Joint Water Recycling Facilities Planning Study for the Cities of Stockton and Lodi

State Water Resources Control Board Project No. 3521-010

Prepared by:

RMC
Water and Environment

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Acknowledgements

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List of Abbreviations

AF	acre-feet
AFY	acre-feet per year
BOD	Biological Oxygen Demand
CDPH	California Department of Public Health
CIMIS	California Irrigation Management Information System
DBCP	Dibromochloropropane
DWR	California Department of Water Resources
EIR	Environmental Impact Report
ET_o	Reference Evapotranspiration
fps	feet per second
GBA	Northeastern San Joaquin County Groundwater Banking Authority
GIS	Geographical Information System
gpd	gallons per day
gpm	gallons per minute
ICU	Integrated Conjunctive Use
ID	irrigation demand
IRWMP	Integrated Regional Water Management Plan
ITRC	California Polytechnic State University, San Luis Obispo Irrigation Training and Research Center
LF	lineal feet
MG	million gallons
mg/L	milligrams per liter
mgd	million gallons per day
NPDES	National Pollutant Discharge Elimination System
PCP	Pacific Coast Producers
PDD	Peak Day Demand
PHD	Peak Hour Demand
Psi	pounds per square inch
RMC	RMC Water and Environment
RWQCB	Central Valley Regional Water Quality Control Board
RWMP	Recycled Water Master Plan
SAR	Sodium Adsorption Ratio
SOI	Sphere of Influence
SWRCB	State Water Resources Control Board
TAF	Total Acre Feet
TDS	Total Dissolved Solids
Title 22	Title 22 California Code of Regulations
TM	Technical Memorandum
TSS	Total Suspended Solids
UWMP	Urban Water Management Plan
WDR	Waste Discharge Requirement

WID	Woodbridge Irrigation District
WPCF	Water Pollution Control Facility
WUF	Water Use Factor
WYA	West Yost Associates

Executive Summary

ES-1 Overview

The Cities of Stockton and Lodi are jointly investigating the feasibility of using Lodi's treated wastewater as a recycled water source for the City of Stockton. This use of recycled water as a non-potable supply in North Stockton would extend the City's water resources, address groundwater overdraft issues west of the City, and would beneficially reuse treated wastewater from the City of Lodi which would otherwise be disposed. This study was completed as part of a settlement related to a lawsuit between the parties (the Cities) over the Sphere of Influence (SOI) asserted by Stockton in its general planning process. This Study documents the work conducted in support of this effort, known as the Joint Water Recycling Facilities Planning Study (Study).

ES-1.1 Study History

The history of this study is summarized in **Table ES-1-1**.

Table ES-1-1: Study History

Date	Action
April 2004	• Cities of Stockton and Lodi completed a Joint Effluent Disposal and Reuse Study (West Yost Associates (WYA) 2004)
April 2005	• Cities of Stockton and Lodi agree to jointly look at the feasibility of using Lodi's treated wastewater as a recycled water source for Stockton as part of the settlement of a lawsuit over the City of Stockton's Sphere of Influence
April 2007 – December 2007	• Consultant completed first phase of work[1]
June 2008	• SWRCB planning grant commitment received
July 2008 – April 2010	• Consultant completed second phase of work[2]

Notes:
1. The first phase of work included identifying project goals and objectives, conducting a market assessment, developing the seasonal storage alternative, and fatal flaws and constraints analysis.
2. The second phase of work included developing the blended supply alternative, selecting the preferred project, and developing an implementation plan for the preferred project.

ES-1.2 Study Objectives and Approach

The objective of the Study is threefold:

1. To define the recycled water alternatives (i.e. reuse sites and demands, distribution alignment, sizing, construction alternatives, etc.) and to identify a Preferred Project.
2. To develop a realistic funding strategy for the Preferred Project.
3. To develop an implementation strategy for the Preferred Project.

Technical activities performed by RMC as part of the Study include market analysis, alternative development and evaluation, stakeholder outreach, and funding investigation. In parallel, the Cities have been meeting with Project stakeholders to build support for the Project, and to identify and address potential concerns in the Project definition.

ES-2 Project Description

The Preferred Project would utilize recycled water from the White Slough Water Pollution Control Facility (WPCF) when available and would blend the recycled water with supplemental supplies during peak summer months. For purposes of this study it is assumed that the supplemental water would be supplied by the Woodbridge Irrigation District (WID).

The Preferred Project would provide approximately 3,720 afy of non-potable water for urban, non-residential landscape irrigation and artificial lake filling. Urban, non-residential landscape irrigation would constitute 95% of the demand. Irrigation would occur primarily during the night (between 6:00 p.m. and 6:00 a.m.). 3,200 afy would be associated with Phase 1 users, i.e. existing users and future developments for which application has been received and/or approved for construction. 520 afy would be associated with other future users. **Figure ES-2-1** shows the location of target users. A complete list of target users is provided in **Table ES-2-1**.

The Preferred Project would include approximately 57,000 ft of 18 to 24 -inch pipe and construction of two operational reservoirs and four pump stations. **Figure ES-2-2** shows the location of the major conveyance facilities. A summary description of major project facilities is provided in **Table ES-2-2**.

Figure ES-2-1: Target Users

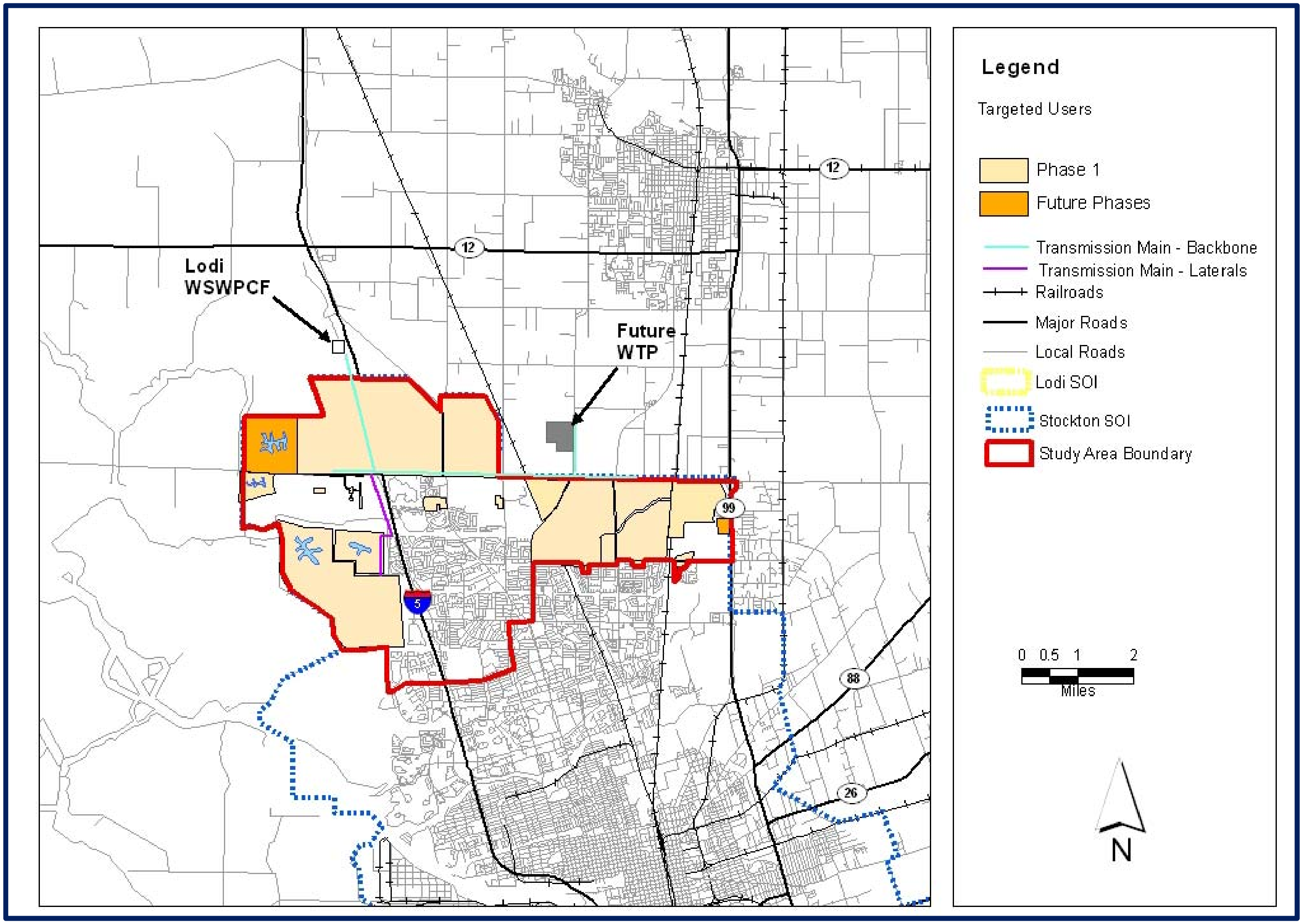


Table ES-2-1: Target Users

User[1]	Acreage	Average Annual Demand, AFY
Existing Facilities		
Office Park	6	20
Stockton WTP	12	41
Existing Residential Development with Greenways/Parks (Scott Creek Drive)	31	105
Matt Equinoa Park	5	15
Existing Residential Development with Greenways/Parks (between Oak Grove Park and Thornton Rd along Eight Mile Rd)	3	10
Bear Creek High School/Julia Morgan Elementary School	30	100
Ansel Adams Elementary	5	20
Manilo Silva Elementary	4	15
Sutherland Elementary	4	15
Elkhorn School	3	10
Westwood Elementary School	7	20
Ron McNair High School	32	110
State Route 99 & Eight Mile Rd	7	24
Total Existing Facilities	**149**	**505**
Proposed Development		
Sanctuary SOI (Artificial Lake Recharge)	10	30
Crystal Bay (Artificial Lake Recharge)	7	20
Atlas Tract (Artificial Lake Recharge)	7	20
Bear Creek West	154	520
Spanos Gateway	147	500
Sanctuary SOI	145	490
North Stockton Village	85	285
Bear Creek South	66	225
Cannery Park	49	165
Bear Creek East	49	165
Atlas Tract	40	135
Crystal Bay	23	75
North Stockton Project III	18	60
Highway 5 & Eight Mile Rd	2	5
Thompson SOI (future phase)	82	275
Proposed Soccer Complex (future phase)	38	125
Thompson SOI (Artificial Lake Recharge) (future phase)	41	120
Total Proposed Development	**963**	**3,215**
Total	**1,112**	**3,720**

Notes:
1. All users are shown as Phase 1 users in Figure ES-2-1, except the Thompson SOI and the proposed soccer complex that are shown as future phases.

Figure ES-2-2: Main Conveyance Pipeline Conceptual-Level Alignment

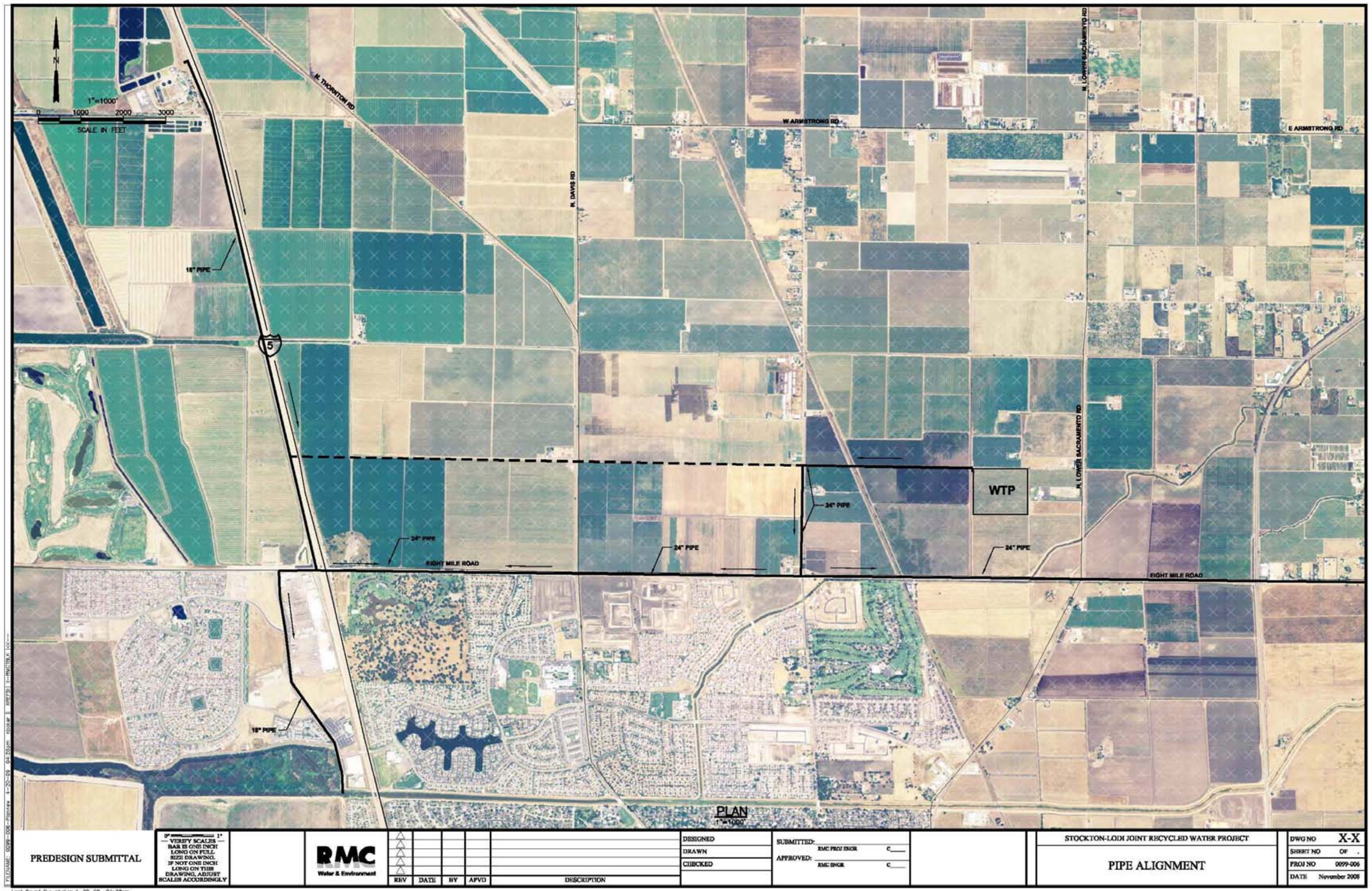


Table ES-2-2: Major Facilities

Description	Unit	Quantity
Users		
Irrigated Acreage	acres	1,112
Peak Hour Demand	mgd	15.9
Distribution System		
18-inch Pipe	LF	21,800
24-inch Pipe	LF	35,100
RR Crossing	LF	200
Intake Pump Station and Operational Storage at WPCF		
Peak Hour Flowrate[1]	gpm	2,250
Peak Flow TDH Required	ft	56
Operational Storage	MG	1.6
Distribution Pump Station at WPCF		
Peak Hour Flowrate[2]	gpm	4,500
Peak Flow TDH Required	ft	167
Intake Pump Station and Operational Storage for Supplemental Supply		
Peak Hour Flowrate[1]	gpm	4,260
Peak Flow TDH Required	ft	53
Operational Storage	MG	3.8
Distribution Pump Station for Supplemental Supply		
Peak Hour Flowrate[2]	gpm	8,520
Peak Flow TDH Required	ft	114

Notes:
1. Flow from intake to operational storage occurs over 24 hours.
2. Flow from operational storage to the distribution system occurs over 12 hours.

ES-3 Cost Estimate

Table ES-3-1 presents a summary of the planning-level cost estimate for the Preferred Project.

Table ES-3-1: Estimated Costs

Facility		Estimated Cost[1] (2008 Dollars)
Recycled Water Storage and Pumping		
	Pump Station Facilities	$1.2M
	Operational Storage	$1.6M
	Total	$2.8M
Supplemental Supply Storage and Pumping		
	Pump Station Facilities	$2.3M
	Chlorination	$0.1M
	Operational Storage	$3.8M
	Total	$6.1M
Main Transmission Pipeline[2]	$/lf	
18-inch diameter pipe	$216	$4.7M
24-inch diameter pipe	$273	$9.6M
UPRR Track Crossing	$1,500	$0.3M
	Total	$14.6M
Pipeline Appurtenances		
Appurtenances	10% of pipeline	$1.5M
	Total	$1.5M
	Raw Construction Costs	$25.1M
	Construction Estimate Allowance (30%)	$7.5M
	Construction Cost	$32.6M
	Engineering, Legal, Administrative, Environmental (35%)	$11.4M
	Total Capital Cost	**$44.0M**
Operations & Maintenance		
	Total Operations and Maintenance	$0.5M/yr
	Annual Capital Costs	$3.4M/yr
	Total Annual Cost	$3.9M/yr
	Recycled Water Yield	3,720 AFY
	Annual Unit Cost	**$1,050/AF**

Notes:
1. Rounded to the nearest $0.1M.
2. Retrofit costs for the thirteen existing use sites are not included in the above estimate as a separate line item but rather included in the construction estimate allowance. Retrofit costs for existing irrigated sites (including signage, painting of above-ground fixtures, purple sprinkler heads, recycled water meters, valving, air gap, and any irrigation system modifications if needed) typically vary greatly depending on the site. Assuming a $15,000 allowance per site to cover retrofit up to the meter would amount to $195,000 for thirteen sites.

ES-4 Comparison to Freshwater Alternative

Table ES-4-1 presents a simple cost and benefits comparison of the Preferred Project and reference freshwater alternatives.

Table ES-4-1: Preferred Project vs. Freshwater Alternatives Comparison

Criteria	Stockton Lodi Joint Recycled Water Project	Delta Supply Intake Expansion Alternative	Increased Groundwater Pumping Alternative
Summary			
Description	Construct distribution system, storage and pumping facilities to provide a blended recycled water/surface water supply for primarily irrigation use.	Expand Stockton's Delta Water Supply Intake, which is currently under construction, and increase surface water diversions from the Delta.	Expand existing groundwater pumping practices
Water Supply	Treated wastewater from the WPCF, meeting Title 22 recycled water standards for unrestricted use which is seasonally blended with surface water (WID raw water).	Surface waters from the Delta	Groundwater
Benefits			
Yield	3,720 AFY, drought-proof supply for non-potable uses	3,720 AFY	3,720 AFY
Other	Improves water supply reliability during drought and emergency conditions		
	Reduces discharge of treated wastewater to the Delta		
	Adheres to local, regional and state recycled water policies		
	Creates opportunity to lessen groundwater pumping; thereby possibly positively affecting the regional salinity gradient and reducing existing groundwater depression		
Costs			
Capital Cost	$44.0 million (2008 dollars)	N/A	N/A
Unit Cost ($/AF)	Retail cost of $1,050/AF (with as much as $650/AF potentially passed onto developers)	Retail cost of $444/AF in 2010; up to $727/AF by 2015	Retail cost of approximately $160/AF
Other Potential Future Costs/Risks		Risk of additional supply reductions in average years and drought years based in climate change impacts or environmental issues in the Delta	Risk of exasperating existing regional salinity gradient or groundwater depression

As described above, the Preferred Project provides key water supply and environmental benefits to the City and its customers. Given the uncertainty associated with the availability of Delta water and existing groundwater issues such as regional salinity gradient or groundwater depression, the Preferred Project appears attractive. However, outside funding would likely be needed to offset part of the City's costs and move the Preferred Project forward.

ES-5 Implementation Plan

Table ES-5-1 presents the major implementation activities and associated timeline assuming a July 2011 start date for pre-design and environmental documentation. This schedule could be accelerated if needed.

Table ES-5-1: Implementation Schedule

Activities	Timeline
Program Management	July 2011 – Mar 2015
Pre-Design	July 2011 – June 2012
Environmental Documentation	July 2011 – June 2013
Funding Pursuit/Financing Plan Development	July 2011 – June 2013
User Assurances/Interagency Agreements	July 2011 – June 2013
Permitting	July 2011 – June 2014
Public Outreach	July 2011 – Mar 2016
Design	July 2013 – July 2014
Bidding	July 2014 – Sept 2014
Construction	Oct 2014 – Feb 2016
Start of Operations	Mar 2016

Chapter 1 Introduction

This Joint Water Recycling Facilities Planning Study (Study) for the Cities of Stockton and Lodi was prepared by RMC Water and Environment (RMC), as a consultant to the Cities of Stockton and Lodi, and is funded in part by a grant from the State of California Water Resources Control Board (SWRCB). This chapter provides background on the Study, and presents the Study objectives, approach and organization.

1.1 Study History

The history of the study is summarized in **Table 1-1.**

Table 1-1: Study History

Date	Action
April 2004	• Cities of Stockton and Lodi completed a Joint Effluent Disposal and Reuse Study (WYA 2004)
April 2005	• Cities of Stockton and Lodi agree to jointly look at the feasibility of using Lodi's treated wastewater as a recycled water source for Stockton as part of the settlement of a lawsuit over the City of Stockton's Sphere of Influence
April 2007 – December 2007	• Consultant completed first phase of work[1]
June 2008	• SWRCB planning grant commitment received
July 2008 – April 2010	• Consultant completed second phase of work[2]

Notes:
1. The first phase of work included identifying project goals and objectives, conducting a market assessment, developing the seasonal storage alternative, and fatal flaws and constraints analysis.
2. The second phase of work included developing the blended supply alternative, selecting the preferred project, and developing an implementation plan for the preferred project.

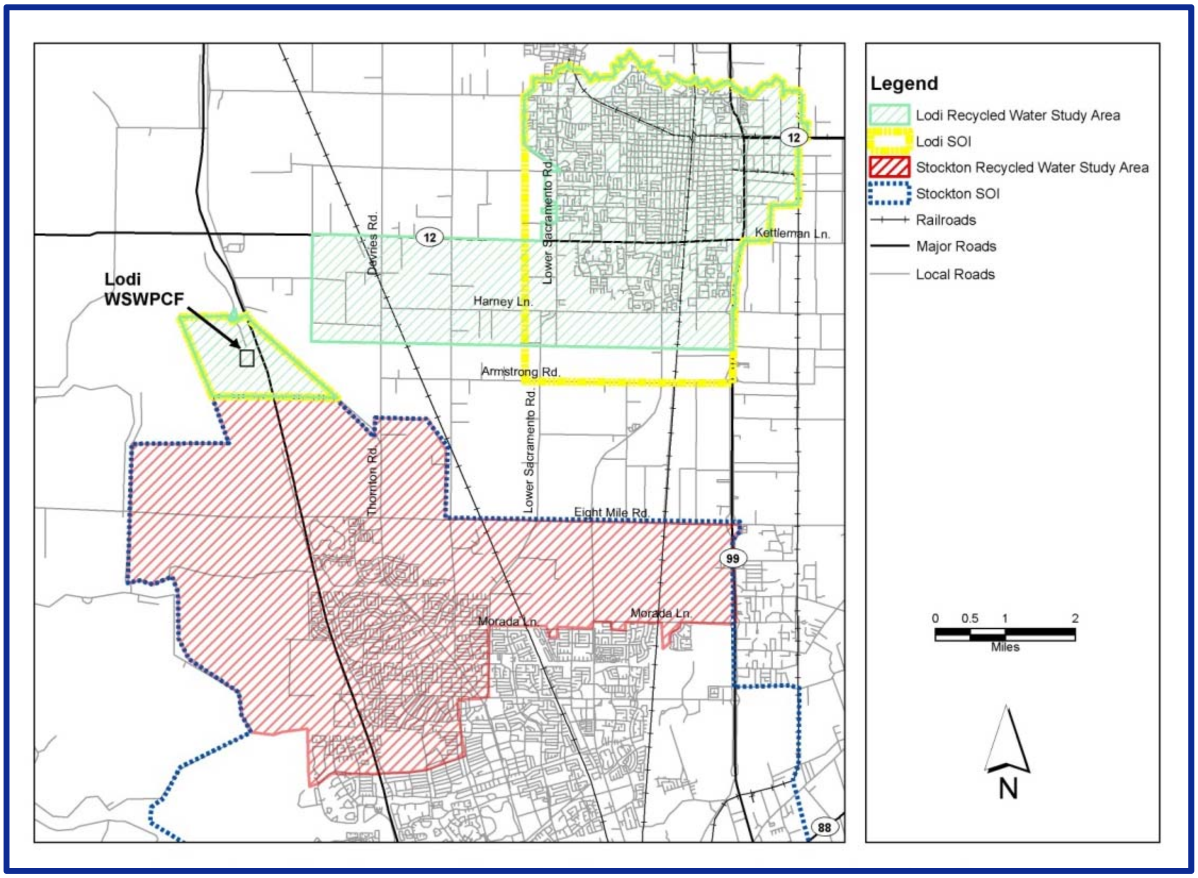
1.2 Study Area

The Cities of Stockton and Lodi jointly took the following approach when considering the feasibility of using recycled water in both cities:

- The City of Lodi's White Slough Water Pollution Control Facility (WPCF) was to be evaluated as the source of recycled water.
- The use of recycled water from the White Slough WPCF within the City of Lodi Recycled Water Service Area was evaluated in the City of Lodi Recycled Water Master Plan (RMC 2008). Based on the Master Plan's conclusions, this Study assumes that none of the preferred recycled water projects identified in this Master Plan (i.e., Agricultural Reuse Project and Urban Non-Potable Water System Project) will be implemented at this time.
- This Study focuses on the use of recycled water from the White Slough WPCF within the City of Stockton Recycled Water Service Area.
- The Stockton Recycled Water Service Area boundaries were defined in coordination with both Cities based on the Stockton proposed Sphere of Influence (SOI) as of September 2008, location of major proposed new developments in the City and distance from the White Slough WPCF.

The City of Stockton Recycled Water Service Area (Study Area), the City of Lodi Recycled Water Service Area, and the location of the City of Lodi's White Slough WPCF are illustrated in **Figure 1-1**.

Figure 1-1: Study Area



Notes:
1. This Study focuses on the use of recycled water from the White Slough WPCF within the Stockton Recycled Water Study Area. The use of recycled water within the Lodi Recycled Water Study Area was evaluated in the City of Lodi Recycled Water Master Plan (RMC 2008).
2. Stockton Proposed Sphere of Influence (SOI) shown in the figure is as of September 2008.

1.3 Project Goals

The goals listed in **Table 1-2** provide the basis for project definition, evaluation of project benefits, and potential cost allocation for a recycled water project within the Study Area (i.e., City of Stockton Recycled Water Service Area).

Table 1-2 Project Goals

Goals	City of Stockton	City of Lodi
Water Supply Reliability	• Free up high quality treated surface water and local groundwater, currently used for landscape irrigation and other purposes, for strictly potable uses • Establish new source of water supply that is reliable, drought resistant, and locally controlled • Diversify local and regional water portfolio and provide basis for more comprehensive 2010 Urban Water Management Plan • Create opportunity to lessen groundwater pumping; thereby possibly positively affecting the regional salinity gradient and reducing existing groundwater depression	• Not applicable[1]
Effluent Management	• Not applicable[1]	• Reduce discharge to surface water • Reduce impacts of new and potentially stricter regulatory limits • Beneficially reuse effluent generated by the City of Lodi
Consistency with State and Federal Goals and Objectives	• Uphold State guidelines and policies relative to recycled water, including the California Water Code, Section 13510, and Section 461, and the 2005 California Water Plan Update, which promote diversification of regional water portfolio and encourage the use of recycled water	

Notes:
1. The project to be defined in this Study is focusing on the use of recycled water from the City of Lodi White Slough WPCF within the City of Stockton proposed SOI (see Section 1.2).

1.4 Study and Project Drivers

The Study and project drivers are summarized in **Table 1-3**.

Table 1-3: Study and Project Drivers

Category	Description
Local Economy Sustainability	• New development has created an immediate need to develop solutions to improve the availability of potable water supplies, manage the groundwater basin, manage wastewater effluent as well as meet other goals identified in Table 1-2.
Implementation Schedule	• Recycled water projects take time to implement. Cities need to start planning now for the potential use of recycled water within the planning area. • The concurrent development and implementation of the City of Stockton's draft non-potable water use ordinance make this Study timely.
Regulatory	• In April 2008, the Central Valley Regional Water Quality Control Board (RWQCB) drafted a resolution emphasizing that prior to all new or expanded discharges being considered by the RWQCB, the discharger and staff must first fully demonstrate that a complete analysis of all reclamation, reuse, and recycling has been evaluated.[1]

Notes:
1. Source: California Regional Water Quality Control Board Central Valley Region.

1.5 Study Objectives and Approach

The Study objectives are listed in **Table 1-4**.

Table 1-4: Study Objectives

Phase	Objectives/Tasks
Feasibility Study	Gauge Potential Demand
	Determine Available Recycled Water Flows
	Select Preferred Alignment and Size Facilities
	Estimate Capital and Operation and Maintenance Costs
	Build Political and Public Support
Implementation Plan	Prepare Facilities Plan
	Develop Implementation Schedule
	Assess Potentially Significant Environmental Impacts
	Facilitate Facility Ownership Discussions

The following major tasks were completed for the development and preparation of the Study:

- Documentation of Project Setting, and Water Supply and Wastewater Characteristics
- Recycled Water Market Assessment
- Project Alternatives Analysis/Feasibility Study
- Documentation of Preferred Project
- Implementation Plan

The details and results of these services are presented and discussed in Chapters 2 through 8 of this report.

1.6 Stakeholder Involvement

The strategy for stakeholder involvement in the preparation of the Study was developed based on discussions with Cities of Stockton and Lodi, experience with recycled water projects and stakeholder outreach, and consideration of the local setting.

The following strategies were recommended and implemented for the main groups of stakeholders:

Potential Customers

The City of Stockton conducted a workshop for potential recycled water customers in September 2008. **Appendix A** contains a list of the stakeholders invited to this workshop as well as the meeting summary. The Lincoln Unified School District and Lodi Unified School District were not represented at the meeting and should be contacted early as part of project implementation.

The City of Lodi conducted similar workshops as part of the City of Lodi Recycled Water Master Plan.

General Public and Elected Officials

The City of Stockton has provided update(s) on the Study and project to the City of Stockton Water Committee, which involves elected officials from the City Council. The City of Lodi has been doing the same through updates to its City Council.

Should the Cities decide on moving forward with implementation of a recycled water project, the Cities should consider early on setting up a website about the Study and the potential recycled water project.

Regulatory Agencies

Starting in the early phase of the Study, the Cities have been engaging with the California Department of Public Health (CDPH) and the RWQCB to obtain input on the project alternatives.

1.7 Report Content

This Facilities Planning Study includes the following sections. Specific sections of the report are included in order to comply with the requirements set forth in Appendix B of the *Water Recycling Funding Program Guidelines*, published by the SWRCB.

- Chapter 1: Introduction
- Chapter 2: Project Setting
- Chapter 3: Water Supply Characteristics
- Chapter 4: Wastewater Characteristics
- Chapter 5: Recycled Water Market Assessment
- Chapter 6: Project Alternatives Analysis/Feasibility Study
- Chapter 7: Preferred Project
- Chapter 8: Implementation Plan

The Study also includes the following appendices:

- Appendix A: September 24, 2008 Stakeholder Workshop
- Appendix B: City of Lodi White Slough WPCF Soil & Groundwater Investigation (WYA, 2006)
- Appendix C: TM No. 2 Land Application: Future Nitrogen Loading Condition (WYA, 2007)
- Appendix D: White Slough WPCF Effluent Water Quality Data
- Appendix E: Recycled Water User Database and Related Information
- Appendix F: Project Alternatives Technical Information and Cost Estimates

- Appendix G: Cash Flow Analysis
- Appendix H: Draft Non-Potable Water Use Ordinance
- Appendix I: Draft Letter of Intent

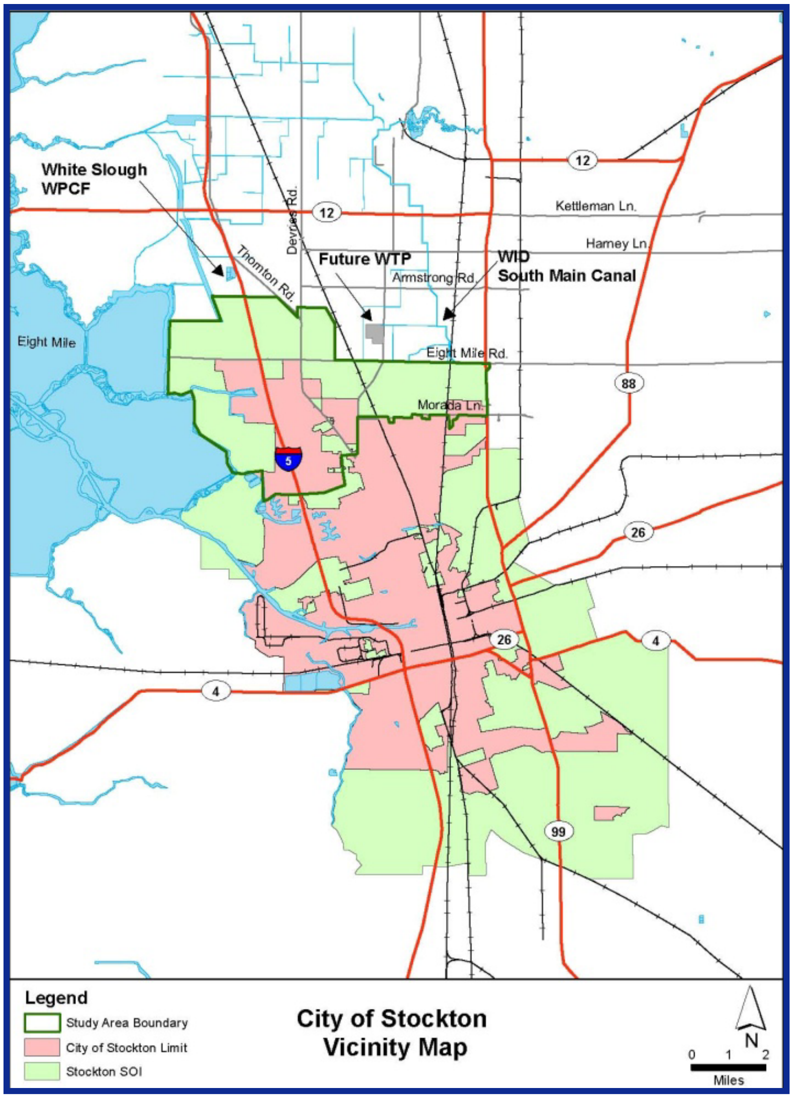
Chapter 2 Project Setting

As discussed in Chapter 1, the Stockton Recycled Water Study Area (Study Area) is the focus of this Study. This chapter provides project setting information relevant to that specific Study Area.

2.1 Location

The City of Stockton (City) is situated near the center of the San Joaquin County, 83 miles east of the San Francisco Bay area and 40 miles south of Sacramento. The City was incorporated in 1850 and has an approximate 2005 population of 279,513.[1] The Study Area for this project is located in North Stockton in the vicinity of Eight Mile Road between Interstate 5 and State Route 99 as shown in **Figure 2-1**.

Figure 2-1: City of Stockton Vicinity Map



Notes: WTP: Water Treatment Plant; WID: Woodbridge Irrigation District; WPCF: Water Pollution Control Facility; Proposed SOI shown in the figure is as of September 2008

[1] Source: City of Stockton General Plan 2035

2.2 Receiving Waters

Receiving waters in the Study Area include: the Calaveras River system, the Stanislaus River system, the San Joaquin River system, and the San Joaquin Valley Groundwater Basin. Beneficial uses of these receiving waters include: drinking water, irrigation, and recreation.

The City of Lodi's White Slough WPCF discharges to Dredger Cut, which is a dead-end slough of the Delta. There are no documented beneficial uses that would be adversely impacted by a reduction in the City of Lodi's discharges, and the City is not required to maintain a specified flow rate in Dredger Cut. However, the City of Lodi does plan to maintain its right to discharge to Dredger Cut indefinitely.

2.2.1 Groundwater Basins and Extraction

The City overlies a portion of the San Joaquin Valley groundwater basin. The California Department of Water Resources (DWR) has declared that the groundwater basin underlying Eastern San Joaquin County is overdrafted, and groundwater levels in the County and the City are generally decreasing. Groundwater levels fluctuate over time depending on precipitation, aquifer recharge, and pumping demands.

The projected supply for 2009 during a multiple dry year period scenario (which is the current condition in Stockton) for the City is 30,837 AF/Y from its underlying groundwater basin.[2]

The groundwater basin underlying the City is described in further detail in the City's 2005 Urban Water Management Plan (UWMP).

2.2.2 Surface Water and Groundwater Water Quality

The quality of surface water and groundwater supplies for the City is discussed in Chapter 3.

2.3 Population and Land Use Trends

The City was incorporated in 1850 and has been one of California's fastest growing communities in recent years. A temperate climate and rich peat soil have made the area one of the richest agricultural and dairy regions in California. Current major crops include asparagus, cherries, tomatoes, walnuts, almonds, and many smaller-production orchard, row and feed crops.[3]

Historically the City's economy has been agriculture-based but now has diversified to include all market sectors. The companies range in size from 10 to 16,000 employees and produce a wide variety of products, services and commodities.

As of 2005, the City's population was approximately 279,500. Based on the City's assumed average annual growth rate of 2.1%, the population in 2025 is expected to be approximately 406,500.[4]

[2] Source: City of Stockton 2005 UWMP
[3] Source: City of Stockton website www.stocktongov.com
[4] Source: City of Stockton 2005 UWMP

Chapter 3 Water Supply Characteristics

This chapter describes the City's water demand and water supply characteristics relevant to this Study. Water supply within the City and Study Area comes primarily from two sources: groundwater and surface water.

3.1 Water Demand

Table 3-1 summarizes the current and projected water supplies over the 2030 planning horizon.

Table 3-1: City of Stockton Current and Projected Surface and Groundwater Supplies (AF/Y)

Source of Supply	2000	2005[a]	2010	2015	2020	2025	2030
Surface Water Supply (SEWD)	15,802	17,439	18,761[b]	19,725[b]	20,934[b]	20,917[b]	19,794[b]
Surface Water Supply (DWSP)	-	-	19,700	20,946	22,504	22,504	22,504
Groundwater Supply	10,289	14,960[c]	2,567	3,159	392	409	1,532
Recycled	-	-	-	-	-	-	-
Totals	26,091	32,399	41,028	43,830	43,830	43,830	43,830

(a) 2005 supplies projected from 2000-2004 annual supplies.
(b) Based upon 35% of SEWD WTP Output.
(c) Average of groundwater production 2000-2004.

Source: City of Stockton 2005 UWMP

The projected demands as indicated in the City's UWMP are equal to the projected supply. Any addition of recycled water would allow the City to reduce its reliance on groundwater and/or surface water supplies in the future.

3.2 Groundwater Supply

The City of Stockton's groundwater distribution system consists of 39 wells and three storage facilities that provide a total of 19 million gallons of storage. The existing groundwater wells are represented in **Figure 3-1**.

3.2.1 Groundwater Management Measures

The groundwater basin is currently in an overdraft condition.[5] A Groundwater Management Plan was therefore developed by the County Groundwater Banking Authority.

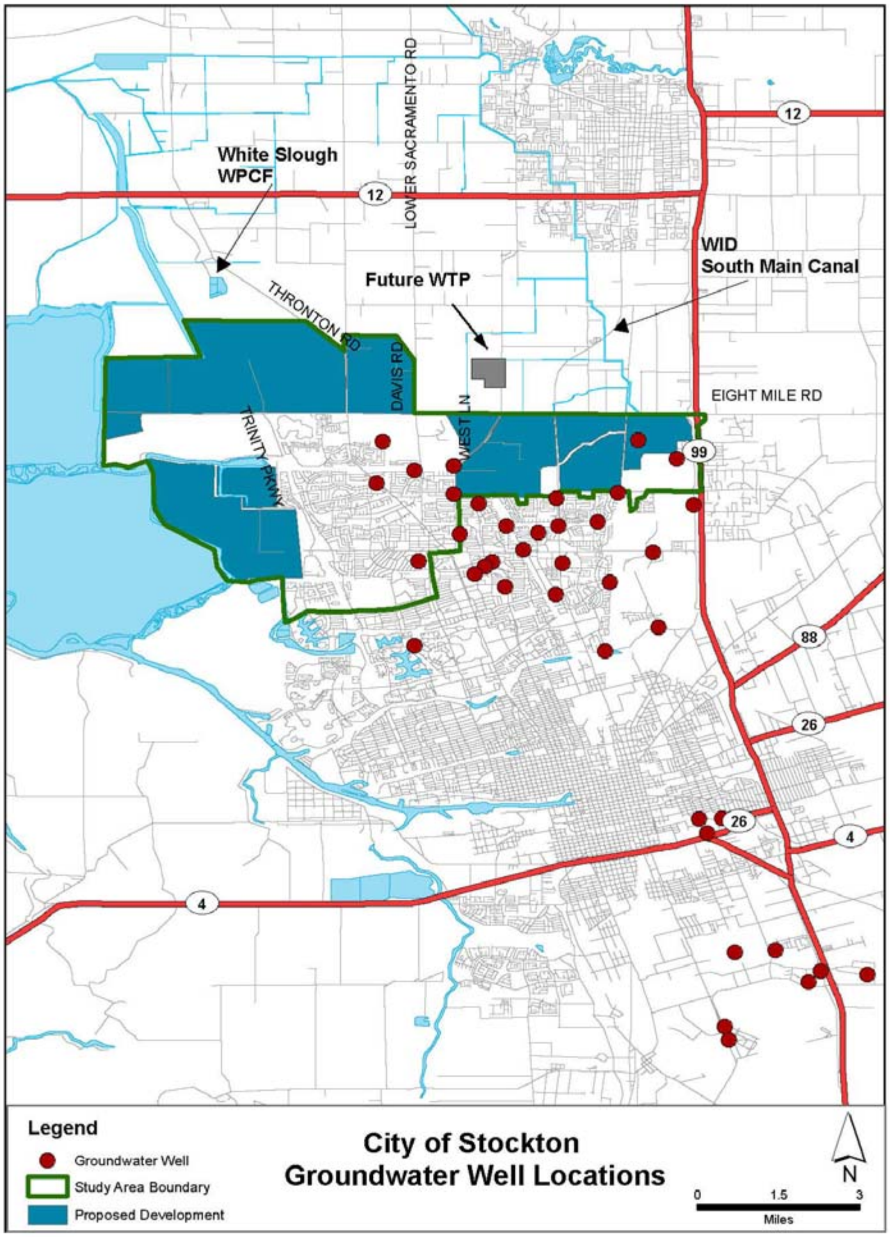
Specific actions being implemented by the City of Stockton to reduce the overdraft (which is most severe five miles east of the City) are twofold:

- Implementing the Delta Water Supply Project (see Section 3.3.3), which will reduce the City's groundwater pumping requirements
- Replacing agricultural wells with City wells as areas develop, with urban demand being significantly less than agricultural demand.

With these actions, the groundwater use is generally projected to be within the basin yield.

[5] Source: City of Stockton 2005 UWMP

Figure 3-1: City of Stockton Groundwater Well Locations



In addition, even though there is no mandate in the Groundwater Management Plan for the City to use alternative supplies as part of the plan implementation, the City is also looking at developing recycled water use, and other non-potable supplies to further reduce groundwater pumping; thereby positively affecting the regional salinity gradient and further reducing existing groundwater depression.

3.2.2 Groundwater Quality

Generally, the quality of the groundwater meets the State of California drinking water quality standards without treatment other than being chlorinated prior to distribution to customers.[6] **Table 3-2** provides as summary of groundwater quality, along with water quality from the Woodbridge Irrigation District (WID) and other City surface water supplies.

3.3 Surface Water Supply

The City of Stockton, the Stockton East Water District, the San Joaquin County and the California Water Service Company form the Stockton Area Water Suppliers, with the City of Stockton serving the Study Area with retail water service.

Each of the Stockton Area water suppliers contract with the Stockton East Water District for a contractual limit of treated surface water, such that when a drought is declared, all member agencies receive a uniform percentage reduction. The Stockton East Water District holds two firm surface water contracts:

- **Calaveras River Contract:** The Stockton East Water District holds a settlement contract with the United States Bureau of Reclamation for water stored in the New Hogan Reservoir that provides a firm water supply in wet or dry years. The maximum amount of water available for Municipal and Industrial Uses is 40.171 total acre feet with 24 total acre feet being available in the future as the Calaveras Water District's service area continues to grow.
- **Stanislaus River Contract:** The Stockton East Water District contracted with the United States Bureau of Reclamation for 75,000 acre-feet of surface water supply from the New Melones Unit, Central Valley Project, to be delivered at the Goodwin Dam on the Stanislaus River. A minimum of 20,000 acre-feet was agreed to be delivered to the City of Stockton by the Stockton East Water District. However, in the mid 1990's with the Central Valley Project Improvement Act and other regulatory actions the surface water supply the Stockton East Water District could rely upon was substantially reduced, especially in dry years.

  The Stanislaus River Contract also included an interim contract for surface water from the Stanislaus River and the Oakdale and South San Joaquin Irrigation District's to transfer surplus water. The water transfer contract allowed for up to 30,000 acre-feet per year (15,000 acre-feet per year from each district) to be transferred until 2009 with an option to renew.

Treated surface water supply accounts for approximately 70 percent of the City of Stockton's water supply during average years.

3.3.1 Surface Water Quality

Table 3-2 provides surface water quality information for the City of Stockton.

[6] Source: City of Stockton 2005 UWMP

Table 3-2: City of Stockton Groundwater, Surface Water, and WID Water Quality

Constituent	Units	Groundwater Quality [1,3]	Surface Water Quality [1]	WID Water Quality [2,3]
Ammonia	mg/L as N	Not tested	Not tested	0.03
Nitrate	mg/L as NO_3	9.3	<2.0	Not tested
Calcium	mg/L	50	16	5
Chloride	mg/L	31	3	2
Electrical Conductivity	mmhos/cm	Not tested	Not tested	0.05
Hardness	mg/L as $CaCO_3$	216	64.6	18
Magnesium	ug/L	---	---	1.5
Magnesium	mg/L	22	6	---
pH	pH units			7.3
Alkalinity	mg/L as $CaCO_3$	176	70	19
Bicarbonate	mg/L as HCO_3	Not tested	Not tested	24
Phosphorus	mg/L	Not tested	Not tested	0.03
Sodium	mg/L	25	5	3
Silica	mg/L as SiO_2	Not tested	Not tested	9
Temperature	degF	Not tested	Not tested	59
Total Dissolved Solids	mg/L	315	120	37
Total Suspended Solids	mg/L	Not tested	Not tested	10
Aluminum	mg/L	<50	<50	22
Arsenic	ug/L	4	<2	0.8
Beryllium[d]	ug/L	Not tested	Not tested	0.3
Boron	ug/L	<100	<100	Not tested
Cadmium[d]	ug/L	Not tested	Not tested	0.6
Chromium	ug/L	<10	<10	1.1
Cobalt	ug/L	Not tested	Not tested	1.2
Copper	ug/L	<50	<50	3.2
Fluoride	mg/L	<0.1	<0.1	0.07
Iron	ug/L	<100	<100	67
Lead	ug/L			1.6
Lithium	ug/L	Not tested		2.3
Manganese	ug/L	28	<20	7.7
Molybdenum	ug/L	Not tested	Not tested	Not detected (5)
Nickel	ug/L	Not detected (10)	<10	0.8
Selenium	ug/L	Not detected (5)	<5	Not tested
Zinc	ug/L	25		10.6
CALCULATED VALUES				
SAR[4]				0.3
Adjusted SAR[4]				0.2

Notes:
1. Source: City of Stockton 2007 Drinking Water Quality Report.
2. Source: City of Lodi RWMP, RMC 2008. Surface water quality reported as the average of data reported by USGS for Station 11325500 (Mokelumne River at Woodbridge, CA) for 1973 through 1994 with monitoring data collected by the City of Lodi at four locations from May, 2006 to May, 2007. Non-detects assumed to be equal to one half the detection limit for averaging purposes.
3. Numbers in parentheses are one-half of the method detection limit.
4. Because groundwater magnesium data is not available, SAR and adjusted SAR for groundwater were estimated using hardness as a surrogate value for calcium plus magnesium.

3.3.2 Plans for New Facilities

The City of Stockton is currently implementing the Delta Water Supply Project (DWSP). The DWSP will develop a new surface water supply for the City of Stockton by pumping water from the Delta to a new water treatment plant. Phase 1 of the DWSP has a capacity of 30 mgd and is scheduled to be complete by February 2012.

3.4 Sources of Water Available to Potential Recycled Water Users

Potential recycled water users and current sources of water available to them are identified in Chapter 4.

Most of the potential urban, commercial, and industrial recycled water users identified rely on groundwater (supplied by the City or through private wells), treated surface water (supplied by the City) or raw water from WID (e.g., Oak Grove Regional Park).

Costs were not available at the time the report was developed and therefore have not been included.

Chapter 4 Wastewater Characteristics

This chapter describes the wastewater treatment facilities, the recycled water supply and the quality of the recycled water from the White Slough WPCF.

4.1 Wastewater Treatment Facilities

The White Slough WPCF is located along the west side of Interstate 5, about two miles north of Eight Mile Road as shown in **Figure 2-1**.

The City of Lodi has been providing wastewater service for the Lodi community since 1923. Originally, wastewater was treated at a facility located nearby the City of Lodi limits. In the 1940's the City of Lodi purchased a portion of the existing 1,040-acre WPCF site, constructed a pipeline from the then-existing wastewater treatment plant to the current site, and began practicing agricultural reuse shortly thereafter.

The initial components of the existing WPCF were originally constructed in 1966. Since that time, several treatment upgrades and capacity expansion projects have been completed. In 2006, the WPCF treated approximately 6.2 mgd (annual average) of municipal wastewater from the City of Lodi.

A total of 880 acres of the existing 1,040-acre City of Lodi property are used for agricultural production. During the summer months, 790-acres of this area are currently used for beneficial reuse of industrial process wastewater (originating primarily from a large cannery) and Class B biosolids. WPCF treated municipal effluent is also used to serve the remaining irrigation demands (and to some extent the nutrient demands) within this area. An additional 90 acres of the City of Lodi owned agricultural property is currently irrigated with groundwater.

Currently, charges for the use of recycled water are included in the lease agreements between the City of Lodi and the growers. These agreements may change in the future.

Municipal effluent not needed to serve the irrigation demands on the 790-acre agricultural area is discharged to Dredger Cut, a dead end slough of the Delta. From approximately September through April, all of the WPCF effluent is currently discharged to Dredger Cut (WYA 2006).

4.1.1 Industrial Wastewater Treatment Processes

Industrial wastewater is collected in a separate industrial sewer line and directed to the White Slough WPCF, where it is screened prior to being directed to agricultural reuse facilities. During the summer, industrial wastewater flows are blended with flows from the City of Lodi's onsite seasonal storage ponds, and applied directly to City-owned land surrounding the treatment plant. During the remaining portions of the year, industrial wastewater is directed to the seasonal storage ponds, where it is stored for land application purposes during the upcoming summer.[7]

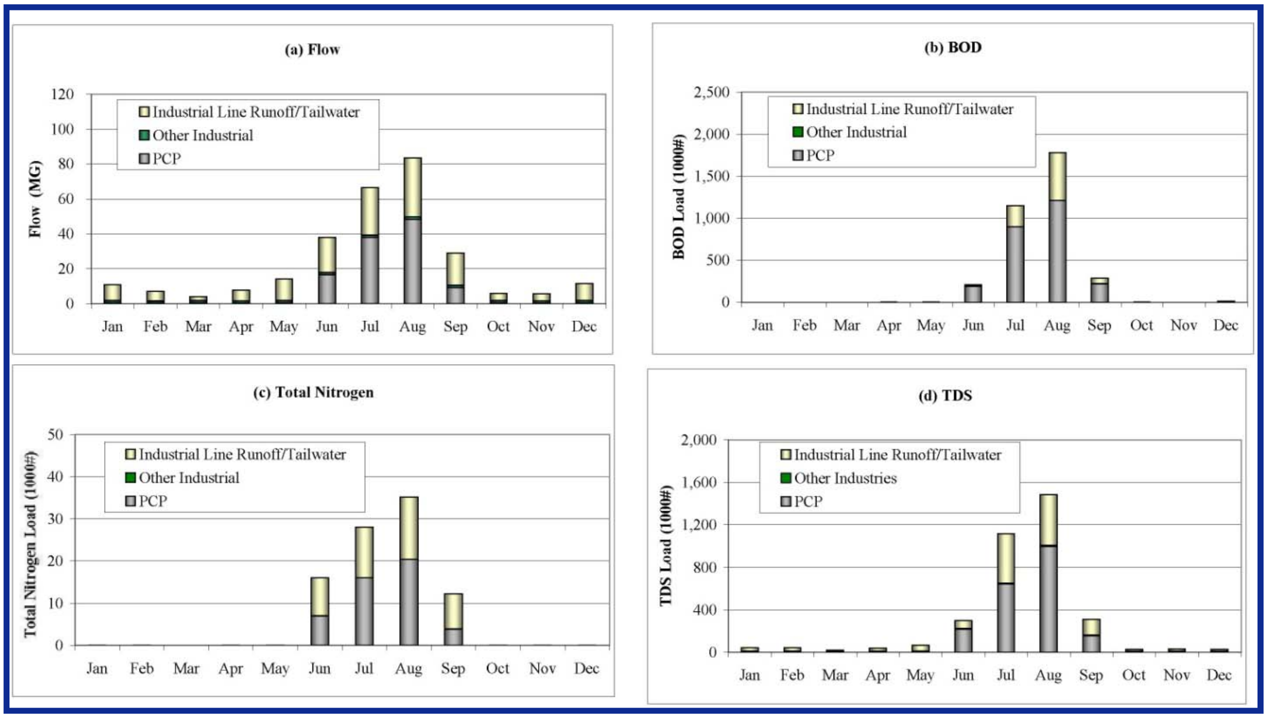
No pretreatment or control measures are currently implemented or planned by the City of Lodi for industrial wastewater flows entering the treatment plant. The largest industrial discharger, Pacific Coast Producers (PCP), a large fruit canning operation, is voluntarily investigating onsite practices to reduce the biological oxygen demand (BOD) and nitrogen levels in its wastewater. The City of Lodi charges PCP based on the flow and BOD of its wastewater.

4.1.2 Industrial Wastewater Quantity & Quality

The quantity, quality and flow variations of the City of Lodi's industrial wastewater, for the period between 2002 and 2005, are identified in **Figure 4-1**.

[7] Source: City of Lodi White Slough WPCF Soil and Groundwater Investigation Existing Conditions Report (WYA 2006).

Figure 4-1: Industrial Wastewater Flows and Loads, 2002-2005



Notes: Source: *City Lodi of White Slough WPCF Soil and Groundwater Investigation Existing Conditions Report* (WYA 2006); PCP = Pacific Coast Producers (cannery)

The quantities and rates of industrial wastewater directed to City-owned land may change in the future, and the City of Lodi has begun several studies to determine the impacts of historical and potential future operations on the surrounding groundwater basin. At the time this Study was developed, there is limited information available to estimate with any certainty future changes in quantities and rates of industrial wastewater directed to City-owned land.

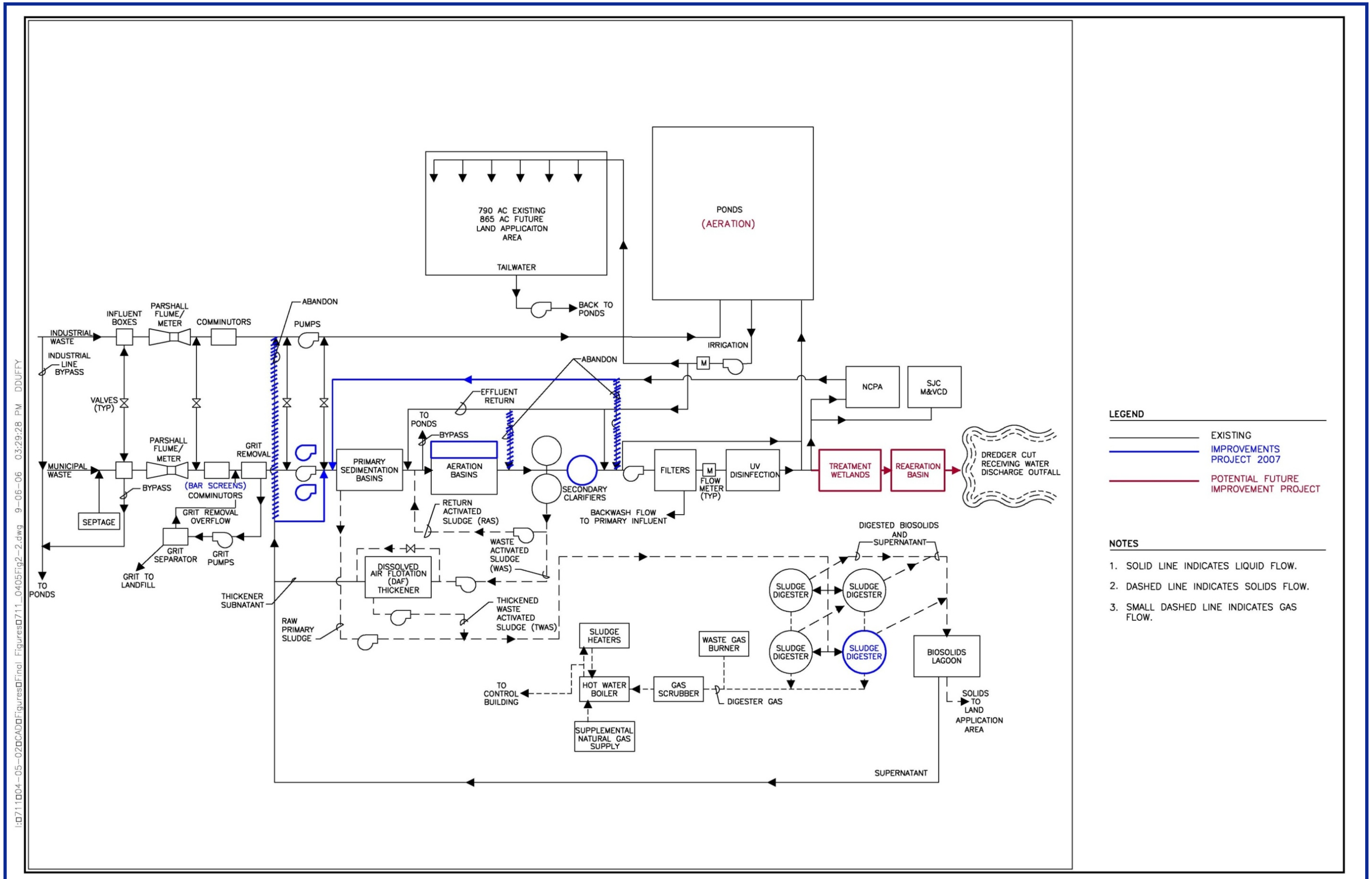
4.1.3 Municipal Wastewater Treatment Processes

The existing municipal treatment process train consists of comminution, grit removal, primary sedimentation, activated sludge treatment, secondary clarification, and effluent filtration and associated chemical feed facilities and UV disinfection facilities. Flow discharged to Dredger Cut under the NPDES program is filtered and disinfected to State of California Title 22 recycled water tertiary standards. Domestic municipal wastewater flows discharged to the land application areas are treated to undisinfected secondary standards.[8] A process flow diagram for the White Slough WPCF is shown in **Figure 4-2**.

For more detailed information regarding the City's wastewater treatment facilities, refer to Chapter 2 of the *City Lodi of White Slough WPCF Soil and Groundwater Investigation Existing Conditions Report* (WYA 2006) in **Appendix B.**

[8] Source: City of Lodi White Slough WPCF Soil and Groundwater Investigation Existing Conditions Report (WYA 2006).

Figure 4-2: White Slough WPCF Process Flow Diagram



Source: *City of Lodi of White Slough WPCF Soil and Groundwater Investigation Existing Conditions Report* (WYA 2006)

4.1.4 Plans for Treatment Process Modifications

The City of Lodi is in the process of implementing the White Slough WPCF Phase 3 Improvements Project 2007 (2007 Improvements Project). The purpose of this project is to increase the available dry weather treatment capacity of the plant to 8.5 mgd, and to improve the City of Lodi's municipal wastewater treatment facilities to meet future NPDES permit limits and long-term land management needs. The planned municipal facility improvements under the 2007 Improvements Project consist of the following:

- Installation of two new influent screens, screenings washers, and two new influent pumps
- Installation of new diffusers in Aerations Basins 1 and 2
- Installation of flow modifications to the aeration basins to achieve improved de-nitrification
- Construction of Aeration Basins 5 and 6, with de-nitrification
- Construction of Secondary Clarifier 3

For more detailed information regarding the planned treatment process modifications, refer to Chapter 2 of the *City Lodi of White Slough WPCF Soil and Groundwater Investigation Existing Conditions Report* (WYA 2006) in **Appendix B.**

4.1.5 RWQCB Water Quality Requirements & Anticipated Changes in Treatment Requirements

The Central Valley Regional Water Quality Control Board (RWQCB) has jurisdiction over the water quality of surface and groundwater resources in the Study Area. The requirements set forth for protecting these resources, and their impact on the City of Stockton's plans for its recycled water supplies, will be evaluated in detail in the environmental impact report (EIR) associated with any project resulting from this Study. The requirements are not anticipated to be a fatal flaw.

In September 2007, Lodi received a new National Pollutant Discharge Elimination System (NPDES) permit and Waste Discharge Requirement (WDR), permit numbers CA0079243 and R5-2007-0113, respectively, from the RWQCB. No substantive changes in the City of Lodi's treatment processes or reuse practices are required at this time, and the City is uncertain of the nature of possible changes in the future. The City of Lodi's new permit does not commit the City to providing tertiary treated recycled water to customers at this time.

Additionally, the State Water Resources Control Board (SWRCB) has recently developed a state-wide Recycled Water Policy (adopted in February 2009) and state-wide General Waste Discharge Requirements for Landscape Irrigation Uses of Municipal Recycled Water (adopted in July 2009), which will need to be considered for any potential project permitting.

4.2 Recycled Water Supply

In 2006, the White Slough WPCF produced an average municipal effluent flow of approximately 6.2 mgd. For the purposes of this Study, municipal effluent production has been estimated as shown in **Table 4-1**. Assuming the planning horizon to be approximately the year 2030, the peak daily supply is projected to be 8.5 mgd (the current permitted flow rate).

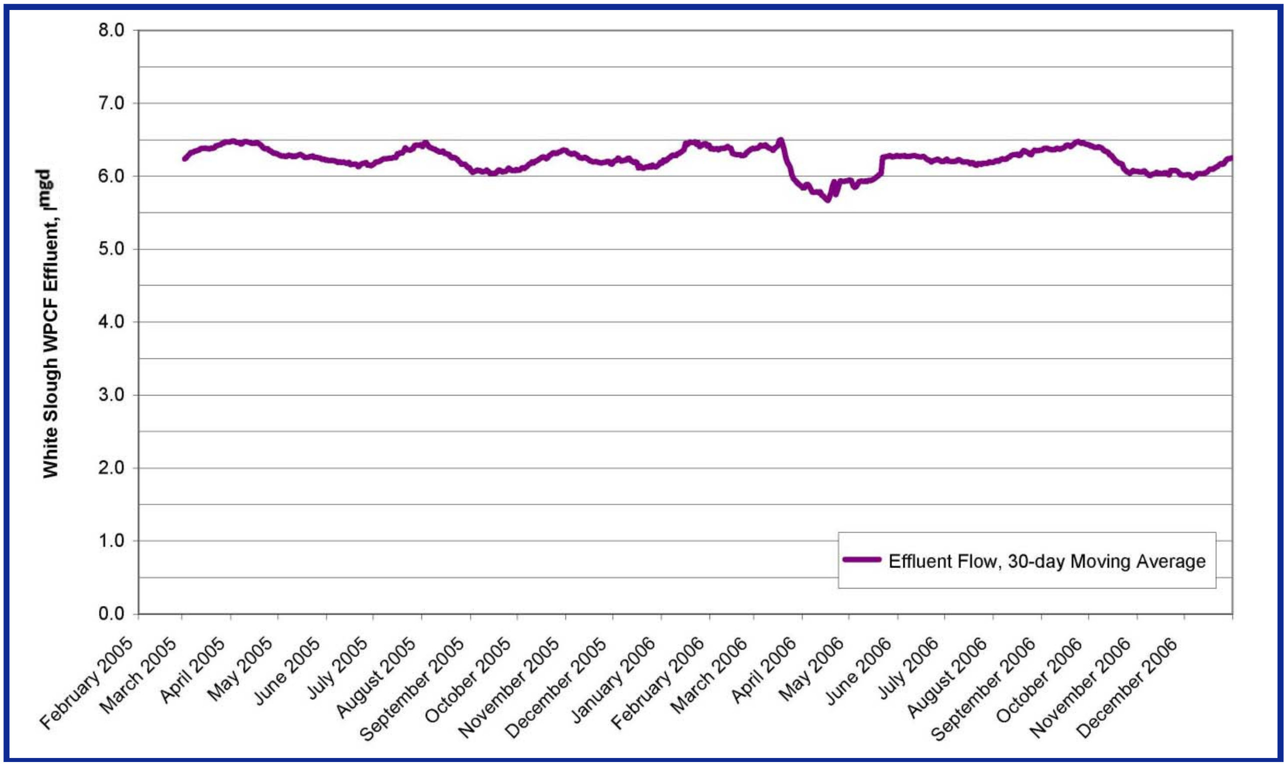
Table 4-1: Average Municipal Effluent Flow

Phase	Daily Average	Annual Average	
	(mgd)	(MG)	(AFY)
2006 (Actual)	6.2	2,263	6,945
2030 (Projected)	8.5[1]	3,103	9,521

Notes:
1. Based on the City of Lodi NPDES Permit/WDR (September 2007).

As illustrated in **Figure 4-3**, historical data does not indicate that seasonal wastewater flow variations are significant. Throughout 2005 and 2006, effluent data show periodic variations of about 0.5 mgd.

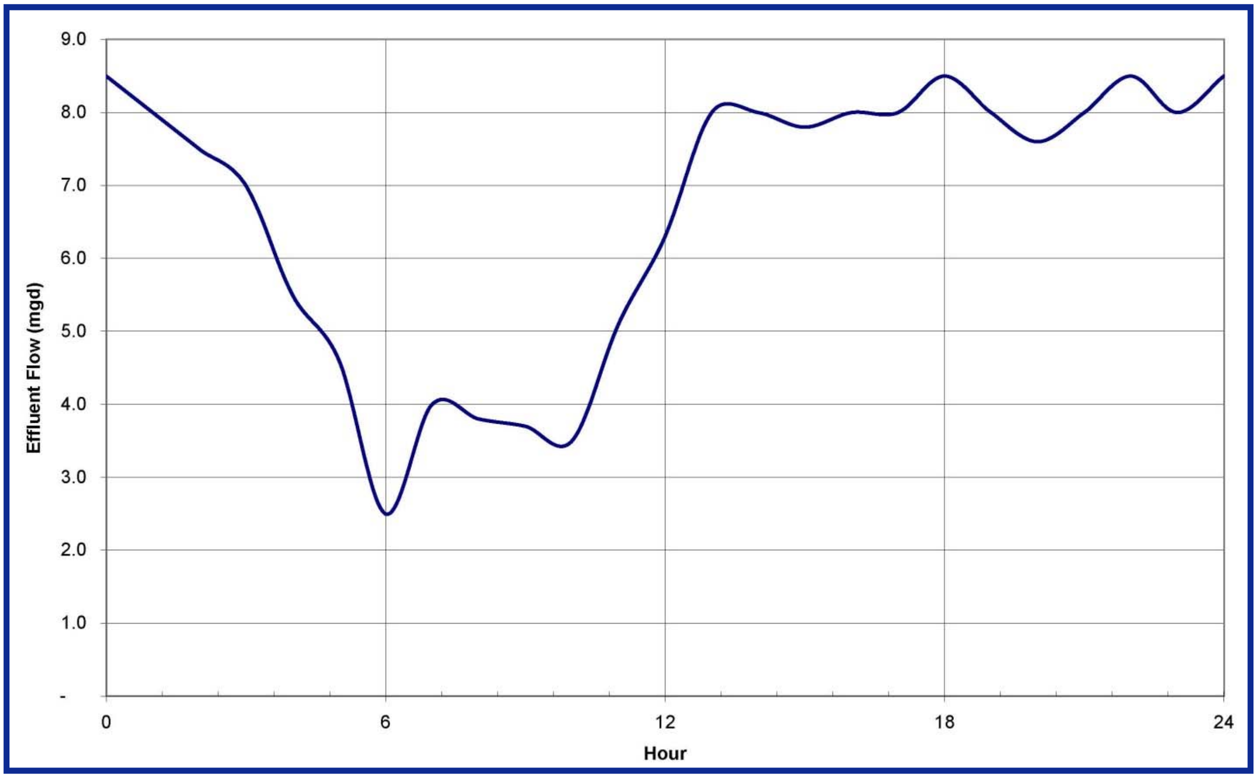
Figure 4-3: Monthly Variations in Municipal Effluent Flow



Source: City of Lodi data

Typical hourly variations in municipal effluent flow at the White Slough WPCF are illustrated in **Figure 4-4**.

Figure 4-4: Typical Hourly Variations in Municipal Effluent Flow



Source: City of Lodi data

1.1.1 Committed Uses of Recycled Water

Table 4-2 summarizes the committed recycled water volumes, including volumes committed to agricultural irrigation and water pollution control.

Agricultural Irrigation/Water Pollution Control – The City of Lodi currently uses 880 acres of the 1,040-acre City-owned property surrounding the White Slough WPCF for agricultural production/water pollution control. The existing agricultural recycled water customers are show in **Figure 4-5**. The City of Lodi leases the land used for agricultural production to farmers.

During the summer months, a portion of the recycled water produced by the City of Lodi is blended with industrial wastewater effluent (as a water pollution control measure) and used to meet irrigation demands. The recycled water used for this purpose is distributed via gravity-fed earthen irrigation ditches; no recycled water distribution pipelines currently exist.

At the time this Study was prepared, it had been determined that approximately 892 million gallons (MG) per year of treated municipal effluent is required for agricultural irrigation and land management needs near the White Slough WPCF. For more information regarding the current and predicted future uses of treated municipal effluent near the White Slough WPCF, refer to the *City Lodi of White Slough WPCF Soil and Groundwater Investigation Existing Conditions Report* and *TM No. 2: Land Application: Future Nitrogen Loading Conditions* in **Appendix B and Appendix C**, respectively.

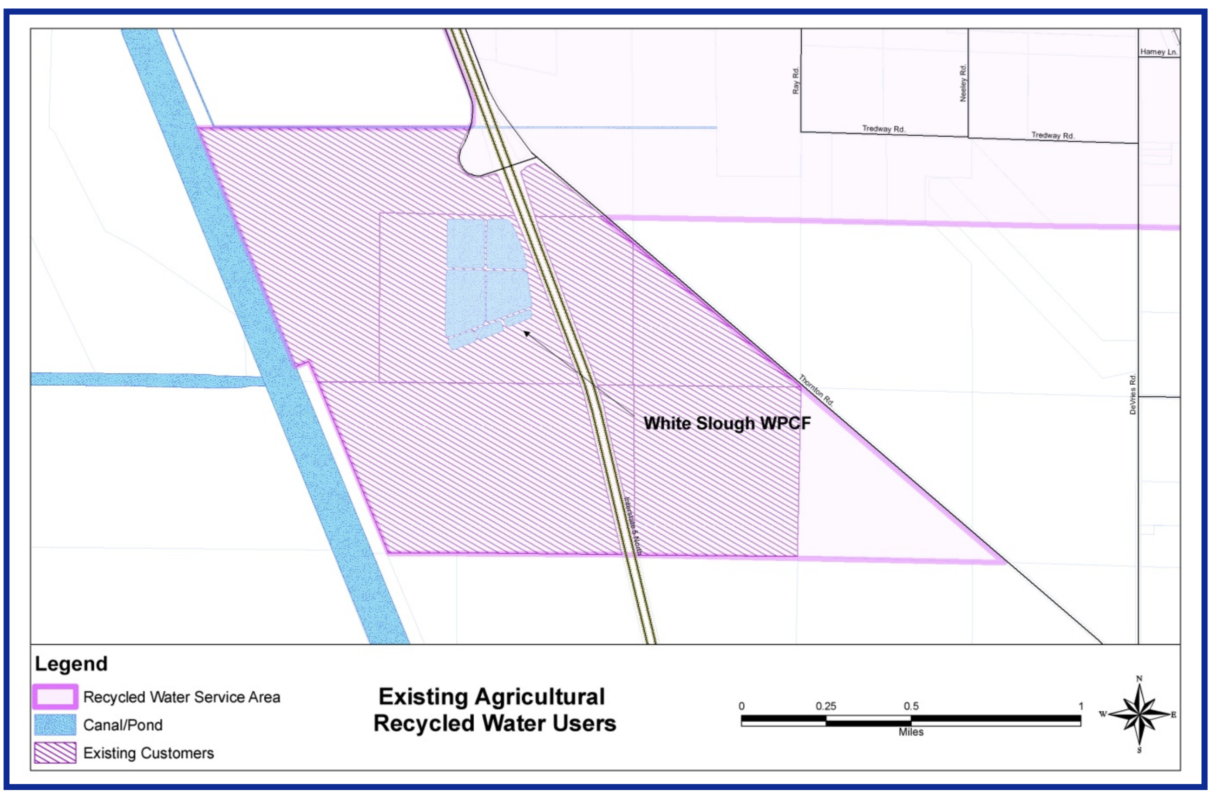
At the time this Study was developed, there was limited information available to estimate with any certainty future changes in quantities and rates of industrial wastewater effluent; the agricultural irrigation and land management needs were assumed to remain constant over the planning horizon.

Table 4-2: Committed Recycled Water Volumes

User	Total Annual Use (MG)	Total Annual Use (af)	Recycled Water Demand Timeframe/Notes
Water Pollution Control/Irrigation	892	2,738	• Municipal effluent required for water pollution control measures treated to undisinfected secondary standards
Existing NCPA Power Plant	25 or less	75 or less	• Peaking plant: Temporary operation during June/July/August/September • Max day demand of 0.25 MG • This demand was not included in committed flows due to temporary, minor demands and possibility to take water during off-peak hours
Existing Mosquito/Fish Ponds	46	141	• Minor demand in shoulder months; Peak demand in June/July/August/September
Lodi Energy Center Power Plant (planned)	358	1,100	• Based on contract signed by with Power Plant. Information provided by Wally Sandelin and Lyman Chang on October 30, 2008
Total	**1,297**	**3,979**	• Existing power plant demand not included.

Note:
1. Annual demand and demand timeframe estimated based on Information provided in the *City of Lodi Recycled Water Master Plan* (RMC 2008) and city input.

Figure 4-5: Existing Agricultural Recycled Water Users



Other Committed Uses – In addition to agricultural irrigation/water pollution control, the City of Lodi is also committed to serve treated municipal effluent to the following facilities:

- Northern California Power Agency (NCPA) Power Plant
- San Joaquin County Mosquito and Vector Control District (SJCM&VCD) Fish Rearing Ponds
- Lodi Energy Center Power Plant (planned) adjacent to the White Slough WPCF Available Recycled Water Supply

1.1.2 Available Recycled Water Supply

Table 4-3 and **Figure 4-6** shows the estimated available monthly recycled water flows given projected recycled water production and committed recycled water uses.

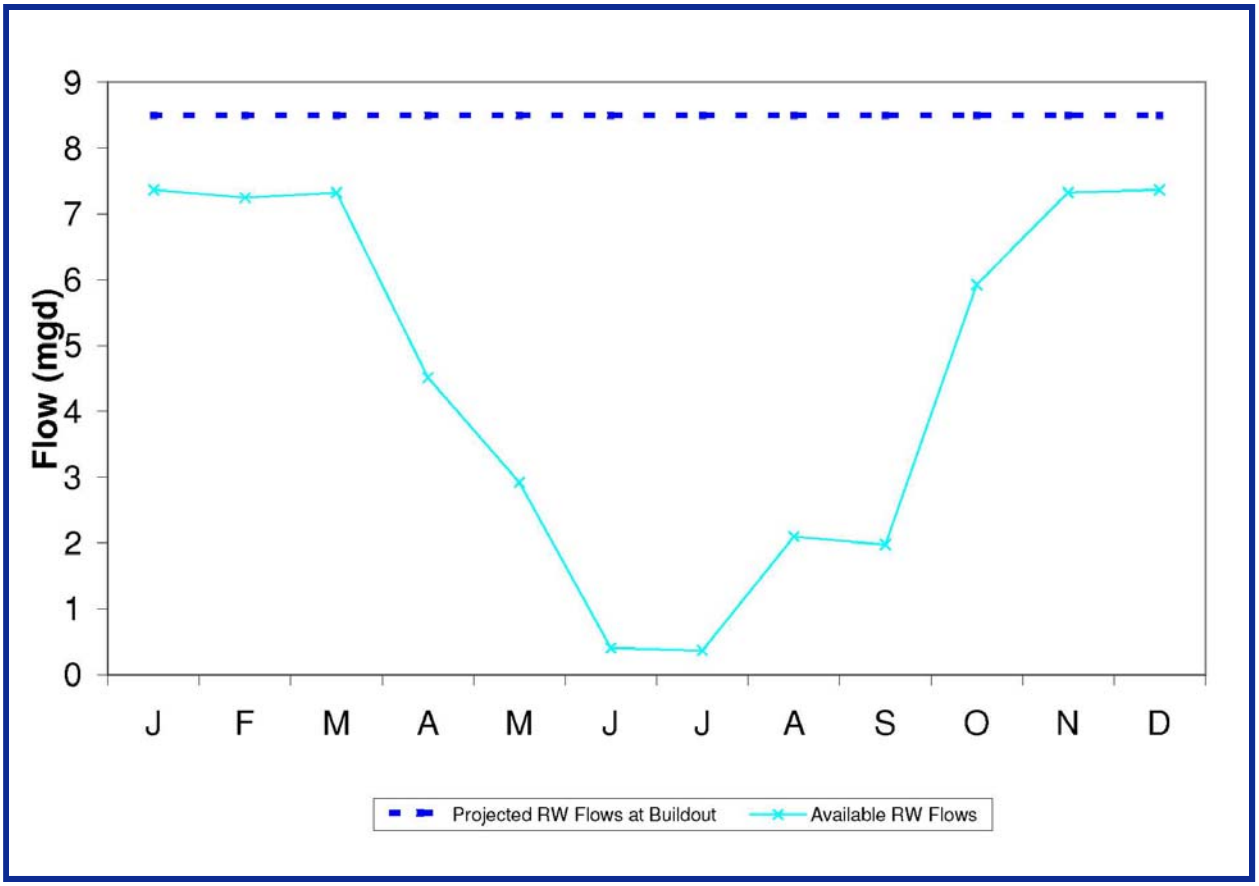
Table 4-3: Estimated Available Recycled Water Supply

Month	No. of Days	Estimated Municipal Production at Buildout[1]		Municipal Effluent required for Water Pollution Control Measures[2]		Other Committed Municipal Effluent Flow[3]		Estimated Available Municipal Effluent/Recycled Water Supply[4]	
		(mgd)	(MG)	(mgd)	(MG)	(mgd)	(MG)	(mgd)	(MG)
January	31	8.5	263.5	--	--	0.81	25.1	7.7	238.4
February	28	8.5	238.0	--	--	0.90	25.1	7.6	212.9
March	31	8.5	263.5	--	--	0.85	26.5	7.7	237.0
April	30	8.5	255.0	2.7	81.2	0.95	28.4	4.9	145.4
May	31	8.5	263.5	4.2	130.7	1.04	32.3	3.2	100.5
June	30	8.5	255.0	6.0	179.6	1.59	47.7	0.9	27.7
July	31	8.5	263.5	6.1	188.1	1.56	48.4	0.9	27.0
August	31	8.5	263.5	4.4	135.7	1.52	47.2	2.6	80.6
September	30	8.5	255.0	4.5	135.0	1.51	45.3	2.5	74.7
October	31	8.5	263.5	1.4	41.7	0.91	28.2	6.3	193.6
November	30	8.5	255.0	**--**	**--**	0.84	25.2	7.7	229.8
December	31	8.5	263.5	**--**	**--**	0.81	25.1	7.7	238.4
Total			**3,103**		**892**		**405**		**1,806**

Notes:
1. Assumed limited seasonal variations. See Figure 4-3.
2. Municipal effluent discharged to land applications areas are treated to undisinfected secondary standards.
3. Existing mosquito ponds and Lodi Energy Center Power Plant. See Table 4-2.
4. Treated to Title 22 disinfected tertiary standards

Rounded monthly values to nearest 0.1 and total values to the nearest 1MG.

Figure 4-6: Estimated Available Recycled Water Supply



Source: See Table 4-3

4.3 Recycled Water Quality

Water quality data for the White Slough WPCF's municipal effluent were collected and analyzed for constituents of interest throughout 2005 and 2006. The White Slough WPCF effluent water quality data for selected constituents of interest are presented in **Appendix D**.

Table 4-4 presents interpretive irrigation water quality guidelines for comparison to recycled water quality for several constituents of interest for potential irrigation customers, which represent the majority of the potential recycled water market. These constituents are above and beyond constituents regulated by the California Department of Public Health (CDPH) to protect public health.

Table 4-4: Urban Irrigation Water Quality Guidelines vs. Recycled Water Quality

Problem and Related Parameters	Units	Water Quality Guidelines[1]			Recycled Water Quality[2]	
		No Problem	Increasing Problems	Severe Problems	Existing	Projected Future
Salinity[3]						
Electrical Conductivity	mmhos/cm	<0.75	0.75 - 3.0	>3.0	0.63	0.41
Total Dissolved Solids	mg/L	<480	480 - 1,920	>1,920	377	245
Specific ion toxicity from root absorption[4]						
Adjusted SAR		<3.0	3.0 - 9.0	>9.0	4	3.9
Chloride	mg/L	<142	142 - 355	>355	64	41
Boron	mg/L	<0.5	0.5 – 2.0	2.0 – 10.0	0.2	Unknown[6]
Foliar absorption-Sprinklers[5]						
Sodium	mg/L	<69	>69	--	73	47
Chloride	mg/L	<106	>106	--	64	41
HCO_3 (Sprinklers)	mg/L	<90	90 – 520	>520	188	122
NH_4-N and NO_3-N	mg/L	< 5	5 - 30	>30	8	Unknown[6]

Notes:
1. Adapted from: Harivandi, A. Interpreting Turfgrass Irrigation Water Test Results; UC Davis Division of Agriculture and Natural Resources (UC ANR), Publication 8009; 1999. Water Quality Guidelines depend on soil type and plant type, but are considered appropriate for soil type and typical plant type in Study Area.
2. Lodi Recycled Water Master Plan (RMC 2008).
3. Assumes water for crop plus needed water for leaching requirement will be applied.
4. Most tree crops and woody ornamentals are sensitive to sodium and chloride. Most annual crops are not sensitive.
5. Leaf areas wet by sprinklers may show a leaf burn due to sodium or chloride absorption under low humidity/high-evaporation conditions.
6. Surface Water Quality Data for Boron, Nitrate and Ammonia not available.

Based on the water quality data in **Table 4-4** above, there would be no major, anticipated water quality issues associated with urban irrigation using recycled water produced at the White Slough WPCF; although it should be noted that the guidelines presented in **Table 4-4** provide general water quality ranges but do not consider the following parameters:

- **Differences in tolerance among plant species** – Plants vary widely in their tolerance to salts. Salt and boron sensitive plants have typically less tolerance to use of recycled water than do more salt tolerant species.
- **Irrigation method** – Plants are more sensitive to sodium and chloride toxicity when water is applied to foliage as opposed to the soil. Therefore, sensitive plantings irrigated by sprinklers respond better to water lower in sodium and chloride. Conversely, drip irrigation emitters can become clogged by calcium carbonate precipitates and suspended solids in the water.
- **Irrigation frequency** – Drought stress occurs at higher soil moisture as water quality declines because salts increase osmotic pressure. When using poorer water quality, irrigation frequency should be increased slightly to maintain a moist soil. As soil dries, salts in the soil solution become more concentrated and plant damage is more likely to occur.

- **Specific soil conditions** – As a rooting environment, soil holds water and elements for root uptake. Some constituents in recycled water can have negative effects on the soil as they concentrate over time. There are three soil characteristics of key importance: soil texture, drainage and chemical characteristics. Sandy soils are less quickly degraded by excess sodium than clay soils. Soil with poor drainage characteristics accumulate salts and cannot be easily leached. The poorer the drainage, the better quality water required. Finally, soils with low concentrations of salts or of low pH can accumulate salts from the water before salt concentrations cause plant damage.

The water quality ranges shown in Table 4-4 do not cover all parameters of potential concern for artificial lake filling (including nitrogen and phosphorous).

4.3.1 Seasonal Variations in Recycled Water Quality

Due to seasonal variations in the source of wastewater entering the White Slough WPCF, corresponding seasonal variations among certain recycled water quality parameters are experienced at the plant.

4.3.2 Recycled Water Quality Monitoring

A recycled water quality monitoring program for selected constituent loads should be implemented during the pre-design or environmental review phase to allow the Cities to confirm suitability of the supply or necessary treatment to support specific proposed end uses, including artificial lake filling.

Although the salinity of the recycled water is well within typical irrigation guidelines (Pettygrove and Asano 1985), best management practices may still be implemented as part of operations to reduce any negative impacts of salinity buildup in soil over time.

Chapter 5 Recycled Water Market Assessment

The purpose of the market assessment is to identify major potential recycled water users within the Study Area, estimate demands, and compare potential demand to available recycled water supply.

5.1 Allowable Non-Potable Recycled Water Uses

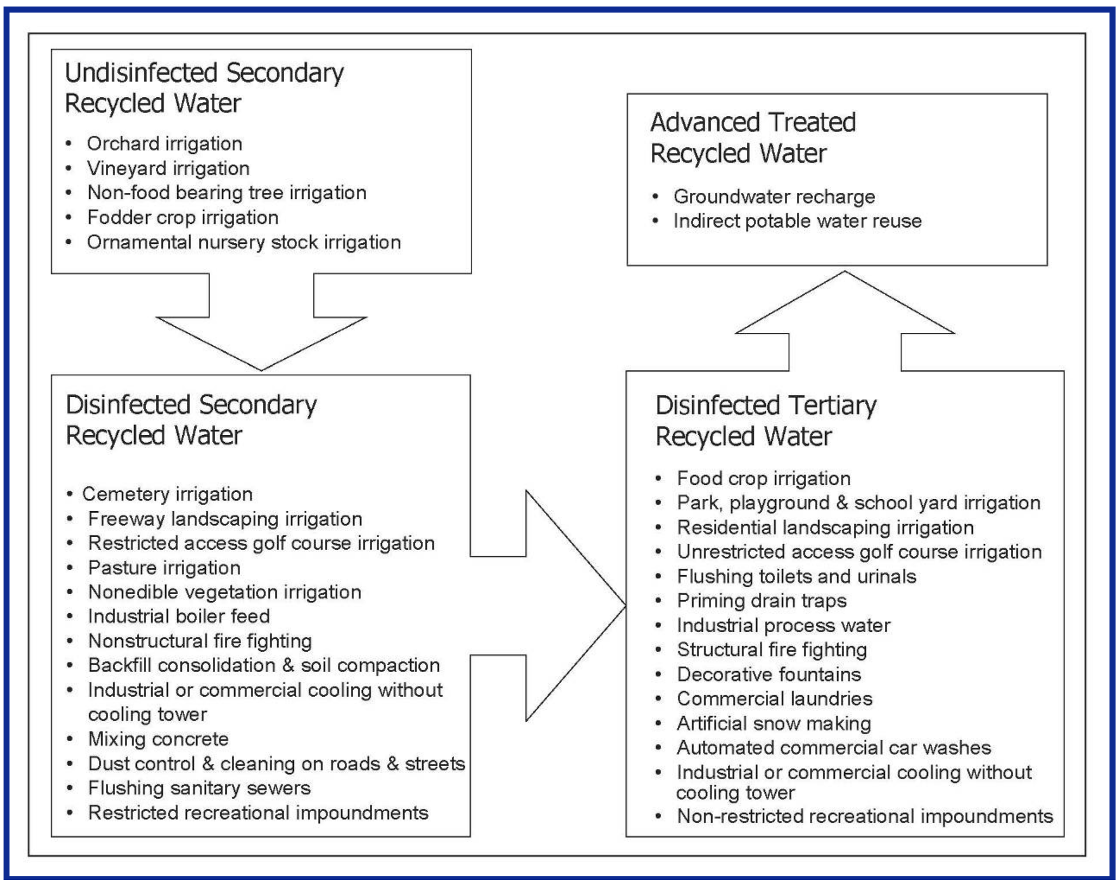
The following health laws govern the use of recycled water in California:

- Health and Safety Code (Division 104; Part 12)
- Water Code (Division 7; Chapters 2, 6, 7 and 22)
- Title 22, California Code of Regulations (Division 4; Chapters 1, 2, and 3)
- Title 17, California Code of Regulations (Division 1; Chapter 5)

General recycled water uses that are currently allowed under these laws and the associated treatment requirements are presented in **Figure 5-1**.

All recycled water produced at the White Slough WPCF meets the requirements for disinfected tertiary recycled water. Hence, all uses listed in **Figure 5-1**, except those listed under "advanced treated recycled water" could be allowable in the Study Area. It is noted, however, the groundwater recharge with disinfected tertiary water is allowed in some cases.

Figure 5-1: General Allowable Recycled Water Uses



Source: Adapted from Title 22, California Code of Regulations (2001). In some cases groundwater recharge with disinfected tertiary water is allowed.

Table 5-1 provides the subset of uses that were considered for the purpose of the market analysis and demand estimate.

Table 5-1: Recycled Water Uses Considered in Demand Estimate

Type of Use	Comment
Urban Landscape Irrigation	Irrigation of all public areas (parks, golf courses, cemetery, etc.) including commercial and industrial sites.
Artificial Lake Filling	Considered only for proposed lakes in new developments.

Irrigation of residential areas was intentionally not considered as the City of Stockton does not desire to serve residential areas. Irrigation of residential areas has been implemented in new residential developments by other Cities and agencies in California, including El Dorado Irrigation District, the Town of Windsor, Irvine Ranch Irrigation District and Yucaipa Water District.

5.2 Potential Users

Figure 5-2 illustrates the location of major potential users associated with the type of uses listed in **Table 5-1** presented above. The complete list of users and more detailed information is provided in **Appendix E.**

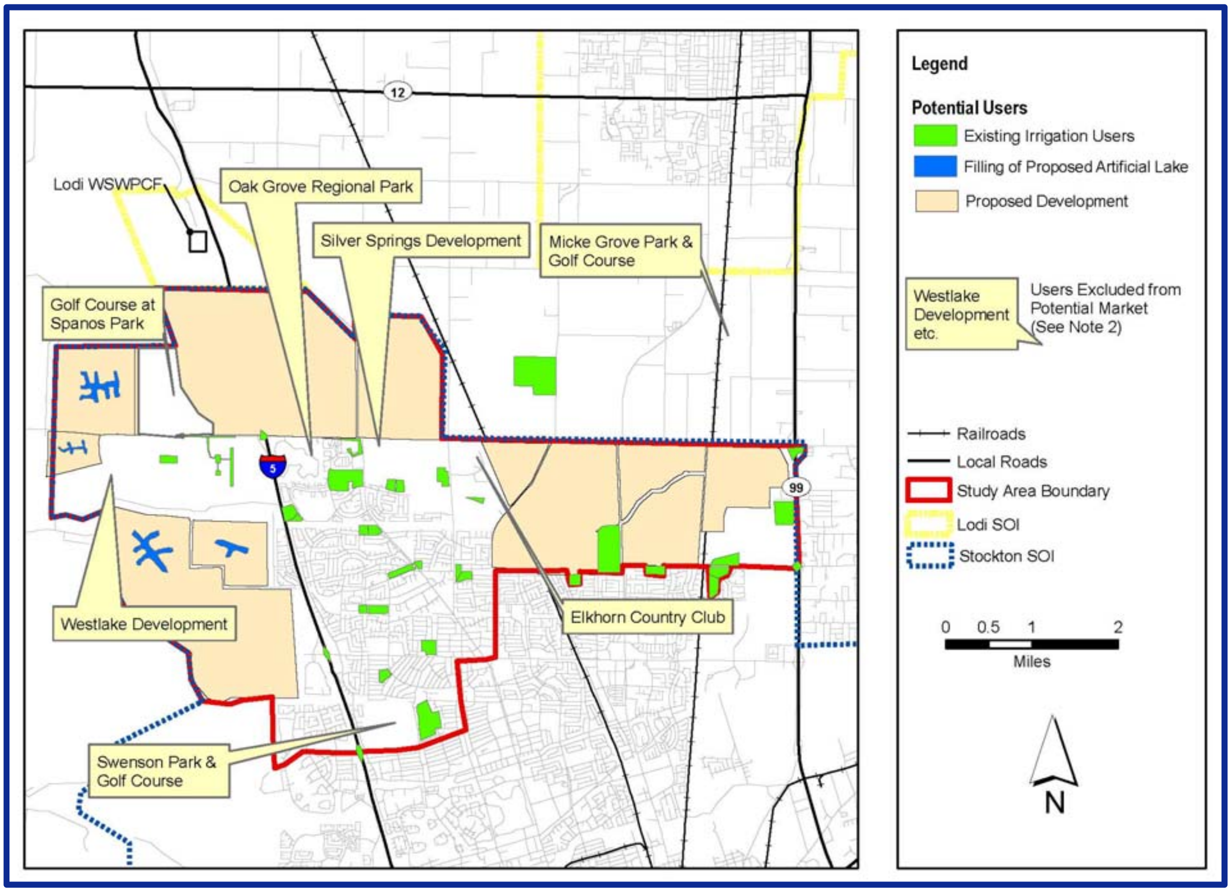
These users were identified based on discussions with City staff and the following data provided by the City, as of September 2008:

- Geographic Information System (GIS) data:
  - Aerial photography
  - Zoning base map including existing and planned parks and schools
- Planning level land use maps for proposed developments
- Historic irrigation meter data for select existing potable water users

The following users were intentionally excluded from the list of potential users due to the availability of other non-potable water sources although currently no infrastructure is in place (these users are labeled above):

- Westlake development due to availability of other non-potable water source (groundwater)
- Swenson park and golf course due to availability of other non-potable water source (groundwater)
- Silver Springs development due to likely use of other water source (groundwater or WID water)
- Golf course at Spanos park due to availability of other non-potable water source (groundwater)
- Elkhorn Country Club due to availability of other non-potable water source (groundwater)
- Micke Grove regional park and golf course due to availability of other non-potable water source (groundwater)
- Oak Grove regional park due to availability of other non-potable water source (WID water)

Figure 5-2: Potential Recycled Water Users



Notes:
1. See Appendix E for list of users, user name, average annual demand estimate and peak month demand, and development project maps.
2. These users were intentionally excluded because of availability of other non-potable water source (groundwater or WID water).

5.3 Demand Estimate Methodology

This section describes the methodology applied to estimate the potential recycled water demand associated with the identified users.

5.3.1 Urban Landscape Irrigation

Table 5-2 summarizes the demand estimate methodology. The methodology and data used are consistent with the methodology and data used in the *Lodi Recycled Water Master Plan* (RMC 2008) and the *Joint City of Stockton, City of Lodi Effluent Disposal and Reuse Study* (WYA 2004), whenever deemed appropriate.

Table 5-2: Urban Landscape Irrigation Demand Estimate Methodology

	Average Annual Demand	Irrigated Areas	Peak Day Demand	Peak Hour Demand
Methodology	= 3.4 afy/acre * irrigated area	• Various Methods (see Appendix E for method applied for each user)	= 2.4 * annual demand	= 2 * peak day demand
Basis	ET Method (see Appendix E for details)	• Aerial photos • Direct input from City or potential user • White Paper; or • Planning information for developments	Modified from Lodi Recycled Water Master Plan (RMC 2008)	

The relevance of the peak day demand factor was confirmed using historic water use records provided by the City for several existing irrigation water users.[9]

5.3.2 Filling of Artificial Lakes

Construction of artificial lakes is part of several large development plans (including Sanctuary SOI, Thompson SOI, Atlas Tract and Crystal Bay). Evaporative water losses in these lakes could be replenished with recycled water. Demands for recharge of new artificial lakes were estimated using the evapotranspiration (ET) demand methodology, modified as follows:

- Average Annual Demand = 2.9 afy/acre * Lake area (Basis: modified ET Method)[10]
- Lake area obtained from developer information
- Same Peak Day and Peak Hour Demand factors as urban landscape irrigation

5.3.3 Agricultural Irrigation

Agricultural areas are currently located north of Eight-Mile Road, east of Davis Road and west of Highway 99. Specific development plans for these agricultural areas were not available at the time of the market assessment. This Study originally assumed that the agricultural areas were going to be developed; but this assumption was ultimately revised based on discussion with the City of Stockton and these agricultural areas were excluded from the Study Area.

5.4 Demand Estimate

Table 5-3 summarizes the demand estimate for the major potential recycled water users within the Study Area, as shown on **Figure 5-2**. Refer to **Appendix E** for the complete user and demand estimate database.

[9] Water use records were reviewed for the following customers: Ron McNair and Bear Creek High Schools; Julia Morgan and Christa McAuliffe Elementary Schools.
[10] See Appendix F for details

Table 5-3: Potential Recycled Water Demand Estimate

Use Category	User Status	User Category	ADD (AFY)	ADD (mgd)	PDD (mgd)	PHD (mgd)
Urban Landscape Irrigation	Existing	Parks/Golf Courses	399	0.36	0.85	1.71
	Existing	School Fields	495	0.44	1.06	2.12
	Existing	Highway 5 & 99 Interchanges	53	0.05	0.11	0.23
	Existing	Commercial Areas	20	0.02	0.04	0.08
	Existing	Industrial Areas	41	0.04	0.09	0.17
	Future	New Development	2,899	2.59	6.21	12.42
	Existing/ Future	Users with alternative non-potable water supplies	2,336	2.08	5.00	10.01
Other	Future	Artificial Lakes	187	0.17	0.40	0.80
Total without Users with Alternative Non-Potable Water Supplies			**4,093**	**3.65**	**8.77**	**17.54**
Total			**6,429**	**5.73**	**13.77**	**27.55**

Notes: ADD: Average Day Demand; PDD: Peak Day Demand; PHD: Peak Hour Demand; Demand estimate was not confirmed with actual water use records. Only limited water use records were available.

As shown in Table 5-3, a total average day recycled water demand (ADD) of 3.65 mgd was identified within the Study Area, excluding potential users with alternative non-potable water supplies as identified in Section 5.2. Approximately 71 percent of this demand (2.59 mgd) is associated with the irrigation of public areas at the eleven proposed developments along Eight-Mile Road.

Existing parks & golf courses and school fields make up the second largest user categories with an ADD of 0.80 mgd. These categories include a few large potential users as well as neighborhood parks with smaller individual demands.

The total estimated average annual recycled water demand associated with the users that were intentionally excluded due to the availability of other non-potable water sources is in excess of 2.0 mgd, or approximately 36 percent of the total average annual recycled water demand identified within the Study Area.[11] These users either have private groundwater wells or currently receive irrigation water from San Joaquin County (groundwater or WID water). Given the availability of relatively inexpensive groundwater and WID water supplies in the region, the project team agreed that there are no significant drivers that would encourage these users to switch to recycled water supply sources, and the users were therefore excluded from the list of targeted users. This assumption should be revisited in the event that regional groundwater pumping restrictions are implemented or WID water supplies become unavailable, as these users could add significant additional recycled water demands

5.5 Target Users

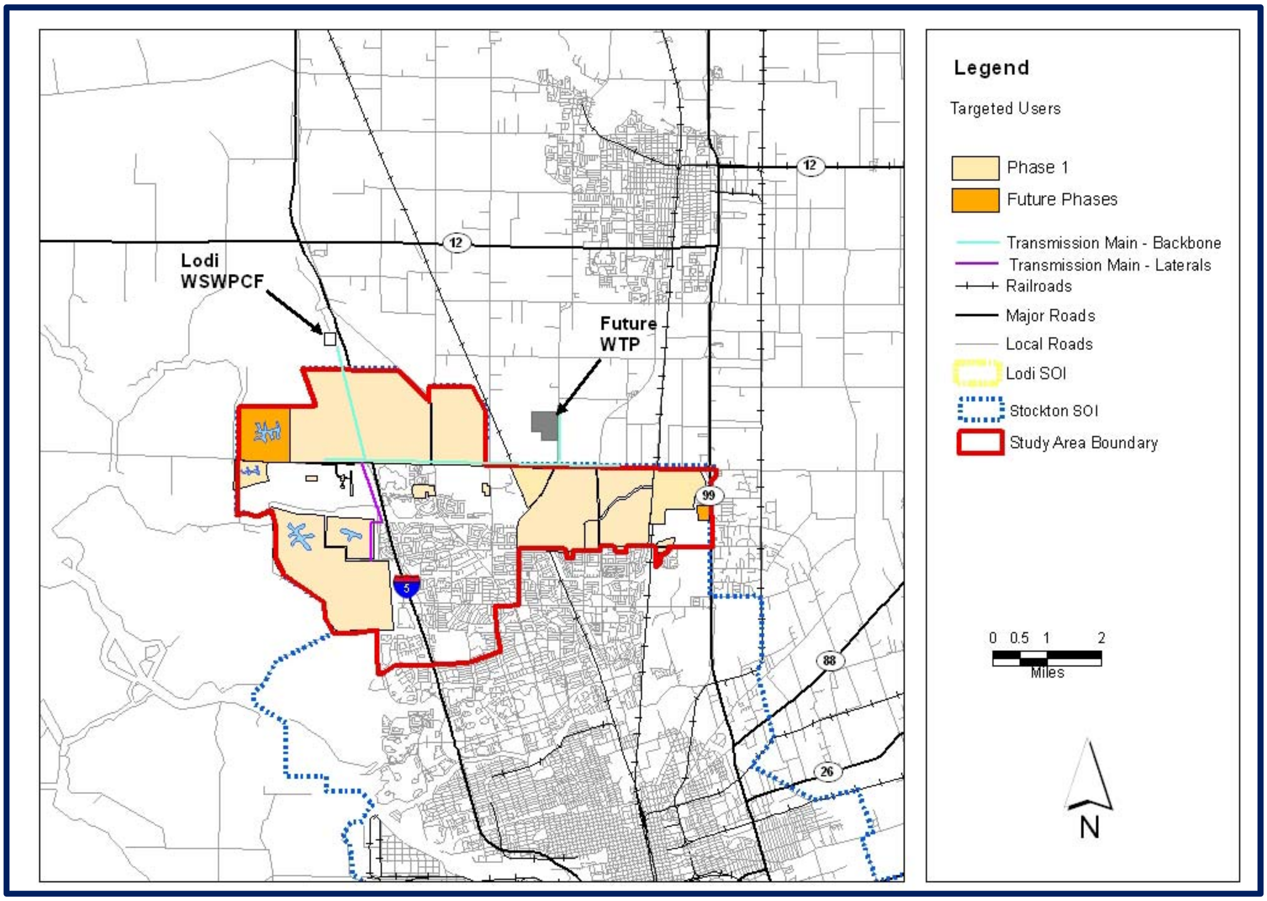
The target users represent a subset of the potential users that appeared most feasible to serve. The existing users located in existing residential areas in the northwestern part of Stockton were excluded from the list of target users. These users include school fields and neighborhood parks. The total ADD associated with these users is approximately 0.3 mgd, or approximately 6 percent of the total ADD

[11] Estimate does not include demands associated with Westlake and Silver Springs developments and Swenson park and golf course. Demands for these users were not estimated as they were excluded early-on in the planning process per input from the City of Stockton.

identified within the Study Area. These users were excluded because construction of recycled water infrastructure and on-site retrofits in existing residential areas (in order to supply relatively minor demands) was not considered cost-effective.

Target users within the Study Area are shown in **Figure 5-3**. The target users were grouped into Phase 1 users if there were existing users or new development for which the application has been received and/or approved for construction, and Future Phases users otherwise. [12,]

Figure 5-3: Target Users



[12] City of Stockton Planning Department anticipates all developments within the Study Area that have applications received will be approved.

Table 5-4 summarizes the demands associated with target users.

Table 5-4: Target Users Demand Estimate

	Approximate Irrigated Acreage	ADD		PDD	PHD
		(AFY)	(mgd)	(mgd)	(mgd)
Phase1	952	3,200	2.9	6.9	13.7
Future Phases	160	520	0.4	1.1	2.2
Total	**1,112**	**3,720**	**3.3**	**8.0**	**15.9**

Notes:
ADD: Average Day Demand; PDD: Peak Day Demand; PHD: Peak Hour Demand

There is also a possibility that users within the Study Area (Sanctuary SOI and Atlas Tract developments) may opt to use irrigation water from adjacent sloughs by use of riparian water rights. In this case, they will be excluded from the target users for a recycled water project, which would reduce the total ADD associated with target users by approximately 0.6 mgd, or approximately 18 percent of the total ADD identified within the Study Area. In addition, the artificial lake recharge in the Study Area, with a ADD of 0.17 mgd, might also be excluded depending on the nitrogen level in the recycled water.

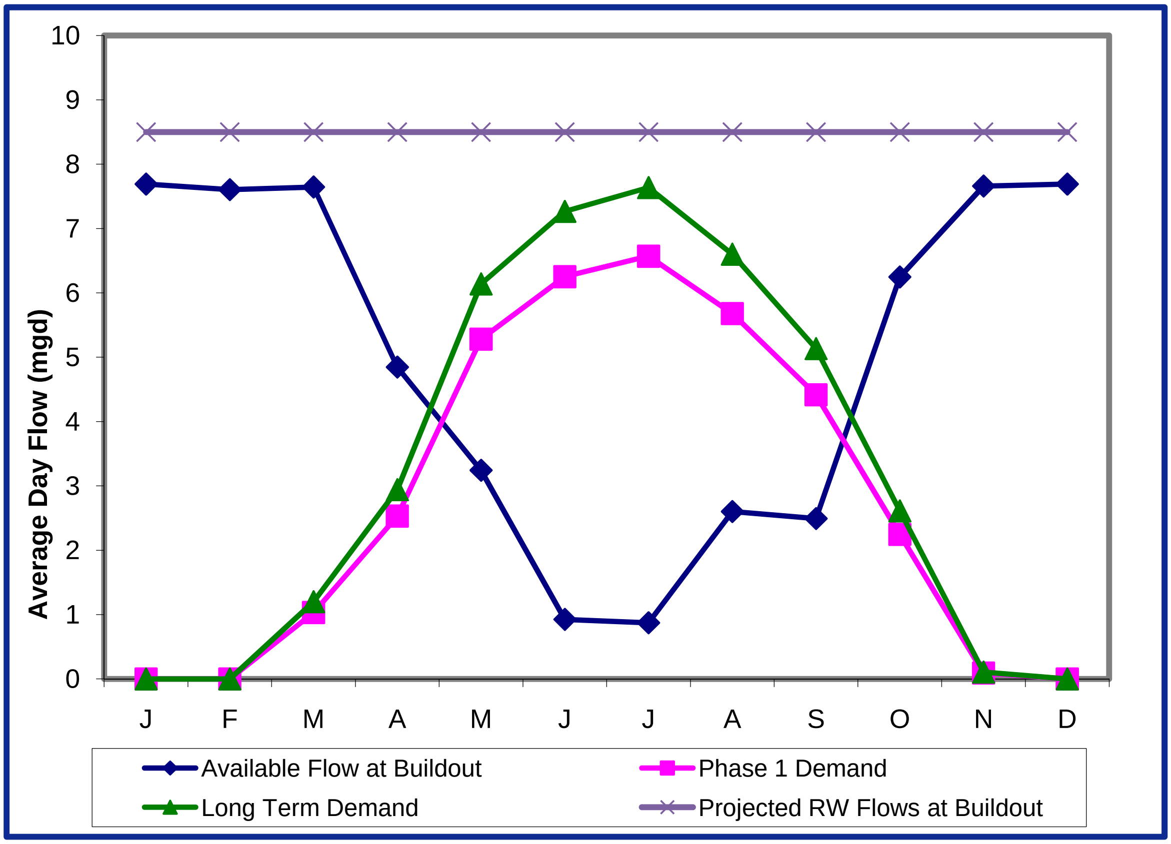
5.6 Recycled Water Demand vs. Available Supply

Figure 5-4 compares the available recycled water supply as established in Chapter 4 with the demand associated with targeted users for Phase 1 and the Future Phases.

Unless additional recycled water becomes available (e.g. reduction of municipal effluent flows needed as dilution water for water pollution control –i.e., for diluting industrial wastes); Figure 5-4 shows a significant gap between supply and demand during April thru September.

This information provides the basis of the project alternatives developed and evaluated in Chapter 6.

Figure 5-4: Recycled Water Demand vs. Available Supply



Chapter 6 Project Alternatives Analysis/Feasibility Study

Two project alternatives were developed and evaluated as part of this Study. Both alternatives bridge the seasonal gap between potential recycled water demand and available supply established in Chapter 5:

- **Seasonal Storage Alternative**, which relies on seasonal storage of recycled water to bridge the seasonal gap between potential recycled water demand and available supply.
- **Blended Supply Alternative**, which relies on recycled water and supplemental sources of non-recycled surface or ground water to bridge the seasonal gap between potential recycled water demand and available supply.

For the alternatives, the pipeline and pump sizes were varied and optimized. Chapters 6 and 7, contain the optimized facilities for each alternative

6.1 Seasonal Storage Alternative

Under the Seasonal Storage Alternative, recycled water produced at the White Slough WPCF during the winter months would be stored in seasonal storage ponds for use during the summer months to the target users.

6.1.1 Project Description

Target Users

Target users considered under the Seasonal Storage Alternative are as shown in **Figure 5-3**. Peak day demand associated with these users is estimated at 8 mgd with an average annual demand of 3,720 afy (see **Table 5-4**).

Seasonal Storage Facilities

Required seasonal storage volumes were estimated based on the projected gap between recycled water supply and demand: approximately 2,130 afy of recycled water would need to be seasonally stored to supply the build-out demand.

The basic conceptual-level design criteria related to seasonal storage are summarized in **Table 6-1**. Because the large volume of seasonal storage required could significantly impact the project cost, two alternatives for seasonal storage construction were evaluated – with and without liner.

Conveyance Facilities

The major facilities associated with the Seasonal Storage Alternative, in addition to the seasonal storage facilities which would be located at the White Slough WPCF, include a pump station at the WPCF and transmission main to, and along Eight Mile Road. It was assumed, based on discussion with City staff that the local distribution systems within the developments would be installed by the developers.

Basic conceptual-level design criteria related to conveyance facilities are summarized in **Table 6-2**.

Figure 6-1 illustrates the location and size of the main facilities associated with the Seasonal Storage Alternative.

Table 6-1: Seasonal Storage Alternative – Seasonal Storage Conceptual-Level Design Criteria

Seasonal Storage Element	Conceptual-Level Design Criteria	Basis/Notes
Storage Basin Liner	• Option 1: No Liner • Option 2: Liner	RMC held a conference call with RWQCB and CDPH on Sept. 27, 2007 to obtain RWQCB/CDPH input. The RWQCB suggested that unlined recycled water storage basins could potentially be constructed due to ambient groundwater quality
Water Depth	20-foot	Deeper basins would minimize required land area and construction costs; however permitting by California Department of Water Resources Safety of Dams (DSOD) would be required.
Excavation Depth	Minimal (1-2 foot)	Excavation volumes were balanced with berm construction volumes to minimize off haul volumes. Deeper excavation would increase project cost by increasing off haul volumes and dewatering issues
Storage Basin Freeboard	2-foot	Standard Assumptions
Number of Basins	1	
Total Storage Basin Size	2,130 AF	

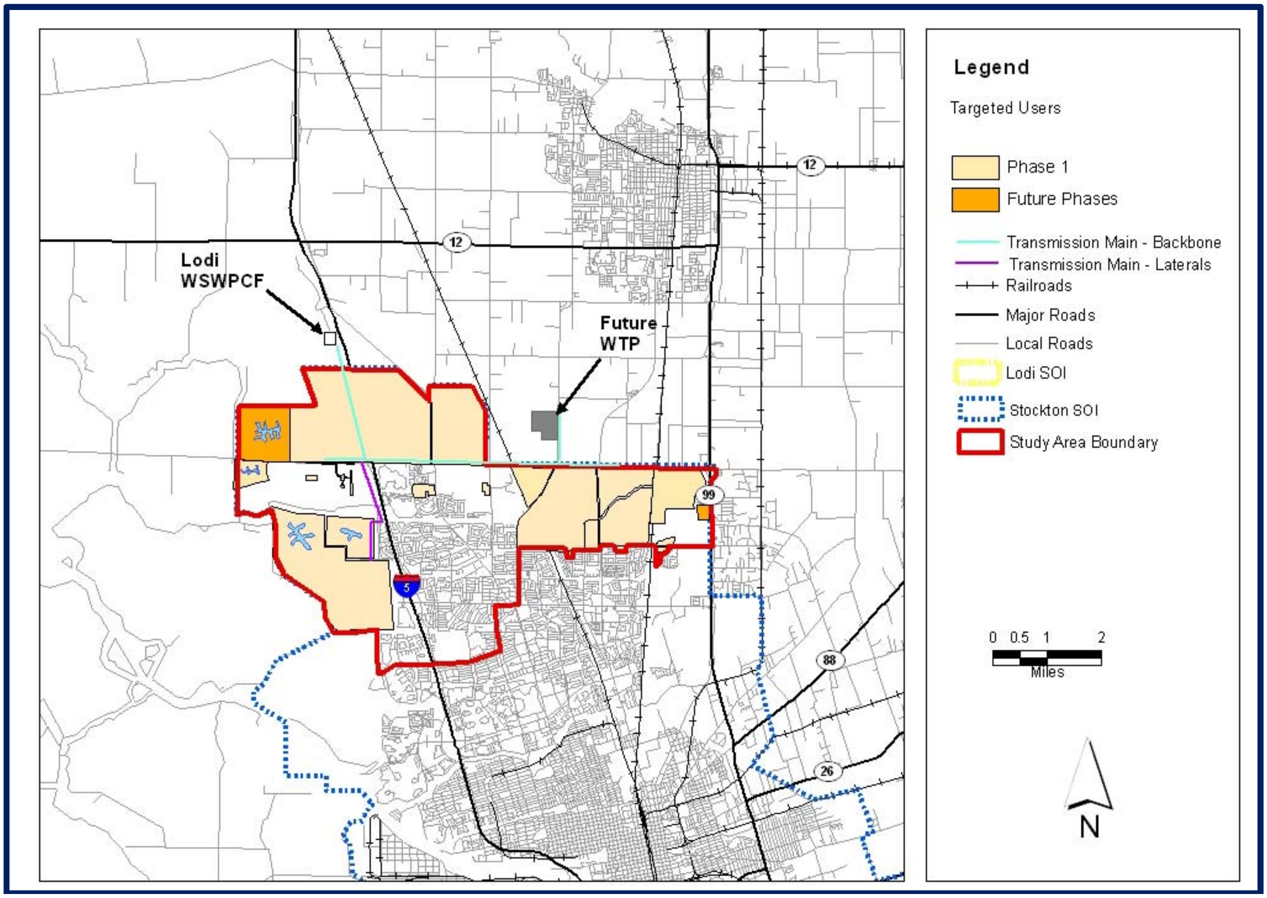
Notes:
Additional coordination with RWQCB staff and possibly additional water quality studies would need to be conducted to verify that construction of unlined storage basins is permissible in the Study Area.

Table 6-2: Seasonal Storage Alternative – Conveyance Facilities Conceptual-Level Design Criteria

Conveyance Element	Conceptual-Level Design Criteria	Notes
Pump Station at WPCF	• 500HP Pump station to seasonal storage basin • 1,000 HP Pump station to distribution system • Sized to deliver a minimum of 80 psi of pressure at turn-out • Sized to overcome headloss of 5 ft per 1,000 ft of pipe length	Depending on the extent of the local distribution system to be installed by the developers, the delivery pressure at the turn out might need to be greater[1]
Transmission Main (backbone & major laterals)	• 40,700-ft of 30-inch backbone • 11,600-ft of 18-inch laterals • Sized to convey peak hour demands at maximum flow velocity of 7 feet per second[2]	--

Notes:
1. It was assumed based on discussion with the City that the local distribution systems within each development would be installed by the developers.
2. Assuming no operational storage provided in the distribution system

Figure 6-1: Seasonal Storage Alternative – Main Conveyance Facilities Conceptual-Level Alignment



6.1.2 Cost Estimate

The conceptual-level cost estimates for the Seasonal Storage Alternative assuming unlined storage basins are summarized in **Table 6-3**. The detailed cost estimates for both the unlined storage basin and lined storage basin options are provided in **Appendix F**.

The cost of the project would be reduced should the water pollution control/cannery dilution flow be reduced, which would decrease the amount of seasonal storage required. If regulations were to change and lined seasonal storage basins were required, unit cost would be substantially higher at $1,460/AF.

6.1.3 Non-Economic Constraints and Fatal Flaws

Non-economic potential constraints associated with institutional arrangements, environmental impacts, and regulatory requirements are summarized in **Table 6-4**. None of these potential constraints are anticipated to be fatal flaws.

Table 6-3: Seasonal Storage Alternative – Conceptual-Level Cost Estimate

Project Element	Construction Cost ($)[1,4]	Capital Costs ($)[2]	Annualized Capital Cost ($/yr)[3]	Annual O&M Cost ($/yr)	Total Annual Cost ($/yr)	Yield (AF/yr)	Unit Cost ($/AF)
Recycled Water Supply, including Seasonal Storage	$11.3M	$15.2	$1.2	$0.5M	$1.7M	3,720	NA
Main Conveyance Pipeline	$23.2M	$31.3M	$2.4M	$0.1M	$2.5M	3,720	NA
TOTAL	**$34.5M**	**$46.5M**	**$3.6M**	**$0.6M**	**$4.2M**	**3,720**	**$1,140**

Notes:
1. Conceptual -level cost estimate (+/- 30%), expressed in 2008 dollars.
2. Capital cost includes a 35% contingency for engineering, legal, admin., and environmental costs.
3. Annualized capital cost includes a 6% discount rate and a useful life of 25 years.
4. Not including property costs for area needed for seasonal storage.

Table 6-4: Seasonal Storage Alternative – Potential Non-Economic Constraints

Category	Description	Potential Constraints/Recommended Actions
Regulatory	• Water Rights	• Water rights are not anticipated to be a constraint based on input from the Cities.
	• Project Permitting	• No significant constraints are anticipated based on Sep. 27, 2007 conference call with RWQCB and CDPH.[1]
Environmental	• Groundwater Quality Impacts	• Groundwater quality impacts of unlined storage basins would need to be evaluated as part of the implementation plan.
Institutional	• “Showstopper” issue from key stakeholders	• No showstopper issues were identified as part of the Stakeholder Workshop conducted in September 2008.

Note:
1. Meeting attendees included Jim Marshall (RWQCB) and Joe Spano (CDPH).

6.2 Blended Supply Alternative

The Blended Supply Alternative would utilize recycled water from White Slough WPCF when available and supplement it with other water sources during the peak summer months. Supplemental water could be treated surface water, raw surface water (e.g., from WID) and/or groundwater. For the purposes of this Study, it was assumed that all of the required supplemental water would be chlorinated surface water from WID.

6.2.1 Project Description

Targeted Users

Targeted users within the Study Area are shown in **Figure 5-3**, and are discussed in further detail in Section 5-5.

Supplemental Water Supply Needs

Table 6-5 summarizes the amount of supplemental water that would be needed to supplement recycled water produced at the White Slough WPCF during the peak summer months to meet Phase 1 demand.

For the purpose of the project alternative analysis, it was assumed that all the supplemental water needs would be met using raw WID water as the main source of supply:

- **WID water availability** – The City of Stockton currently has a contract with WID to supply water for the DWSP. The intake is located on the Wilkerson canal west the City of Stockton's future WTP. With the intake at this location it was assumed that a new turnout would not be needed and that the facilities associated with the supplemental supply would be located on site at the WTP.

  It was also assumed that the City of Stockton could amend its contract with WID to secure necessary water supplies during the months of August and September (current contract only supplies water between March and July).

- **WID water quality and treatment needs –** As noted in City of Lodi Recycled Water Master Plan, the CDPH standards for recycled water systems to not require additional treatment prior to or following the blending of raw WID water, assuming a) the raw water is blended with recycled water downstream of the White Slough WPCF, and b) the blended water is intended for non-potable use.

  However, potential recycled water customers have brought up concerns regarding the water quality when using WID water as the supplemental water. To address these concerns the blended supply alternative assumes that chlorination would be needed. In addition, to control algae growth in artificial lakes using recycled water, additional onsite treatment could be required. Estimated costs for lake algae control are not anticipated to be significant and have not been included herein.

Main Facilities

The conceptual-level design criteria for the major facilities associated with the Blended Supply Alternative are summarized in **Table 6-5**.

The conceptual-level conveyance pipeline alignment for the Blended Supply Alternative is shown in **Figure 6-2**, **Figure 6-3** and **Figure 6-4** show the conceptual-level facilities layout at the White Slough WPCF and future WTP.

Table 6-5: Blended Supply Alternative – Supplemental Water Supply Needs

Month	Phase One PHD[1]	Available Recycled Water Supply	Supplemental Water Supply Needs
	mgd	mgd	mgd
January	0	0	0
February	0	0	0
March	2.06	2.06	0
April	5.06	5.06	0
May	10.56	6.48	4.08
June	12.50	1.85	10.66
July	13.14	1.74	11.40
August	11.36	5.20	6.16
September	8.83	4.98	3.85
October	4.49	4.49	0
November	0.18	0.18	0
December	0	0	0

Notes:
1. PHD: Peak Hour Demand. Used to size the blended supply pump station facilities and pipelines

Table 6-6: Blended Supply Alternative – Main Facilities Conceptual-Level Design Criteria

Project Component	Conceptual-Level Design Criteria	Notes
Recycled Water Supply (Pump Station and Pipeline)	• 100 HP Intake/pump station • 1.6-MG operational storage • 500 HP Distribution pump station • 12,200 feet of 18-inch pipe	• See Appendix G for storage sizing • Sized for long-term demand (Phase 1 and future phases) • Sized to convey peak hour demands at a maximum flow velocity of 7 feet per second • Sized to overcome a headloss of 5 feet per 1,000ft of pipe length • Installed horsepower is the firm capacity • Sized to meet a minimum of 80 psi of pressure at turn-out
Surface Water Supplemental Supply (Pump Station and Pipeline)	• 100 HP Intake/pump station, and chlorination system • 3.8-MG operational storage • 6,600 feet of 24-inch pipe	• See Appendix G for storage sizing • Sized for long-term demand (Phase 1 and future phases) • Sized to convey peak hour demands at a maximum flow velocity of 7 feet per second • Sized to overcome a headloss of 5 feet per 1,000ft of pipe length • Installed horsepower is the firm capacity • Sized to meet a minimum of 80 psi of pressure at turn-out
Main Conveyance Pipeline	• 28,500 feet of 24-inch pipe along Eight Mile Road • 9,600 feet of 18-inch pipe to Atlas Tract	• Sized for long-term demand (Phase 1 and future phases) • Sized to convey peak hour demands at a maximum flow velocity of 7 feet per second • Sized to overcome a headloss of 5 feet per 1,000ft of pipe length • Installed horsepower is the firm capacity • Sized to meet a minimum of 80 psi of pressure at turn-out

Figure 6-2: Blended Supply Alternative – Main Conveyance Pipeline Conceptual-Level Alignment

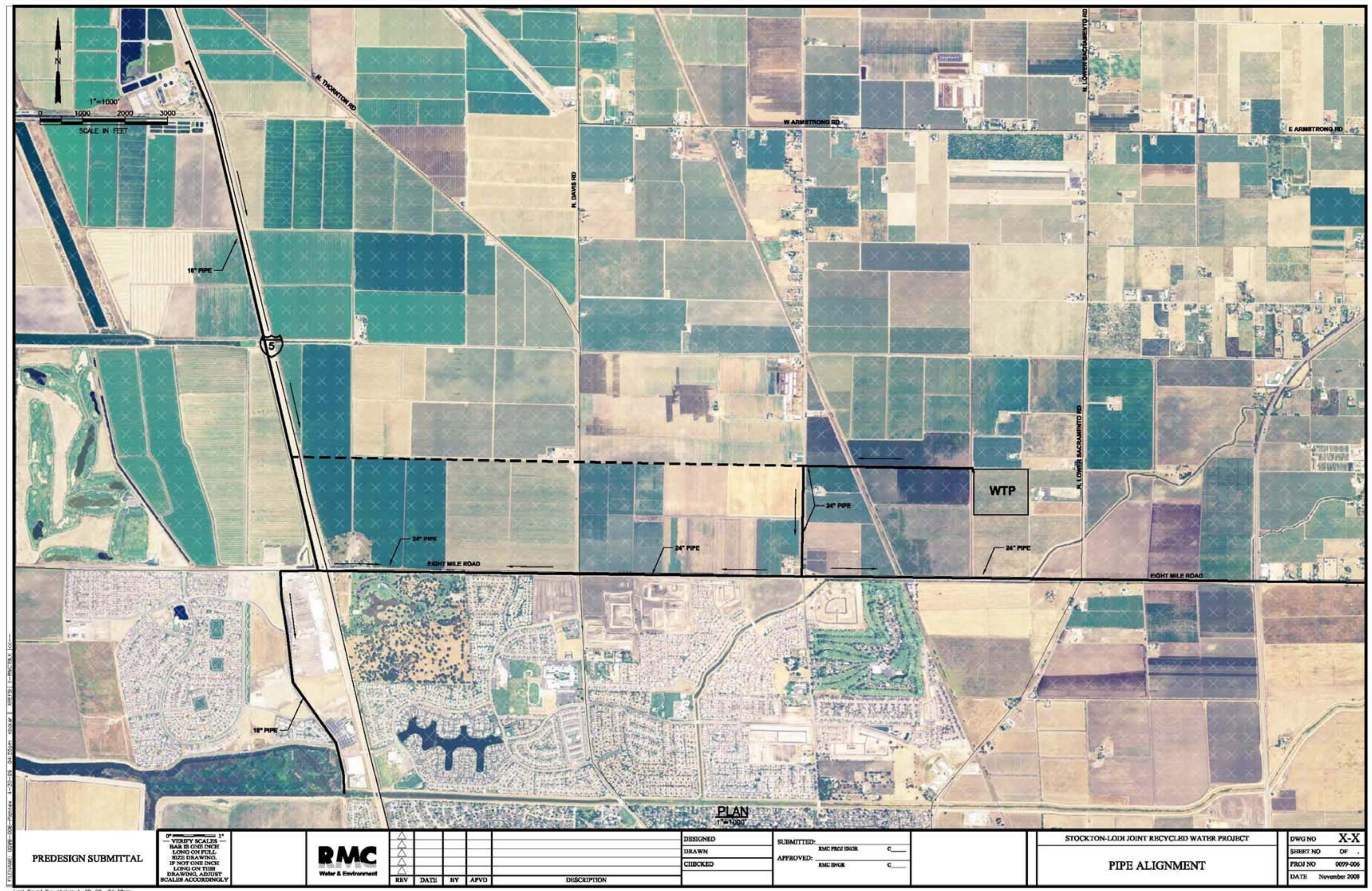


Figure 6-3: Blended Supply Alternative – Storage and Pumping Facilities at WPCF Conceptual-Level Layout

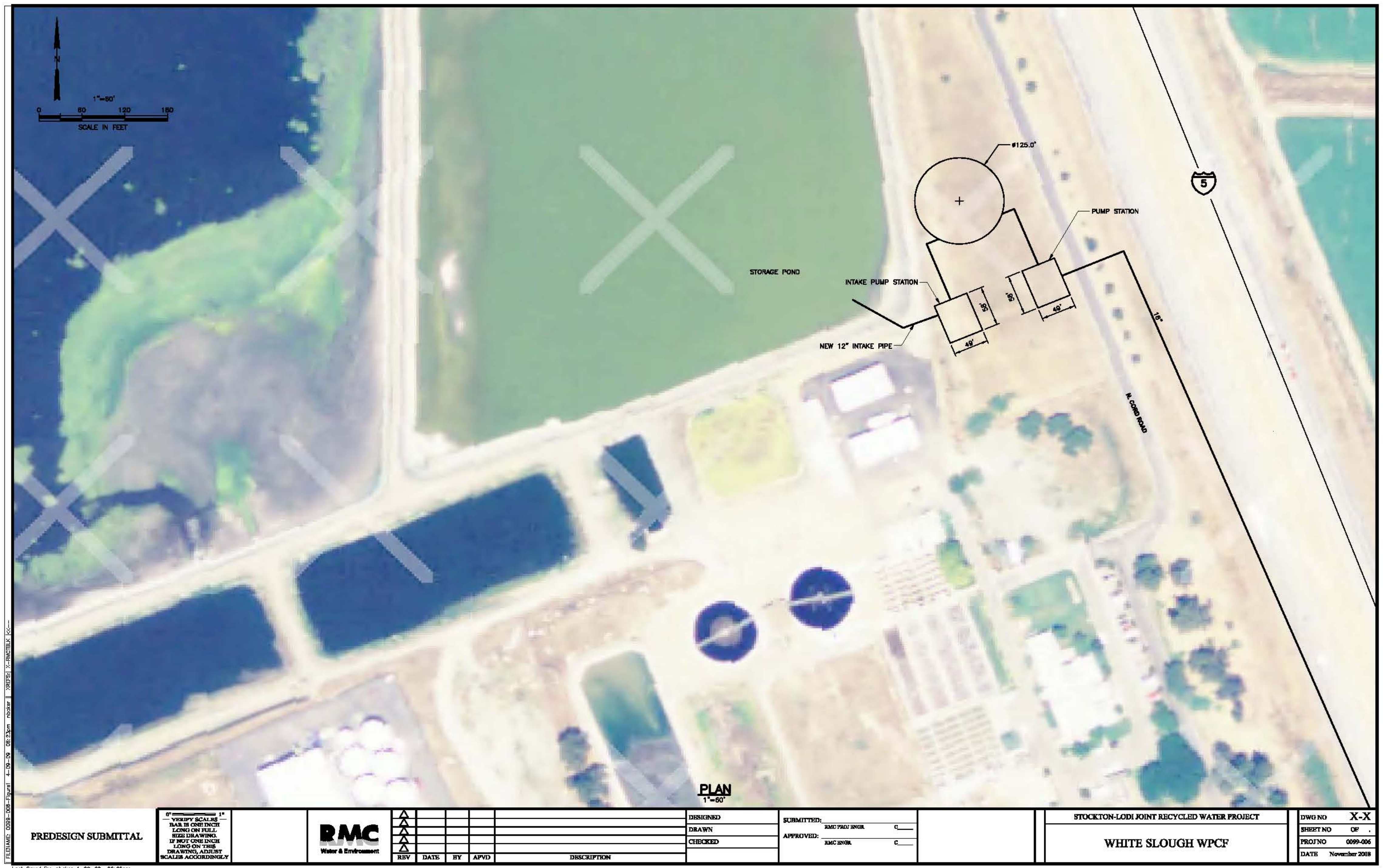
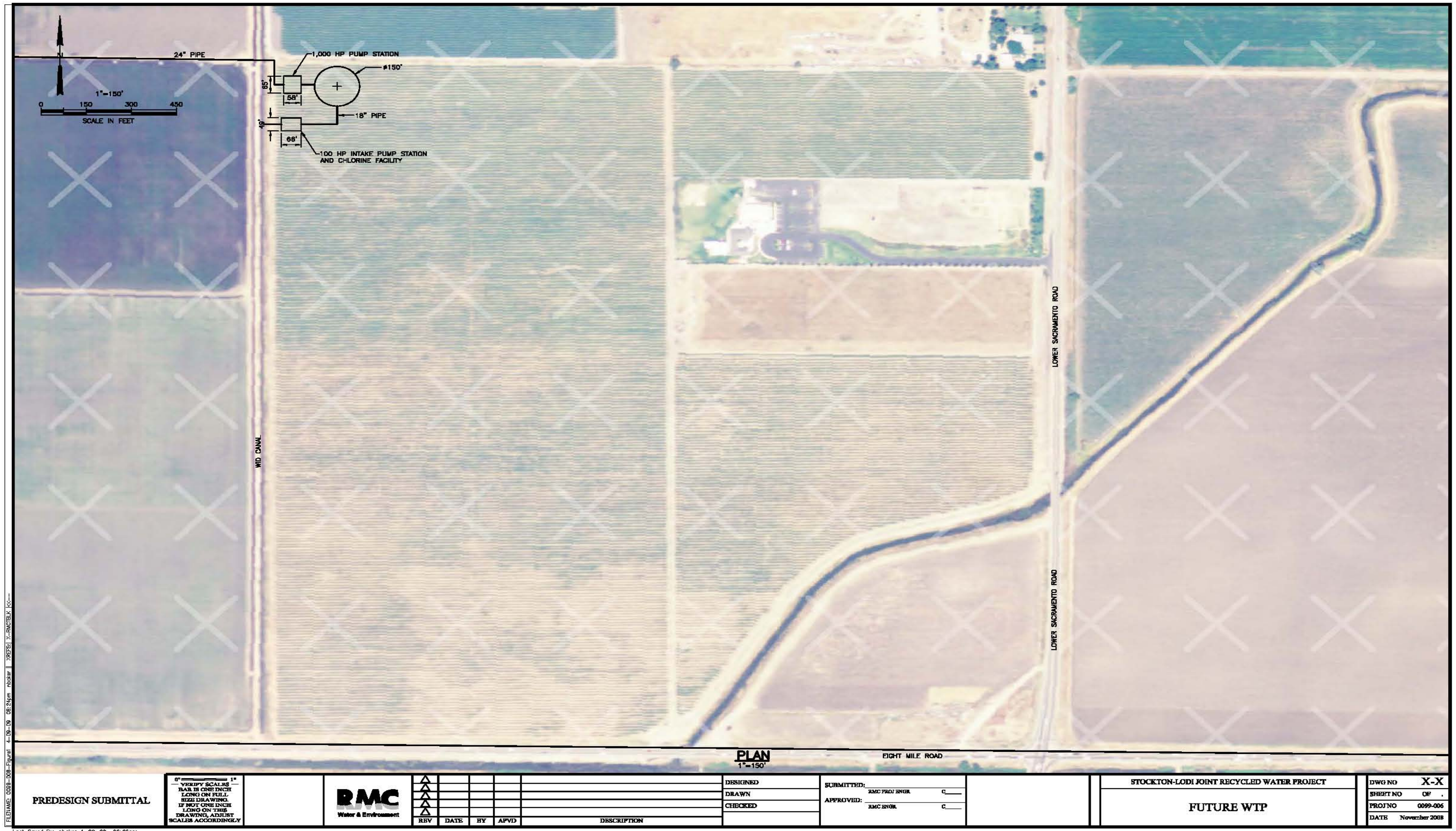


Figure 6-4: Blended Supply Alternative – Supplemental Water Facilities at Future WTP Conceptual-Level Layout



6.2.2 Cost Estimate

The conceptual level cost estimate for the Blended Supply Alternative is summarized in **Table 6-7**. The detailed cost estimates are provided in **Appendix F**.

Table 6-7: Blended Supply Alternative – Conceptual-Level Cost Estimate

Project Element	Construction Cost ($)[1,4]	Capital Costs ($)[2]	Annualized Capital Cost ($/yr)[3]	Annual O&M Cost ($/yr)	Total Annual Cost ($/yr)	Yield (AF/yr)	Unit Cost ($/AF)
Recycled Water Supply	$3.7M	$5.0M	$0.4M	$0.1M	$0.5M	1,500	NA
Surface Water Supply	$8.0M	$10.8M	$0.8M	$0.3M	$1.1M	2,220	NA
Main Conveyance Pipeline	$20.9	$28.2M	$2.2M	$0.1M	$2.2M	NA	NA
TOTAL	**$32.6M**	**$44.0M**	**$3.4M**	**$0.5M**	**$3.9M**	**3,720**	**$1,050**

Notes:
1. Preliminary, conceptual level cost estimates (+/- 30%); expressed in 2008 dollars.
2. Excludes the cost to purchase RW and supplemental supply water.
3. Capital cost includes a 35% contingency for engineering, legal, administrative, and environmental costs.
4. Annualized capital cost includes a 6% discount rate and a useful life of 25 years.

6.2.3 Non-Economic Constraints and Fatal Flaws

The potential non-economic constraints and fatal flaws associated with institutional arrangements, environmental impacts and regulatory requirements are summarized in **Table 6-8**.

Table 6-8: Blended Supply Alternative – Potential Non-Economic Constraints

Category	Description	Potential Constraints/Recommended Actions
Regulatory	• Water Rights	• Water rights are not anticipated to be a constraint based on input from the Cities
	• Project Permitting	• The level of treatment that would be required for the raw surface water is currently unknown. Treatment above and beyond that assumed in this Study might ultimately be required by CDPH
Institutional	• “Showstopper” issue from key stakeholders	• No showstopper issues were identified as part of the Stakeholder Workshop conducted in September 2008.
	• Availability of supplemental water supply	• Should sufficient WID supply not be available, the City could use groundwater or treated surface water; however, these alternatives would likely impact the cost and would not meet the project goal of maximizing non-potable water uses.

6.3 Alternative Analysis and Conclusions

Table 6-9 compares the key elements of the two alternatives evaluated in this Chapter.

Table 6-9: Comparison of Non-potable Water Supply Alternatives

<table>
<tr><th>Evaluation Criteria</th><th>Description</th><th>Seasonal Storage Alternative[1]</th><th>Blended Supply Alternative</th></tr>
<tr><td rowspan="2">Estimated Cost</td><td>Capital Cost</td><td>$46.5M</td><td>$44.0M</td></tr>
<tr><td>Unit Cost</td><td>$1,140/AF [2]</td><td>$1,050/AF [3]</td></tr>
<tr><td>Non-Potable Water Yield</td><td>AFY</td><td colspan="2">3,720</td></tr>
<tr><td rowspan="2">Regulatory Constraints</td><td>Water Rights</td><td colspan="2">Water rights are not anticipated to be a constraint for either alternative based on input from Cities</td></tr>
<tr><td>Project Permitting</td><td colspan="2">No significant constraints are anticipated based on Sep. 27, 2007 conference call with RWQCB and CDPH[4]</td></tr>
<tr><td>Environmental Constraints</td><td>Groundwater Quality Impacts</td><td>Groundwater quality impacts of unlined storage basins to be evaluated as part of implementation plan[5]</td><td>None</td></tr>
<tr><td>Institutional Constraints</td><td>“Showstopper” issue from key stakeholders</td><td colspan="2">No showstopper issues were identified as part of the Stakeholder Workshop conducted in September 2008</td></tr>
</table>

Notes:
1. Assumes the most economical seasonal storage alternative; construction of unlined storage basins. If the basin lining was required the associated capital and unit cost would be $61.8M and $1,460/af, respectively.
2. Total unit cost, excluding the cost to purchase land.
3. Total unit cost, excluding the cost to purchase RW and supplemental supply water.
4. Meeting attendees included Jim Marshall (RWQCB) and Joe Spano (CDPH)
5. Groundwater quality impacts will be evaluated if the seasonal storage alternative is selected.

The following conclusions can be made:

- Under current assumptions and based on input from the City of Stockton, the Seasonal Storage Alternative is not economical for the City to pursue at this time. This conclusion could be affected should a combination of the following happen:
    - Reduction in cannery flows to the White Slough WCPF that would increase the availability of recycled water and reduce the size of the seasonal storage needs – especially if lined storage basins were required and/or the cost of land for the storage basins had to be borne by the project.
    - Substantial outside funding becomes available which brings the cost of non potable water at or below the cost of alternative supplies.
- The Blended Supply Alternative appears to be slightly more economical than the Seasonal Storage Alternative (or much more economical if lined storage basins and/or land costs had to be borne by the Seasonal Storage Alternative). It could also be phased more readily than the

Seasonal Storage Alternative. The availability of raw surface water from WID and the level of treatment that would be required would need to be confirmed early in the project.

- Similar to the Seasonal Storage Alternative, the Blended Supply Alternative would be favorably affected by a reduction in cannery flows to the White Slough WCPF and a corresponding increase in recycled water availability during the summer months.
- Based on the conclusions above, it is recommended that Blended Supply Alternative be carried forward in Chapter 7 as the Preferred Project.

Chapter 7 Preferred Project

This chapter describes the Preferred Project identified in Chapter 6. The Preferred Project description includes project facilities and associated costs, financing considerations, and the implementation strategy.

7.1 Blended Supply Alternative

Based on the conclusions in Chapter 6 it is recommended that the Blended Supply Alternative is the preferred alternative when compared to the Seasonal Storage Alternative. The blended supply alternative was selected, for the following reasons:

- **Cost Effectiveness.** The blended supply alternative has the lowest capital cost.
- **Regulatory Constraints.** The blended supply alternative is less susceptible to future regulatory constraints than the unlined seasonal storage alternative.

7.2 Target Users

The Preferred Project would provide approximately 3,720 afy of non-potable water for urban, non-residential landscape irrigation and artificial lake filling. Urban, non-residential landscape irrigation would constitute 95% of the demand.

3,200 afy would be associated with Phase 1 users, i.e. existing users and future developments for which application has been received and/or approved for construction. 520 afy would be associated with other future users.

Figure 7-1 illustrates the location of the target users, including the artificial lakes.

Table 7-1 lists the target users, and estimated irrigated acreages and estimated recycle water demands for each target user. See Appendix E for further details on each user.

Figure 7-2 illustrates the location of new developments within the City of Stockton, including those identified as Phase 1 users in Table 7-1.

Figure 7-1: Target Users

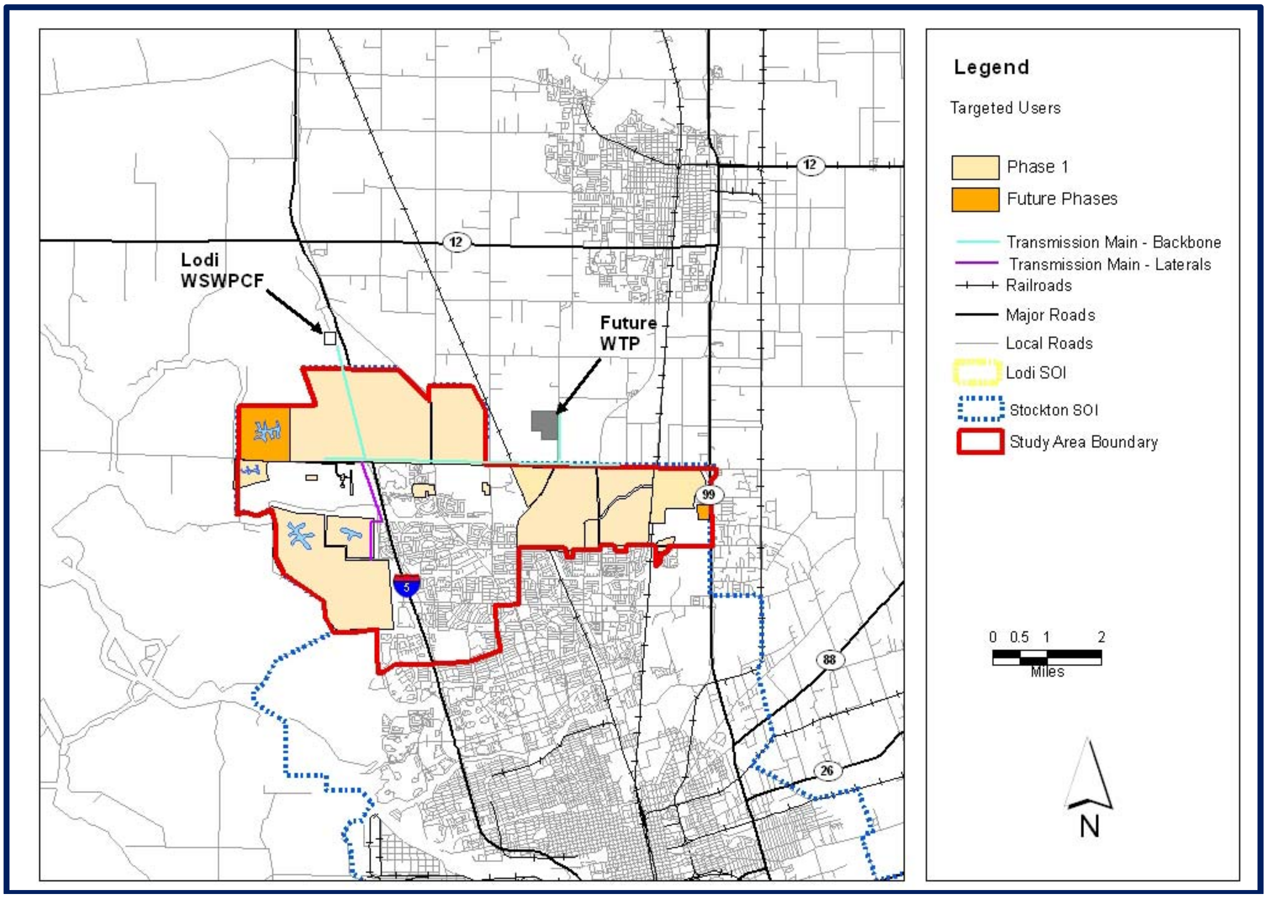
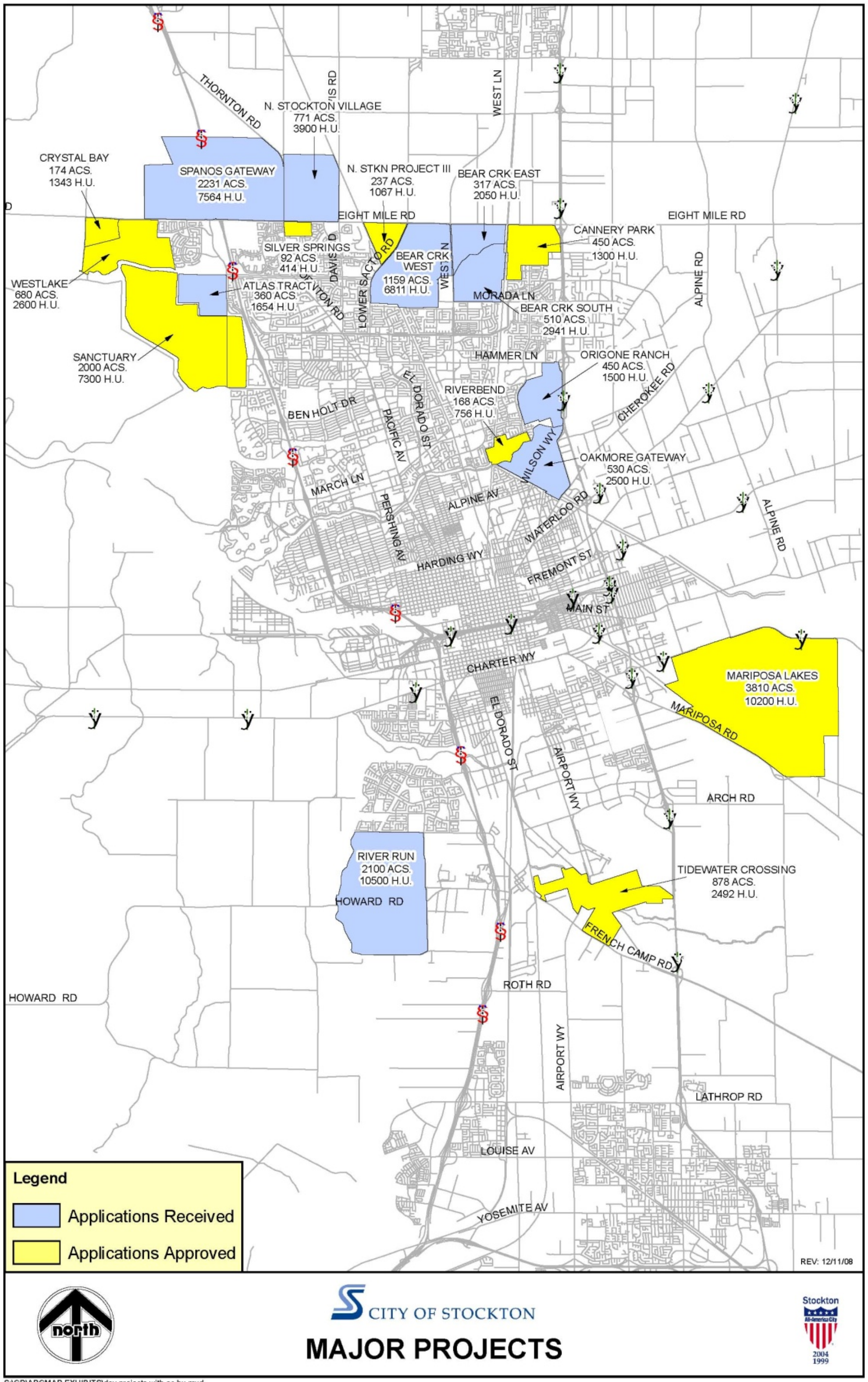


Table 7-1: Target Users

User[1]	Acreage	Average Annual Demand, AFY
Existing Facilities		
Office Park	6	20
Stockton WTP	12	41
Existing Residential Development with Greenways/Parks (Scott Creek Drive)	31	105
Matt Equinoa Park	5	15
Existing Residential Development with Greenways/Parks (between Oak Grove Park and Thornton Rd along Eight Mile Rd)	3	10
Bear Creek High School/Julia Morgan Elementary School	30	100
Ansel Adams Elementary	5	20
Manilo Silva Elementary	4	15
Sutherland Elementary	4	15
Elkhorn School	3	10
Westwood Elementary School	7	20
Ron McNair High School	32	110
State Route 99 & Eight Mile Rd	7	24
Total Existing Facilities	**149**	**505**
Proposed Developments		
Sanctuary SOI (Artificial Lake Filling)	10	30
Crystal Bay (Artificial Lake Filling)	7	20
Atlas Tract (Artificial Lake Filling)	7	20
Bear Creek West	154	520
Spanos Gateway	147	500
Sanctuary SOI	145	490
North Stockton Village	85	285
Bear Creek South	66	225
Cannery Park	49	165
Bear Creek East	49	165
Atlas Tract	40	135
Crystal Bay	23	75
North Stockton Project III	18	60
Highway 5 & Eight Mile Rd	2	5
Thompson SOI (future phase)	82	275
Proposed Soccer Complex (future phase)	38	125
Thompson SOI (Artificial Lake Filling) (future phase)	41	120
Total Proposed Development	**963**	**3,215**
Total	**1,112**	**3,720**

Notes:
1. All users would be Phase 1 users, except the Thompson SOI and the proposed soccer complex.

Figure 7-2: New Developments



7.3 Primary Facilities

Table 7-2 summarizes the primary facilities required for this project. **Figure 6-2, Figure 6-3** and **Figure 6-4** in the previous Chapter show the location of these primary facilities.

Table 7-2: Primary Facilities

Project Facilities	Quantity	Unit
Main Transmission Pipelines[1]		
18-in	9,600	LF
24-in	47,300	LF
Operational Storage		
Recycled Water	1.6	MG
Supplemental Supply Water	3.8	MG
Pumping		
200-HP Recycled Water Pump Station at WPCF	1	ea
100-HP Recycled Water Pump Station at WPCF	1	ea
100-HP Supplemental Supply Pump Station	1	ea
1,000-HP Supplemental Supply Pump Station	1	ea

Notes:

1. It is assumed that the local distribution system within each new development will be installed by the developers. For the thirteen target existing irrigated sites located along the main transmission pipelines, the City will likely need to implement facilities beyond the main transmission pipelines, including laterals and retrofits up to the recycled water meter.

Some of the key issues that will need to be taken into consideration during pre-design include the following:

- Retrofit requirements for the thirteen existing irrigated sites along the main transmission pipelines
- Back-up water supply water quality requirements and WID water availability
- Water quality needs associated with artificial lake recharge
- Construction/traffic impacts

7.3.1 Cost Estimate

Table 7-3 summarizes the estimated costs for the project.

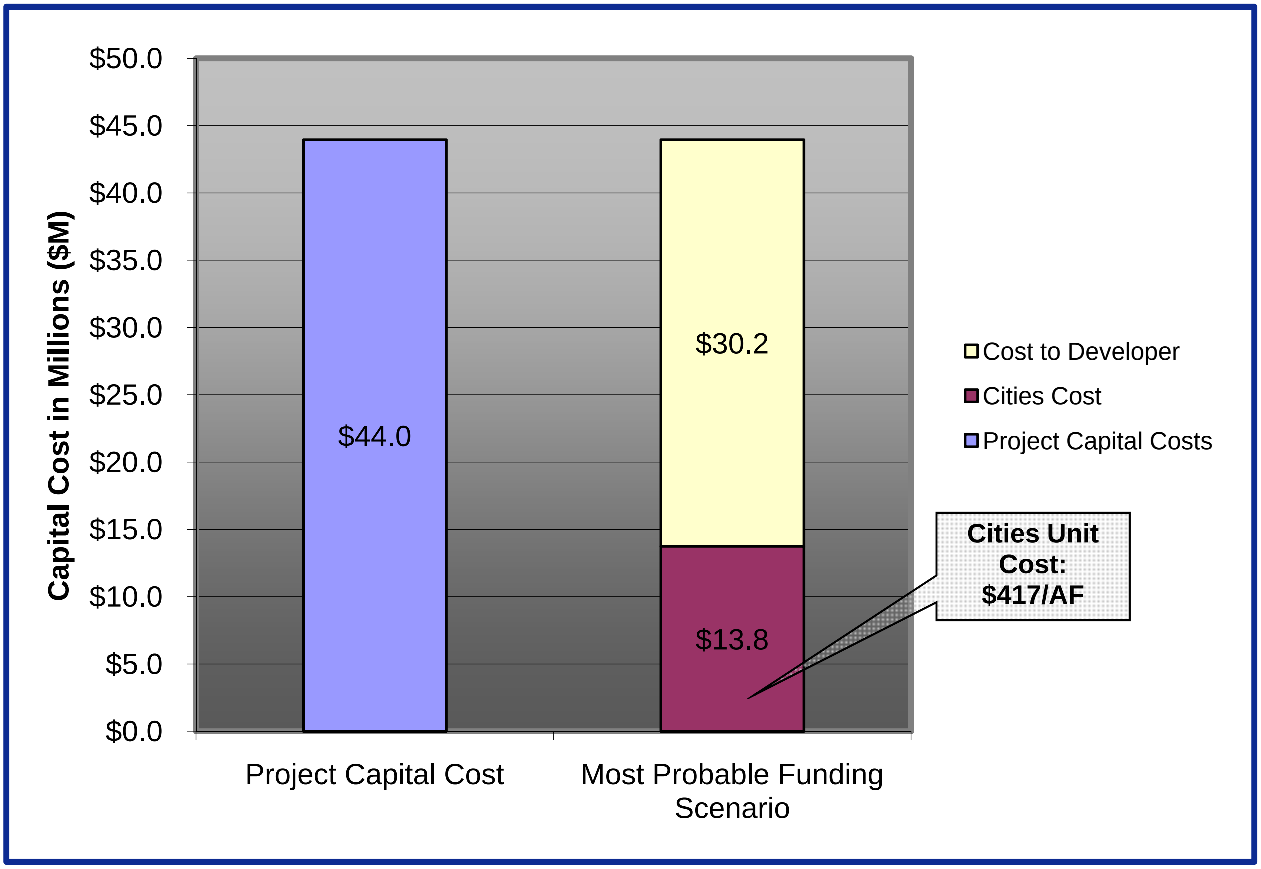
Table 7-3: Estimated Costs

Facility		Estimated Cost[1] (2008 Dollars)
Recycled Water Storage and Pumping		
	Pump Station Facilities	$1.2M
	Operational Storage	$1.6M
	Total	**$2.8M**
Supplemental Supply Storage and Pumping		
	Pump Station Facilities	$2.3M
	Chlorination	$0.1M
	Operational Storage	$3.8M
	Total	**$6.1M**
Main Transmission Pipeline[2]	$/lf	
18-inch diameter pipe	$216	$4.7M
24-inch diameter pipe	$273	$9.6M
UPRR Track Crossing	$1,500	$0.3M
	Total	**$14.6M**
Pipeline Appurtenances		
Appurtenances	10% of pipeline	$1.5M
	Total	$1.5M
	Raw Construction Costs	**$25.1M**
	Construction Estimate Allowance (30%)	$7.5M
	Construction Cost	**$32.6M**
	Engineering, Legal, Administrative, Environmental (35%)	$11.4M
	Total Capital Cost	**$44.0M**
Operations & Maintenance		
	Total Operations and Maintenance ($M/yr)	$0.5M/yr
	Annual Capital Costs ($M/yr)	$3.4M/yr
	Total Annual Cost ($M/yr)	$3.9M/yr
	Recycled Water Yield (AFY)	3,720 AFY
	Annual Unit Cost ($/AF)	**$1,050/AF**

Notes:
1. Rounded to the nearest $0.1M.
2. Retrofit costs for the thirteen existing use sites are not included in the above estimate as a separate line item but rather included in the construction estimate allowance. Retrofit costs for existing irrigated sites (including signage, painting of above-ground fixtures, purple sprinkler heads, recycled water meters, valving, air gap, and any irrigation system modifications if needed) typically vary greatly depending on the site. Assuming a $15,000 allowance per site to cover retrofit up to the meter would amount to $195,000 for thirteen sites.

Figure 7-3 shows the most probable division of cost for the project.

Figure 7-3: Probable Funding Scenario



The following assumptions were made:

- The Cities would be responsible for the costs for all of the recycled water facilities (including the recycled water distribution pipeline), and the supplemental supply pump station and treatment.
- The developers would be responsible for the supplemental supply distribution pipeline, the backbone along Eight Mile Road and the pipe to development south of Eight Mile Road. These pipelines would need to be funded by an earlier consortium of developers and a reimbursement agreement prepared allowing the early developers to be compensated by future development as that development occurred over time. An example of such agreement is provided in **Appendix G**.
- The project cost would be allocated in proportion to the benefit received from the project. Thus since the Preferred Project is proposed to serve demands located in the City of Stockton, it is assumed that the City of Stockton would be responsible for the project cost. If, in the future discharge regulation were to change such that the City of Lodi was required to reduce its permitted discharge and were to elect to increase its recycled water use to accomplish that requirement, the cost allocation between the two Cities could be revisited and the distribution shared in proportion to the discharge avoidance benefit accruing to the City of Lodi. Until then, it is recommended that both Cities maximize State and Federal funding opportunities to reduce capital cost of this regional project.

7.4 Economic Analysis

Table 7-4 presents a simple cost and benefits comparison of the Preferred Project and reference freshwater alternatives.

Table 7-4: Preferred Project vs. Freshwater Alternatives Comparison

Criteria	Stockton Lodi Joint Recycled Water Project	Delta Supply Intake Expansion Alternative	Increased Groundwater Pumping Alternative
Summary			
Description	Construct distribution system, storage and pumping facilities to provide a blended recycled water/surface water supply for primarily irrigation use.	Expand Stockton's Delta Water Supply Intake, which is currently under construction, and increase surface water diversions from the Delta.	Expand existing groundwater pumping practices
Water Supply	Treated wastewater from the WPCF, meeting Title 22 recycled water standards for unrestricted use which is seasonally blended with surface water (WID raw water).	Surface waters from the Delta	Groundwater
Benefits			
Yield	3,720 AFY, drought-proof supply for non-potable uses	3,720 AFY	3,720 AFY
Other	Improves water supply reliability during drought and emergency conditions		
	Reduces discharge of treated wastewater to the Delta		
	Adheres to local, regional and state recycled water policies		
	Creates opportunity to lessen groundwater pumping; thereby possibly positively affecting the regional salinity gradient and reducing existing groundwater depression		
Costs			
Capital Cost	$44.0 million (2008 dollars)	N/A	N/A
Unit Cost ($/AF)	Retail cost of $1,050/AF (with as much as $650/AF potentially passed onto developers)	Retail cost of $444/AF in 2010; up to $727/AF by 2015	Retail cost of $160/AF (approximately)
Other Potential Future Costs/Risks		Risk of additional supply reductions in average years and drought years based in climate change impacts or environmental issues in the Delta	Risk of exasperating existing regional salinity gradient or groundwater depression

As described above, the Preferred Project provides key water supply and environmental benefits to the City and its customers. Given the uncertainty associated with the availability of Delta water and existing groundwater issues such as regional salinity gradient or groundwater depression, the Preferred Project appears attractive. However, outside funding would likely be needed to offset part of the City's costs and move the Preferred Project forward.

Chapter 8 Implementation Plan

Table 8-1 presents the major implementation activities and associated timeline assuming a July 2011 start date for pre-design and environmental documentation.

Table 8-1: Implementation Schedule

Activities	Timeline
Program Management	July 2011 – Mar 2015
Pre-Design	July 2011 – June 2012
Environmental Documentation	July 2011 – June 2013
Funding Pursuit/Financing Plan Development	July 2011 – June 2013
User Assurances/Interagency Agreements	July 2011 – June 2013
Permitting	July 2011 – June 2014
Public Outreach	July 2011 – Mar 2016
Design	July 2013 – July 2014
Bidding	July 2014 – Sept 2014
Construction	Oct 2014 – Feb 2016
Start of Operations	Mar 2016

8.1 Environmental Documentation

The development of this Study has been undertaken with California Environmental Quality Act (CEQA) Requirements, permitting, rights of way and construction issues in mind. The formal CEQA process has not been initiated. These steps represent the preliminary planning stage for the project, enabling pre-design and design to begin in the near future assuming funding pursuits are successful.

8.2 Funding Pursuit and Financing Plan

This section identifies relevant outside funding sources, outlines potential revenue sources and pricing, establishes preliminary cash flow, and identified key variables that may impact the cost estimate and financing plan.

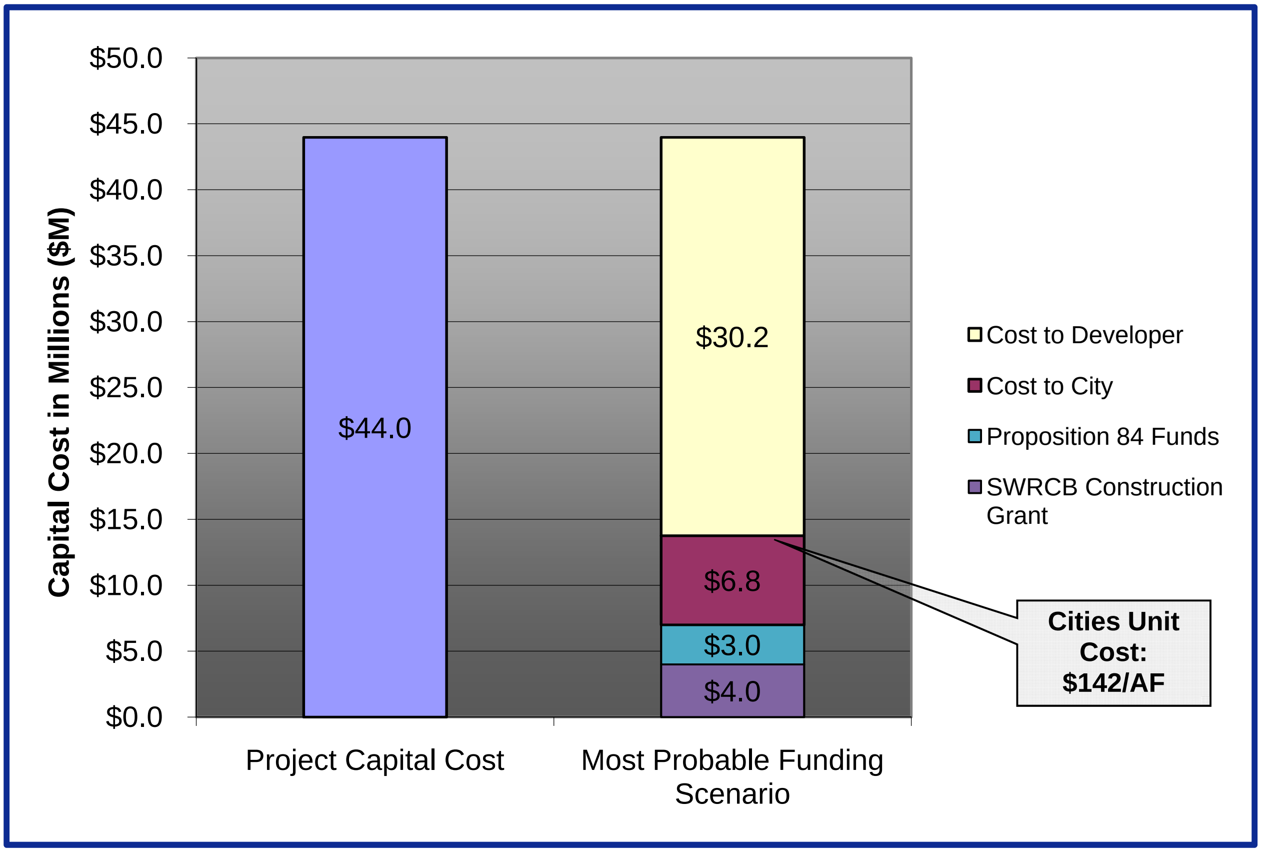
8.2.1 Outside Funding Sources

Securing outside funding will improve the feasibility of the Preferred Project. It is therefore recommended that the City consider outside funding sources while completing the financial planning effort. **Table 8-2** summarizes outside funding sources that are considered to be the best available sources of funding for this project. **Figure 8-1** presents potential funding scenarios and their impact on project costs.

Table 8-2: Potential Outside Funding Sources

Outside Funding Source	Comment	Potential Impact to Project
SWRCB Construction Grant	The Cities have applied for a SWRCB Facilities Grant for the planning phase of this project and consequently have a higher priority for obtaining a construction grant. A grant can cover 25% of eligible project cost provided funds are available. It is a competitive process. Readiness to proceed is currently the main criterion for selection. • Eligible Cost: For the Preferred Project, on average, approximately 40 percent of the blended water would be recycled water. This ratio must be considered when evaluating the project costs eligible for WRFP funds. It is assumed herein that $16M of the $32.6M construction cost would be eligible for WRFP grant funding. The $16M currently assumes $3.6M for recycled water storage and pumping (100% of the estimated recycled water storage and pumping construction cost), $11.3M for conveyance and distribution (100% of the estimated recycled water conveyance pipeline construction cost plus 40% of the distribution system construction cost on 8-mile road), and $1.1M for supplemental supply storage and pumping to provide an emergency backup water supply for the recycled water system (25% of the supplemental supply storage and pumping construction cost). • Funds Availability: Funds are available from repayments of the Proposition 13 fund. For fiscal year 2009/10 SWRCB had approximately $10M available for grant funding. On an annual basis, 60% and 40% of the available funds are allocated to northern California and Southern California projects, respectively. The project would need to be placed on the SRF Priority Project List to be considered.	$4M
Proposition 84 through the IRWMP	The Cities can pursue Proposition 84 funds via the Eastern San Joaquin Integrated regional Water Management Plan (IRWMP) prepared by GBA, which includes conjunctive use and recycled water projects in which the Cities plans to participate, Proposition 84 funds will be awarded by DWR through a competitive process. It is conceivable that the Cities may be successful in funding approximately 20 % of estimated project cost through Proposition 84 grants, $3M (the maximum grant amount).	$3M
Financing		
SWRCB State Revolving Fund (SRF) Loan	The Cities can apply for the SRF Loan program which provides low interest loans to public agencies using a priority list process. The Cities could apply for this 20-year loan, with an interest rate equal to one-half the most recent State General Obligation Rate, typically 2.5 to 3.5%.	Savings on debt rather than debt contribution to capital funding.

Figure 8-1: Potential Outside Funding Scenario



8.2.2 Cash Flow Analysis

Cash Flow Projections are included in **Appendix G**. Projections are based on anticipated outside funding sources and revenue sources. The Cities will complete a more detailed financing plan (including refined annual financial projections) after a decision to move forward with the Project is made and a timeline is established.

8.2.3 Sensitivity Analysis

The financial plan to be completed by Cities will be most influenced by the following factors (in addition to project cost):

- **Outside Funding**. At this preliminary stage in the Project, there is uncertainty regarding securing outside funding. The feasibility on implementing the Project is largely dependent on obtaining funding from one or more of the opportunities identified in **Table 8-2**.
- **Market Recovery**. Currently development has slowed, causing the cash flow from the future assessment districts to slow. The rate of development of the mapped developments will be dependent on the market recovery.

8.2.4 Revenue Sources and Pricing

Revenue sources for the planned project will be generated from the City of Stockton's new non-potable water Assessment Districts. The Assessment District will require the use of non-potable water as well as the construction of non-potable water infrastructure at the time the development is being constructed. No Assessment District has been created yet. The Districts would be structured similarly to the Stormwater

Assessment Districts already in place in a number of areas within the City of Stockton. The Districts would be created in parallel to the project implementation.

8.3 User Assurances

Securing user assurances will play a vital role in advancing the project.

The primary recycled water market that needs to be secured is associated with new developments (85% of the average annual demand).

To this effect, the City is planning on adopting a Non-Potable Water Use Ordinance to be enforced through the new non-potable water Assessment Districts described under Section 8.2.4. The draft Non-Potable Water Use Ordinance is provided in **Appendix H**.

To a lesser degree, user assurances will also need to be secured for existing customers (15% of the demand).

These assurances could consist of letters of intent, individual user agreement or a mandatory use ordinance. The City has not decided at this time the preferred pathway for existing customers. In parallel to the user assurance, the City will need to consider potential incentive for existing sites to convert to recycled water, particularly if the sites require significant retrofits (if the irrigation system is already separate, retrofits are usually minor).

8.4 Interagency Agreements

Should the project move forward, interagency agreements for Lodi's recycled water and WID water will need to be developed, including description of water amounts, seasonal variations or restrictions, costs, and roles and responsibilities. A draft letter of intent between Lodi and Stockton is provided in **Appendix I**.

8.5 Permitting, Design and Construction

Table 8-3 lists major jurisdictional and stakeholder agencies and identifies required permits and approvals required for implementing the preferred project.

Table 8-3 Jurisdictional and Stakeholder Agencies for Permitting Review

Agency Name	Permits or Special Topics
Federal Aviation Administration	Notice of Proposed Construction or Alteration
City of Stockton Public Works Department	Grading and Excavation Permit
City of Stockton	Encroachment and Street Work Permit
San Joaquin County	Grading, Excavation, Encroachment and Street Work Permits
San Joaquin County Office of Emergency Services	Hazardous Material Permit, if necessary
San Joaquin Valley Air Pollution Control District	Authority to Construction and Permit to Operate
Central Valley Regional Water Quality Control Board (RWQCB) and State Water Resources Control Board	NPDES Permit for construction activities and construction Storm Water Pollution Prevention Plan (SWPPP)
	Waste Discharge Requirements (WDR) and Water Recycling Requirements (WRR)[1]
	Salt and Nutrient Management Plan
California Department of Public Health (CDPH)	Title 22 – Recycled Water Regulations
California Department of Fish and Game	Stream Bed Alteration Agreement/Waiver, if necessary
California Occupational Safety and Health Administration	Underground Classification for Tunnels, in necessary
Caltrans	Encroachment Permit
Pacific Gas and Electric, cable and telecom providers	Infrastructure review

Notes:
1. The project will need to comply with RWQCB Waste Discharge Requirements (WDR) and Water Recycling Requirements (WRR) for delivering water to sites within the Study area, including artificial lakes.

The July 2011 start date for pre-design shown in Table 8-1 assumes that the Preferred Project implementation will be timed with the anticipated market recovery such that the level of development assumed will occur within ten years of construction of the Preferred Project. This schedule could be accelerated if needed. In addition to timing the implementation of the Preferred Project with market recovery, the majority of target users are proposed new developments for which the City of Stockton has already processed development permits, further guaranteeing that the capacity of the project can be used within ten years of completion of construction.

Some of the key issues that will need to be taken into consideration during pre-design include the following:

- Retrofit requirements for the thirteen existing irrigated sites along the main transmission pipelines
- Back-up water supply water quality requirements and WID water availability
- Water quality needs associated with artificial lake recharge
- Construction/traffic impacts

References

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