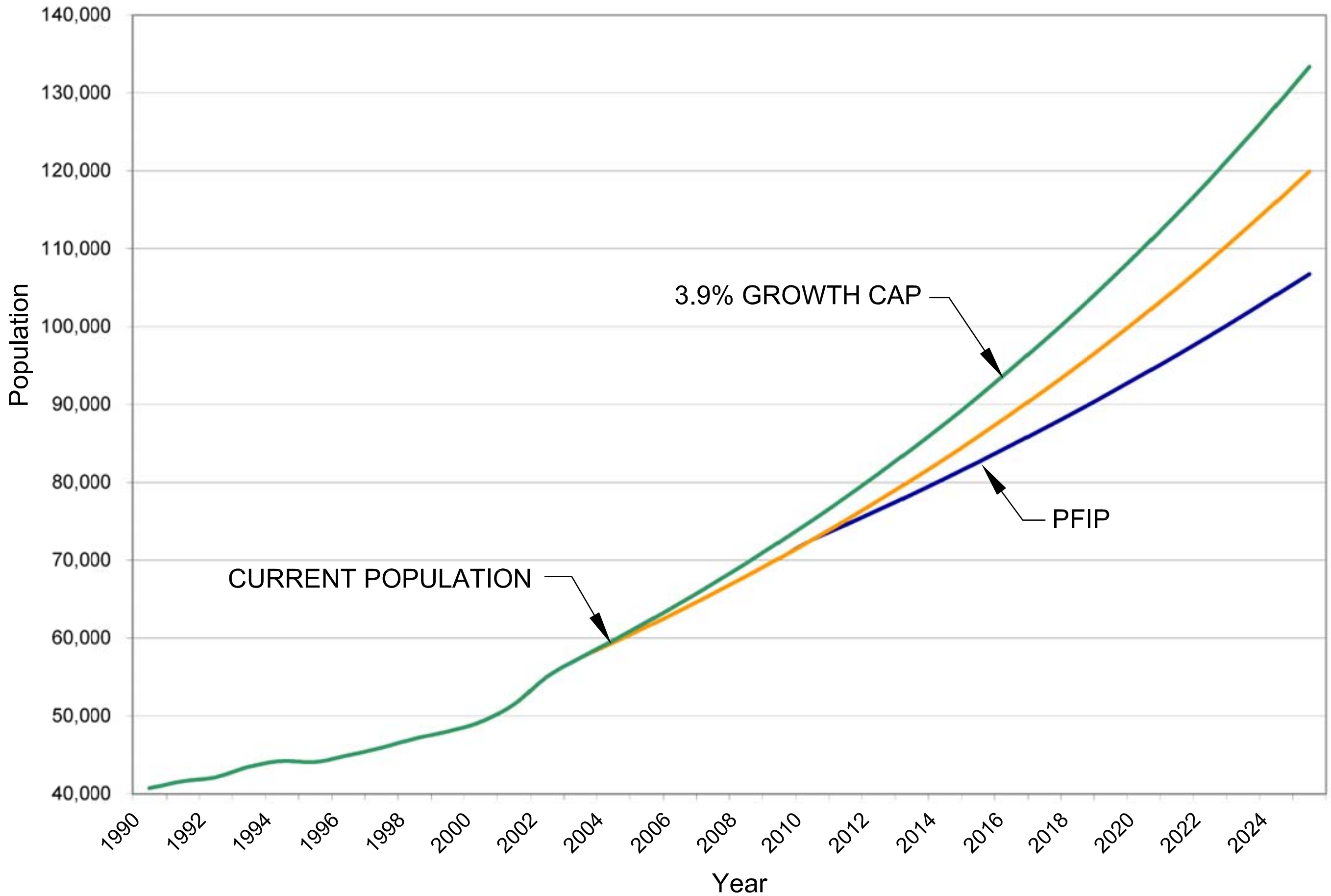
Review of the 2000 U.S. Census data indicates that the average number of persons per household in Manteca is 2.98.

2.3 Water Use Projections

This section describes the assumptions utilized for determining existing and projected water use. Three key benchmark water use values are developed in this section, annual water consumption (acre-feet per year), maximum day water demand (million gallons and gallons per minute) and peak hour instantaneous demand (gallons per minute).

The City has historically met the annual water demand through groundwater extraction. The completion of the SSJID South County Surface Water Supply Project will provide additional water resources to the City. The use of surface water supplies will allow the City to balance their use of groundwater with surface water to reduce or eliminate overdraft of the local groundwater aquifer due to City consumption.

GROWTH PROJECTION COMPARISION



PFIP GROWTH
3.4% GROWTH
3.9% GROWTH

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City of Manteca
2005 Water Master Plan

Growth Projection Comparision

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Figure 2-3

Annual water use estimates reflect the water consumption in acre-feet per year (AF/YR) and indicate the total volume of water consumed by the City in a year. This estimate is used for planning and determination of the following items:

- Groundwater Aquifer Safe Yield Allowances
- Conjunctive Use Capacity Based on Surface Water and Groundwater Aquifer Safe Yield Allowances Balance
- Required Cumulative Surface Water to Meet Conjunctive Use Balance

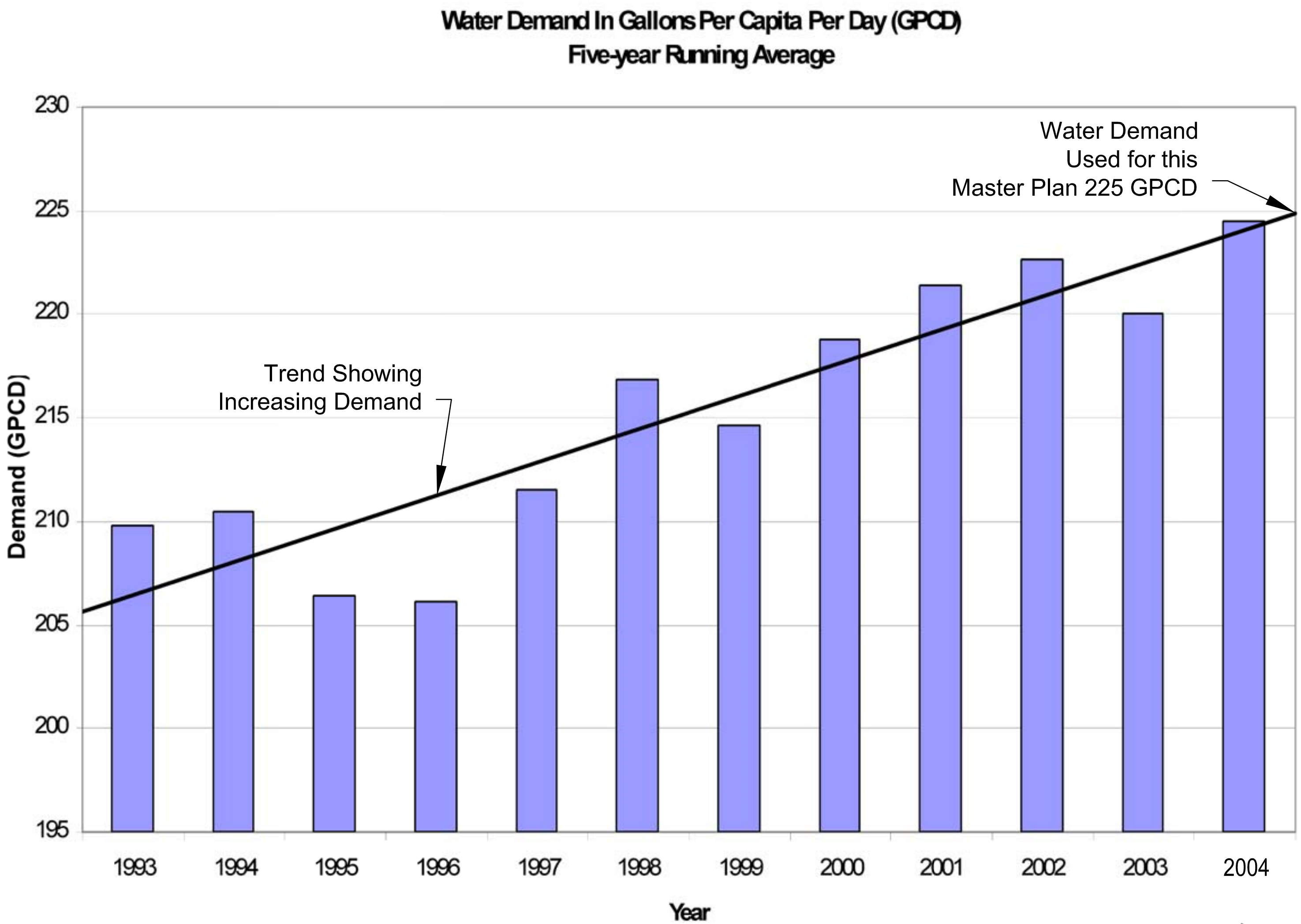
Maximum day water demand reflects the minimum volume of reliable water supply required under California Code of Regulations, Title 22 for the highest water use day for the year. This supply is measured in millions of gallons per day (mgd) and is used to determine required treatment and pumping capacities. The mgd value is also used to estimate storage requirements for flow equalization to address daily peaks. Maximum day demand is also reported in gallons per minute (gpm) for use in calculating the instantaneous flow rates required through pumping or in allocating demand. The City currently meets its maximum day demand with 100% groundwater. The SSJID surface water project will provide a portion of the maximum day demand, reducing reliance on groundwater.

Peak hour demand is measured in gpm and reflects the greatest single hour water use during the year. The peak hour demand is typically supplied by water storage facilities. Manteca has historically met this demand using groundwater extracted through wells and a portion of a 300,000 gallon elevated water storage tank. The SSJID surface water project does not specifically provide for storage to contribute to peak hour supply requirements. Peak hour demand in the future will be met by groundwater, the existing elevated water storage tank, and new water storage facilities.

2.3.1 Historic Water Usage

Historic water production data are based on the City's well meter records. Water consumption projections were based on population growth projections and historical water production trends. Water production data were provided by the City Planning Department's Historic Water Production Log, which includes annual data from 1960 through present.

Water use data were reviewed for the past 15 years. The current City 5-year average water consumption is 224 gallons per capita day (GPCD), as can be seen in Figure 2-4. Although the daily average per capita consumption fluctuates from year to year, there has been an increase of approximately 14 GPCD in the past 10 years, up from approximately 210 GPCD in 1993. Therefore, this Master Plan uses 225 GPCD to provide a conservative estimate of water consumption and to account for recent trends indicating increases in user demand. The per capita average is inclusive of all City water consumption, including residential, commercial, industrial, unaccounted-for-water, and all other land use types and reflects the assumption that the per capita demand reflects all services and uses needed to support the overall community. Site specific or land use specific water duties were used only for determination of the ultimate water demand. Equivalent population was calculated based on the estimated ultimate water demand.



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City of Manteca
2005 Water Master Plan

Five-Year Running Average GPCD

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Figure 2-4

Table 2-5: Historic Population and Water Use Through 2003

Year	Population	Annual Water Production		Average Day Water Production	Average Day Production Per Person
		AF/YR	MG/YR	MGD	GPCD
1960	8,242	2,277	742	2.03	246
1961	8,662	2,486	810	2.20	256
1962	9,350	2,575	839	2.30	246
1963	10,175	2,225	725	1.99	196
1964	10,700	2,461	802	2.19	205
1965	11,200	2,467	804	2.20	196
1966	12,000	2,777	905	2.48	207
1967	12,550	2,547	830	2.27	181
1968	12,950	2,802	913	2.49	193
1969	13,500	3,004	979	2.68	199
1970	13,824	3,115	1,015	2.78	201
1971	14,600	3,225	1,051	2.88	197
1972	15,650	3,710	1,209	3.30	211
1973	16,350	3,646	1,188	3.25	199
1974	17,050	3,621	1,180	3.23	189
1975	17,750	3,901	1,271	3.48	196
1976	18,000	4,478	1,459	3.99	221
1977	18,400	3,830	1,248	3.42	186
1978	20,107	4,619	1,505	4.12	205
1979	21,600	5,472	1,783	4.88	226
1980	23,150	5,785	1,885	5.15	222
1981	25,641	6,485	2,113	5.79	226
1982	27,009	6,319	2,059	5.64	209
1983	27,891	6,604	2,152	5.90	212
1984	29,027	8,142	2,653	7.27	250
1985	32,545	8,621	2,809	7.70	240
1986	35,437	9,099	2,965	8.12	229
1987	37,125	9,437	3,075	8.42	227
1988	38,220	8,881	2,894	7.93	207
1989	39,664	10,124	3,299	9.04	228
1990	40,733	9,873	3,217	8.81	216
1991	41,632	8,940	2,913	7.98	192
1992	42,147	9,695	3,159	8.65	205
1993	43,469	10,272	3,347	9.17	211
1994	44,236	10,290	3,353	9.19	208
1995	44,111	10,631	3,464	9.49	215
1996	44,961	11,014	3,589	9.83	219
1997	45,938	11,938	3,890	10.66	232
1998	47,114	10,545	3,436	9.41	200
1999	48,027	12,273	3,999	10.96	228
2000	49,258	12,607	4,108	11.25	228
2001	51,500	12,969	4,226	11.58	225
2002	55,100	13,509	4,402	12.06	219
2003	57,485	14,298	4,659	12.76	222

Note: Water production data for August through December 1985 were not available. The 1985 figures are an average of 1984 and 1986 data.

It is assumed that 225 GPCD will represent the average day per capita water consumption rate. The City is pursuing alternative irrigation supply sources including irrigation wells and reclaimed water sources. The 225 GPCD demand projection does not incorporate conservation goals, use of reclaimed water for irrigation or other conservation-derived supplies. It is likely that, with conservation, the City will see a reduction in the per capita water use. However, the last 10-year trend has shown an increase in per capita water use and conservation is, therefore, not considered in projections in this report. Future updates to this Master Plan may possibly reflect changes in City water use patterns.

2.3.2 Equivalent Dwelling Units (EDU)

The 2002 City Water Rate Study identifies the typical equivalent dwelling unit for determination of water rates as a 5/8-inch metered residential connection. The Water Rate Study further provided a conversion from total connections, all types included, to equivalent dwelling units (EDU's) of 1.168 EDU per gross City connection. The resulting EDU water requirements are shown in Table 2-6.

Table 2-6: Equivalent Dwelling Unit Water Requirements

Description	Annual Water Requirement	Average Day Demand	Maximum Day Demand	Peak Hour Demand
5/8 Equivalent Meter (EDU)	Surface Water 0.451 ac/ft/year	0.49 gpm	0.98 gpm	1.372 gpm
	Groundwater 0.34 ac/ft/year	706 gallons per day	1,412 gallons per day	1,977 gallons per day
	Total Water 0.791 ac/ft/year			

The number of EDU's equivalent with the existing 2005 population was estimated using a total number of services of 16,769 and includes all existing non-residential water uses. The existing number of EDU's used for Master Planning is 19,586.

Planned development approved by the City is reported to include approximately 5,600 residential lots. The corresponding development maps have been conditioned for water supply requirements requiring construction of Wells 26, 27, and 28. Actual growth infill has been assumed to follow the historical trend and resulting in a 3.4% growth rate.

2.3.3 Ultimate Buildout Water Demand

Ultimate buildout water demand reflects the full development of land within the City in accordance with the General Plan. However, after review of the allowable densities and possible maximum population it became apparent that alternative criteria needed to be considered in planning for water use. Three alternatives were reviewed as follows:

2.3.3.1 Alternative 1 – Full Buildout to the Maximum Density

Under this alternative the total residential acreage by land use type was assigned the maximum allowable density to determine the highest possible water use resulting from the General Plan. The resulting total City population at buildout is approximately 194,000 persons. The corresponding water demand using existing use patterns is approximately 48,898 acre-feet per year. This exceeds the planned supply by approximately 16,608 acre-feet per year.

The planned water supply for the PUSA is approximately 32,290 acre-feet at buildout and is discussed further in Section 4. However, using the planned water supply to limit allowable demand, the resulting average per capita water use would have to be reduced to 148 gpcd. This is equivalent to the typical winter indoor use only demand plus an allowance for water system losses.

It is assumed that growth resulting in the maximum density allowed by the General Plan is unsustainable without significant additional water supplies.

2.3.3.2 Alternative 2 – Full Buildout Limited by Planned Water Supply

A second evaluation focused on the allowable population supportable based on the existing water supply and water use patterns. The planned sustainable supply for the PUSA is 32,290 acre-feet per year. This supply will support a buildout population of 128,110 persons. This level of growth can be attained with no changes to the existing water use patterns or practices.

2.3.3.3 Alternative 3 – Full Buildout Matching Existing City Development

The last alternative built off the existing water use factors by land use to estimate water demands should the City develop consistent with the existing City. This approach resulted in a population of approximately 130,400 persons at total buildout to average densities consistent with current development by land use type. The resulting annual water use is estimated at 32,865 acre-feet per year. As stated before, the sustainable water supply is approximately 32,290 acre-feet per year resulting in a deficit of 575 acre-feet per year or approximately 2%. It is assumed that conservation and recycling can provide for the required 575 acre-feet of additional supply per year.

2.3.3.4 Projected Water Use

The three alternatives addressed above are compared in Table 2-7 below:

Table 2-7: Comparison of Alternative Ultimate Buildout Water Requirements

Description	Annual Water Requirement	Sustainable Supply	Deficit	Discussion
Alternative 1- Full Buildout to the Maximum Density (194,000 population)	48,898 acre-feet/year	32,290 acre-feet/year	16,608 acre-feet/year	Aggressive conservation and use of recycled water supply required. Additional potable water supplies required to support this level of growth.

Table 2-7: Comparison of Alternative Ultimate Buildout Water Requirements (cont'd)

Description	Annual Water Requirement	Sustainable Supply	Deficit	Discussion
Alternative 2- Full Buildout Limited by Planned Water Supply (128,110 population)	32,290 acre-feet/year	32,290 acre-feet/year	0 acre-feet/year	Building limitations required once sustainable water supply allocated
Alternative 3 – Full Buildout Matching Existing City Development (130,391 population)	32,865 acre-feet per year	32,290 acre-feet/year	575 acre-feet per year	Conservation and use of recycled water supply required for 2% conservation.

This Master Plan has assumed Alternative 3 as the basis for projecting growth in water use. Actual growth may exceed the sustainable density and result in the need for aggressive conservation, use of recycled water supplies and possibly a moratorium of further development once the sustainable supply of 32,290 acre-feet per year is allocated within the existing PUSA.

2.3.3.5 Calculation of Adjusted Water Duty Demands

A comparison was made of water duty demands from the 1993 PFIP with existing land use and metered potable water demand for 2003 provided by the City. The water consumption data for each land use type were correlated to land uses described in the 2003 General Plan, and the 1993 PFIP water duties were calibrated to reflect existing actual demand distribution. It was assumed that the current water use characteristics per land use type will remain constant through buildout. This assumption does not account for conservation goals, water recycling and other possible conservation derived sources of supply as discussed above. Future updates to this Master Plan may possibly reflect changes in City water use patterns.

Future analysis of water demands associated with construction of industrial facilities should be considered on a case-by-case basis. The adjusted water duty for industrial land uses presented in Table 2-8 may not reflect the actual impacts of construction of future industrial facilities.

Table 2-8: Water Duty Demands by Land Use Type

Land Use Type	Existing 1993 PFIP Water Duty[a] (gpd/acre)	Adjusted Water Duty[b] (gpd/acre)
Very Low Density Residential (VLDR)	1,950	1,700
Low Density Residential (LDR)	3,250	2,800
Medium Density Residential (MDR)	4,050	3,500
High Density Residential (HDR)	7,650	6,500
Low Industrial (LI)[b]	2,500	300
High Industrial (HI)[b]	2,500	300
Neighborhood Commercial (NC)	3,000	2,200

Table 2-8: Water Duty Demands by Land Use Type (cont'd)

Land Use Type	Existing 1993 PFIP Water Duty[a] (gpd/acre)	Adjusted Water Duty[b] (gpd/acre)
Business Industrial Park (BIP)	300	300
Commercial Mixed-Use (CMU)	3,000	2,200
General Commercial (GC)	2,000	1,500
Open Space (OS)	4,000	4,000
Park (P)	4,000	4,000
Public/Quasi-Public (PQP)[b]	2,000	300

(a) 1993 Public Facilities Implementation Plan
(b) Adjusted water duties calculated using 2003 water consumption data provided by the City. Water duties form Open Space and Park Land Use Categories were not adjusted due to lack of sufficient data to calculate adjustment.

Further refinement of water duties may be presented in the PFIP update reflecting evaluation of development fee classifications and the PFIP values should govern where final numbers in the PFIP differ from the values presented here.

2.3.3.5 Demand Projections Summary

Annual water use, including average day, maximum day, and peak hour water demands are summarized in Table 2-9. Section 2.3.5 of this report provides a detailed discussion of the calculation of demand peaking factors for determination of Maximum Day and Peak Hour demands.

Table 2-9: Projected Water Demand By Source of Supply

			Supply Required[1,2,3]			
Year	Population Projections (3.4% Growth)	Demand Projections (AF/YR)	Surface Water (53% Minimum) (AF/YR)	Groundwater (47% maximum or 1 AF/AC/YR) (AF/YR)	Additional Supply (AF/YR)	Total Supply (AF/YR)
2003	57,485	14,298	NA	14,298	-	14,298
2004	59,439	14,982	NA	14,982	-	14,982
2005	61,460	15,491	8,210	7,281	-	15,491
2006	63,550	16,018	8,489	7,528	-	16,018
2007	65,711	16,562	8,778	7,784	-	16,562
2008	67,945	17,125	9,077	8,049	-	17,125
2009	70,255	17,708	9,385	8,323	-	17,708
2010	72,644	18,310	9,704	8,606	-	18,310
2011	75,114	18,932	10,034	8,898	-	18,932
2012	77,668	19,576	10,375	9,201	-	19,576
2013	80,308	20,242	10,728	9,514	-	20,242
2014	83,039	20,930	11,093	9,837	-	20,930
2015	85,862	21,641	11,470	10,171	-	21,641
2016	88,781	22,377	11,860	10,517	-	22,377
2017	91,800	23,138	12,263	10,875	-	23,138
2018	94,921	23,925	12,680	11,245	-	23,925
2019	98,148	24,738	13,111	11,627	-	24,738
2020	101,485	25,579	13,557	12,022	-	25,579
2021	104,936	26,449	14,018	12,431	-	26,449
2022	108,504	27,348	14,495	12,854	-	27,348
2023	112,193	28,278	14,987	13,291	-	28,278
2024	116,007	29,240	15,497	13,743	-	29,240
2025	119,952	30,234	16,444	13,790	-	30,234
2026	124,030	31,262	17,472	13,790	-	31,262
2027	128,247	32,325	18,500	13,790	35	32,325
2028	132,607	33,424	18,500	13,790	1,134	33,424
2029	137,116	34,560	18,500	13,790	2,270	34,560
2030	141,778	35,735	18,500	13,790	3,445	35,735
2031	146,599	36,950	18,500	13,790	4,660	36,950
2032	151,583	38,206	18,500	13,790	5,916	38,206
2033	156,737	39,505	18,500	13,790	7,215	39,505
2034	162,066	40,849	18,500	13,790	8,559	40,849
2035	167,576	42,237	18,500	13,790	9,947	42,237
2036	173,274	43,674	18,500	13,790	11,384	43,674
2037	179,165	45,158	18,500	13,790	12,868	45,158
2038	185,256	46,694	18,500	13,790	14,404	46,694
2039	191,555	48,281	18,500	13,790	15,991	48,281
Buildout	194,000	48,898	18,500	13,790	16,608	48,898

1. Sustainable PUSA Area Supply = 32,290 AF/year
2. Groundwater constitutes 100% of City water supply until the first full year of SW availability, 2006.
3. Surface water supply may exceed 53% of annual water usage when available from SSJID.

2.3.4 Water Demand Factors

Water demands during peak use periods are determined to assist with the analysis of existing water system facilities and to evaluate the need for future system improvements. This was accomplished by reviewing City water production records and level changes in the elevated storage tank, and considering variations in weather and fluctuations in demand patterns.

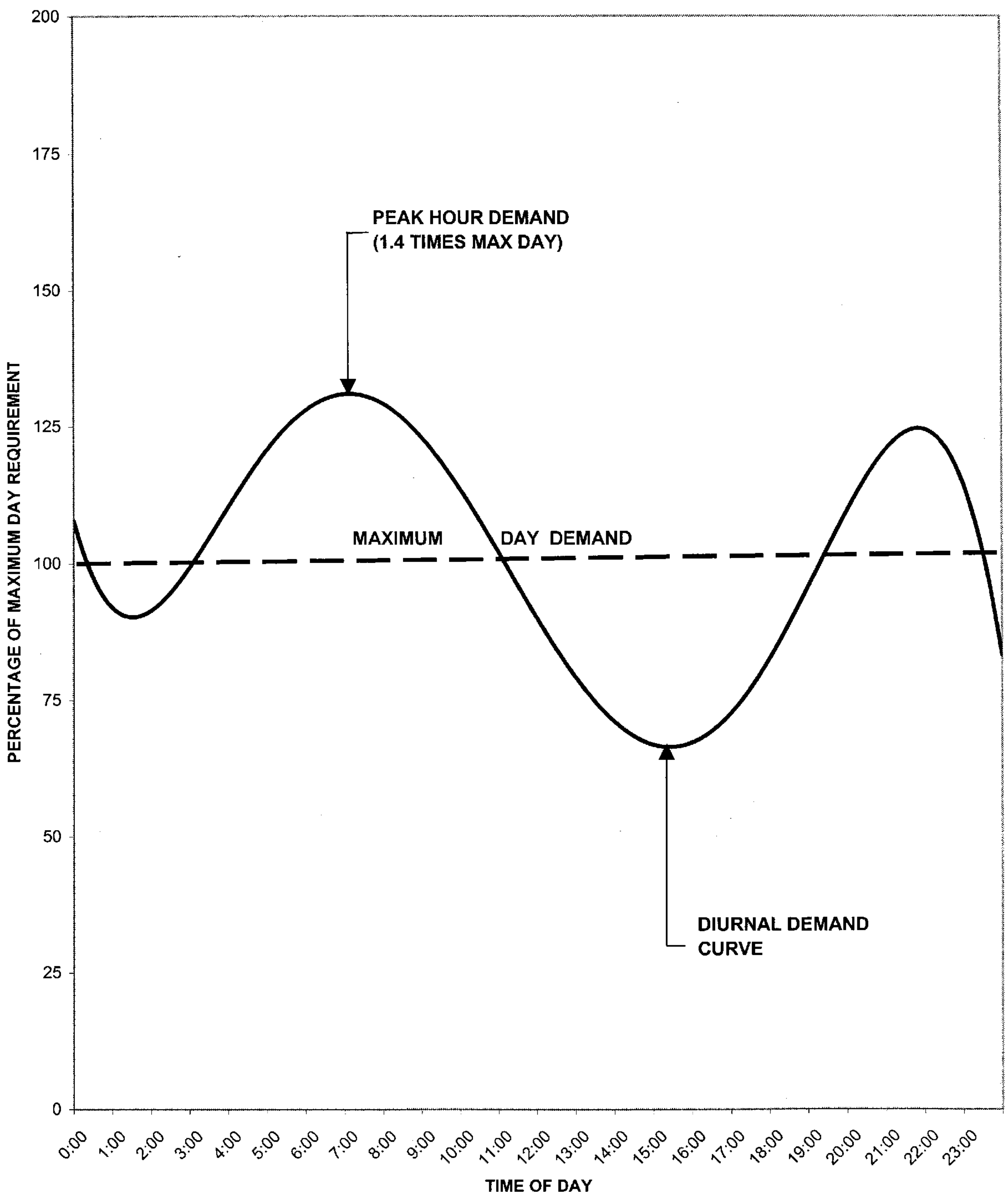
The average day water demand was calculated by dividing total annual water production by 365 days. This average day was assigned a normal demand factor of 1.0 and served as the base to which the maximum day and peak hour demand factors are applied.

The maximum day water demand, taken from actual records, represents the highest total water production on a single day during 1 year. California Code of Regulations, Title 22, requires that maximum day demand be the minimum long-term sustained water supply that must be provided by a water system. Title 22 allows either water storage or additional water supply capacity to meet peak hour demand.

Peak hour is the highest hourly use in the water system. Peak hour conditions have changed with the widespread use of automatic sprinkler systems and water conservation and a more diverse work environment. In addition, the City has proactively managed water demands with staggered irrigation days and water conservation. The resulting changes have reduced the peak hour flow in Manteca from 3.5 times the average day demand in 1985 to approximately 2.8, based on the 1996 water production data. In addition, the period for the peak has shifted from a single peak between 7:00 PM and midnight to two smaller peaks. The current demand profile indicates a peak beginning in the early morning and lasting for 5 to 6 hours and a second peak in the traditional peak period of the early evening.

This is likely a result of providing irrigation to schools, parks, commercial and residential landscaping in the early morning hours and the later domestic uses in the early evening after people arrive home from work. Figure 2-5 presents the City Water Master Plan daily water use diurnal curve.

Maximum Day Diurnal Demand Curve



NOTE:
1. MAXIMUM DAY DEMAND IS THE 24 HOUR AVERAGE OF THE HIGHEST USE DAY.

Kennedy/Jenks Consultants

City of Manteca
2005 Water Master Plan

Maximum Day
Diurnal Demand Curve

K/J 032511.00

Figure 2-5

The demand factors presented in Table 2-10 were used for the purposes of this Water Master Plan. The demand factors are applied to the average day water demand. These factors represent the actual data based on City production records (Appendix). Events that can impact the use of water and increase the peak demands are extended periods of hot weather, changes in irrigation patterns, and shifts in development patterns.

Table 2-10: Water Demand Factors

Water Demand	Demand Factor
Average Day	1.0
Maximum Day	2.0
Peak Hour	2.8
Winter Average Day	0.5
Winter Peak Hour	0.8

2.3.5 Fire Flow Demands

Fire flow requirements vary with the type and size of construction, building use, and spacing between buildings. The City Fire Department has established the following fire flow criteria:

Table 2-11: Fire Flow Requirements(a)

Land Use	Required Fire Flows(b)
Single-Family Residential	1,250 gallons per minute (gpm) for 2 hours
Multi-Family Residential and Community Commercial	2,000 gpm for 2 hours
Office	2,500 gpm for 2 hours
Highway and General Commercial	3,000 gpm for 3 hours
Industrial	3,500 gpm for 3 hours

(a) According to City policy, fire flows above 3,500 gpm (as required by UFC Appendix III-A and ISO schedule) will be the responsibility of developers.
(b) At a minimum of 20 psi residual pressure.

2.4 Water Distribution System

Water distribution system improvements proposed by developers and other non-City interests were assumed to be designed to meet the City's demand, fire flow, system pressure and water quality requirements. The following assumptions were made for the purposes of conducting the water system hydraulic analyses and developing the CPI:

1. The water system will be operated as a single pressure zone.
2. The new water distribution system will continue to be a 12-inch diameter pipe grid on one-half mile spacing to generally provide adequate water pressure and flow distribution.

3. New wells will be located as needed to supplement existing groundwater and surface water supplies, optimize distribution, and maintain minimum pressures during peak conditions throughout the system.

2.5 Water System Reliability and Redundancy

The following assumptions regarding water system operation were used as the basis for planned improvements:

1. Prior to the City obtaining surface water from the SSJID Project, it is assumed the City will meet the peak hour water demand with 15 percent of the production capacity off-line. Once the SSJID Project is operational, peak hour water demands will be met with surface water deliveries reduced by approximately 14%, or with 15 percent of the production capacity off-line, whichever is the greater reduction for the study period. The reduction to SSJID surface water deliveries is described in the South County Surface Water Supply Project Environmental Impact Report, July 1999.

2. Standby power facilities will be provided at all new wells and booster pump stations to meet maximum day plus fire flow demand in the event of a power outage. SSJID Project turnouts will not be equipped with standby power.

3. Commencing in mid-2005, the average annual water supply will be 53 percent SSJID surface water and 47 percent City groundwater, with surface water used as the base load water supply and groundwater to supplement the balance of demand.

4. Future winter water supply will be primarily SSJID surface water with supplemental supply from wells to meet peak winter water demands and as required to maintain well production capacity and water quality.

Table 2-12 below summarizes events that could lead to interruptions in drinking water supply production or distribution, and the recommended reliability and redundancy measures to minimize the likelihood of service disruptions.

Table 2-12: Proposed Reliability/Redundancy (R&R) Measures

Event	Existing R&R Criteria	Proposed R&R Measures
Power Outage	Backup generators on Maximum Day wells plus fire supply.	Backup generators on all wells and booster pump stations.
Mechanical Failure or groundwater contamination	15% Peak Hour Well Production Offline	• 15% Peak Hour Well Production or 14% SSJID Project Supply Offline, whichever is greater • Standby wells (Wells without treatment) • SW B.P. Station[(a)] and Storage

Table 2-12: Proposed Reliability/Redundancy (R&R) Measures (cont'd)

Event	Existing R&R Criteria	Proposed R&R Measures
Aquifer Overdraft	Surface Water Online 2005	• SSJID Project online 2005 • Water Use Management • Conservation-derived supply • Recycled water
Severe Drought	None	• Surface Water scheduling management with SSJID • Voluntary and Mandatory Conservation • Use of SW Storage Tanks and B.P. Stations
Fire	Maximum Day (MD) Supply plus Fire Flow from Wells	MD from Wells, Fire from storage or standby wells

2.6 Preliminary Cost Estimates

Preliminary CIP cost estimates were based on an Engineering News Record (ENR) 20-Cities Average Cost Index for September 2004 of 7,298. These cost estimates include a 20 percent contingency for estimation and construction uncertainties, and a 20 percent allowance for engineering and administrative costs.

2.7 Water System Standards and Design Criteria

This section describes the standards and criteria that were used in evaluating the existing and proposed water systems.

2.7.1 Water Distribution System

The water distribution system design criteria presented below are recommended to maintain a high level of service and to ensure adequate flow and pressure characteristics which will help to minimize operations and maintenance activities and unanticipated capital costs. Minimum design criteria for the water distribution system include the following:

- Design all piping, valves and appurtenances for a minimum pressure of 150 psi. This will allow for normal operating pressures and transient surges.
- Design or select water system materials and components to meet American Water Works Association (AWWA) standards.
- Loop the distribution system to the greatest extent practical to avoid dead end pipes. Where dead ends are unavoidable, such as on some dead end streets, a minimum water main line size of 8 inches is used to help ensure that minimum fire flows to hydrants are achievable.

- Design water mains so that the velocities under average day, maximum day, and peak hour conditions are less than 3 fps, 5 fps and 7 fps, respectively. This will reduce damage to pipe linings and valves and minimize excessive head loss. Ultimately, this will help preserve the life of the pipeline and will contribute to lower maintenance costs.

- Size all mains to limit head loss to three feet per 1,000 feet of length under average day conditions per AWWA recommendations. This is based on an analysis of optimum pipe sizes for lowest total cost of pipeline and pumping costs.

The following table summarizes additional distribution system criteria:

Table 2-13: Water Distribution System Criteria

Item	Criteria
Hazen-Williams "C" factor (Friction Coefficient)	130 for all new pipes "C" factors in the hydraulic model provided by the City were unchanged
Minimum water system pressure under peak hour water demand conditions	40 psi
Minimum water system pressure under maximum day water demand conditions	40 psi
Minimum water system pressure under maximum day plus fire water demand conditions	20 psi
Maximum water system pressure	80 psi

2.7.2 Water Conservation

The City has an active water conservation program that includes the following:

- **Consumer Education** – General public and direct classroom education;

- **Water Saving Fixtures and Appliances** – Adoption of Uniform Plumbing Code and State of California Energy Commission guidelines requiring low flow fixtures for all new construction and distribution of water conservation kits to water customers upon request;

- **Lawn and Garden Irrigation Techniques** – Distribution of pertinent articles and information in utility bills with tips and recommendations on how to reduce irrigation water demands;

- **System Water Audit** – Periodic water audits to evaluate water system losses. Future water audits will focus on commercial, industrial, and park irrigation practices;

- **Water Conservation Enforcement** – A mandatory water conservation program has been in effect in the City since June 1992. Mandatory water conservation is imposed each year from April through October even during wet weather years;

- **Water Rate Evaluation** – Adoption and implementation of a new 5-year inclining block rate schedule that promotes water conservation;

- **Benefit-to-Cost Analyses** – Completion of benefit-to-cost analyses in accordance with the California Urban Water Management Planning Act. The analyses indicate that the programs implemented by the City have positive benefit-to-cost ratios;

- **Water Shortage Contingency Plan** – Development of water shortage contingency measures for 12-, 24-, and 36-month periods.

2.7.3 Unaccounted-for Water

Unaccounted-for water is the difference between water production and the metered demand. A portion of this water may be from system leaks. Underground leaks could be located in water transmission mains, distribution pipelines, service lines, residential meter boxes and/or valves. These leaks are often associated with excessive pressures, ground settlement, overloading, improper installation, or improper materials. According to the AWWA Water Audit and Leak Detection Guidebook, water losses other than leakage can generally be attributed to hydrant flushing of pipelines for operations and maintenance (O&M) purposes, fire hydrant flows for fire fighting, construction practices, illegal connections, malfunctioning distribution system controls, reservoir seepage and leakage, and theft.

In a Municipal Leak Detection Program Loss Reduction document prepared for the State of California Department of Water Resources, Office of Water Conservation, it is estimated that the average unaccounted-for water in the State of California is 9.5 percent. The City water records indicate that the annual unaccounted for water is less than 10 percent. In the summer months, however, the losses exceed 10 percent of the total water produced indicating unaccounted-for water may be due to unmetered irrigation uses rather than leaks within the system.

Prior to 1996, the City parks and landscaped areas used unmetered water and contributed to the unaccounted-for water. In 1996, the City began installing meters at parks to more accurately track water use and losses. The City plans to continue installation of meters at City parks and construct dedicated irrigation wells at the larger City parks to reduce demand on City water supplies. If the unaccounted-for water continues to exceed 10 percent in any given month, a water audit may be required to help locate leaks and identify illegal connections in the system.

Existing records reflect some months where the water demand exceed the water production. This is attributed to a lag between the daily production data collection and the monthly (less frequent) consumption meter reading. The occurrence of consecutive months reflecting this imbalance, however, indicates that other factors may be influencing the data. It is recommended that the City conduct a meter calibration program and conduct a more thorough review of actual reading data to identify potential sources of error. In addition to providing flawed data, inaccurate meter readings could be contributing to incorrect billing (over or under charging) to City customers.

2.8 Recycled Water

The City Wastewater Treatment Plant (WWTP) treats an average dry-weather flow of approximately 6.95 MGD. The City currently uses reclaimed (recycled) water to irrigate City-owned land near the WWTP from about May through September each year. In the remaining months, the WWTP effluent is generally discharged to the San Joaquin River.

The City evaluated potentially treating and distributing recycled water for irrigation of City parks and other open spaces as an alternative to the currently used domestic water supply. The City identified 817 acres of irrigable urban landscape at buildout. Assuming an application rate of 54 inches per year per acre, approximately 3,677 acre feet of water would be conserved. During the irrigation period this is equivalent to approximately 3.28 million gallons per day of reclaimed recycled water would be discharged for urban landscape irrigation.

The incorporation of recycled water in future subdivisions and with relatively large greenbelt or park lands should be reconsidered approximately every 5 years and if a project proponent establishes additional financial benefits to the City.

Section 3: Water Treatment Requirements

The City has provided a safe and reliable water supply based on groundwater for many decades. Recent changes in the Federal Drinking Water Standard have lowered the maximum contaminant level for arsenic in drinking water from 50 µg/l to 10 µg/l. Manteca's wells average about 12.4 µg/l and will require treatment for reduction of arsenic and several sites.

In addition, the City is proceeding with implementing the SSJID South County Water Supply Project bringing new surface water supplies to the community this year. The addition of this new water supply brings with it the added treatment regulatory compliance issues of the surface water treatment rules. To the City's benefit, SSJID will be responsible for the majority of the compliance issues. The City will, however, be responsible for compliance with Stage 1 Disinfection Byproduct Rule testing.

On the horizon is the Stage 2 Disinfection Byproduct Rule requirements, possible Groundwater Rule and continued movement to regulate radon and other potential constituents of concern. This section discusses the water treatment related issues facing the City.

3.1 Groundwater Quality and Existing Water Treatment Facilities

Water quality test data provided by the City were reviewed and the results indicate that the City meets all DOHS drinking water standards. There have been additional instances in the past, where iron, DBCP, EDB, PCE, nitrates, manganese and radioactivity have exceeded the MCLs. Arsenic in the groundwater is known to exceed the new Federal MCL and will be in violation of the standard following the required testing in 2006 at several City wells.

The organic constituents observed in the City wells include DBCP, EDB, and PCE. The City's monitoring program tracks the levels of these organics and the wells that have exceeded the MCLs for these chemicals have either been abandoned or have had treatment facilities installed to keep levels below the MCLs. Well 11 was abandoned due to EDB and DBCP. Granular Activated Carbon (GAC) treatment facilities were in operation from April 1996 through October 2003 at Well 17 and have been effective in reducing levels of DBCP and EDB to below detectable limits.

Nitrates are present in all of the City's wells. The nitrate MCL was exceeded in two wells (Wells 5 and 23) in December of 2001. Additional testing of the wells indicated anomalies in well sampling and operation may have produced the high nitrate levels. The DOHS has required Well 23 to be pumped to waste at startup and the City has installed continuous monitoring for nitrate at Wells 5 and sealed off a high nitrate strata in Well 23 as a result of the December 2001 samples.

Federal law requires testing of public water supplies for radioactivity. The extent of testing depends on the level of gross alpha present in the well. Tests for radium or uranium are required when the gross alpha exceeds the federal indicator level of 5 picocuries per liter (pci/l).

The City has tested for uranium in several of their wells, but has only exceeded the MCL in Well 7, which was subsequently abandoned due to high radioactivity levels.

3.2 Federal and State Regulatory Requirements

As previously mentioned, the City drinking water supply is currently 100% groundwater. After implementation of the SSJID Project in 2005, the City will utilize surface water supply conjunctively with groundwater. Because SSJID will ensure that the surface water supply meets Federal and State water quality requirements, the City will have no responsibility for surface water treatment. This chapter addresses drinking water regulations that will affect the City's groundwater supply, including both current and proposed regulations.

3.2.1 Current Groundwater Regulations

Regulations regarding groundwater supplies in community systems in the United States are undergoing significant revisions. Those revisions are being driven by the Safe Drinking Water Act (SDWA) Amendments of 1986 and 1996, by a regulatory negotiation (Reg-Neg) process of health, environmental and economic issues involving the USEPA and by local concerns in the State of California, where the DOHS has primacy. The evaluation in this report takes into consideration existing regulatory requirements and potential impacts of future regulations to the extent practical.

Groundwater must comply with a number of water quality regulations, including the USEPA and DOHS Primary and Secondary Drinking Water Standards (CCR Title 22), the Lead and Copper Rule (LCR) and the Total Coliform Rule (TCR). The DOHS primary and secondary MCLs meet or are more stringent than the USEPA standards. Current regulations require that each water supplier monitor water source and distribution system quality through a routine sampling program, which must be approved by DOHS. The City water system is currently in compliance with existing drinking water regulations.

3.2.2 Proposed Groundwater Regulations

Federal and State proposed water quality regulations which may affect groundwater include Stage 1 Disinfectants and Disinfection By-Products Rule (D/DBPR), arsenic, radon, sulfate, fluoridation, and the Groundwater Rule (GWR).

3.2.2.1 Disinfectants and Disinfection By-Products Rule (59 FR 38668; July 29, 1994)

D/DBPR mainly pertains to surface water since groundwater typically has very low organic concentrations. Organic constituents, in combination with some disinfection chemicals, can contribute to the generation of disinfection by-products, which are regulated by the D/DBPR. Groundwater typically requires minimal disinfection treatment to obtain an effective disinfection residual in the distribution system. Surface waters, however, typically have higher disinfectant demands and organics (by-product precursor) concentrations and are the primary focus of the D/DBPR regulations.

USEPA is required by Congress to issue new proposed maximum contaminant level goals (MCLGs) and MCLs for the D/DBPRs. USEPA, under Stage 1 and Stage 2 - D/DBPRs, is expected to set new MCLs for selected disinfection by-products, establish maximum residual disinfectant levels (MRDLs), and provide a list of acceptable treatment techniques for control of Disinfection By-Product Precursors (DBPPs). On the basis of the Reg-Neg rulemaking process, the MCL for the disinfection by-products, trihalomethanes (THMs), will be reduced initially from 100 μg/l to 80 μg/l (in Stage 1) and may be reduced later to 40 μg/l (placeholder for Stage 2). The City's groundwater supply has a low total THM concentration with a range of 0 to 4.3 μg/l for 1996 and should continue to comply with the Stage 1 and Stage 2 THM MCLs. However, it should be noted that the surface water source testing requirements for D/DBPR will become applicable once the City starts delivery of SSJID supplies.

3.2.2.2 Arsenic

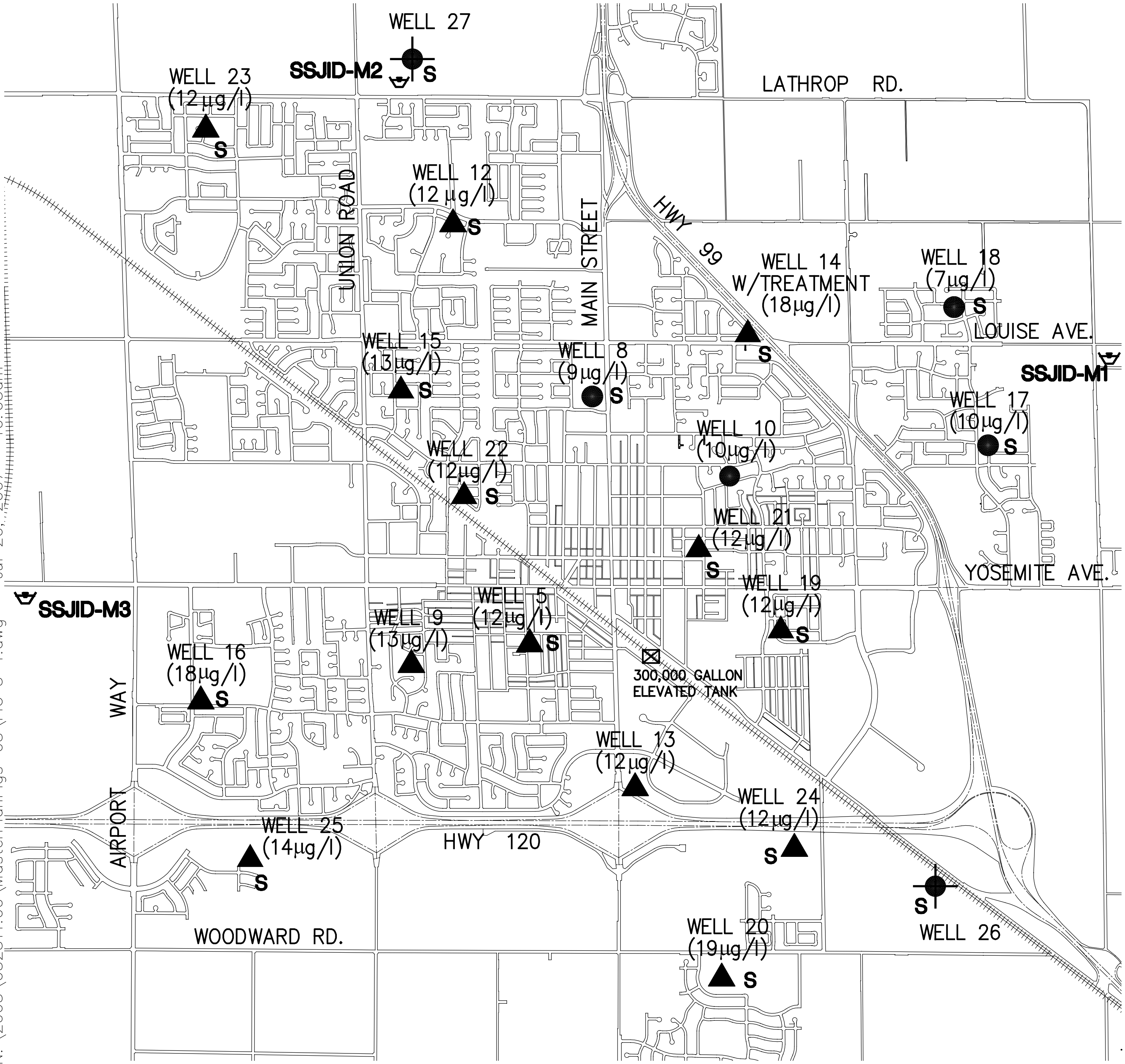
In January 2001, USEPA issued a new regulation for arsenic in community water supplies based on a study of health risks associated with low-level concentrations. The EPA regulation lowered arsenic from the current MCL of 50 μg/l (0.050 mg/l) to 10 μg/l (0.010 mg/l) and further defines the sampling reporting criteria as to the nearest 1 μg/l (0.001 mg/l) under Code of Federal Regulations (CFR) 141.23(i)(4). The Final Rule includes guidance on rounding of sample results such that a 10.4 μg/l (0.0104 mg/l) rounds to 10 μg/l (0.010 mg/l) and 9.5 μg/l (0.0095 mg/l) rounds to 10 μg/l (0.010 mg/l)

Table 3-1 shows the arsenic level in each well based on recent testing results. Figure 3-1 shows the location and arsenic levels for the City Wells.

Table 3-1: Average Arsenic Concentrations at Existing Well Sites

Well Number:	***5***	***8***	***9***	***10***	***12***	***13***	***14***	***15***	***16***	***17***	***18***	***19***	***20***	***21***	***22***	***23***	***24***	***25***
Arsenic Concentrations (μg/l)	11	9.3	12.75	9.5	11.25	12.3	18.25	13	17.5	9.5	6.5	12	18.3	12	12	12	12	14
Arsenic Reporting for Compliance (μg/l)	11	9	13	10	11	12	18	13	18	10	7	12	18	12	12	12	12	14

This regulation has a significant effect on the City groundwater supply. Sixteen (16) wells have arsenic concentrations at or above the 10 μg/l MCL. The State of California Department of Health Services (DOHS) has not adopted the EPA standard as of April 2005 and may establish a more stringent arsenic MCL with a state ruling on arsenic expected in late 2005. However, in order to proceed with a compliance plan, the City has directed Kennedy/Jenks to use a target treatment goal of 8 μg/l for compliance with a 10 μg/l Drinking Water Standard.



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NOTES:
ARSENIC WATER QUALITY RESULTS PROVIDED BY THE CITY. FEDERAL DRINKING WATER STANDARD IS 10μg/l)

LEGEND

- ● EXISTING WELLS MEETING FEDERAL ARSENIC STANDARD
- ▲ EXISTING WELLS NOT MEETING FEDERAL ARSENIC STANDARD
- ⊕ PROPOSED WELLS
- **S** WELLS WITH STANDBY POWER OR GAS ENGINE DRIVE

Kennedy/Jenks Consultants

City of Manteca
2005 Water Master Plan

City Wells Arsenic Levels Location Map

K/J 032511.00

Figure 3-1

Monitoring for arsenic compliance with the EPA rule starts 23 January 2006 and requires sampling over four (4) consecutive quarters and calculation of the average arsenic concentration for determination of compliance. Sampling must occur at the well site and be water drawn before the point of entry to the distribution system. This is particularly important for the City because the City will be receiving SSJID water and many wells will be off-line for approximately half of 2006 while SSJID supplies meet City demands. During this time any samples draw from the distribution system for arsenic compliance will be substantially surface water and will test low for arsenic.

At this time, nether EPA or DOHS provide a method to account for the annual arsenic dosage reduction resulting from conversion to an alternate water supply such as the SSJID surface water supply. Under current rules, each source must be operated for testing quarterly and the results used to demonstrate compliance.

The City has proceeded with the addition of treatment for arsenic reduction at Well 14 to meet an arsenic standard of 10 μg/l. All other wells are addressed by this Master Plan based on the criteria and assumptions listed above.

3.2.2.3 Radon and Radionuclides

The USEPA proposed new regulations for radon on November 2, 1999. A date for issuance of the final radon regulation has not been published. The proposed MCL for radon is 300 pci/l. The proposed regulation provides water utilities with options for complying with the 300 pci/l MCL. The options involve the development of programs that address health risks from radon in indoor air. The programs are known as Multimedia Mitigation programs (MMM). If a MMM is developed by the state, the water utility may adopt the MMM and an alternative MCL of 4,000 pci/l. If the state does not develop a MMM, the water utility may develop its own MMM and adopt the 4,000 pci/l alternative MCL. Significant revision of the approach to regulations for radon and a suitable MCL is underway with no expected reissue date for a revised proposed rule. At present, the City has not tested for radon at any of its wells.

Both DOHS and the USEPA regulate radionuclides. The USEPA issued the final rule for radionuclides on November 7, 2000. The California regulations are for natural and manmade radioactive materials and are listed in 22 CCR 64441 and 64443. The California and USEPA radioactivity MCLs are listed in Table 3-2.

Table 3-2: Radionuclide MCL

Parameter	USEPA	DOHS
Combined Radium 226 and 228	5 pci/l	5 pci/l
Gross Alpha	15 pci/l [a]	15 pci/l [a]
Tritium	--	20,000 pci/l
Strontium 90	--	8 pci/l
Gross Beta	--	50 pci/l
Uranium	30 μg/l	20 pci/l
Beta/Photon Radioactivity	$\leq$ 4 mrems/year	--

(a) Includes Radium 226, excludes Radon and Uranium

3.2.2.4 Sulfate

Sulfate is a secondary contaminate regulated by the DOHS. The City is required to monitor every 3 years for this contaminate. The recommended MCL is 250 ppm with an upper limit of 500 ppm. The City's water quality data show groundwater concentrations for sulfate well below the MCL.

3.2.2.5 Fluoridation

The State of California passed Assembly Bill 733 (Chapter 660, Statutes of 1995) requiring communities with a population over 10,000 to install and operate chemical feed systems to fluoridate the water supply. The legislation dictates that, before enforcing implementation of the fluoridation program, the State must fund the planning, design, installation, operation and maintenance of any fluoridation system. City wells are not fluoridated and the City has no plans to implement fluoridation until State funding has been provided. Existing City groundwater natural fluoride concentrations average about 0.2 mg/l. The City would have to treat groundwater to a fluoride concentration of approximately 0.8 mg/l.

3.2.2.6 Groundwater Rule

The GWR is being developed by the USEPA and has been delayed for several years. The GWR may require disinfection of all municipal groundwater supplies with possible exemptions for communities with wellhead protection programs. The City currently disinfects all well water using sodium hypochlorite solution systems. The only potential significant impact to the City's existing groundwater disinfection practices, if written into the GWR, would be contact time (CT) and the associated empirical immobilization credit requirements that could mandate storage in order to obtain minimum established disinfection contact time before arriving at the first user. Early indications are that this will not be made a part of the GWR, but that a sanitary survey/inspection approach will be required instead.

3.3 Projected Groundwater Treatment Facilities

The City operated a GAC treatment facility to remove organic compounds from the water at Well 17 from April 1996 to October 2003. Future wells, especially in the eastern portion of the City, may have concentrations of organic compounds that exceed some drinking water MCLs. In those cases, similar groundwater treatment facilities may be required along with the well construction. For the purposes of developing the Capital Improvement Program, it was assumed that 20 percent of the new wells through year 2025 will require GAC or similar treatment facilities. This preliminary estimate is based on past experience with City wells and the locations of the existing wells requiring treatment. If groundwater regulations change and MCLs are decreased, the number of new wells requiring treatment for organic compounds may exceed the 20 percent assumed.

The EPA MCL for arsenic will require the installation of treatment systems in many of the City wells. Eighty-nine percent (89%), or 16 of the 18 existing wells exceed the arsenic MCL and will need treatment to continue operation. It is assumed that all new wells constructed through 2025 will require treatment for arsenic. The City's previous Water Master Plan, CIP, and current rate schedule have anticipated the changing arsenic regulation and the City is currently budgeting for treatment and the additional cost of operation and maintenance. This Master Plan amends the approaches used in previous documents and reflects a higher cost of compliance.

The USEPA Arsenic Rule requires testing for compliance starting in January 2006 with the results to be reported for compliance confirmation in the last quarter of 2006. Groundwater systems could have until the last quarter of 2007 to comply if the existing three year sampling frequency is the trigger for the start of arsenic compliance testing. Systems shown to not be in compliance by this testing will be required to come into compliance at that time. USEPA guidance documentation provides for 3-year compliance exemptions to allow for study, design and construction of facilities. Communities such as Manteca with fairly low arsenic in comparison to the previous standard of 50 µg/l may be eligible for up to three 3-year exemptions following the USEPA guidance.

California has not adopted the USEPA standard and is expected to draft its own rule with different guidance and compliance language. However, the state is over 2 years behind schedule in preparing a draft rule. Indications are that DOHS will follow the concept of providing additional time for communities to plan and construct treatment facilities; however, California will not use the exemption approach. DOHS will likely develop community-specific compliance schedules with specific action items and milestones to demonstrate progress towards meeting the new MCL.

This Master Plan assumes that DOHS will implement a compliance schedule approach to arsenic compliance. The Master Plan presents a strategic approach based on the following key milestones:

1. Complete replacement water supply project using surface water (SSJID Project) meeting the full City demand during at least half the year.
2. Construct arsenic treatment for Well 14.
3. Reduce pumping from the two wells with the highest arsenic levels; Wells 16 and 20.
4. Prioritize lead wells to utilize the wells with the lowest arsenic concentrations to the maximum extent.
5. Construct treatment consisting of blending and arsenic removal where feasible to produce a fully compliant water supply.

For the purposes of this Master Plan, the City has directed Kennedy/Jenks to use an assumed California arsenic MCL of 10 µg/l with a maximum treated water goal of 80% of the assumed standard or 8 µg/l.

Section 4: Water Supply Evaluation

Historically, the City has relied upon groundwater as it sole source of potable water supply. Groundwater has provided a safe, reliable and sustainable supply for decades. However, as growth has continued the groundwater basin has exhibited overdraft resulting in declining water tables throughout San Joaquin County. SSJID, in conjunction with the City of Manteca, City of Tracy, City of Lathrop and City of Escalon, has undertaken construction of a surface water supply project including a new water treatment plant and transmission infrastructure to address the basin overdraft.

Construction of the SSJID Project was initiated in 2004 with initial surface deliveries scheduled for 2005. The Water Master Plan assumes the City will begin receiving surface water deliveries June 2005 from the surface water supply project. All future City water supply scenarios include a conjunctive use balance of groundwater and treated surface water based on groundwater extraction limited to 1 acre-foot per acre per year. The SSJID Project will provide the additional supply required to meet City demands up to a maximum delivery of 18,500 AF/YR.

4.1 Water Supply Criteria

The City water supply must meet the projected water demands as presented in Chapter 2. To this end, the City supply has been developed taking advantage of conjunctive use, storage and groundwater supplies for a balanced and reliable supply. The criteria presented in Table 4-1 have been used in assessing adequacy of supply projections and delivery alternatives. The stated criteria include provisions related to the uncertainty for reliability, redundancy and drought.

Table 4-1: Water Supply Criteria

Description	Criteria
Reliable Existing Groundwater Supply	Maximum Annual Extraction – 13,790 acre-feet (PUSA Gross Area) Existing Wells Meeting As Water Quality Standards – Wells 8, 14, 18: Capacity – 5.9 MGD, 4,100 gpm Existing Wells Not Meeting As Water Quality Standards – Wells 5, 9, 10, 12–17, 19–25: Capacity – 33.8 MGD, 23,475 gpm Total Existing Pumping Capacity: 39.7 MGD, 27,575 gpm Reliable Existing Groundwater Supply: 15% Reduction – or two wells

Table 4-1: Water Supply Criteria (cont'd)

Description	Criteria
Reliable Surface Water Supply	Phase 1 – Annual Delivery: 11,500 AF/YR Drought Delivery (14% Reduction)[a]: 9,890 AF/YR Maximum Delivery (1.1 Peak): 12.27 MGD, 8,520 gpm Turnouts: M2 and M3 Phase 2 – 18,500 AF/Yr Total SSJID Planning Area 18,500 AF/Yr Net PUSA Planning Area Annual Delivery: 18,500 AF/YR Drought Delivery (14% Reduction)[a]: 15,910 AF/YR Maximum Delivery (1.1 Peak): 18.17 MGD, 12,614 gpm Turnouts: M1, M2, M3
Reliable Surface Water Supply (cont'd)	Drought reductions identified as 14% reduction in deliveries without stipulations as to schedule in the SSJID environmental impact report (EIR).[a] – Negotiate drought year delivery reduction schedule stipulating winter reductions first, spring/fall reductions second, and summer reduction last. City would rely on temporary supplemental use of groundwater both within SSJID and the City to make up the difference.[b] – Implement conservation measures to achieve minimum 14% reduction in use.
Reliable Water Storage	City Storage – Elevated Tank Volume 300,000; Maximum withdrawal 700 gpm. SSJID Storage – Phase 1 – Two (2) 1 million gallon tanks; Not available for peak supply Phase 2 – Three (3) 1 million gallon tanks; Not available for peak supply

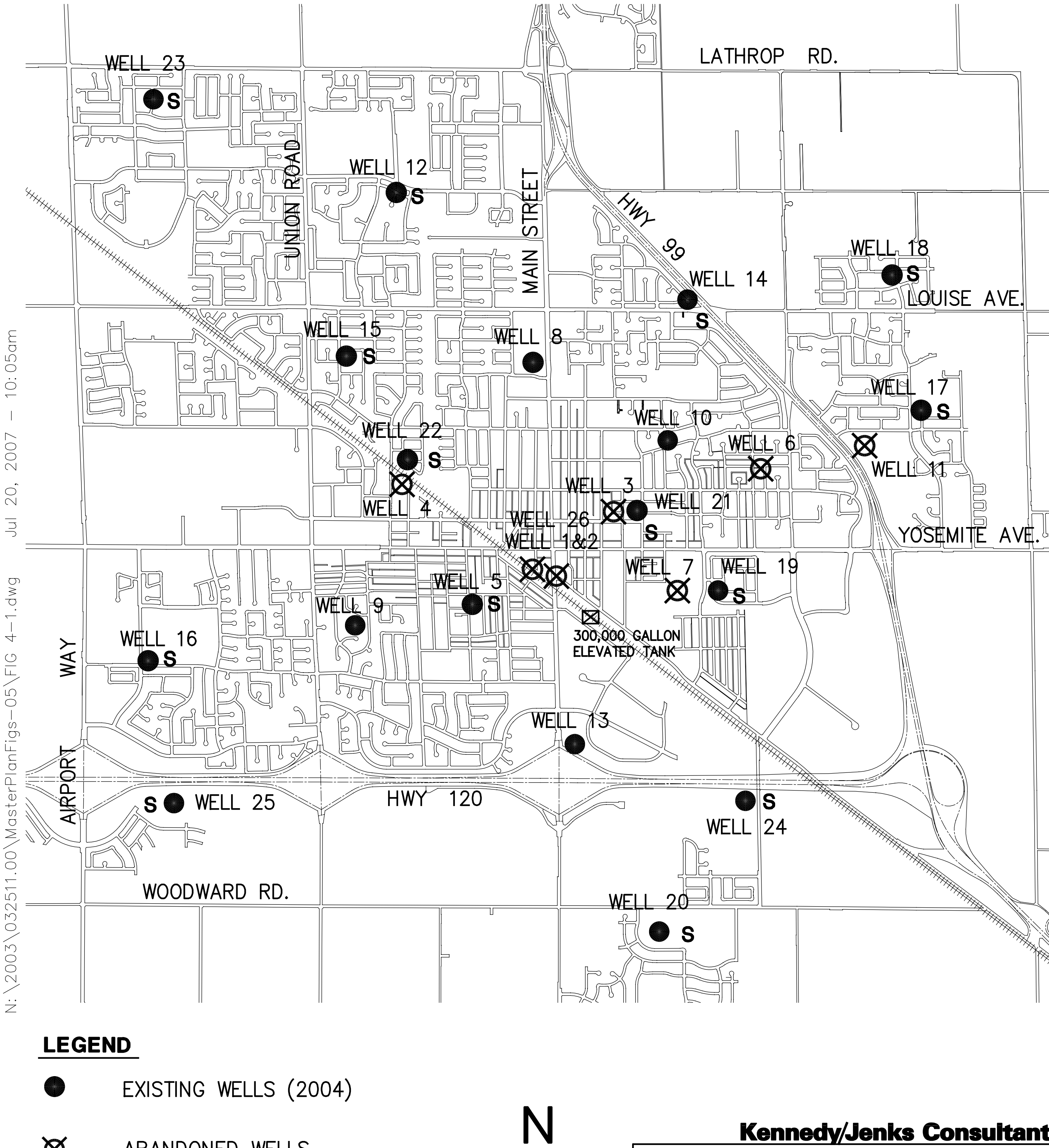
(a) Reduction based Section 5.4.3 of South County Surface Water Supply Project, EIR July 1999, Table 5-6 Expected Surface Water Supply Shortages – SSJID Based on a 71-year Hydrologic Sequence. Reductions assumed Case 5 Year 2025 six-year drought.

(b) Temporary supplemental use of groundwater during drought is addressed under Impact 5.4.6 Cumulative Groundwater Impacts as Less than Significant.

4.2 Conjunctive Water Supply

The City currently operates 18 groundwater wells, with well depths ranging from approximately 190 feet to 400 feet. The locations of the 18 operating wells in the City water system and anticipated location of Well 26 are shown in Figure 4-1. To date, the City has abandoned seven wells due to facility deterioration and/or water quality problems. Two wells (24 and 25) were drilled in 2004 with construction of the pumping facilities expected to be completed in mid-2005.

Development within the City has resulted in overdraft of the aquifer and declining water levels in wells. The SSJID Project provides a surface water supply to supplement the groundwater resource and provide a conjunctive balance using fifty-three (53%) percent surface water and forty-seven (47%) percent groundwater on an annual basis.



LEGEND

- EXISTING WELLS (2004)
- ABANDONED WELLS
- S WELLS WITH STANDBY POWER

N

NOT TO SCALE

Kennedy/Jenks Consultants

City of Manteca
2005 Water Master Plan

City Well Location Map

K/J 032511.00

Figure 4-1

The total surface water supply planned for Manteca is 18,500 acre-feet annually, however, the delivery to the PUSA at a 53% surface water to 47% groundwater ration would limit the maximum delivery to 15,550 acre-feet annually based on the maximum sustainable groundwater with drawl of 13,790 acre-feet. However, nothing in this Master Plan should limit the allowable use of surface water in excess of the 53% ratio when available and at the discretion of the City.

The completion of the SSJID Project will provide supplies to address groundwater overdraft and provide a sustainable water supply as follows:

- 13,790 acre-feet/year sustainable groundwater supply
- 15,550 acre-feet/year PUSA area and 3,000 acre-feet/year exceeding the 53% contribution of surface water supply
- 32,340 acre-feet/year total water supply

The SSJID water treatment plant when completed will have the capacity to deliver the full allotment of Phase 1 water. Figure 4-2 depicts the annual water use by month with a uniform 53% to 47% balance between supplies.

4.2.1 Existing Supply Verses Demand

Tables 4-2 through 4-8 below summarize the balance of groundwater and surface water supplies for the planning periods through buildout of the PUSA.

Table 4-2: Existing Water Supply Verses Demand

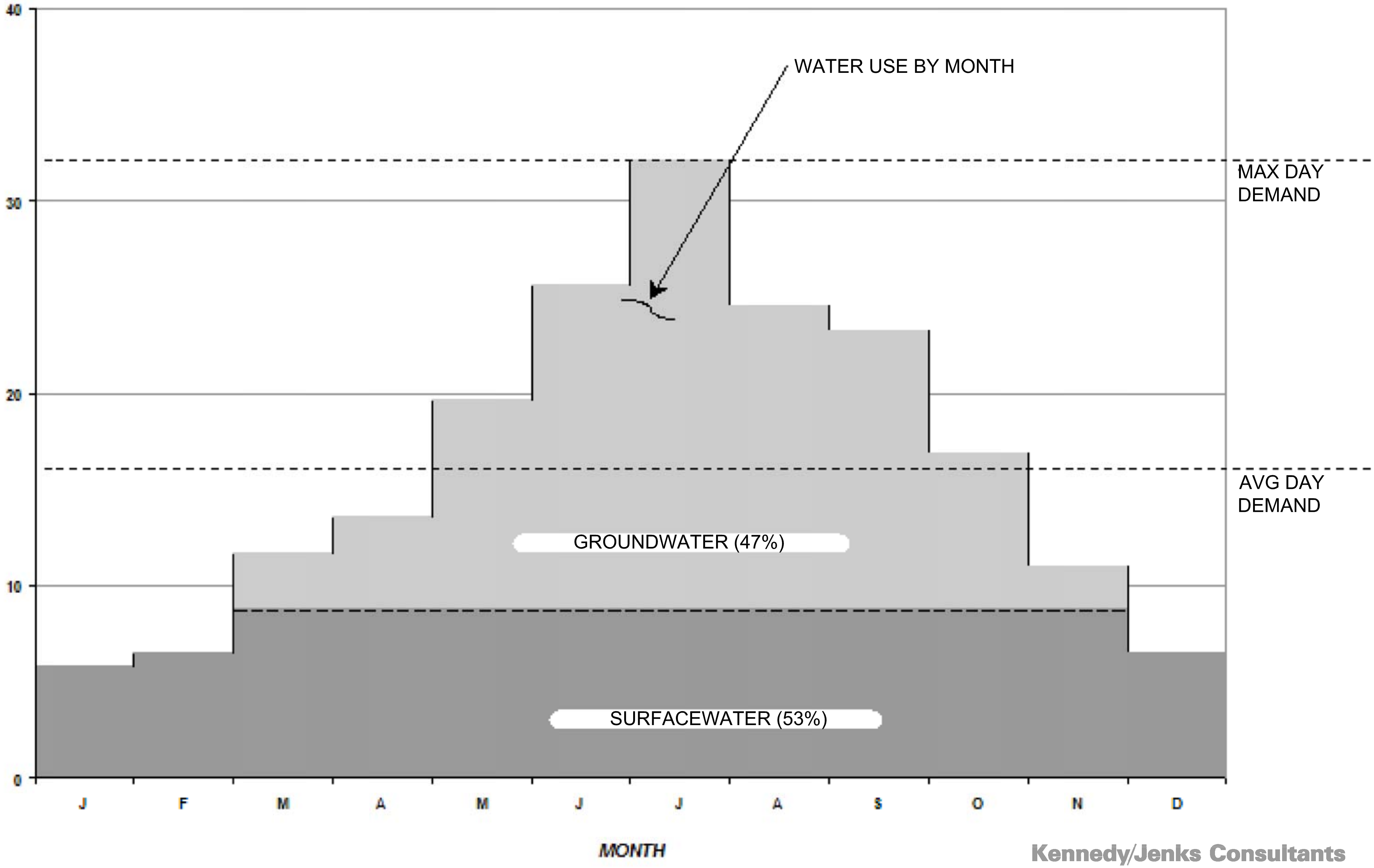
2005 Demand Criteria	Surface Water (mgd)	Groundwater (mgd)	Storage[a] (mgd)	Total (mgd)
Average Day Demand (13.83 MGD)	7.33	6.5	---	13.83
Maximum Day Demand (27.66 MGD)	8.06	19.61	---	27.67
Peak Hour Demand (38.72 MGD)	8.06	19.61	11.06	38.73
Redundancy (15% Groundwater)	---	2.94	---	2.94

(a) Storage may be supplied from tanks or groundwater wells.

Table 4-3: 2010 Water Supply Verses Demand

2010 Demand Criteria	Surface Water (mgd)	Groundwater (mgd)	Storage[a] (mgd)	Total (mgd)
Average Day Demand (16.34 MGD)	8.67	7.68	---	16.35
Maximum Day Demand (32.69 MGD)	9.53	23.17	---	32.69
Peak Hour Demand (45.77 MGD)	9.53	23.17	13.08	45.78
Redundancy (15% Groundwater)	---	3.48	---	3.48

(a) Storage may be supplied from tanks or groundwater wells.



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City of Manteca
2005 Water Master Plan

ANNUAL WATER USE BY MONTH

K/J 032511.00

Figure 4-2

Table 4-4: 2015 Water Supply Verses Demand

2015 Demand Criteria	Surface Water (mgd)	Groundwater (mgd)	Storage[a] (mgd)	Total (mgd)
Average Day Demand (19.32 MGD)	10.24	9.08	---	19.32
Maximum Day Demand (38.64 MGD)	11.26	27.38	---	38.64
Peak Hour Demand (54.09 MGD)	11.26	27.38	15.45	45.78
Redundancy (15% Groundwater)	---	4.11	---	4.11

(a) Storage may be supplied from tanks or groundwater wells.

Table 4-5: 2020 Water Supply Verses Demand

2020 Demand Criteria	Surface Water (mgd)	Groundwater (mgd)	Storage[a] (mgd)	Total (mgd)
Average Day Demand (22.83 MGD)	12.10	10.73	---	22.83
Maximum Day Demand (45.67 MGD)	13.31	32.36	---	45.67
Peak Hour Demand (63.94 MGD)	13.31	32.36	18.27	63.94
Redundancy (15% Groundwater)	---	4.85	---	4.85

(a) Storage may be supplied from tanks or groundwater wells.

Table 4-6: 2025 Water Supply Verses Demand

2025 Demand Criteria	Surface Water (mgd)	Groundwater (mgd)	Storage[a] (mgd)	Total (mgd)
Average Day Demand (26.99 MGD)	14.30	12.69	---	26.99
Maximum Day Demand (53.98 MGD)	15.74	38.24	---	53.98
Peak Hour Demand (75.57 MGD)	15.74	38.24	21.59	75.57
Redundancy (15% Groundwater)	---	5.74	---	5.74

(a) Storage may be supplied from tanks or groundwater wells.

Table 4-7: 2035 Water Supply Verses Demand

2035 Demand Criteria	Surface Water (mgd)	Groundwater (mgd)	Storage[(a)] (mgd)	Total (mgd)
Average Day Demand (37.72 MGD)	18.17	19.55	---	37.72
Maximum Day Demand (75.43 MGD)	18.17	57.26	---	75.43
Peak Hour Demand (105.60 MGD)	18.17	57.26	30.17	105.60
Redundancy (15% Groundwater)	---	8.59	---	8.59

(a) Storage may be supplied from tanks or groundwater wells.

Table 4-8: Buildout Water Supply Verses Demand

Buildout Demand Criteria	Surface Water (mgd)	Groundwater (mgd)	Storage[(a)] (mgd)	Total (mgd)
Average Day Demand (43.65 MGD)	18.17	25.48	---	43.65
Maximum Day Demand (87.30 MGD)	18.17	69.13	---	87.30
Peak Hour Demand (122.22 MGD)	18.17	69.13	34.92	122.22
Redundancy (15% Groundwater)	---	10.37	---	10.37

(a) Storage may be supplied from tanks or groundwater wells.

The estimated total design capacity of the City's 18 operating wells is 28,275 gpm. Individual capacities of the operating wells range from approximately 575 gpm to 2,500 gpm. City wells have historically provided a safe and reliable supply, however recent changes in drinking water standards and enforcement have impacted several existing wells. Table 4-9 provides a summary of the existing condition of each well and lists current water quality concerns.

4.2.2 Standby Wells

Standby wells are divided into two distinct categories: Regulatory Compliant wells and Regulatory Non-Compliant. Both well classifications, although distinct in their ability to provide additional water supply to the distribution system, provide redundancy for the supply system in the event other water sources become unavailable.

Compliant Wells

Compliant standby wells meet all drinking water regulatory requirements, via treatment or otherwise, and are able to operate at any time the system requires, and for any duration. These wells are in excess of wells used to meet maximum day and peak hour demands, and are simply a redundant supply to the system. There are no specifically designated compliant standby wells since any existing compliant well may be placed on standby status.

Table 4-9: Conditions at Existing Well Sites

Well No.	Well Drill Date	Existing Capacity (gpm)	Arsenic Concentration	Water Quality Concerns	Well Site Existing Condition Description
5	1952	1,150	11 µg/l	Arsenic and Nitrate	The Well No. 5 site is in a residential neighborhood and currently serves as a corporation yard for the City. The well has a natural gas backup power supply; however, the generator engine is not functioning and there is currently no available backup power. The well contains high nitrate levels and has a nitrate analyzer to monitor concentrations. The corporation yard is paved and contains a stockpile of pipe, valves and fittings, as well as City operations and maintenance vehicles. There are three access points to the site: two on the east side and an alley which enters via the northwest corner of the site.
8	1962	575	9 µg/l		Well No. 8 is located behind a strip commercial development and is on a small lot with no existing property for treatment. The well meets the arsenic standard if 10 µg/l is adopted by state and the arsenic concentration currently averages about 9 µg/l.
9	1964	450	13 µg/l	Arsenic and Sand	Well No. 9 is located in a park and is housed in a small building in the middle of a grassy area. The existing well produces sand and runs only during peak hour demand at a fixed speed to produce about 450 gpm. The pump pedestal does not currently meet the minimum height requirements of 18 inches above ground level. The site is bounded by a sewer gravity main in the street on the east side, a fence from residential housing on the south side, and a collapsed cable tool well on the north side. There is approximately an 81' x 66' area which may be available for development into an arsenic removal facility or a new well site. The site may also be abandoned due to its lack of water production and infrequent use in the distribution system. (Note: Well abandoned in 2006)
10	1965	800	10 µg/l	Arsenic	This is a low capacity well located in the back of a deep residential lot. The site is next to high power transmission towers and there may be conflicts expanding the site to accommodate treatment due to the power lines.
12	1973	2000	12 µg/l	Arsenic	Well No. 12 is located in a park at 799 Northgate Street and includes land that could be used for construction of treatment facilities. The site is currently scheduled to have a building renovation, new engine generator, site improvements and fencing installed. The pump pedestal does not currently meet the minimum height requirements of 18-inches above ground level.
13	1980	1,000	12 µg/l	Arsenic and DBCP	Well No. 13 is equipped with new 125-hp motor and pump. The well currently produces approximately 1,000 gpm, with a maximum production capacity of about 1,400 gpm. The well site is also used as the chemical storage facility for the City with limited room for expansion to include treatment. The site is located adjacent to an industrial body shop and concrete cutter that are Potential Contaminating Activities (PCA) under the Drinking Water Source Assessment and Protection (DWSAP) criteria. In addition, a 1,2-dibromo 3-chloropropane (DBCP) plume may be moving towards Well No. 13.

Table 4-9: City Well Existing Conditions (cont'd)

Well No.	Well Drill Date	Existing Capacity (gpm)	Arsenic	Water Quality Concerns	Well Existing Condition Description
14	1982	1,800	18 µg/l	Arsenic and Manganese	Well 14 is equipped with a manganese green sand pressure filter system with capability to feed ferric chloride for reduction of both manganese and arsenic. This well discharges the backwash to the City sewer system.
15	1985	2,000	13 µg/l	Arsenic	Well No. 15 is located in a park with ample available area for installation of treatment plant for arsenic.
16	1991	2,000	18 µg/l	Arsenic	Well No. 16 is located on a corner with adjacent school baseball field improvements on one side. There is approximately 768 sq. ft. (32' x 24') of area available for future treatment facilities on the northwest side of the site if an existing baseball pitching cage is relocated.
17	1995	1,200	10 µg/l	Arsenic and DBCP	Well No. 17 contains two existing 12-ft. diameter GAC tanks that were once used for DBCP treatment. DBCP at this site is currently at a non-detectable level and the GAC filters decommissioned in October 2003. Arsenic treatment would fit in the same footprint of the GAC filters.
18	1996	1,500	7 µg/l		Well 18 currently meets drinking water standards.
19	1997	2,200	12 µg/l	Arsenic	Well No. 19 is located at the rear of the City Fire Department. There is approximately 1,431 sq. ft. of land available adjacent to the existing well building. Improvements would have to be coordinated with the Fire Department for use of the adjacent land.
20	1998	1,200	19 µg/l	Arsenic	Well 20 is in an unimproved park and additional land may be available in the park for treatment if necessary. Visual screening may be required to reduce impacts for the adjacent residential land use.
21	1999	1,000	12 µg/l	Arsenic	Well 21 is in a small neighborhood park. Addition of arsenic treatment will further reduce the useable park space and may be unacceptable. However, land does exist for treatment if any siting issues are resolved.
22	1999	950	12 µg/l	Arsenic	Well 22 is located in a residential area and may have adequate space for the addition of arsenic treatment.
23	1999	2,200	12 µg/l	Arsenic and Nitrate	Well 23 is located in an improved park with adequate room for the addition of treatment. Visual screening may be required to reduce impacts for the adjacent residential land use.
24	2004	2,000	12 µg/l	Arsenic	Well 24 is located in a compact site with room for treatment. Facilities are currently being constructed at this site to accommodate side stream treatment.
25	2003	2,500	14 µg/l	Arsenic	Well 25 is located in a compact site with room for treatment. Facilities are currently being constructed at the site to accommodate side stream treatment.

Non-Compliant Wells

According to the California Department of Health Services (DHS), wells that are not compliant with the Arsenic MCL may be used as emergency standby water sources for short periods of time. The California Health and Safety Code, Title 22, Section 64414 Standby Sources describes requirements for non-regulatory compliant, standby wells:

"(a) A source which has been designated "standby" shall be monitored a minimum of once every compliance cycle for all inorganic, organic, and radiological MCLs, unless a waiver has been granted by the Department pursuant to §64432(k) or (l) for inorganics, or §64445(d) for organics.

(b) A standby source which has previous monitoring results indicating nitrate or nitrite levels equal to or greater than 50 percent of the MCL shall collect and analyze a sample for nitrate and nitrite annually. In addition, upon activation of such a source, a sample shall be collected, analyzed for these chemicals and the analytical results reported to the Department within 24 hours of activation.

(c) A standby source shall be used only for short-term emergencies of five consecutive days or less, and for less than a total of 15 calendar days a year.

(d) Within 3 days after the short-term emergency use of a standby source, the water supplier shall notify the Department. The notification shall include information on the reason for and duration of the use.

(e) The status of a designated standby source shall not be changed to that of a regular source of drinking water supply, unless the source meets all existing drinking water standards and approval is obtained from the Department in advance."

Non-compliant wells that are maintained and used only as necessary over short durations will provide a significant supply redundancy to the system. This methodology will alleviate the necessity to construct and maintain compliant standby wells. Compliant standby wells will have a much higher capital and O&M cost than non-compliant wells, however, compliant wells would be able to remain in operation for much longer durations than non-compliant wells.

4.3 New Wells

New wells drilled for the City are assumed to require treatment of arsenic and may include the addition of storage and booster pumping to provide peak hour capacity. Typical site configurations were prepared for various treatment processes and are shown in Figures 4-3 through 4-6. More detailed discussion regarding treatment requirements and constraints are provided in section 6. Table 4-10 summarizes the typical lot size required to accommodate future wells and treatment.

Table 4-10: Future Typical Well Site Assumptions

Description	Typical Lot Size (Acres)
1,500 gpm well with packaged anion exchange sidestream treatment system	0.26
1,500 gpm well with arsenic treatment, no sidestream	0.39
1,500 gpm well with arsenic treatment with sidestream	0.26
1,500 gpm well with arsenic treatment, 1.5 MG storage, and booster pump station (based onsite for Well 26)	2.0

4.4 Surface Water

The SSJID Project was developed based on a 53 percent surface water and 47 percent groundwater conjunctive balance to maintain a sustainable groundwater resource. As stated earlier, the maximum planning area for the SSJID Project is approximately 16,500 acres. The planning area for this Master Plan is 13,790 acres and is within the planned SSJID Project area. For the purposed of this Master Plan the available groundwater supply is 13,790 acre-feet per year with a corresponding full allocation of 18,500 acre-feet per year of surface water.

The Water Treatment Plant and transmission main to the City was under construction at the time this document was prepared. The SSJID surface water supply project is anticipated to begin water deliveries to the City in mid-2005. Surface Water will be provided to the City through a single large diameter water transmission main. Water will flow initially by gravity and ultimately be pumped as demands increase. SSJID will provide water to the City through surface storage reservoirs and booster pump stations. There are currently two new turnout facilities. The City is currently using the two new turnouts as groundwater storage reservoirs and withdrawing water during peak hour periods.

Each new turnout facility has a 1 million gallon (MG) storage tank, with a booster pump station capable of pumping up to 5,600 gpm. The pump stations are equipped with two duty pumps and one backup pump. All three pumps are equipped with variable frequency drive equipment to provided for a variable discharge to the City system. There are no backup power facilities installed at the SSJID turnouts.

The SSJID pumping facilities are designed to discharge the maximum inflow allotment at each turnout and do not have long-term peaking capacity. Pumping at rates higher than the initial maximum daily allotment and thus drawing the 1 million gallon tank water level down over time can achieve short-term peaking capacity. This short-term capacity has been considered in scheduling arsenic compliance projects between 2005 and 2010. However, any long term use of peaking capacity from the SSJID facilities will require additional pumping and possibly storage capacity, as discussed later.

The SSJID facilities are being constructed in two phases. Phase 1 is currently under construction. Once completed, the full phase 1 capacity is reported to be available to the City. The primary planning objective of the surface water project is to off set groundwater overdraft.

This Master Plan assumes a linear annual increase in water deliveries from the water treatment plant (WTP). Actual surface water (SW) deliveries may vary due to operational issues and delivery reductions are also possible in periods of severe drought. Mitigation of surface water delivery reductions during drought periods is discussed later.

Once Phase 1 is complete, up to 11,500 AF will be available annually. The SW allotment will be increased each year to maintain the conjunctive balance. Based on growth projections, the City will need Phase 2 completion by 2015 to continue to meet conjunctive use goals. This is 3 years later than reflected in the SSJID Project EIR.

4.5 Water Storage and Booster Pumping

The City currently has one storage tank; the elevated 300,000 gallon tank. Two surface tanks were constructed as part of the SSJID project and are owned and operated by SSJID. The SSJID reservoirs are 1 million gallons each and are coupled with booster pumping capacity equal to the maximum inflow. For this reason, no peaking capacity has been attributed to the SSJID tanks.

Construction of ground level water storage tanks equipped with booster pumps for delivery of peak demand supply was considered in lieu of additional wells. This strategy would utilize a well pumping directly into the system and indirectly filling ground level storage during off peak periods. The tanks would then be pumped during the peak demand periods using a booster pump station and thereby reducing the need for wells. This approach was considered to reduce the required installed wellhead treatment capacity to match the maximum day demand and supporting peak hour from tanks.

Each water storage tank is assumed to be composed of steel construction with a reinforced concrete foundation. There are three components to storage: equalization, fire and emergency, as follows:

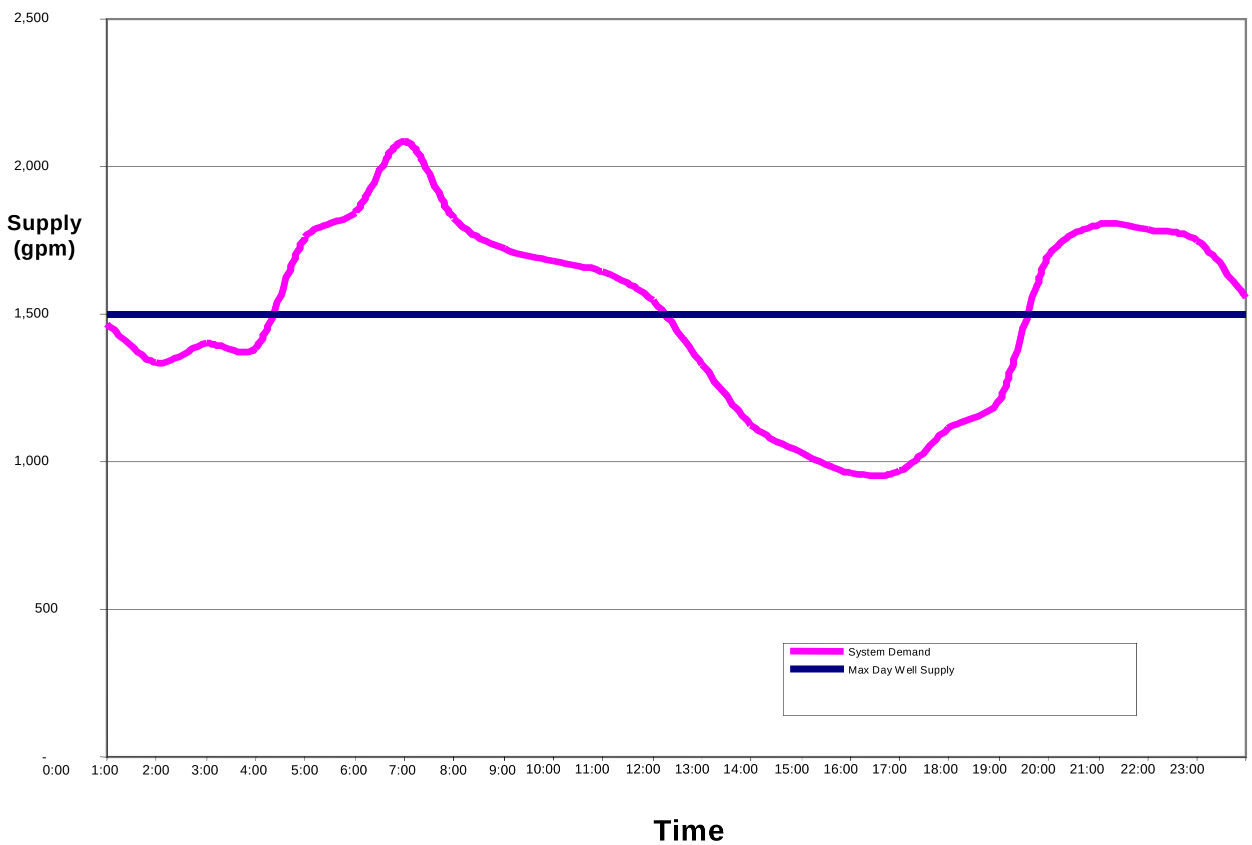
1. **Equalization Storage:** Portion of peak hour demand that may be provided by one well during maximum day demand will enable the storage tank to be completely full by the end of the 24 hour maximum day demand period. For conservative estimation of allowable storage, a 20-hour drain and fill period was assumed.
2. **Fire Flow Storage:** The City will provide storage and pumping capacity for a fire during maximum day demand. The highest existing fire flow requirement the City is required to provide for is an industrial area at 3,500 gpm for 3 hours. Therefore, storage will be sized with adequate capacity to provide 3,500 gpm of flow for 3 hours, or 630,000 gallons.
3. **Emergency Storage:** 25% of tank equalization storage

The following additional assumptions were made regarding the supply reliability from storage.

- Future storage will meet minimum fire flow demand requirements.
- Each booster pump station will include a standby pump and full backup power generation.

Figure 4-3 shows the theoretical storage component available from a single 1,500 gpm well. The estimated supply volume available for equalization storage is 250,000 gallons. The associated peak pumping capacity required is approximately 700 gpm. Using the sizing criteria listed above the fire storage is 630,000 gallons and the emergency is 25% of 250,000. The net minimum tank size is approximately 1 million gallons.

Figure 4-3: Theoretical Storage for 1,500 gpm Well



Assuming a minimum of two wells will feed a single tank increases the minimum tank size to 1.3 million gallons.

The recommended minimum tank size for surface storage is 1.3 million gallons and must be supported by a minimum of two wells operating at 1,500 gpm during the entire 24 hour maximum day period. The minimum installed pumping capacity is 3,500 gpm for fire flow and is estimated based on three pumps at 1,800 gpm each; two are duty pumps and one is standby.

4.6 Well System Operation and Control

Most of the City water system wells turn on and off based on assigned pressure settings. These assigned pressure settings remain constant throughout the year and are not reset seasonally. The exceptions to this are Well 18 and Well 19, which come on at low pressure but shut off at low flow. The low flow is a result of the pressure sustaining valve partially closing due to increased system pressure. The resulting lower flows and higher heads available at Wells 18 and 19 provide some flexibility in the pumped supply operating curve and reduce pump on/off cycling.

The pressure and flow settings are set individually at each well and can be monitored or adjusted both manually and electronically via the City SCADA program. Through practical application and experience, the City has sequenced the wells in order of priority based on well water quality, reliability, location, and capacity.

The SCADA system utilizes remote telemetry units (RTUs). RTUs at the storage tank and well sites communicate via radio to the Master RTU and supervisory computer at the Water Division yard. The supervisory computer includes operator interface software. The Master RTU also communicates via leased telephone line to a second computer at the Corporation Yard. The SCADA system monitors tank level, well discharge pressures, flows, power demands, groundwater levels, and pressure setpoints to start and stop each well pump; displays intrusion, power fail, standby generator engine running, standby generator engine fail, and remote control disabled alarms; totalizes well flows and pump run time hours; and has an historical trend feature.

Section 5: Water Distribution System Evaluation

The City water distribution system has been evaluated for two differing criteria: existing condition and replacement liability over the next ten (10) years, and expansion to address planned growth. The existing liability has been addressed through ten (10) grouped projects to replace existing steel pipelines up to 6-inch diameter and cast iron pipelines with known condition problems. In addition, hydraulic improvement projects have been developed to address pipelines with insufficient diameters that exist between existing larger diameter water mains and to address areas with inadequate pressures and flows during peak use periods.

It is assumed that water system expansion will accommodate future growth to include new wells, tanks, and booster pump stations constructed as projected demand approaches capacity. The final location and configuration of these facilities cannot be determined at this time, however a preliminary capital improvement schedule has been provided using the projections presented in previous chapters.

Water system expansion to accommodate future growth assumes a water main grid system consisting of 12- to 16-inch pipelines on a grid system with subdivision specific distribution piping being provided by developers.

5.1 Description of Existing Distribution System

The City's existing water distribution system consists of a buried network of pipelines ranging from 1- to 6-inch pipelines in the older parts of the City, to 8-, 12-, and 16-inch diameter pipes in the newer areas. The distribution system conveys water from the sources to customers and must provide capacity to meet all domestic, industrial, irrigation, and fire suppression demands. Due to the distributed nature of the groundwater wells, large transmission pipelines were not needed to move large volumes of water around the City. However, hydraulic limitations will exist as wells are abandoned as the City begins to utilize only newer wells equipped with arsenic treatment.

Existing water distribution facilities that were reviewed include pipelines and the elevated storage tank to develop recommendations for planned system maintenance. These recommendations address the increasing cost of repairing buried assets verses replacement through a capital reinvestment program. Also included in the planned system maintenance recommendations are improvements to connect the existing larger diameter pipelines in the core City area to strengthen the system hydraulically and address anticipated hydraulic limitations resulting from well abandonment as part of the City's arsenic compliance program.

5.1.1 Planned System Maintenance

A planned system maintenance approach assumes that buried assets such as pipes and valves deteriorate at a predictable rate based on materials type, environmental conditions and age. This approach also assumes that replacement at approximately 80% of the useful life provides a significant benefit in deferring emergency repair costs from repeat failures in the same general pipeline segments.

5.1.1.1 Distribution System Projects

Installation of pipeline improvements in developed areas historically was completed without the full abandonment and transfer of services from older and smaller pipelines to the new pipelines. Maintaining operation of the smaller pipelines was initially not a significant expense. However, as the pipes approach the end of their useful life the repair costs will exceed the expense of a systematic planned system maintenance approach to replace the pipes.

City operation and maintenance personnel compiled maps identifying problem areas, and these maps were further evaluated by Kennedy/Jenks. During this process, approximately 25,000 lineal feet (LF) of 4-inch and smaller pipelines in poor condition were identified. Many of these lines are in alleys and back lots with limited access for maintenance. In addition, approximately 4,750 LF of 6-inch pipe was identified for abandonment.

Figure 5-1 identifies ten areas for the staged replacement of the aging infrastructure. The order was assumed based on the vicinity to the central City core. Projects range from abandonment of small lines with conversion of services to existing newer pipelines to full replacement of water mains and services. The minimum 4-inch diameter pipe was assumed for short deadend lines serving a limited number of customers. The 4-inch pipe is proposed to reduce the residence time of the water in the pipe and potential for formation of disinfection byproducts as the water ages in the pipe. The balance of the replacement pipelines is recommended to be 6- and 8-inch pipes. Recommendations for pipelines larger than 8 inches have been presented in the next section as hydraulic improvement projects.

SCALE: 1" =1000'

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PROJECT BOUNDARY

Kennedy/Jenks Consultants

City of Manteca
2005 Water Master Plan

Planned System Maintenance Distribution System Projects

K/J 032511.00
Figure 5-1

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The actual implementation schedule may consider other planned infrastructure projects, pavement resurfacing and redevelopment efforts. Table 5-1 provides a listing of the findings for each of the ten areas.

Table 5-1: Planned System Maintenance – Distribution System Projects

Project Area Number	Infrastructure to be Abandoned	Replacement Infrastructure	Implementation Schedule	Estimated Cost
1	Pipelines: 4-inch and Smaller – 700 LF 6-inch – 850 LF	Pipelines: 6-inch – 1,500 LF 8-inch – 850 LF Services: Replacement – 34 each	2005 – 2007	$386,000
2	Pipelines: 4-inch and Smaller – 3,600 LF 6-inch – 2,350 LF	Pipelines: 4-inch – 200 LF 6-inch – 1,450 LF 8-inch – 6,900 LF Services: Replacement – 85 each Relocation – 134 each	2006 – 2008	$1,769,000
3	Pipelines: 4-inch and Smaller – 5,400 LF	Services: Relocation – 155 each	2007 – 2009	$477,000
4	Pipelines: 4-inch and Smaller – 900 LF	Pipelines: 8-inch – 700 LF Services: Relocation – 35 each	2008 – 2010	$210,000
5	Pipelines: 4-inch and Smaller – 6,100 LF	Services: Relocation – 144 each	2009 – 2011	$444,000
6	Pipelines: 4-inch and Smaller – 1,050 LF	Pipelines: 4-inch – 150 LF 6-inch – 550 LF Services: Replacement – 31 each	2010 – 2012	$178,000
7	Pipelines: 4-inch and Smaller – 3,450 LF 6-inch – 1,440 LF	Pipelines: 8-inch – 7,400 LF Services: Replacement – 50 each Relocation – 84 each	2011 – 2013	$1,454,000
8	Pipelines: 4-inch and Smaller – 1,500 LF 6-inch – 950 LF	Pipelines: 6-inch – 1,500 LF 8-inch – 850 LF Services: Replacement – 34 each	2012 - 2014	$400,000

Table 5-1: Planned System Maintenance – Distribution System Projects (cont'd)

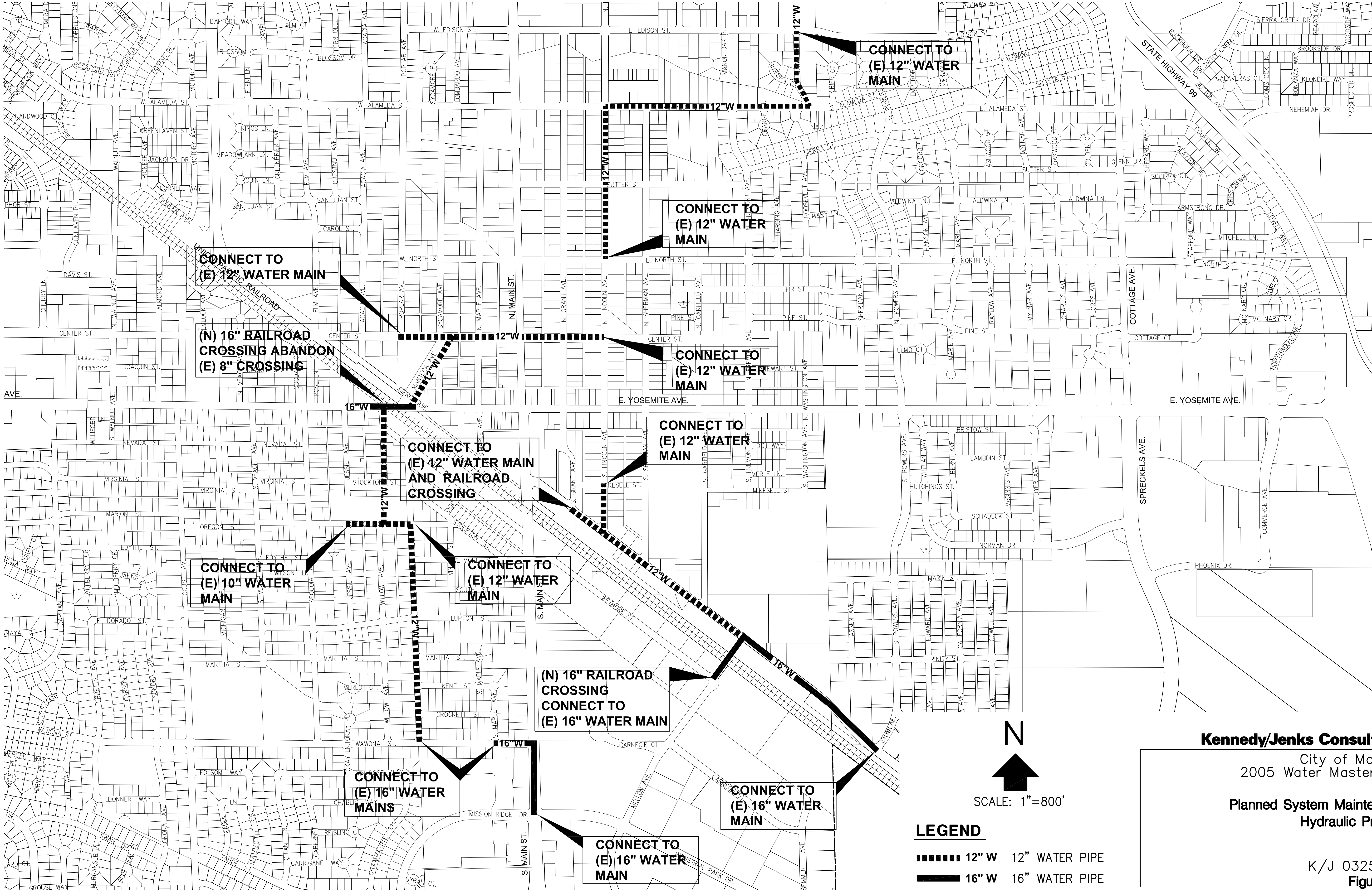
Project Area Number	Infrastructure to be Abandoned	Replacement Infrastructure	Implementation Schedule	Estimated Cost
9	Pipelines: 4-inch and Smaller – 700 LF 6-inch – 950 LF	Pipelines: 6-inch – 450 LF 8-inch – 750 LF Services: Replacement – 45 each	2013 - 2015	$294,000
10	Pipelines: 4-inch and Smaller – 1,850 LF	Pipelines: 6-inch – 300 LF 8-inch – 850 LF Services: Relocation – 80 each	2014 - 2016	$401,000

Note: Service relocation reflects relocating the service from the street to the back of the lot and abandoning the existing service connection. Service replacement reflects replacement of a front lot service with a front lot service.

5.1.1.2 Hydraulic Projects

Pipeline improvements completed in the past have generally included construction of larger pipes to convey water from wells to distribute water supplies throughout the City. The resulting improvements consist of larger pipes near wells transitioning to smaller pipes further away from the well. This approach has historically worked well for the City, however, the need to consolidate well production, as part of constructing treatment facilities for arsenic will require connecting these existing larger pipe segments together.

The identified hydraulic improvements are shown in Figure 5-2 and are described in Table 5-2.



LEGEND

12" W — 12" WATER PIPE

16" W — 16" WATER PIPE

Kennedy/Jenks Consultants

City of Manteca
2005 Water Master Plan

Planned System Maintenance Hydraulic Projects

K/J 032511.00

Figure 5-2

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Table 5-2: Hydraulic Improvement Projects

Description	Quantities	Implementation Schedule	Estimated Cost
• 16-inch extension S. Main from Mission Ridge Dr. to Wawona Street and S. Maple Avenue	• 1,050 LF 16-inch Main	2005 - 2007	$306,000
• 12-inch extension N. Lincoln Ave, E. North Ave. to W. Alameda St. • 12-inch extension W. Alameda St., N. Lincoln Ave. to Dawn Dr. • 12-inch extension Dawn Dr., W. Alameda St. to E. Edison St.	• 3,850 LF 12-inch Main	2006 - 2008	$792,000
• 12-inch extension Manteca Ave., Yosemite Ave. to Center St. • 12-inch extension Center Street, Poplar Ave. to N. Lincoln Ave.	• 2,600 LF 12-inch Main	2007 – 2009	$512,000
• 16-inch extension Moffat Blvd. • 16-inch Railroad Crossing with extension to Wetmore Street • 12-inch extension to S. Grant Ave. • 12-inch extension S. Lincoln to Mikesell St.	• 2,100 LF 16-inch Main • 200 LF Railroad crossing with 24 inch jack and bore • 2,300 LF 12-inch Main	2008 - 2010	$2,094,000
• Yosemite Avenue Railroad Crossing – replacement of old 8-inch pipe with 16-inch crossing	• 400 LF 16-inch Main • 200 LF Railroad crossing with 24-inch jack and bore	2009 – 2011	$1,407,000
• 12-inch extension Park Avenue for Wawona Ave. to Oregon St. • 12-inch extension Oregon St. to Willow Ave, and up to W. Yosemite Ave.	• 3,500 LF 12-inch Main	2010 – 2012	$607,000

5.1.1.3 Elevated Storage Tank

The City's elevated water storage tank was last inspected in 2001 and reported to be in generally good condition with the painting and coating system intact and limited corrosion observed. The City completed building code updates in 1996 resulting from an inspection completed in 1995. The 1995 inspection repair recommendations included the following:

1. Adjust wind struts and diagonal members by pre-stressing the member with the tank empty to reduce sagging when the tank is filled.

2. Weld strut ends throughout the structure to address minor joint damage.

3. Install anchor chain covers and pack with grease.

No significant deficiencies were identified at the time of the 1995 inspection, 1996 modifications or 2001 inspection. Kennedy/Jenks observed the tank from the base and inspected the footings, steel coating and appurtenances visible from the ground. The following observations were made:

1. The anchor bolts were tight with no significant corrosion observed. The painting system appeared in good condition.

2. There were no apparent leaks in any portion of the tank.

3. The structure appeared to be in fair to good condition.

Based on the history of favorable maintenance records, there is not indication that the structure is significantly compromised from its original design condition. The painting system is reported to have been applied in 1987 and is consequently approaching 20 years of service. Table 5-3 provides the recommended planned system maintenance for the elevated tank.

Table 5-3: Planned System Maintenance – Elevated Tank

Description	Recommended Maintenance	Schedule	Estimated Cost
Coating System	● Inspect coating system	2006	$10,000
Structural System	● Inspect tank structural elements	2006	$15,000
Structural System Testing	● Conduct non-destructive testing of all structural elements and evaluate for seismic upgrade prior to recoating tank	2012	$25,000
Coating System	● Remove and recoat entire tank at 25 years	2012	$450,000

5.1.2 Distribution System Extension for Planned Growth

Extension of the existing City water distribution system to provide service to new developments is proposed using 12- and 16-inch water distribution main pipelines along a grid of approximately ½- to 1-mile blocks. This system of main lines supports the project specific infrastructure constructed by developers as part of subdivision improvements. This neighborhood piping further reinforces the infrastructure grid and increases the distribution system reliability.

The 12-inch diameter grid piping provides for reliable distribution of flow and enables the system to meet fire flow and pressure requirements. The 16-inch piping supports larger well projects such as the planned Well 26 anticipated to produce approximately 2,000 to 2,500 gpm.

Figures 5-1 through 5-4 present the projected infrastructure mains and possible well projects through Well 29. The figures show the City separated into four areas reflecting the large tracks of developable land. The estimated total length of 12-inch water main required to support building is 169,600 lineal feet or approximately 32 miles. Table 5-4 lists the estimated piping requirements for the four areas shown in the figures.

Table 5-4: Distribution System Extension for Planned Growth

Description	Estimated Piping	Estimated Cost
Northern Area within the Primary Urban Service Area north of Lathrop Road, west of Highway 99 and east of Airport Road	41,600 LF of 12-inch diameter pipeline to support total buildout	$6,670,000
West Central Area within the Primary Urban Service Area north of Highway 120 and west of Airport Road	18,700 LF of 12-inch diameter pipeline to support total buildout	$3,041,000
East Central Area within the Primary Urban Service Area east of Highway 99 and north of Louise Avenue	7,000 LF of 12-inch diameter pipeline to support total buildout	$1,188,000
Southern Area within the Primary Urban Service Area south of Highway 120	102,100 LF of 12-inch diameter pipeline to support total buildout	$19,467,000

5.1.3 Water Supply Development for Planned Growth

Water supply development for planned growth includes a combination of surface water and groundwater. Surface water is planned to comply with the minimum 53% contribution to supply with the balance coming from a maximum of 47% groundwater (limited to 1 acre foot pre acre per year) for a conjunctive supply balance. As noted in Table 4-2 however, growth allowable under the General Plan exceeds planned water supply utilizing groundwater and current contracted surface water deliveries through SSJID. This section addresses the groundwater element to support growth. Identifying additional supplies to meet ultimate buildout are beyond the scope of this work.

The water requirement for maximum day demand to be support an equivalent dwelling unit (EDU) identified in Table 2-6 is 0.98 gpm. Assuming surface water provides 1.1 times the maximum day demand as available supply, the balance to be met with groundwater is 0.69 gpm. The peak hour demand however must also be met with reliable supply that can come from additional wells or from storage. For planning purposes we have assumed additional groundwater supply will be constructed to meet peak hour demand. The resulting total groundwater supply per EDU to meet peak hour demand is 1.09 gpm.

New wells are assumed to have a reliable capacity of 1,500 gpm each. Using the 1.09 gpm per EDU the capacity available per well is 1,376 EDU. The estimated cost per well is $3,241,000 with full arsenic treatment. The existing EDU commitments for the City are 19,586 or a population of approximately 58,400. Ultimate buildout population is 194,000 or an additional 135,600 persons. The resulting EDU count is 45,500 and a required 33 wells to meet the groundwater component of peak hour supply (without redundancy).

The estimated cost for construction of 33 new wells with arsenic treatment is $106,953,000. The cost per EDU is $2,350.

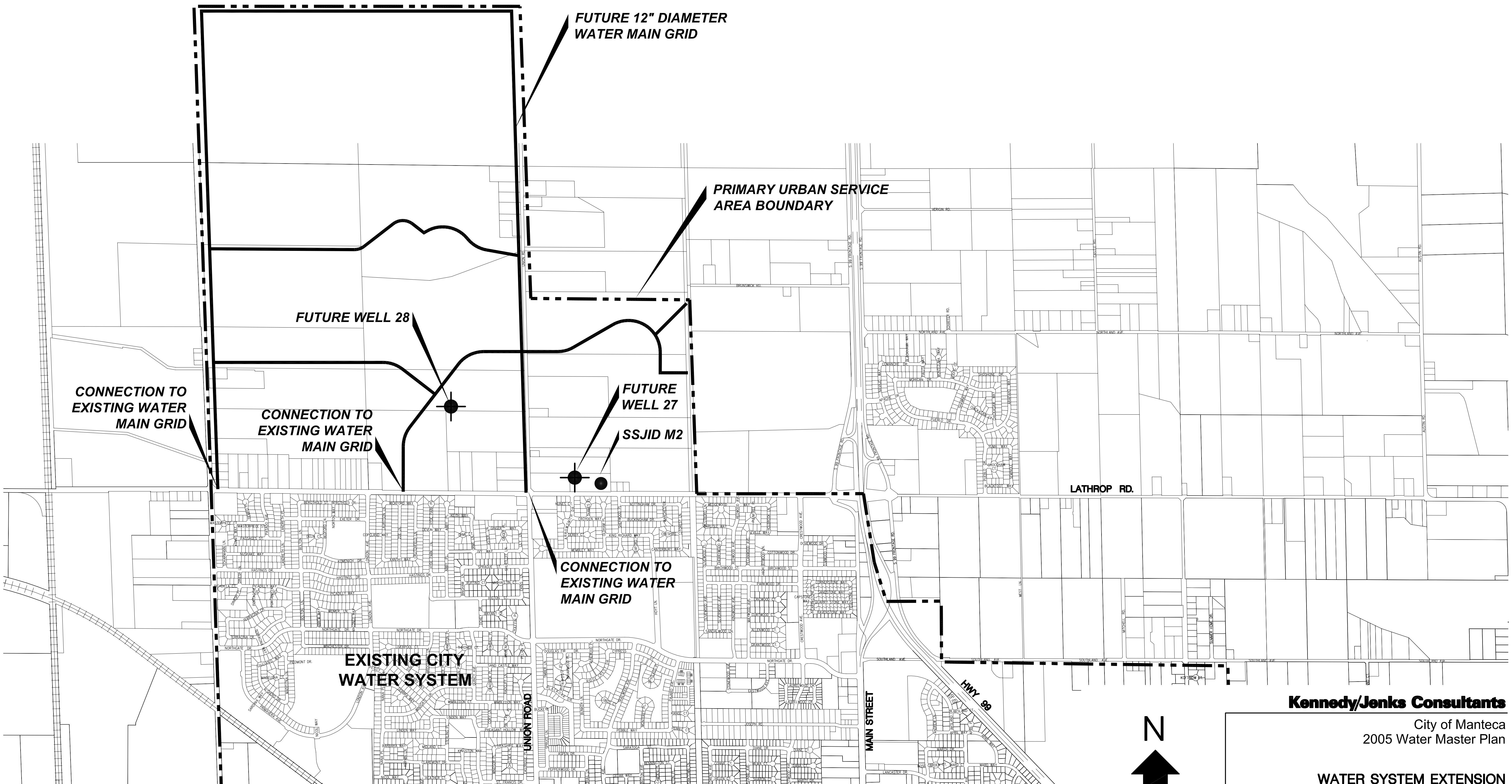
5.1.4 Summary Cost per EDU through Ultimate Buildout

The combined cost for distribution expansion and supply development is $137,319,000. This will not provide for the total supply required to meet ultimate buildout as previously discussed, however, assuming conservation and use of reclaimed water reduces demand, the cost per EDU at ultimate buildout is approximately $3,018.

5.2 Water System Model

The existing City hydraulic computer model utilizes Haestad Methods WaterCad for Windows software. Originally created in KYPIPE in 1985, the model was converted to Cybernet 2.0 in 1994, and to WaterCad for Windows in 1997. The City has maintained the WaterCad software since 1997 and the model has been periodically updated to reflect new developments and City well improvements. This Master Plan includes an update of the water model to address the following changes:

- Conversion of all wells to variable speed drive pumps and calibration of on, off and pressure setting control sets.
- Review of all past model scenarios to delete non-viable proposed development projects.
- Update of SSJID turnout pump stations preliminary design criteria to reflect final design parameters.



LEGEND

FUTURE 12" DIAMETER PIPELINES

FUTURE WELL PROJECTS

SSJID TURNOUT

Kennedy/Jenks Consultants

City of Manteca
2005 Water Master Plan

WATER SYSTEM EXTENSION NORTHERN AREA

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Figure 5-3

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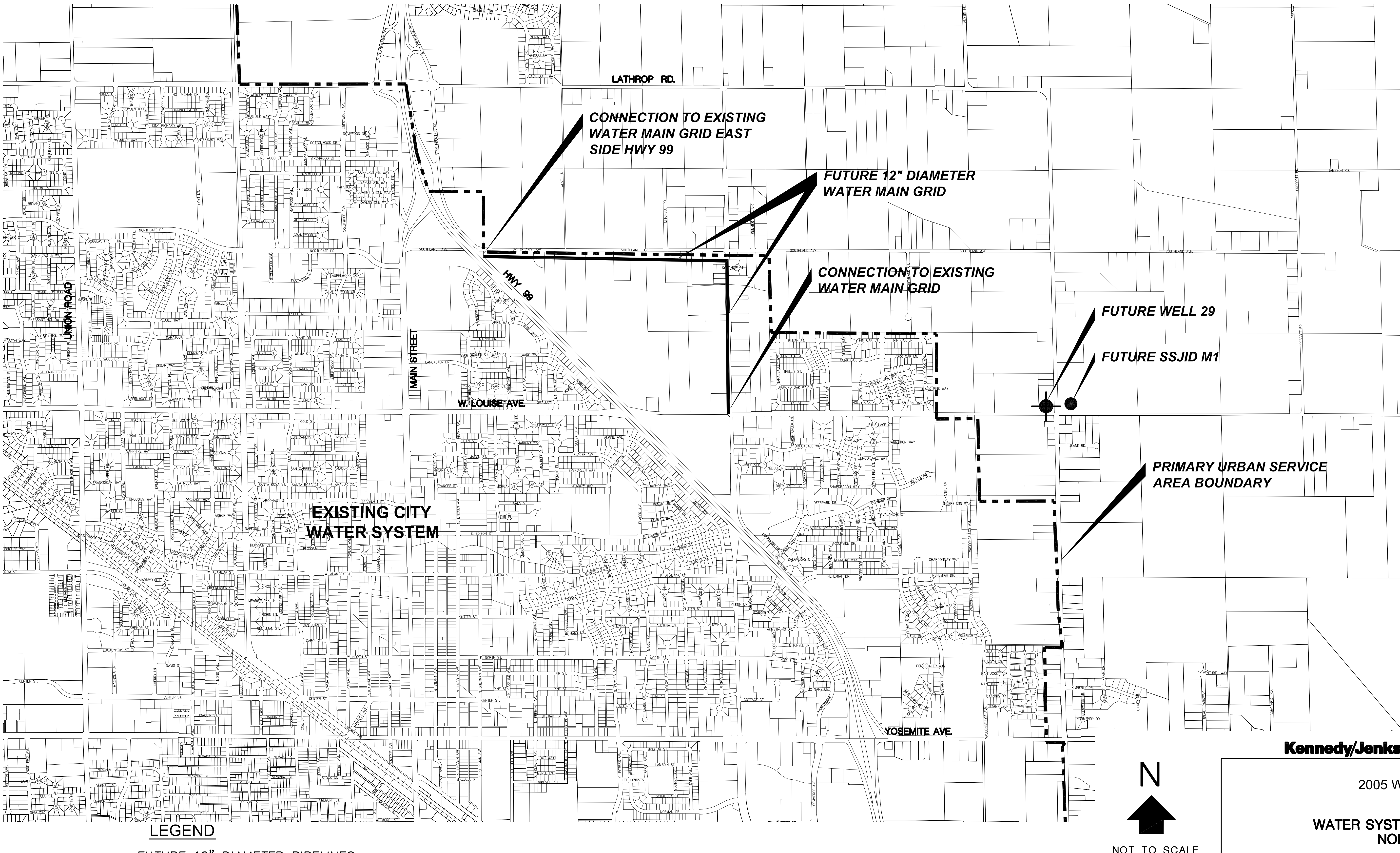

LEGEND

FUTURE 12" DIAMETER PIPELINES

FUTURE WELL PROJECTS

SSJID TURNOUT

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City of Manteca
2005 Water Master Plan

WATER SYSTEM EXTENSION
NORTHEAST AREA

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Figure 5-4

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Updated model scenarios were created with the corresponding demand and control sets for the following conditions:

- Existing Condition
    - Demand Sets: Average Day Demand, Maximum Day Demand, Maximum Day with Fire Flow, and Peak Hour
    - Control Sets: SSJID Full Allocation, SSJID Reduced Allocation
- 2009 Arsenic Compliance
    - Demand Sets: Average Day Demand, Maximum Day Demand, Maximum Day with Fire Flow, and Peak Hour
    - Control Sets: SSJID Full Allocation, SSJID Reduced Allocation, Wells Based on Alternative Compliance Scenario
- Future Buildout Modeling
    - See next section

The ultimate buildout model development was limited to definition of demands, piping requirements and supply requirements. The actual staging and siting of facilities, however, is subject to future planned development and was not modeled. Project specific modeling will be required for significant developments as they are proposed to confirm compliance with City water system standards.

5.2.1 Future Buildout System Analysis

The future buildout condition was considered to confirm both that the existing pipe construction requirements for new projects are sufficiently large to accommodate the future needs and to review the reliability with the third SSJID turnout on line.

A total of six scenarios were modeled to test buildout conditions:

- Winter Day with SSJID surface water only
- Peak Hour with SSJID surface water and groundwater
- Peak Hour without SSJID surface water
- Maximum Day plus fire flow at a four-point pipe intersection
- Maximum Day plus fire flow at a three-point pipe intersection
- Maximum Day plus fire flow at a two-point pipe intersection

5.2.2 Winter Day Demand

The proposed SSJID base supply alternative during a winter demand condition was modeled. The condition tested included a total SSJID delivery distributed from the three proposed delivery points and all wells turned off. The system pressure exceeded the minimum 40-psi criterion with an average pressure in the upper 50-psi range and a maximum pressure near 70 psi at the SSJID delivery points.

The model results demonstrate that the wells will not turn on under this condition and that either a manual well exercise program or resetting of well pressure ranges will be required to maintain periodic well operation through the winter.

5.2.3 Peak Hour with SSJID Surface Water

Peak hour demand was modeled with three SSJID surface water delivery points and sufficient wells to maintain pressure. The peak demand requirement was set at 60,750 gpm and SSJID was limited to a maximum delivery of 12,604 gpm total surface water supply capacity. The balance of 48,150 gpm was supplied by wells with an unused well production capacity of approximately 9,100 gpm (15 percent of 60,750 gpm) held in reserve. The required number of wells to meet the peak hour case with the 15 percent reserve is approximately 38 wells at ultimate buildout. This is based on an assumed 1,500 gpm per well capacity.

The resulting system pressures were above the 40-psi minimum at all locations. The average pressure was in the low 50's with maximum pressures in the high 60's psi near the SSJID delivery points.

5.2.4 Peak Hour without SSJID Surface Water

The system was next tested with the SSJID supply off-line to simulate a treatment plant, pump station, or pipe outage affecting the ability of SSJID to provide water. The recommended well capacity along with the reserve production capacity of 15 percent provides for adequate pressure throughout the system.

An extended SSJID outage condition is unlikely and additional well capacity to provide for normal maintenance during the outage was not considered in the modeling. In addition, a drought year condition with SSJID deliveries limited to 50 percent would allow for a reserve well capacity of approximately 8,000 gpm, or 5 to 6 wells.

The peak hour results of modeling at buildout without use of the SSJID supply demonstrate that minimum pressures can be maintained with 100 percent of the wells on-line. Under a reduced SSJID delivery schedule of approximately 50 percent, minimum pressures can be maintained with 5 to 6 wells off-line.

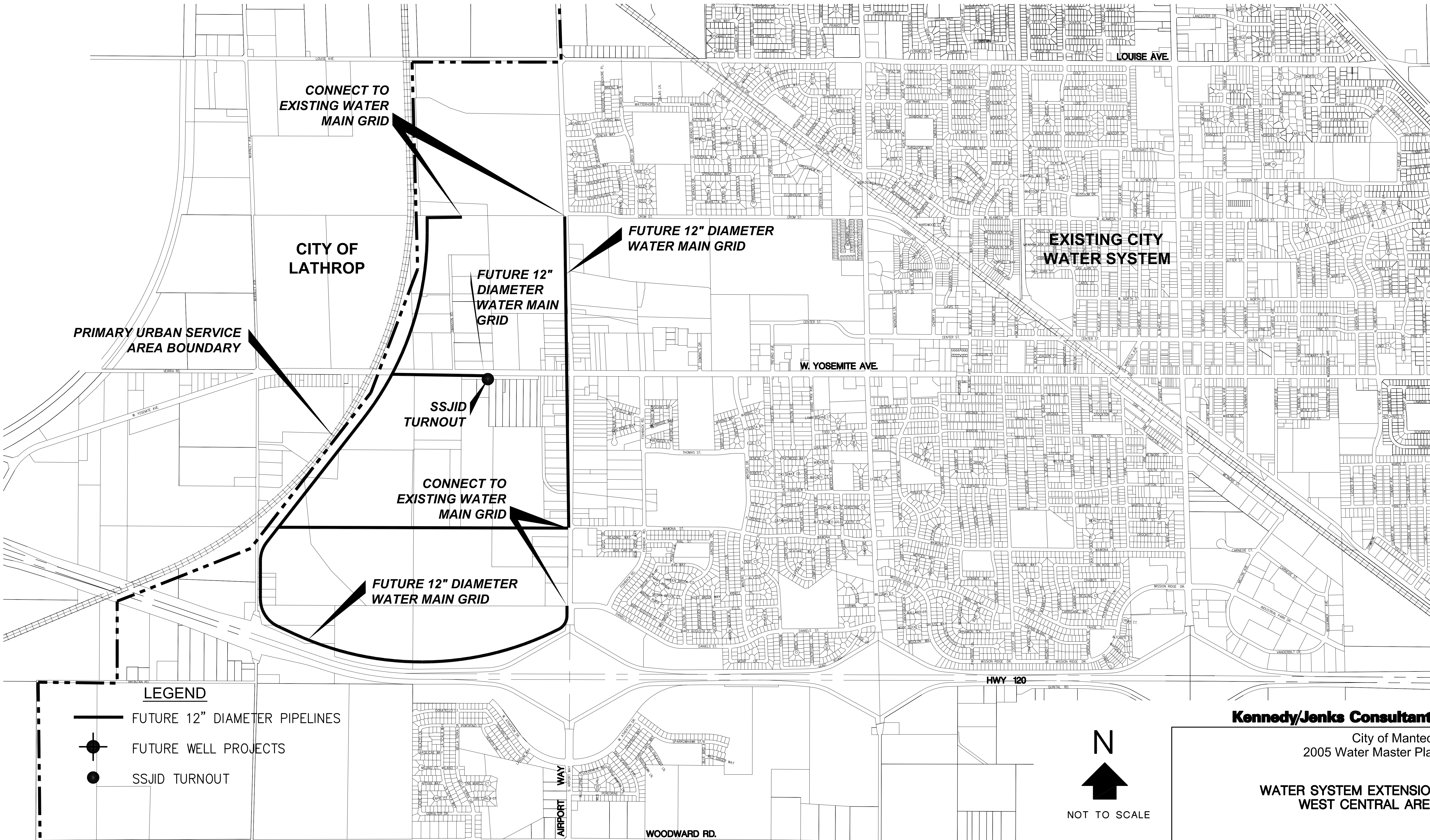
5.2.5 Maximum Day with Fire Flow

The model was used to test the ability of the system to meet a 20-psi residual pressure at a fire location during a maximum day demand condition. The segment of the system previously evaluated under existing conditions was not retested. The proposed 12-inch pipe grid was modeled with an assumed 3,500-gpm industrial area fire condition at grid intersections. The 3,500 gpm fire flow was selected given the uncertainty about land use and development. This is the greatest fire flow requirement considered in this Water Master Plan.

The half-mile grid intersections include junctions with four 12-inch branches, three 12-inch branches, and two 12-inch branches. Model runs were completed at several intersections of each type to identify locations where the minimum pressure could not be met. The minimum pressures observed exceeded 20 psi at all fire locations tested and a minimum of 40 psi was maintained in the system beyond the influence of the fire demand.

5.3 Summary of Modeling Results

The hydraulic modeling results indicate that the City system will meet minimum flow and pressure requirements with the recommended improvements. The requirement for 12-inch diameter mains as the backbone grid is sufficient to meet future demands but not oversized for current needs. The assumption of continued use of groundwater with wells constructed central to the locations of growth is consistent with past infrastructure expansion patterns and supports the grid network approach. Consideration of aboveground storage facilities with booster pumping to avoid building peak hour groundwater production capacity does not impact the sizing of the 12-inch grid. Localized pipeline sizes up to 16-inch are included with the capital projects element for the tanks and pump stations as needed to provide reliability and redundancy.



Kennedy/Jenks Consultants

City of Manteca
2005 Water Master Plan

WATER SYSTEM EXTENSION
WEST CENTRAL AREA

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Figure 5-5

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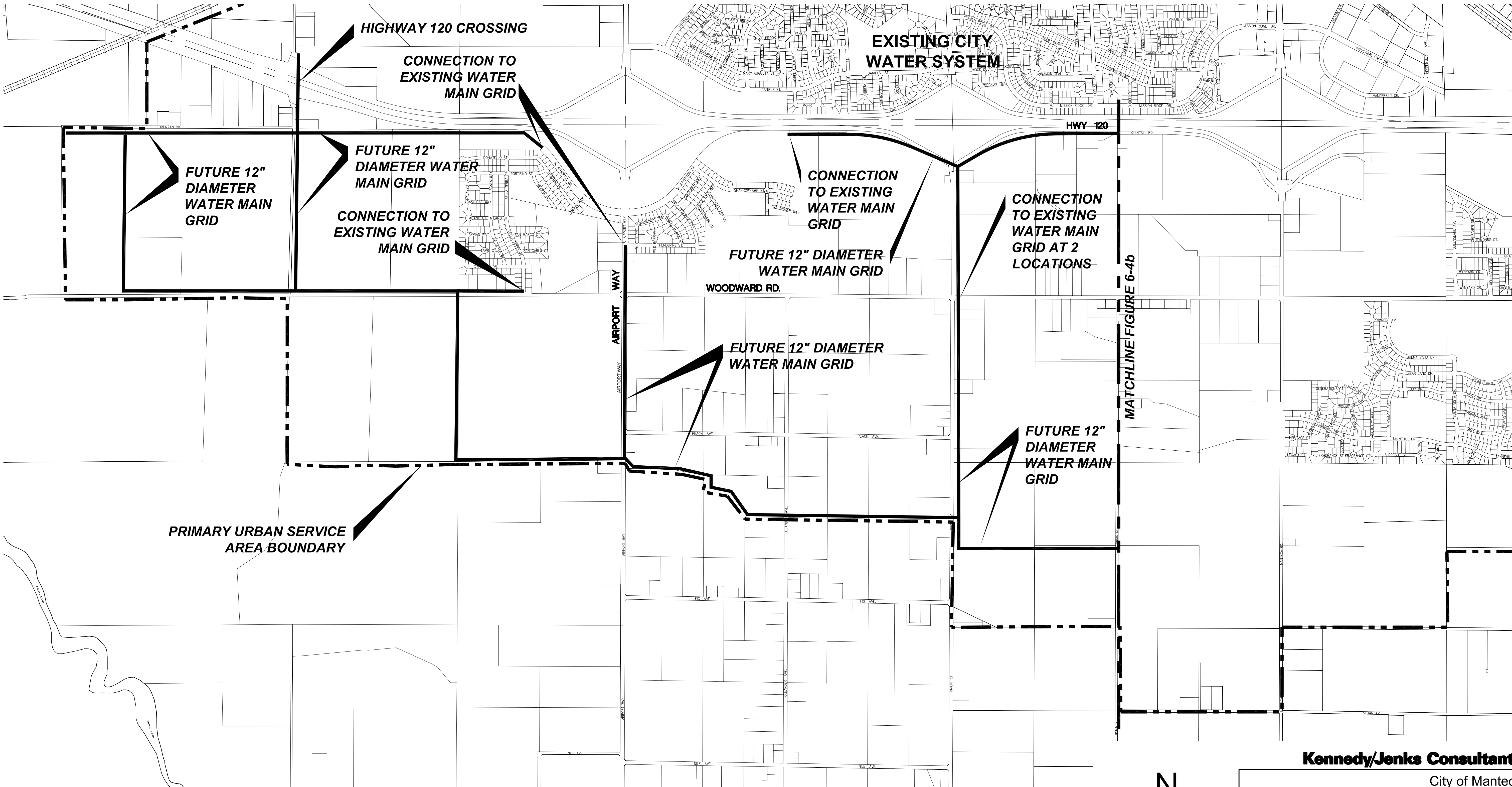

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LEGEND

FUTURE 12" DIAMETER PIPELINES

FUTURE WELL PROJECTS

SSJID TURNOUT

Kennedy/Jenks Consultants

City of Manteca
2005 Water Master Plan

WATER SYSTEM EXTENSION
SOUTHERN AREA (WEST)

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Figure 5-6a

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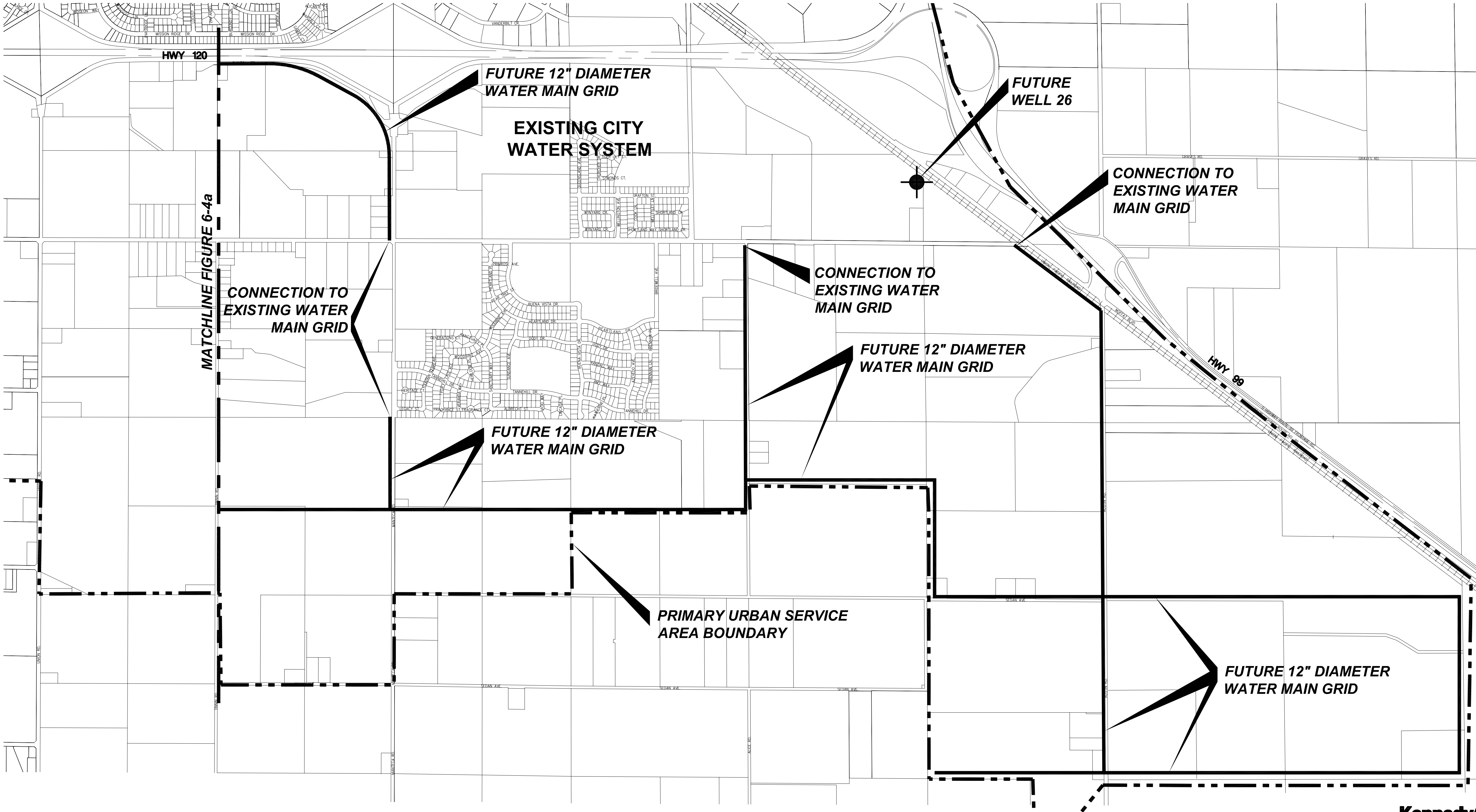

LEGEND

FUTURE 12" DIAMETER PIPELINES

FUTURE WELL PROJECTS

SSJID TURNOUT

Kennedy/Jenks Consultants

City of Manteca
2005 Water Master Plan

WATER SYSTEM EXTENSION
SOUTHERN AREA (EAST)

K/J 032511.00
Figure 5-6b

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Section 6: Recommended Water System Improvements

This section presents alternatives of recommended capital improvements to the City water supply and distribution system and identifies the preferred alternative in each instance. Improvement recommendations are based on addressing existing system deficiencies and accommodating future planned growth.

This section provides recommendations in the following sequence:

1. Groundwater Treatment for Arsenic - These improvements are necessary to meet existing water demands and are cataloged separately. Recommendations include the estimated costs assigned to the existing water service accounts of the City.

2. Planned System Maintenance – These projects include replacement of deteriorating pipelines, relocation of meters from back lots to front lots to allow abandonment of existing 4-inch and smaller water mains, installation of 12-inch and larger transmission mains for hydraulic improvements, and inspection and recoating of the elevated water tower. The costs of these improvements have been cataloged separately and are assigned to the existing water service accounts.

3. Public Facilities Improvements Plan (PFIP)– These projects include 12-inch main extensions, water storage facilities, booster pump stations, groundwater wells and groundwater treatment plants. The costs of these improvements have been estimated and cataloged separately and assigned to new growth. Phase 2 SSJID project costs are not included in the PFIP project costs.

The recommended implementation schedule is presented in the Capital Improvement Program in Section 7.

6.1 Groundwater Treatment for Arsenic

Groundwater will continue to be a substantial element of the City water supply as a vital part of the conjunctive use of surface water and groundwater. Continued development of groundwater pumping capacity will be needed to provide the maximum day demand and components of peak hour production capacity for projected future water demands. The base SSJID surface water supply will provide 53 percent of the annual water supply required. Although groundwater will supply 47 percent of the annual water demand, groundwater will be relied upon to meet approximately 70 to 84 percent of the peak hour water demand in normal years (depending on the capital improvement alternative selected) and potentially over 80 to 90 percent in dry years with reduced surface water supplies.

Unfortunately, the aquifer beneath the City contains both naturally occurring and introduced contaminants that can exceed federal and state drinking water standards. The introduced contaminants detected include nitrate and DBCP. The City has historically abandoned affected wells or treated the discharges when either of these constituents was detected above the MCL. Naturally occurring contaminants detected at levels exceeding drinking water standards include manganese and arsenic. The City has historically treated manganese by sequestering.

However, the City is now removing manganese with a green sand water treatment plant at Well 14. Sequestering is no longer a treatment approach being used by the City for manganese in the drinking water.

Arsenic is present in all City wells and monitoring for compliance with the Federal Drinking Water Standard of 10 μg/l is required to start 23 January 2006. Monitoring will include sampling at the source over four consecutive quarters and determination of the average arsenic concentration. Based on previous sampling, all but one of the City wells has an arsenic concentration of 9 μg/l or higher and are likely to require treatment for reduction of arsenic.

It is important for the City to maximize the use of extensive capital investments it has made in its water supply infrastructure. However, some wells will soon exceed their useable life span and others have insufficient land area available for construction of arsenic removal facilities. The alternatives presented below identify wells to receive treatment, wells to be demolished and wells to be placed in backup/standby status. Scheduling of construction of arsenic treatment improvements for lead wells utilizes other existing wells temporarily to maintain system reliability during construction. Once groundwater treatment is in place, the remaining existing wells are recommended to be demolished or placed on backup/standby status.

Three alternative compliance plans have been developed to identify the range of options and general costs of implementation. Replacement water supplies through importing additional surface water or by developing groundwater that complies with drinking water standards without treatment were discussed with the City and have been determined to not be feasible at this time. All three alternatives, therefore, include treatment for reduction of arsenic so existing supplies will be fully compliant with a drinking water standard of 10 μg/l with a maximum arsenic concentration of 8 μg/l. The three alternatives are summarized below:

Alternative 1 – Maximize Blending with Surface Water for Arsenic Reduction

This alternative includes blending of low arsenic concentration surface water with higher arsenic concentration groundwater for a resulting compliant water supply. This alternative provides for the minimum arsenic treatment by removal and would result in highest average annual arsenic dosage to the City population.

Alternative 2 – Maximize Wellhead Treatment for Arsenic Reduction

This alternative includes groundwater treatment at the well sites (wellheads) to reduce the arsenic concentration to 8 μg/l. This alternative uses wells for meeting peak flows and provides the greatest reduction in arsenic in the drinking water supply and the lowest average annual arsenic dosage to the City population.

Alternative 3 – Optimize Blending, Wellhead Treatment and Storage for Arsenic Reduction

This alternative includes for taking advantage of blending as described in Alternative 1, treatment as described in Alternative 2 and storage for meeting peak hour demands. This alternative reduces the number of wellhead treatment plants identified in Alternative 2 while also attaining some of the advantage of removing arsenic from the drinking water supply not achieved through a pure blending approach. This alternative results in a reduced average annual arsenic dosage to be within the drinking water standard.

6.1.1 Alternative 1 – Maximize Blending with Surface Water for Arsenic Reduction

This alternative was developed to quantify the cost of using blending of surface water with groundwater to meet the arsenic drinking water standard. This approach requires a significant capital investment in pipelines, tanks, and booster pumping but results in a lower operation and maintenance cost over wellhead treatment noted in Alternative 2.

The water supply improvements necessary to meet the existing 2005 customer demands are listed in Table 6-1. Table 6-1 and Figure 6-1 presents the improvements recommended to meet existing demands using water blending with SSJID. Table 6-2 summarizes the improvements for meeting both existing population and population growth through the year 2035. Included in Table 6-2 are the proposed implementation schedule and preliminary cost estimates.

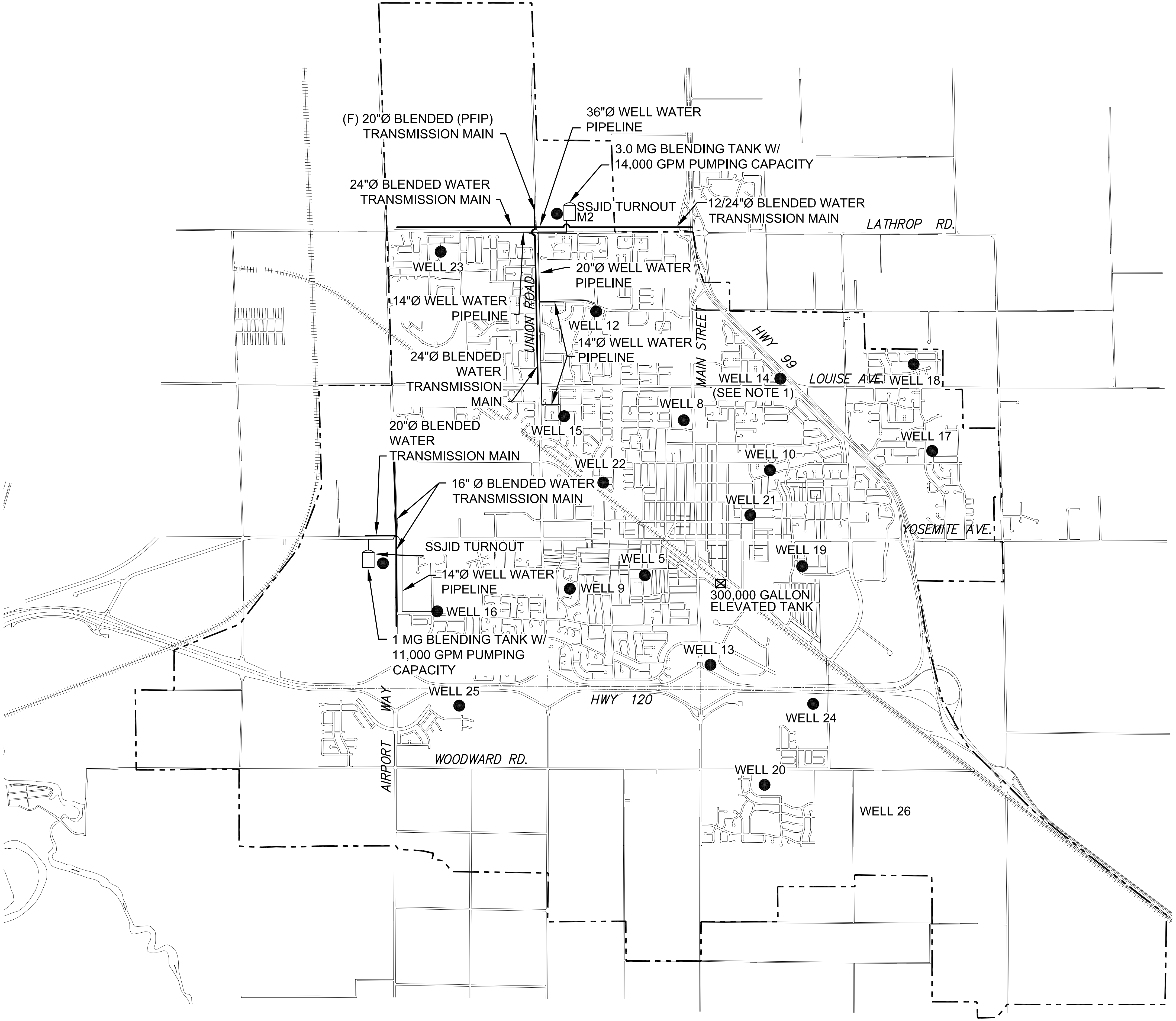
Table 6-1: Alternative 1 – Capital Improvements to Meet Existing Demands

	Capacity	
Description	**Max Day**	**Peak Hour**
Surface Water/Blended Supply		
1. M2 Surface Water Turnout – Blending facility with surface water, Wells 12, 15, and 23; new 3.0 MG steel storage tank; new 10,500 gpm booster pump station (3,500 gpm x 4, 3 duty and 1 backup)	9,550 gpm	13,370 gpm
2. M3 Surface Water Turnout – Blending facility with surface water, limit Well 16 production to 1,800 gpm to meet blending capacity; construct new 0.7 MG Steel storage tank; new 3,500 gpm booster pump station (1,750 gpm x 3, 2 duty and 1 backup)	4,050 gpm	5,670 gpm
Groundwater Supply		
3. Maintain and operate existing Well No. 8 and Well No. 18	1,800 gpm	1,800 gpm
4. Add ferric-chloride chemical feed system to Well No. 14 for removal of arsenic.	1,800 gpm	1,800 gpm
5. Construct wellhead treatment for arsenic removal at Well No. 17	1,300 gpm	1,300 gpm
6. Construct Wellhead treatment for arsenic removal at Well No. 25	2,500 gpm	2,500 gpm
Storage		
7. Operate and maintain existing 300,000-gallon elevated storage tank.	–-	700 gpm
Subtotal Supply –	**21,000 gpm**	**27,140 gpm**
Existing (2005) Customer Demand –	**19,206 gpm**	**26,889 gpm**
Redundancy		

Table 6-1: Alternative 1 – Capital Improvements to Meet Existing Demands (cont'd)

Description	Capacity	
	Max Day	Peak Hour
8. Surface Water Redundancy – 0 gpm (see Section 2.5, Water System Reliability and Redundancy)	0 gpm	0 gpm
9. Groundwater Redundancy – 15% of production capacity (3,225 gpm minimum) – Equip Well No. 19 and Well No. 24 with treatment facilities	4,200 gpm	4,200 gpm
Total Supply –	**25,200 gpm**	**31,340 gpm**
Existing (2005) Customer Demand –	**19,208 gpm**	**26,900 gpm**

(a) Existing Wells No. 20, 21, and 22 are recommended to be used as standby-only production wells.



N

NOT TO SCALE

LEGEND

- BLENDING SUPPLY WELLS
- GROUNDWATER WELLS TO SYSTEM
- STANDBY NON–COMPLIANT WELLS
- WELLS TO BE ABANDONED
- SSJID SURFACE WATER TURNOUTS
- PRIMARY URBAN SERVICE AREA BOUNDARY

NOTE:

1. WELL 14 IS EQUIPPED WITH TREATMENT FOR ARSENIC REDUCTION.

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City of Manteca
2005 Water Master Plan

Alternative 1: SSJID Blending for Arsenic Compliance Exisitng Customers (2005)

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Figure 6-1

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Table 6-2: Alternative 1 – Capital Improvements to Maximize Blending with Surface Water for Arsenic Reduction

Project No. and	Facility Name	Project Description	Schedule	Estimated Cost
A1-1	Well No. 14 Treatment Improvements	Retrofit existing manganese greensand filters with ferric-chloride chemical feed to precipitate arsenic. Discharge backwash stream to sanitary sewer.	2004-2005	Completed
A1-2	SSJID Peaking Tank and Booster Pump Station at or near M2 Turnout Site	Construct 3.0 MG welded steel ground level storage tank and 10,500 gpm booster pump station. Construct well water pipelines from Well No. 12, Well No. 15, and Well No. 23 to SSJID M2 site. Pipelines will include 20,800 LF of new 14-inch diameter, 4,800 LF of new 20-inch diameter, and 2,900 LF of 36-inch diameter pipe. Construct 30,400 LF of new 24-inch diameter blended water transmission mains.	2006-2009	$19,481,000
A1-3	SSJID Peaking Tank and Booster Pump Station at or near SSJID M3 Turnout Site	Construct 1.0 MG welded steel ground level storage tank and 3,500 gpm booster pump station (two 1,750 gpm pumps). Construct well water pipelines from Well No. 16 to SSJID M3 site. Limit Well No. 16 production to 1,800 gpm to meet blending requirements. Pipelines will include 10,600 LF of new 12-inch diameter well water pipe. Construct 11,100 LF of new 16-inch diameter and 3,000 LF of 20-inch diameter blended water transmission mains.	2007-2010	$7,865,000
A1-4	New Well No. 17 Treatment Plan	Construct arsenic reduction treatment plant using a side stream approach.	2005-2007	$1,810,000
A1-5	New Well No. 19 Treatment Plan	Construct arsenic reduction treatment plant using a side stream approach.	2005-2007	$1,810,000
A1-6	New Well No. 24 Treatment Plan	Construct arsenic reduction treatment plant using a side stream approach.	2005-2007	$1,810,000
A1-7	New Well No. 25 Treatment Plan	Construct arsenic reduction treatment plant using a side stream approach.	2005-2007	$3,350,000
A1-8	Abandon Wells No. 10 and 13	Remove existing buildings, improvements and surface features. Rip casings and abandon wells using grout placed in lifts to establish positive seal through impermeable zones during closure.	2010-2012	$100,000

Table 6-2: Alternative 1 – Capital Improvements to Maximize Blending with Surface Water for Arsenic Reduction (cont'd)

Project No. and	Facility Name	Project Description	Schedule	Estimated Cost
A1-9	Abandon Well No. 5	Remove existing building, improvements and surface features. Rip casing and abandon well using grout placed in lifts to establish positive seal through impermeable zones during closure. Note: Well 5 could be converted to an irrigation well and used to irrigate the nearby school and park, reducing the demand on the potable system.	2010-2012	$50,000
A1-10	Convert to standby Wells No. 20, 21, and 22	These wells would be maintained and operated monthly to confirm they are fully functional and in good working order. All production would be to waste during monthly well exercising.	2010	$90,000
A1-11	Convert Well No. 9 to Irrigation Well	Disconnect from distribution system and replumb to supply park irrigation supply.	2010-2012	$25,000

The total estimated cost for this alternative is $36,391,000.

6.1.2 Alternative 2 – Maximize Wellhead Treatment for Arsenic Reduction

Alternative 2 includes the use of treatment at a sufficient number of wells to provide the required groundwater component of the City supply. This alternative is based on wellhead treatment capacity equal to the peak hour demand with redundancy less the reliable surface water supply. Table 6-3 provides a summary of the water supply required to meet existing demands within the City using wellhead treatment.

The existing City well inventory was evaluated and five (5) wells identified for either destruction or standby status. Table 6-4 provides the proposed treatment plan, schedule and estimated cost for twelve wells identified for equipping with wellhead treatment. Figure 6-2 presents the recommended wellhead treatment sites and describes the alternative.

Table 6-3: Alternative 2 – Capital Improvements to Meet Existing Demand

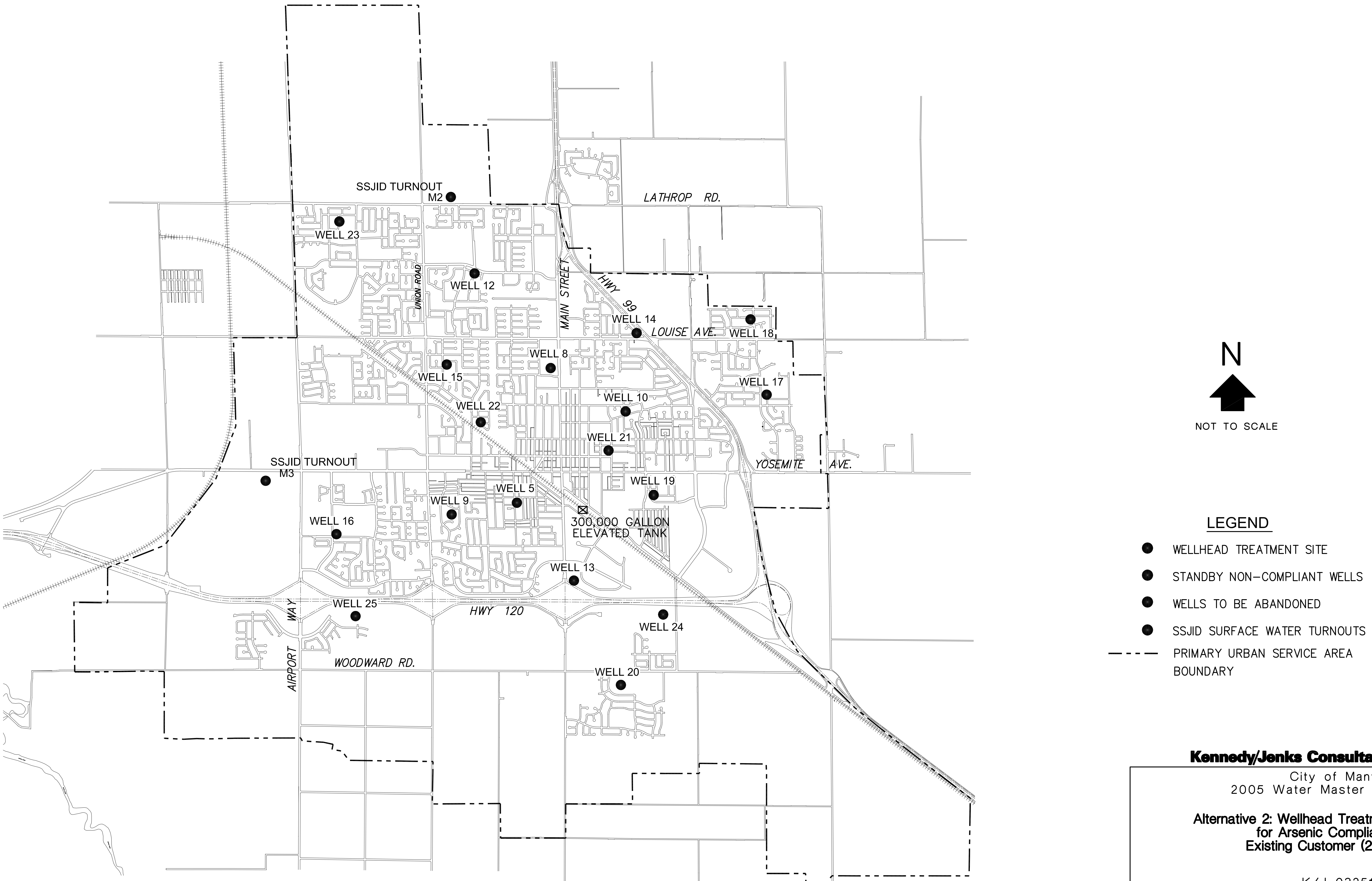
Description	Capacity	
	Max Day	Peak Hour
Surface Water		
1. M2 Surface water turnout[(a)]	2,800 gpm	2,800 gpm
2. M3 Surface water turnout[(a)]	2,800 gpm	2,800 gpm
Groundwater Supply		
3. Maintain and operate existing Wells 8 and 18	1,800 gpm	1,800 gpm
4. Add ferric-chloride chemical feed system to Well 14 for removal of arsenic.	1,800 gpm	1,800 gpm
5. Construct wellhead treatment facilities for arsenic removal at Wells 12, 15, 16, 17, 19, 20, 23, 24, and 25	17,200 gpm	17,200 gpm
Storage		
6. Operate and maintain existing 300,000 gallon elevated storage tank.	–-	700 gpm
Total Supply –	**26,400 gpm**	**27,100 gpm**
Existing (2005) Customer Demand –	**19,206 gpm**	**26,889 gpm**
Redundancy		
7. Surface Water Redundancy – 0 gpm (see Section 2.5, Water System Reliability and Redundancy)	0 gpm	0 gpm
8. Groundwater Redundancy – 15% of production capacity (4,035 gpm minimum) – Equip Well No. 21 and Well No. 22 with treatment, drill new Well No. 5 and equip with wellhead treatment	4,200 gpm	4,200 gpm
Total Supply –	**36,600 gpm**	**31,300 gpm**
Existing (2005) Customer Demand –	**19,208 gpm**	**26,900 gpm**

(a) Surface water turnout capacities are based on peaked surface water delivery rate (53%x1.1) for existing City customers.
(b) Wells 19 and 20 are recommended to be used as peak-only facilities due to higher overall average reported arsenic concentrations.

Table 6-4: Alternative 2 –Capital Improvements to Maximize Wellhead Treatment for Arsenic Reduction

Project No.	Facility Name	Project Description	Schedule	Estimated Cost
A2-1	Well No. 14 Treatment Improvements	Retrofit existing manganese greensand filters with ferric-chloride chemical feed to precipitate arsenic. Discharge backwash stream to sanitary sewer.	2004-2005	Completed
A2-2	Well No. 24 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2005-2006	$1,810,000
A2-3	Well No. 15 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2005-2006	$2,150,000
A2-4	Well No. 25 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2005-2006	$3,350,000
A2-5	Well No. 16 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2006-2007	$1,810,000
A2-6	Well No. 23 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2006-2007	$1,810,000
A2-7	Well No. 12 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2006-2007	$1,810,000
A2-8	Well No. 19 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2007-2008	$1,810,000
A2-9	Well No. 22 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2007-2008	$1,810,000
A2-10	Well No. 21 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2007-2008	$1,000,000
A2-11	Well No. 17 Arsenic Treatment	Reconstruct existing GAC filters to use granular ferric oxide (GFO) media for arsenic reduction using a side-stream approach. Install pH adjustment and 14-foot diameter backwash tank with reclamation pumping.	2008-2009	$1,810,000
A2-12	Well No. 20 Arsenic Treatment.	Construct GFO arsenic reduction treatment plant using a side stream approach. Install pH adjustment and 14-foot diameter backwash tank with reclamation pumping.	2008-2009	$1,000,000
A2-13	Well No. 5 Replacement Well with Treatment	Construct new well at site of existing Well No. 5 with arsenic reduction treatment plant using a sidestream approach	2008-2009	$2,692,000
A2-14	Abandon Wells No. 10 and 13	Remove existing buildings, improvements and surface features. Rip casings and abandon wells using grout placed in lifts to establish positive seal through impermeable zones during closure.	2010-2012	$100,000
A2-15	Convert Well No. 9 to Irrigation Well	Disconnect from distribution system and replumb to supply park irrigation supply.	2010-2012	$25,000

The total estimated cost for this alternative is $21,177,000.



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City of Manteca
2005 Water Master Plan

Alternative 2: Wellhead Treatment for Arsenic Compliance Existing Customer (2005)

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Figure 6-2

6.1.3 Alternative 3 – Optimize Blending, Wellhead Treatment and Storage for Arsenic Reduction

Alternative 3 provides a balance between wellhead treatment, blending with surface water and use of storage for meeting peak demands and limiting the construction of arsenic treatment plants to approximately maximum day capacity. Table 6-5 provides a summary of the water supply requirements under this option to meet the existing City demands. Table 6-6 and Figure 6-3 present the proposed improvements.

Table 6-5: Alternative 3 – Capital Improvements to Meet Existing Demand

Description	Capacity	
	Max Day	Peak Hour
Surface Water/Blended Supply		
1. M2 Surface water turnout[(a)] Blending Facility with surface water, Wells 12 and 23; new 2.0 MG steel storage tank; new 7,000 gpm booster pump station	7,000 gpm	9,800 gpm
2. M3 Surface water turnout – no blending	2,800 gpm	2,800 gpm
Groundwater Supply		
3. Maintain and operate existing Well 18	1,000 gpm	1,000 gpm
4. Add ferric-chloride chemical feed system to Well 14 for removal of arsenic.	1,800 gpm	1,800 gpm
5. Construct wellhead treatment facilities for arsenic removal at four (4) sites co-located with existing Wells 15, 19, 24, and 25[(b)].	6,500 gpm	6,500 gpm
Storage		
6. Construct 3.4 MG steel storage tank with 5,100 gpm[(c)] booster pumping capacity	__	5,100 gpm
Total Supply –	**19,100 gpm**	**27,000 gpm**
Existing (2005) Customer Demand –	**19,206 gpm**	**26,889 gpm**
Redundancy		
7. Surface Water Redundancy – 0 gpm (see Section 2.5, Water System Reliability and Redundancy)	0 gpm	0 gpm
8. Groundwater Redundancy – 15% of production capacity (2,100 gpm minimum) – Equip Well No. 17 with wellhead treatment, operate and maintain existing Well No. 8	2,100 gpm	2,100 gpm
9. Storage Redundancy – Operate and maintain existing elevated 300,000 gal storage tank.	–-	700 gpm
Total Supply –	**21,200 gpm**	**29,800 gpm**
Existing (2005) Customer Demand –	**19,208 gpm**	**26,900 gpm**

(a) Surface water turnout capacities are based on peaked surface water delivery rate (53%x1.1) for existing City customers. Blending based on 2,800 gpm delivered to M2 and 2,800 delivered to M3 to meet required volume at M2 for blending.
(b) Wells 16, 19, 20, 21, and 22 to be used as standby facilities.
(c) Booster pump capacity based on fire flow requirements of 3,500 gpm for 3 hours. Sustainable capacity for equalization is approximately 2,000 gpm.

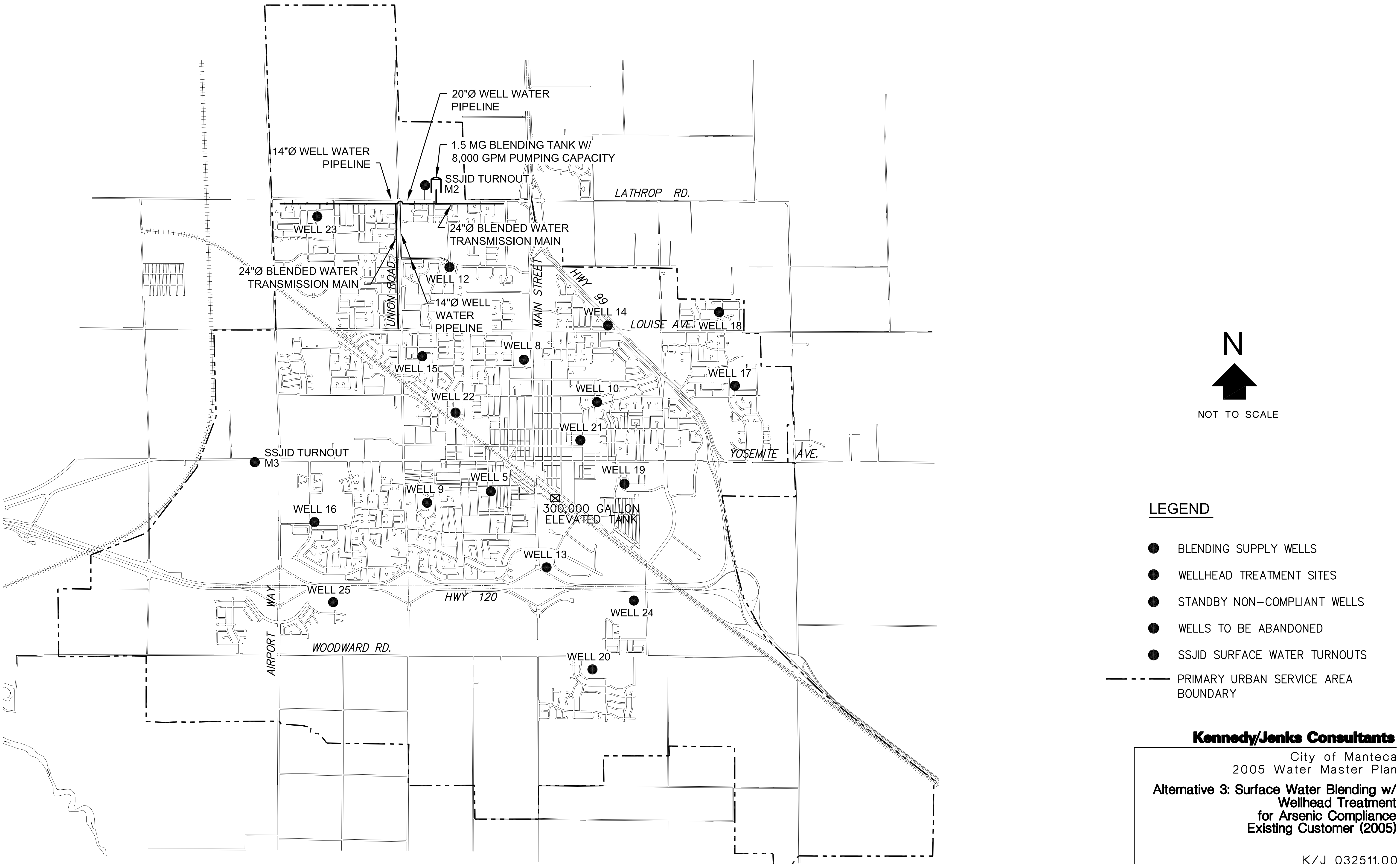
Table 6-6: Alternative 3 – Capital Improvements to Optimize Blending, Wellhead Treatment and Storage for Arsenic Reduction

Project No.	Facility Name	Project Description	Schedule	Estimated Cost
A3-1	Well No. 14 Treatment Improvements	Retrofit existing manganese greensand filters with ferric-chloride chemical feed to precipitate arsenic using a side-stream approach and develop revised control system programming. Discharge backwash stream to sanitary sewer.	2004-2005	Completed
A3-2	Well No. 24 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2005-2006	$1,810,000
A3-3	Well No. 15 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2005-2006	$2,150,000
A3-4	Well No. 25 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2005-2006	$3,350,000
A3-5	SSJID Peaking Tank and Booster Pump Station at or near SSJID M2 Turnout site	Construct 2.0 MG welded steel ground level storage tank and 7,700 gpm booster pump station. Construct pipelines from Well 12 and Well 23 to SSJID M2 site. Project will include 17,000 LF of new 14-inch diameter, and 3,000 LF of new 20-inch diameter pipelines. Construct 25,700 LF of new 24-inch diameter blended water transmission main.	2006-2009	$9,949,000
A3-6	Well No. 19 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2006-2007	$1,810,000
A3-7	Storage Tank and Booster Pump Station	Construct 3.4 MG steel storage tank and 5,100 gpm booster pump station.	2006-2007	$8,413,000
A3-8	Well No. 17 Arsenic Treatment	If needed, construct arsenic reduction treatment plant using a side stream approach.	2007-2008	$1,810,000
A3-9	Abandon Well No. 5	Remove existing building, improvements and surface features. Rip casing and abandon well using grout placed in lifts to establish positive seal through impermeable zones during closure. Note: Well 5 could be converted to an irrigation well and used to irrigate the nearby school and park, reducing the demand on the potable system.	2010-2012	$50,000
A3-10	Abandon Wells No. 10 and 13	Remove existing buildings, improvements and surface features. Rip casings and abandon wells using grout placed in lifts to establish positive seal through impermeable zones during closure.	2010-2012	$100,000

Table 6-6: Alternative 3 – Capital Improvements to Optimize Blending, Wellhead Treatment and Storage for Arsenic Reduction (cont'd)

Project No.	Facility Name	Project Description	Schedule	Estimated Cost
A3-11	Convert Wells No. 16, 20, 21, and 22 to Standby Status	These wells would be maintained and exercised monthly to confirm they are fully functional and in good working order. All production would be to waste during monthly operations.	2010	$90,000
A3-12	Convert Well No. 9 to Irrigation Well	Disconnect from distribution system and replumb to supply park irrigation supply.	2010-2012	$25,000

The total estimated cost for this alternative is $29,557,000.



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City of Manteca
2005 Water Master Plan

Alternative 3: Surface Water Blending w/ Wellhead Treatment for Arsenic Compliance Existing Customer (2005)

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Figure 6-3

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6.1.4 Alternative Selection

The alternatives developed are intended to provide a range of costs for differing approaches allow the City to comply with the new arsenic drinking water standards. All approaches result in abandonment of existing wells and all approaches have significant financial impacts. The following factors were considered in developing a recommendation:

1. Ability to reliably meet the drinking water standard of 10 μg/l. All three alternatives provide for meeting the goal. However, they do not all provide the same average annual arsenic reduction for the City population. Although the EPA has set the drinking water standard at 10 μg/l and this Master Plan has proceeded with the assumption that the State of California will also set a 10 μg/l standard, the State Public Health Goal is 4 parts per trillion of 0.004 μg/l. Therefore, we ranked the alternatives based on total arsenic reduction from the system. The ranking is as follows: Alternative 2 ranked highest with the highest arsenic reduction, Alternative 3 ranked second highest with moderate arsenic reduction, and Alternative 1 ranked last with the least arsenic reduction. Again, all three alternatives meet the federal and assumed state standard of 10 μg/l.

2. Capital cost for the initial construction of the alternative. This cost is reflected in present worth for a side-by-side comparison.

3. Estimated annual cost for each alternative. This criterion addresses the life cycle impacts of treatment verses blending and is presented as an annual cost assuming a 30-year, four (4%) percent interest rate for capital costs and an estimated operation and maintenance (O&M) cost. The O&M cost includes labor, energy, capital replacement and disposal of spent media for treatment options. Ranking is from three (3) to one (1) with three (3) being lowest ranking and one (1) the highest ranking.

Table 6-7 provides a summary of the decision factors.

Table 6-7: Arsenic Compliance Alternative Comparison

Alternative Title	Ability to Meet Drinking Water Standard	Capital Cost – Present Worth	Ranking Annual Cost	Overall Ranking
Alternative 1 – Maximize Blending with Surface Water for Arsenic Reduction	Meets Criteria – Lowest net reduction in total arsenic Ranking: 3	$36,391,000	Lowest O&M Cost	2
Alternative 2 – Maximize Wellhead Treatment for Arsenic Reduction	Meets Criteria – Highest net reduction in total arsenic Ranking: 1	$21,177,000	Highest O&M Cost	1
Alternative 3 – Optimize Blending, Wellhead Treatment and Storage for Arsenic Reduction	Meets Criteria – Between lowest and highest net reduction in total arsenic Ranking: 2	$29,557,000	Intermediate O&M Cost	3

Based on the results listed above, Alternative 2 is ranked the highest and is the recommended alternative.

6.2 Planned System Maintenance and Hydraulic Improvements

A planned system maintenance program was identified in Section 5 of this report.

6.3 PFIP Water System Improvements

6.3.1 New Wells with Treatment

6.3.1.1 Water Supply and Storage Improvements 2011-2015

Tables 6-8 through 6-10 below provide water supply and storage improvement recommendations for Alternatives 1, 2, and 3 from the planning period 2011-2015.

Table 6-8: Water Supply and Storage Improvements 2011-2015

Project No.	Project	Description	Schedule	Estimated Cost
1	(N) 1,500 gpm Well with Arsenic Treatment	New well with arsenic treatment.	2010-2011	$2,692,000
2	(N) 1,500 gpm Well with Arsenic Treatment	New well with arsenic treatment.	2013-2014	$2,692,000
3	1.3 MG Storage Tank and Booster Pump Station	Construct 1.6 MG welded steel ground level storage tank 3,500 gpm booster pump (Two at 1,750 gpm duty pump, one standby). 2,000 gpm peak booster pumping capacity.	2013-2014	$4,214,000

The estimated present worth for these improvements is $9,598,000.

6.3.1.2 Water Supply Improvements 2016-2025

Table 6-9 below provides water supply and storage improvement recommendations for Alternatives 1, 2, and 3 from the planning period 2016-2025.

Table 6-9: Water Supply and Storage Improvements 2016-2025

Project No.	Project	Description	Schedule	Estimated Cost
1	1.0 MG Storage Tank and Booster Pump Station at or near (F) M1 or M3 SSJID Surface water Turnout Site.	Option 1 – Construct 1.0 MG welded steel ground level storage tank with two 1,500 gpm capacity booster pumps (1 duty, 1 standby). 1,500 gpm peak booster pumping capacity.	2011-2016 (In conjunction with planning and design for M1 turnout)	$4,199,000 $2,692,000 $6,891,000
2	Construct (N) 1,500 gpm well with Arsenic Treatment	New well with arsenic treatment.	2015-2016	$2,692,000
3	Construct (N) 1,500 gpm well with Arsenic Treatment	New well with arsenic treatment.	2017-2018	$2,692,000

Table 6-9: Water Supply and Storage Improvements 2016-2025 (cont'd)

Project No.	Project	Description	Schedule	Estimated Cost
4	Construct (N) 1,500 gpm well with Arsenic Treatment	New well with arsenic treatment.	2019-2020	$2,692,000
5	Construct (N) 1,500 gpm well with Arsenic Treatment	New well with arsenic treatment.	2021-2022	$2,692,000
6	Construct (N) 1,500 gpm well with Arsenic Treatment	New well with arsenic treatment.	2023-2024	$2,692,000

The estimated present worth for these improvements is $20,351,000.

6.3.1.3 Water Supply Improvements Buildout

Section 2 presented a projected buildout year of 2025. For that reason, capital improvement projects have not been identified.

Table 6-10: Water Supply and Storage Improvements 2026-Buildout

Project No.	Project	Description	Schedule
A1-24	Construct (N) 1,500 gpm well with Arsenic Treatment	New well with arsenic treatment	2026-2027
A1-25	Construct (N) 1.3 MG Storage Tank w/ 2,000 gpm booster pump station.		2027-2028 (buildout)

6.3.2 Groundwater Supply Improvements 2005 to 2010

The 2002 to 2004 improvements are based on the commencement of surface water deliveries in the year 2005 and completion of Wells 24 and 25 (both without arsenic treatment). The construction of additional wells should be based on actual annual growth and planned development. Assuming SSJID comes on-line in 2005, and growth continues as projected in this Water Master Plan, the City should construct a minimum of one to two wells per year to maintain peak hour production capacity.

Recommendations

- 2005-6 – Continue construction of arsenic removal at City wells that exceed the MCL of 10 μg/l. (Estimated number of wells requiring treatment is 10 to 12 wells.)

- 2005 to 2010 – Construct six wells with standby power for a combined additional pumping capacity of 9,000 gpm. It is assumed that four of these wells will require treatment for arsenic.

- 2005 to 2010 – Implement a well exercise program. The SSJID surface water supply will decrease the number of wells required for operation. A well exercise and disinfection program is recommended on a monthly or semi-monthly basis to maintain the wells and their pumping and treatment facilities, and to prevent bacteria from forming.

6.3.3 Groundwater Supply Improvements 2011 to 2025

The 2011 to 2025 development of groundwater pumping capacity will be contingent on the SSJID plant expansion schedule and actual growth. The SSJID water treatment plant is scheduled to expand to ultimate capacity in 2010. However, actual expansion may be delayed due to lower growth trends, changes in participation or other factors currently not anticipated.

This Water Master Plan assumes that water deliveries to the City will reach the 2010 capacity as the SSJID plant reaches capacity. If growth does not occur, and the SSJID surface water expansion is not required in 2010, the City should distribute the recommended improvements over a longer time period as dictated by actual growth.

The following recommendations will provide the City with improvements through buildout conditions.

<u>Recommendations</u>

- 2011 to 2025 – Construct 13 new wells with standby power for an additional 19,500 gpm pumping capacity. It is assumed that 10 wells will require treatment for arsenic.

- 2011 to 2025 – Continue well exercise program.

6.4 Surface Water Supply Improvements

Beginning in the year 2005, 53 percent of the City's annual water supply is assumed to come from the SSJID surface water supply project. Distribution system improvements are required in preparation for deliveries through the proposed SSJID surface water supply delivery points. The recommended improvements have been scheduled for completion by 2005.

The SSJID surface water treatment plant expansion from 28 MGD to 39 MGD is scheduled to be on-line after 2010, but the schedule will be driven by growth and actual water demands.

6.4.1 Surface Water Supply Improvements 2005 to 2010

Two connections to SSJID have been completed with deliveries from SSJID starting in June 2005.

6.4.2 Surface Water Supply Improvements 2011 to 2025

The SSJID surface water treatment plant expansion from 28 MGD to 39 MGD will take several years to complete, but is scheduled to be on-line in 2010. A third SSJID surface water delivery point, SSJID-1, is recommended in the eastern portion of the system after the plant is expanded. For the purposes of providing a basis for the CIP, the pipeline improvements were assumed to be similar to SSJID-2 and SSJID-3. The construction of a meter and flow control valve was assumed to be incorporated into the SSJID expansion work and were not included in the CIP.

<u>Recommendations</u>

- 2011 to 2025 – Monitor SSJID surface water deliveries and groundwater levels. Adjust flow control settings at the SSJID connection to provide the appropriate annual water delivery.

- 2011 – Construct SSJID-1 pipeline improvements in the vicinity of Louise Avenue and Austin Road.

6.5 Distribution Piping Improvements

Distribution piping improvements for the two planning periods of 2005 to 2010 and 2011 to 2025 are summarized below.

6.5.1 Distribution Piping Improvements 2005 to 2010

As the City continues to grow, the current policy of providing 12-inch pipelines on a 1/2-mile grid will continue a strong distribution system backbone to provide good pressure and flow distribution and to enable the system to meet required fire flows.

6.5.2 Distribution Piping Improvements 2011 to 2025

The third SSJID surface water delivery point may require additional piping if the service area has not expanded to the southwest by that time. If this is the case, the delivery point should be connected to the 12-inch pipeline grid system.

6.6 Operation and Control

Operation and control of the City's water distribution system and wells could remain essentially unchanged until the SSJID surface water supply comes on-line. Operation and control of the City's water system will be a cooperative effort between the City and SSJID after commencement of SSJID surface water deliveries in conjunctive use with the City's groundwater wells. The Supervisory Control and Data Acquisition (SCADA) systems of the City and SSJID will need to communicate to coordinate SSJID surface water deliveries with City well deliveries. The overall objective will be to limit the annual groundwater production to the safe yield of 1.0 acre-foot per acre per year. The City's groundwater safe yield has been estimated at 46 percent of the City's annual water use. Projected annual groundwater safe yield volumes and SSJID surface water volumes are shown in Table 4-2. The projected annual water delivery objective in 2005 is 8,100 acre-feet of groundwater and 9,900 acre-feet of surface water.

It is recommended that the surface water and groundwater flow rates and delivery volumes be continually monitored and totalized by the SSJID and City SCADA systems. Pumps will be turned on and off at the SSJID delivery pump station and City wells will be turned on and off in order to balance the surface water and groundwater delivery volumes and to maintain proper delivery pressures in the City water system.

City wells will be turned on based on distribution system low pressure and will be turned off based on either distribution system high pressure or low water well flow. The well control set points and the control logic for the SSJID pump station will need to be adjusted as experience is gained with the conjunctive use water deliveries in order to balance water delivery volumes and maintain water system pressures. Other nearby water suppliers such as Stockton East Water District and Modesto Irrigation District, which deliver surface water to surface water/groundwater conjunctive use purveyors, could be consulted to gain from their experience in operating and controlling such facilities.

It is recommended that the City monitor groundwater levels to assess the impacts of the conjunctive use program and determine whether groundwater levels show stabilization. In the City's conjunctive use program, it will not be necessary to balance the surface water and groundwater deliveries on a daily, or even monthly, basis because impacts on the groundwater basin are measured in years. As suggested in Chapter 4, it may be desirable for the City to take delivery of more surface water than scheduled in wet years (up to contractual limits), allowing the groundwater basin to "bank" water, so more groundwater could be pumped during severe drought years if surface water supplies must be reduced.

Adjustment of well setpoints is recommended with the connection to the SSJID surface water supply. The operation of the wells will need to be adjusted to accomplish the desired surface water deliveries. Adjustment will vary by well location, elevation, and well capacity, as well as seasonally. Sequencing of the wells is also recommended based on well capacity, distance from SSJID surface water supply connections, and water quality issues.

Section 7: Capital Improvement Plan

7.1 Introduction

The Capital Improvement Plan (CIP) provides for the scheduled implementation of the recommendations presented in Chapter 6. The CIP does not include the project elements and costs associated with the SSJID treatment plant, pipeline water delivery stations, and pumping facilities. The 12-inch pipe on 1/2-mile grid is assumed to be paid by development and not included in the CIP.

7.2 Basis of Cost

The estimated capital costs presented in the CIP schedule are conceptual level estimates that have been prepared based on prior bid results, standard estimating guide cost curves and engineering judgment. The cost estimates include a 20 percent contingency to provide for reasonable estimating and construction uncertainties, and a 20 percent factor for engineering and administrative costs.

The cost estimates are in September 2004 baseline dollars, which correspond to an Engineering News Record, 20-Cities Construction Cost Index of 7,298.

Property acquisition, environmental documentation, and mitigation costs have not been estimated for the various projects due to the uncertainty regarding these potential costs. It is recommended that the City review each project on a case-by-case basis during preliminary design to minimize potential environmental impacts.

7.3 CIP Schedule

The CIP schedule matches the order of the recommendations provided in Chapter 6 and planning periods 2005 to 2010 and 2011 to 2025. Table 7-1 presents the CIP for each of the planning periods. The actual timing of capital improvements scheduled for the periods 2005 to 2010 and 2011 to 2025 will be driven by growth and development.

The implementation of the SSJID Project and conjunctive use water supply will affect the CIP schedule. The SSJID planning documentation assumes that Manteca will reach buildout in 2025. The CIP assumes no delay in the SSJID schedule, however, the information provided in this Water Master Plan permits adjustment of the CIP time schedule to reflect actual growth and development of conjunctive water supplies.

7.4 Non-Capital Improvements

This Water Master Plan includes recommendations for implementing a well exercise program, balancing SSJID water deliveries by adjusting flows and/or pressures at the City wells and SSJID connection points. The possibility of groundwater banking is also proposed. The use of additional surface water during wet years may provide additional groundwater for use during periods of drought. This conjunctive balance does not provide for additional sustainable supply suitable for increased development commitments.

7.5 Water Quality Uncertainties

Future changes in drinking water regulations may result in the need for additional treatment of groundwater within the City. Constituents, which have a potential to impact the City, include arsenic, nitrate, DBCP, EDB, and radioactivity. The CIP includes treatment at 75 percent of the wells for arsenic and 20 percent of the wells for other constituents based on current standards and broad assumptions regarding the potential risk of contamination and naturally occurring constituents. It is recommended that the City monitor water quality regulation change to be prepared to address future changes as they occur.

Table 7-1: Capital Improvement Plan

Planned System Maintenance – Distribution System Projects

Project Area Number	Infrastructure to be Abandoned	Replacement Infrastructure	Implementation Schedule	Estimated Cost
1	Pipelines: 4-inch and Smaller – 700 LF 6-inch – 850 LF	Pipelines: 6-inch – 1,500 LF 8-inch – 850 LF Services: Replacement – 34 each	2005 – 2007	$386,000
2	Pipelines: 4-inch and Smaller – 3,600 LF 6-inch – 2,350 LF	Pipelines: 4-inch – 200 LF 6-inch – 1,450 LF 8-inch – 6,900 LF Services: Replacement – 85 each Relocation – 134 each	2006 – 2008	$1,769,000
3	Pipelines: 4-inch and Smaller – 5,400 LF	Services: Relocation – 155 each	2007 – 2009	$477,000
4	Pipelines: 4-inch and Smaller – 900 LF	Pipelines: 8-inch – 700 LF Services: Relocation – 35 each	2008 – 2010	$210,000
5	Pipelines: 4-inch and Smaller – 6,100 LF	Services: Relocation – 144 each	2009 – 2011	$444,000
6	Pipelines: 4-inch and Smaller – 1,050 LF	Pipelines: 4-inch – 150 LF 6-inch – 550 LF Services: Replacement – 31 each	2010 – 2012	$178,000
7	Pipelines: 4-inch and Smaller – 3,450 LF 6-inch – 1,440 LF	Pipelines: 8-inch – 7,400 LF Services: Replacement – 50 each Relocation – 84 each	2011 – 2013	$1,454,000
8	Pipelines: 4-inch and Smaller – 1,500 LF 6-inch – 950 LF	Pipelines: 6-inch – 1,500 LF 8-inch – 850 LF Services: Replacement – 34 each	2012 - 2014	$400,000

Table 7-1: Capital Improvement Plan (cont'd)

Planned System Maintenance – Distribution System Projects (cont'd)

Project Area Number	Infrastructure to be Abandoned	Replacement Infrastructure	Implementation Schedule	Estimated Cost
9	Pipelines: 4-inch and Smaller – 700 LF 6-inch – 950 LF	Pipelines: 6-inch – 450 LF 8-inch – 750 LF Services: Replacement – 45 each	2013 - 2015	$294,000
10	Pipelines: 4-inch and Smaller – 1,850 LF	Pipelines: 6-inch – 300 LF 8-inch – 850 LF Services: Relocation – 80 each	2014 - 2016	$401,000

Note: Service relocation reflects relocating the service from the street to the back of the lot and abandoning the existing service connection. Service replacement reflects replacement of a front lot service with a front lot service.

Planned System Maintenance – Hydraulic Improvements Projects

Description	Quantities	Implementation Schedule	Estimated Cost
• 16-inch extension S. Main from Mission Ridge Dr. to Wawona Street and S. Maple Avenue	• 1,050 LF 16-inch Main	2005 - 2007	$306,000
• 12-inch extension N. Lincoln Ave, E. North Ave. to W. Alameda St. • 12-inch extension W. Alameda St., N. Lincoln Ave. to Dawn Dr. • 12-inch extension Dawn Dr., W. Alameda St. to E. Edison St.	• 3,850 LF 12-inch Main	2006 - 2008	$792,000
• 12-inch extension Manteca Ave., Yosemite Ave. to Center St. • 12-inch extension Center Street, Poplar Ave. to N. Lincoln Ave.	• 2,600 LF 12-inch Main	2007 – 2009	$512,000

Table 7-1: Capital Improvement Plan (cont'd)

Planned System Maintenance – Hydraulic Improvements Projects (cont'd)

Description	Quantities	Implementation Schedule	Estimated Cost
• 16-inch extension Moffat Blvd. • 16-inch Railroad Crossing with extension to Wetmore Street • 12-inch extension to S. Grant Ave. • 12-inch extension S. Lincoln to Mikesell St.	• 2,100 LF 16-inch Main • 200 LF Railroad crossing with 24 inch jack and bore • 2,300 LF 12-inch Main	2008 - 2010	$2,094,000
• Yosemite Avenue Railroad Crossing – replacement of old 8-inch pipe with 16-inch crossing	• 400 LF 16-inch Main • 200 LF Railroad crossing with 24-inch jack and bore	2009 – 2011	$1,407,000
• 12-inch extension Park Avenue for Wawona Ave. to Oregon St. • 12-inch extension Oregon St. to Willow Ave, and up to W. Yosemite Ave.	• 3,500 LF 12-inch Main	2010 – 2012	$607,000

Planned System Maintenance – Elevated Tank Projects

Description	Recommended Maintenance	Schedule	Estimated Cost
Coating System	• Inspect coating system	2006	$10,000
Structural System	• Inspect tank structural elements	2006	$15,000
Structural System Testing	• Conduct non-destructive testing of all structural elements and evaluate for seismic upgrade prior to recoating tank	2012	$25,000
Coating System	• Remove and recoat entire tank at 25 years	2012	$450,000

Table 7-1: Capital Improvement Plan (cont'd)

Water Treatment – Existing Systems, Maximize Wellhead Treatment for Arsenic Reduction

Project No.	Facility Name	Project Description	Schedule	Estimated Cost
A2-1	Well No. 14 Treatment Improvements	Retrofit existing manganese greensand filters with ferric-chloride chemical feed to precipitate arsenic. Discharge backwash stream to sanitary sewer.	2004-2005	Completed
A2-2	Well No. 24 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2005-2006	$1,810,000
A2-3	Well No. 15 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2005-2006	$2,150,000
A2-4	Well No. 25 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2005-2006	$3,350,000
A2-5	Well No. 16 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2006-2007	$1,810,000
A2-6	Well No. 23 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2006-2007	$1,810,000
A2-7	Well No. 12 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2006-2007	$1,810,000
A2-8	Well No. 19 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2007-2008	$1,810,000
A2-9	Well No. 22 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2007-2008	$1,810,000
A2-10	Well No. 21 Arsenic Treatment	Construct arsenic reduction treatment plant using a side stream approach.	2007-2008	$1,000,000
A2-11	Well No. 17 Arsenic Treatment	Reconstruct existing GAC filters to use granular ferric oxide (GFO) media for arsenic reduction using a side-stream approach. Install pH adjustment and 14-foot diameter backwash tank with reclamation pumping.	2008-2009	$1,810,000
A2-12	Well No. 20 Arsenic Treatment.	Construct GFO arsenic reduction treatment plant using a side stream approach. Install pH adjustment and 14-foot diameter backwash tank with reclamation pumping.	2008-2009	$1,000,000
A2-13	Well No. 5 Replacement Well with Treatment	Construct new well at site of existing Well No. 5 with arsenic reduction treatment plant using a sidestream approach	2008-2009	$2,692,000
A2-14	Abandon Wells No. 10 and 13	Remove existing buildings, improvements and surface features. Rip casings and abandon wells using grout placed in lifts to establish positive seal through impermeable zones during closure.	2010-2012	$100,000
A2-15	Convert Well No. 9 to Irrigation Well	Disconnect from distribution system and replumb to supply park irrigation supply.	2010-2012	$25,000

Table 7-1: Capital Improvement Plan (cont'd)

PFIP – Distribution System Extension for Planned Growth

Description	Estimated Piping	Estimated Cost
Northern Area within the Primary Urban Service Area north of Lathrop Road, west of Highway 99 and east of Airport Road	41,600 LF of 12-inch diameter pipeline to support total buildout	$6,670,000
West Central Area within the Primary Urban Service Area north of Highway 120 and west of Airport Road	18,700 LF of 12-inch diameter pipeline to support total buildout	$3,041,000
East Central Area within the Primary Urban Service Area east of Highway 99 and north of Louise Avenue	7,000 LF of 12-inch diameter pipeline to support total buildout	$1,188,000
Southern Area within the Primary Urban Service Area south of Highway 120	102,100 LF of 12-inch diameter pipeline to support total buildout	$19,467,000

PFIP Water Supply Projects – 2006 through 2011

	Cost Estimate
1) (N) 1,500 gpm Well	$ 2,122,000
2) (N) 1,500 gpm Well with Arsenic Treatment	$ 3,662,000
3) (N) 1.3 MG Tank with Booster Pump Station	$ 3,703,000
4) (N) 1,500 gpm Well with Arsenic Treatment	$ 3,662,000
5) (N) 1,500 gpm Well with Arsenic Treatment	$ 3,662,000
Total	**$16,811,000**

PFIP Water Supply Projects – 2012 through 2023

	Cost Estimate
1) (N) 1.3 MG Tank with Booster Pump Station	$ 3,703,000
2) (N) 1,500 gpm Well with Arsenic Treatment	$ 3,662,000
3) (N) 1,500 gpm Well	$ 2,122,000
4) (N) 1.3 MG Tank with Booster Pump Station	$ 3,703,000
5) (N) 1,500 gpm Well with Arsenic Treatment	$ 3,662,000
6) (N) 1,500 gpm Well with Arsenic Treatment	$ 3,662,000
7) (N) 1.3 MG Tank with Booster Pump Station	$ 3,703,000
8) (N) 1,500 gpm Well with Arsenic Treatment	$ 3,662,000
9) (N) 1,500 gpm Well with Arsenic Treatment	$ 3,662,000
Total	**$31,541,000**

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