2015 AGRICULTURAL WATER MANAGEMENT PLAN

Prepared by

DAVIDS ENGINEERING, INC
www.davidsengineering.com

December 2015

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South San Joaquin Irrigation District

2015 AGRICULTURAL WATER MANAGEMENT PLAN

Prepared in Accordance with

the Water Conservation Act of 2009

(Senate Bill x7-7)

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PREFACE

This Agricultural Water Management Plan (AWMP or Plan) has been prepared by South San Joaquin Irrigation District (SSJID or District) in accordance with the requirements of the Water Conservation Act of 2009, also known as Senate Bill x7-7 (SBx7-7). SBx7-7 modifies Division 6 of the California Water Code (CWC or Code), adding Part 2.55 (commencing with §10608) and replacing Part 2.8 (commencing with §10800). In particular, SBx7-7 required all agricultural water suppliers greater than 25,000 acres in size to prepare and adopt an AWMP as set forth in the California Water Code (CWC) and the California Code of Regulations (CCR) on or before December 31, 2015. Thereafter, the Plan must be updated every 5 years (§10820 (a)). Additionally, the CWC requires suppliers to implement certain efficient water management practices (EWMPs). On April 1, 2015 Governor Brown issued an Executive Order B-29-15, which directs agricultural water suppliers to develop a drought management plan (DMP) and incorporate it into the AWMP by the December 31, 2015 deadline.

The main resources used to develop this 2015 AWMP were the CWC itself, the relevant sections of the CCR, the 2012 DWR Agricultural Water Management Plan Guidebook , the 2015 Agricultural Water Management Plan Guidebook (when the final became available in late July 2015), the CWC, and the Governor's April 2015 Executive Order. The resolution of adoption and a cross-reference identifying the locations(s) in the AWMP within which each of the applicable requirements of SBx7-7 and the corresponding sections of the CWC and CCR is addressed are provided on the following pages. This cross-reference is intended to support efficient review of the AWMP to verify compliance with the Law.

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SOUTH SAN JOAQUIN IRRIGATION DISTRICT
RESOLUTION 15-12-W
ADOPTION OF AGRICULTURAL WATER MANAGEMENT PLAN

WHEREAS, the Agricultural Water Management Planning Act (Act) , codified in section 10800 et seq.,of the Water Code (CWC), requires all agricultural water suppliers equal to or greater than 10,000 acres in size to update its Agricultural Water Management Plan by December 31, 2015 and every five years thereafter; and

WHEREAS, South San Joaquin Irrigation District (District) prepared an agricultural water management plan in accordance with the Act in 2013 (AWMP or Plan) and has prepared an updated Plan in accordance with the requirements of Section 10826 of the CWC and the regulations implementing the Plan adopted by the Department of Water Resources (DWR's Regulations); and

WHEREAS, the District provided notice of the November 24, 2015 hearing in accordance with Government Code section 20841 by published notice in the Manteca Bulletin, a newspaper of general circulation for two consecutive weeks and notified each of the three cities and the County of San Joaquin in accordance with Government Code section 20821, of the availability of the Plan and of the time and place for a public hearing to be held on the Plan at the November 24, 2015 meeting of the District's Board of Directors; and

WHEREAS, the District held a public hearing at the November 24, 2015 meeting of the District's Board of Directors and no public comments were made,

NOW, THEREFORE BE IT RESOLVED AND ORDERED, by the Board of Directors of the South San Joaquin Irrigation District as follows:

> The 2015 update to the District's Agricultural Water Management Plan is hereby adopted and ordered filed with the District;
>
> The District's Water Conservation Coordinator is hereby authorized and directed within 30 days to distribute copies of the Plan to the California Department of Water Resources and the other entities described in Section 10843 of the CWC and to cause the Plan to be posted on the District's website in accordance with Section 10844 of the CWC;

The General Manager is hereby authorized and directed to take appropriate action to implement the updated Plan in accordance with the Act and DWR's Regulations, as such may be modified from time to time;

PASSED AND ADOPTED on this 16th day of December, 2015 by the following roll call vote:

AYES:	HOLBROOK HOLMES KAMPER KUIL ROOS
NOES:	NONE
ABSTAIN:	NONE
ABSENT:	NONE

ATTEST:

Peter M. Rietkerk, Secretary

CROSS-REFERENCE TO REQUIREMENTS OF SBX7-7

California Water Code, Division 6, Part 2.55. Sustainable Water Use and Demand Reduction

Chapter 4. Agricultural Water Suppliers				
Division	**Subdivision**	**Paragraph**	**Code Language**	**Applicable AWMP Section(s)**
10608.48	(a)		On or before July 31, 2012, an agricultural water supplier shall implement efficient water management practices pursuant to subdivisions (b) and (c).	**7**
	(b)		Agricultural water suppliers shall implement all of the following critical efficient management practices:	(see below)
		(1)	Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of Section 531.10 and to implement paragraph (2)	**3.8, 7.2**
		(2)	Adopt a pricing structure for water customers based at least in part on quantity delivered.	**3.9, 7.2**
	(c)		Agricultural water suppliers shall implement additional efficient management practices, including, but not limited to, practices to accomplish all of the following, if the measures are locally cost effective and technically feasible:	(see below)
		(1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	**7.3**
		(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	**7.3**
		(3)	Facilitate the financing of capital improvements for on-farm irrigation systems.	**7.3**
		(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at the farm level. (B) Conjunctive use of groundwater. (C) Appropriate increase of groundwater recharge. (D) Reduction in problem drainage. (E) Improved management of environmental resources. (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	**3.9, 7.3**
		(5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce seepage.	**3.4, 7.3**
		(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits.	**3.7, 7.3**

		(7)	Construct and operate supplier spill and tailwater recovery systems.	**3.4, 7.3**
		(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area.	**4.3, 5, 7.3**
		(9)	Automate canal control structures.	**3.4, 7.3**
		(10)	Facilitate or promote customer pump testing and evaluation.	**7.3**
		(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.	**7.3**
		(12)	Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following: (A) On-farm irrigation and drainage system evaluations. (B) Normal year and real-time irrigation scheduling and crop evapotranspiration information. (C) Surface water, groundwater, and drainage water quantity and quality data. (D) Agricultural water management educational programs and materials for farmers, staff, and the public.	**7.3**
		(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	**7.3**
		(14)	Evaluate and improve the efficiencies of the supplier's pumps.	**7.3**
10608.48	(d)		Agricultural water suppliers shall include in the agricultural water management plans required pursuant to Part 2.8 (commencing with Section 10800) a report on which efficient water management practices have been implemented and are planned to be implemented, an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future. If an agricultural water supplier determines that an efficient water management practice is not locally cost effective or technically feasible, the supplier shall submit information documenting that determination.	**7.5**

California Water Code, Division 6, Part 2.8. Agricultural Water Management Planning

Chapter 3. Agricultural Water Management Plans

Article 1. General Provisions

Division	Subdivision	Paragraph	Code Language	Applicable AWMP Section(s)
10820	(a)		An agricultural water supplier shall prepare and adopt an agricultural water management plan in the manner set forth in this chapter on or before December 31, 2012, and shall update that plan on December 31, 2015, and on or before December 31 every five years thereafter.	**2**
10821	(a)		An agricultural water supplier required to prepare a plan pursuant to this part shall notify each city or county within which the supplier provides water supplies that the agricultural water supplier will be preparing the plan or reviewing the plan and considering amendments or changes to the plan. The agricultural water supplier may consult with, and obtain comments from, each city or county that receives notice pursuant to this subdivision.	**2**
	(b)		The amendments to, or changes in, the plan shall be adopted and submitted in the manner set forth in Article 3 (commencing with Section 10840).	**2**

Article 2. Contents of Plans

Division	Subdivision	Paragraph	Code Language	Applicable AWMP Section(s)
10826			An agricultural water management plan shall be adopted in accordance with this chapter. The plan shall do all of the following:	(see below)
	(a)		Describe the agricultural water supplier and the service area, including all of the following:	(see below)
		(1)	Size of the service area.	**3.3**
		(2)	Location of the service area and its water management facilities.	**3.3, 3.4**
		(3)	Terrain and soils.	**3.5**
		(4)	Climate.	**3.6**
		(5)	Operating rules and regulations.	**3.7**
		(6)	Water delivery measurements or calculations.	**3.8**
		(7)	Water rate schedules and billing.	**3.9**
		(8)	Water shortage allocation policies.	**3.10**
10826	(b)		Describe the quantity and quality of water resources of the agricultural water supplier, including all of the following:	(see below)

		(1)	Surface water supply.	**4.2**
		(2)	Groundwater supply.	**4.3**
		(3)	Other water supplies.	**4.4**
		(4)	Source water quality monitoring practices.	**4.5**
		(5)	Water uses within the agricultural water supplier's service area, including all of the following: (A) Agricultural. (B) Environmental. (C) Recreational. (D) Municipal and industrial. (E) Groundwater recharge. (F) Transfers and exchanges. (G) Other water uses.	**5**
		(6)	Drainage from the water supplier's service area.	**5**
10826	(b)	(7)	Water accounting, including all of the following: (A) Quantifying the water supplier's water supplies. (B) Tabulating water uses. (C) Overall water budget.	**5**
		(8)	Water supply reliability.	**1.1, 4.2, 5.8**
	(c)		Include an analysis, based on available information, of the effect of climate change on future water supplies.	**6**
	(d)		Describe previous water management activities.	**1, 2, 3, 4, 7**
	(e)		Include in the plan the water use efficiency information required pursuant to Section 10608.48.	**7**
Article 3. Adoption and Implementation of Plans				
Division	Subdivision	Paragraph	Code Language	Applicable AWMP Section(s)
10841			Prior to adopting a plan, the agricultural water supplier shall make the proposed plan available for public inspection, and shall hold a public hearing on the plan. Prior to the hearing, notice of the time and place of hearing shall be published within the jurisdiction of the publicly owned agricultural water supplier pursuant to Section 6066 of the Government Code. A privately owned agricultural water supplier shall provide an equivalent notice within its service area and shall provide a reasonably equivalent opportunity that would otherwise be afforded through a public hearing process for interested parties to provide input on the plan. After the hearing, the plan shall be adopted as prepared or as modified during or after the hearing.	**2**
10842			An agricultural water supplier shall implement the plan adopted pursuant to this chapter in accordance with the schedule set forth in its plan, as determined by the governing body of the agricultural water supplier.	**7**

10843	(a)		An agricultural water supplier shall submit to the entities identified in subdivision (b) a copy of its plan no later than 30 days after the adoption of the plan. Copies of amendments or changes to the plans shall be submitted to the entities identified in subdivision (b) within 30 days after the adoption of the amendments or changes.	**2**
	(b)		An agricultural water supplier shall submit a copy of its plan and amendments or changes to the plan to each of the following entities:	(see below)
		(1)	The department.	**2**
		(2)	Any city, county, or city and county within which the agricultural water supplier provides water supplies.	**2**
		(3)	Any groundwater management entity within which jurisdiction the agricultural water supplier extracts or provides water supplies.	**2**
		(4)	Any urban water supplier within which jurisdiction the agricultural water supplier provides water supplies.	**2**
		(5)	Any city or county library within which jurisdiction the agricultural water supplier provides water supplies.	**2**
		(6)	The California State Library.	**2**
		(7)	Any local agency formation commission serving a county within which the agricultural water supplier provides water supplies.	**2**
10844	(a)		Not later than 30 days after the date of adopting its plan, the agricultural water supplier shall make the plan available for public review on the agricultural water supplier's Internet Web site.	**2**
	(b)		An agricultural water supplier that does not have an Internet Web site shall submit to the department, not later than 30 days after the date of adopting its plan, a copy of the adopted plan in an electronic format. The department shall make the plan available for public review on the department's Internet Web site.	**2**

Executive Order B-29-15 (April 1, 2015).				
Division	Subdivision	Paragraph	Code Language	Applicable AWMP Section(s)
		12	Agricultural water suppliers that supply water to more than 25,000 acres shall include in their required 2015 Agricultural Water Management Plans a detailed drought management plan that describes the actions and measures the supplier will take to manage water demand during drought. The Department shall require those plans to include quantification of water supplies and demands for 2013, 2014, and 2015 to the extent data is available. The Department will provide technical assistance to water suppliers in preparing the plans.	**3.10, Attach-ment D**

CONTENTS

TABLES

FIGURES

ATTACHMENTS

- Customer Delivery Measurement Compliance Documentation
- Rules and Regulations Governing the Distribution of Water in the South San Joaquin Irrigation District
- On-Farm Water Conservation Program 2014 Program Description
- South San Joaquin Irrigation District Drought Management Plan

ACRONYMS AND ABBREVIATIONS

ADFM	acoustic Doppler flow meter
af	Acre-Feet
af/ac	Acre-Feet per Acre
af/ac-yr	Acre-Feet per Acre per Year
APN	Assessor's Parcel Number
ASABE	American Society of Agricultural and Biological Engineers
ASCE	American Society of Civil Engineers
AWMP	Agricultural Water Management Plan
AWMC	Agricultural Water Management Council
BCSD	bias comparison and spatial disaggregation
BMO	Basin Management Objective
BO	Biological Opinion
C2VSim	California Central Valley Groundwater – Surface Water Simulation Model
CALFED	CALFED Bay Delta Program
CCR	California Code of Regulations
CCUF	Crop Consumptive Use Fraction
CDEC	California Data Exchange Center
CDM	Camp, Dresser, & McKee
cfs	Cubic Feet per Second
CIMIS	California Irrigation Management Information System
CIP	Cast In Place
CNRA	California Natural Resources Agency
CMIP3	Coupled Model Intercomparison Project Phase 3
CSJWCD	Central San Joaquin Water Conservation District
CVP	Central Valley Project
CWC	California Water Code
DE	Davids Engineering, Inc.
DF	Delivery Fraction
DM	Division Manager
DWR	California Department of Water Resources
ESJ IRWMP	Eastern San Joaquin Integrated Regional Water Management Plan
EC	Electrical Conductivity
EQIP	Environmental Quality Incentives Program
ET	Evapotranspiration
ET_{aw}	Crop Evapotranspiration of Applied Water
ETc	Crop Evapotranspiration
ET_o	Reference Evapotranspiration
ET_{pr}	Crop Evapotranspiration of Precipitation
EWMP	Efficient Water Management Practice
FCC	Federal Communications Commission

FCOC	The French Camp Outlet Canal
FWUA	Friant Water Users Authority
GCMs	Global climate models
gpm	Gallons per Minute
GDD	growing degree day
IDC	The Integrated Water Flow Model – Demand Calculator
ILRP	Irrigated Lands Regulatory Program
in	Inches
IWFM	Integrated Water Flow Model
k_c	Crop Coefficient
LAFCO	Local Agency Formation Commission
LMSC	Lower Main Supply Canal
M&I	Municipal & Industrial
MDC	Main Distributary Canal
Merced ID	Merced Irrigation District
METRIC	Mapping EvapoTranspiration at high Resolution with Internalized Calibration
MGD	million gallons per day
mi/hr	Miles per Hour
MID	Modesto Irrigation District
MSC	Main Supply Canal
NIWR	net irrigation water requirements
NPDES	National Pollutant Discharge Elimination System
NRCS	Natural Resources Conservation Service
OID	Oakdale Irrigation District
PAT	Program Administration Tool
PG&E	Pacific Gas and Electric
PU607	Planning Unit 607
Program	On-Farm Water Conservation Program or Pilot Delivery Measurement Assessment Program
P&P	Provost and Pritchard Consulting Group
psi	Pounds per Square Inch
PVC	Polyvinyl Chloride
RWQCB	Regional Water Quality Control Board
SBx7-7	Senate Bill x7-7, Water Conservation Act of 2009
SCADA	Supervisory Control and Data Acquisition
SCWSP	South County Water Supply Program
SDWA	South Delta Water Agency
SGMA	Sustainable Groundwater Management Act of 2014
SEWD	Stockton East Water District
SIDE	System Improvements for Distribution Efficiency
SJCFCWD	San Joaquin County Flood Control and Water Conservation District
SLDMWA	San Luis-Delta Mendota Water Agency
SOI	Sphere of Influence

SSURGO	Soil Survey Geographic database
SSJID	South San Joaquin Irrigation District
SWSF	Surface Water Supply Fraction
TAF	Thousands of Acre-Feet
TDS	Total Dissolved Solids
TID	Turlock Irrigation District
TP	TruePoint
UMSC	Upper Main Supply Canal
UCB	University of California at Berkeley
USBR	United States Bureau of Reclamation
USGS	United States Geological Survey
VAMP	Vernalis Adaptive Management Program
VFD	Variable Frequency Drive
WMF	Water Management Fraction
WCRP	World Climate Research Program
WTP	Water Treatment Plant
WUE	Water Use Efficiency
WWCRA	West-Wide Climate Risk Assessment

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EXECUTIVE SUMMARY

INTRODUCTION

This Agricultural Water Management Plan (AWMP or Plan) has been prepared by the South San Joaquin Irrigation District (SSJID or District) to describe the District's agricultural water management activities in accordance with Senate Bill x7-7 (SBx7-7), also referred to as the Water Conservation Act of 2009. Preparation of the AWMP includes a detailed evaluation of the District's water management operations as they relate to the implementation of mandatory and other locally cost-effective efficient water management practices (EWMPs).

Water for irrigation is foundational to supporting agriculture, the economic engine of San Joaquin County. In 2013, $3.0 billion in agricultural commodities were produced in the County, providing a total economic impact of over $18 billion[1]. Key strategies employed by SSJID to support overall water management objectives are the conjunctive management of surface and groundwater supplies and water conservation.

Development of the AWMP represents a substantial effort by SSJID to evaluate its water management, including the development of detailed water balances spanning the period from 1994 to 2014 for the five primary water accounting centers:

1. Upper Main Supply Canal (UMSC) and Woodward Reservoir
2. Lower Main Supply Canal (LMSC) and Main Distributary Canal (MDC)
3. District Laterals
4. Irrigated Lands
5. Drainage System

The AWMP consists of an introduction to SSJID, its history, and previous water management activities; a review of the public participation process to prepare and adopt this AWMP; a detailed description of the District's physical setting, formation, organization, operations, and facilities; an inventory of water supplies and uses, a discussion of potential impacts of climate change and adaptation strategies, an evaluation of the implementation of EWMPs and corresponding WUE improvements, and drought management plan.

WATER MANAGEMENT OBJECTIVES AND ACTIONS

The District's primary water management objective is to maintain a reliable, affordable, high quality water supply for agriculture and other uses. To that end, SSJID has conducted and participated in numerous local and regional water management projects and initiatives, in addition to the day-to-day operation and maintenance of the District's supply and distribution

[1] San Joaquin County Agricultural Commissioner's 2013 Crop Report. The estimated total economic value of $18 billion is based on the agricultural commissioner's estimated economic multiplier of 6.

system to meet irrigation, domestic, and M&I water demands while also generating hydropower. Actions of note initiated or completed in the last 15 years include the following:

- Approved a plan to install SCADA on 100 magnetic flow meters used to measure water deliveries to customers.
- Funded a feasibility study to assess the costs and benefits of providing pressurized service, similar to that provided by the Division 9 project, District-wide.
- In 2015, updated and improved accuracy of the District's water balance for 1994 to 2014 providing a benchmark of recent historical water use within the District to allow for assessment of current water management and planning and evaluation of future improvements;
- Participated in the San Joaquin County Integrated Regional Water Management Plan.
- Developed storm drainage agreements with Manteca and Escalon that provide enhanced safeguards with regard to water quality and quantity standards for water that enters the District's distribution and drainage systems.
- Division 9 Project Completion in 2012, resulting in the availability of pressurized water for irrigators with arranged demand and online ordering, also reducing reliability on groundwater of lesser quality.
- Development and implementation of SSJID's On-Farm Water Conservation Program in 2011, providing direct incentives to SSJID irrigators to utilize available surface water supplies while implementing water conservation practices;
- In 2011, the District licensed its own Federal Communications Commission (FCC) frequency and built eight (8) microwave towers to support the enhancement of its Supervisory Control and Data Acquisition (SCADA) system.
- Installation and implementation of TruePoint water ordering software in 2009 to improve accounting of individual customer deliveries and support volumetric water charges.
- Acceleration of capital improvement projects from 2008 through 2010 to create local jobs and to take advantage of reduced construction costs;
- Development and implementation of a Flow Measurement Plan in 2010, including phased measurement improvements at boundary outflows, delivery measurement accuracy assessment, and pilot testing of delivery measurement alternatives;
- Preparation of a Joint Canal hazard study and completion of tunnel improvements on the Joint Canal and Upper Main Supply Canal between 2005 and 2010 totaling approximately $5 million;
- Development of a 15 year water balance for 1994 to 2008 in 2009, providing a benchmark of recent historical water use within the District to allow for assessment of current water management and planning and evaluation of future improvements;
- Development of the South County Water Supply Program (SCWSP) through a collaborative and cooperative effort between SSJID, Manteca, Escalon, Lathrop and Tracy to provide treated surface water to supplement the City's existing groundwater

supply through the construction of the Nick C. DeGroot Water Treatment Plant (WTP), including a 35-mile concrete-lined steel supply pipeline to supply Manteca, Lathrop and Tracy. From 2005 to 2010, the WTP delivered a combined average of 15,700 af annually. The opportunity to provide supplemental water to municipalities was made possible through SSJID's extensive conservation and water management efforts in the 1980's and 90's that resulted in significant reductions in spillage and increased system efficiency. These improvements increased flexibility and reliability in the delivery of water for irrigation;

- Development and implementation of the System Improvements for Distribution Efficiency (SIDE) project in 2003, resulting increased flexibility for system operations and deliveries in the surrounding area.

Recent drought conditions reemphasize the importance of recharge from surface water supplies for the Eastern San Joaquin Groundwater Subbasin to achieve sustainability, as envisioned by the recent enactment of the Sustainable Groundwater Management Act of 2014 (SGMA). Analysis shows that seepage and deep percolation of most of SSJID's surface water supply serves as a primary source of recharge to the groundwater system. Thus, a significant portion of the water used by others within the Eastern San Joaquin Groundwater Subbasin is derived from management of surface water resources by SSJID and its irrigation customers. Even with the seepage and deep percolation from SSJID, groundwater levels continue to decline in area to the east of Stockton and north of SSJID where surface water supplies are limited. A large cone of depression has formed there, so that groundwater flow under SSJID now flows northerly rather than to the west. Extended drought or other circumstances which limit surface water supplies are likely to exacerbate this condition. SSJID will continue to work with others within the Eastern San Joaquin Groundwater Subbasin to comply with SGMA. In addition to its own water management practices, SSJID will work with local interests to develop the tools needed to achieve long-term groundwater sustainability by identifying additional ways to maximize local water supplies, enhance conjunctive management practices, and recharge the groundwater system.

IMPLEMENTATION OF EFFICIENT WATER MANAGEMENT PRACTICES

SBx7-7 lists sixteen EWMPs aimed at promoting efficient water management. According to SBx7-7, two of these are "critical" or mandatory, and the remaining fourteen "conditional" EWMPs are to be implemented if technically feasible and locally cost effective. Of the fourteen conditional EWMPs, SSJID is implementing all of those that are technically feasible at locally cost effective levels. The EWMPs, along with past and future implementation activities by SSJID are described in Table ES-1.

Since the completion of the 2012 AWMP, the District has focused EWMP evaluation and implementation efforts on the potential expansion of its Division 9 pilot project, a state-of-the-art pressurized delivery system completed prior to the 2012 irrigation season. This award-winning project has been enthusiastically accepted by the customers it serves, due to the appreciable benefits the pressurized system has provided. These benefits, described in Section 7.1 of this AWMP, have prompted the District to fund a feasibility study to assess the costs and benefits of providing pressurized service District-wide. Initial feasibility study results indicate that benefits outweigh the costs if the District can transfer the water conserved by the project and use the transfer revenues to help cover the capital cost of the project. District-wide pressurization would implement all the EWMPs.

CONCLUSION

Development of this AWMP has provided SSJID with an opportunity to evaluate and describe its ongoing water management activities and to evaluate how these actions support the District's water management objectives, described above, as well as water use efficiency improvements from the State's perspective. As demonstrated in the Plan, SSJID is a local leader in water management and is committed to the ongoing evaluation and implementation of water management practices that meet water management objectives. In the future, SSJID will continue efforts to effectively manage available surface water and groundwater supplies.

Table ES-1. Summary of EWMP Implementation Status

Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
Critical (Mandatory) Efficient Water Management Practices				
10608.48.b(1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	Because SSJID is studying the feasibility of expanding pressurized service District-wide, similar to Division 9, including magnetic flow meters on SCADA at every turnout, the District limited implementation of the corrective action plan in 2014 to only those actions that would not be wasted if District-wide pressurized service is implemented. The feasibility study is scheduled for completion by the end of 2015 at which time the District will decide whether to pursue District-wide pressurized service with measurement, or to resume implementation of the corrective action plan, or a refined version of the plan. In the meantime, SSJID continues to install magnetic flow meters at selected pump deliveries through its on-farm water conservation program. More than 100 magnetic meters have been installed to date and are compatible with district-wide pressurized service should the decision be made to implement it.	
10608.48.b(2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented	SSJID adopted a pricing structure based in part on volume delivered on July 31, 2012. The new pricing structure includes a $3 per af charge to begin in 2014 in addition to the current $24 per acre flat rate charge. On September 22, 2015, the District modified the pricing structure by increasing the cost per af charge to $10 per acre for the volume used that is more than 48 inches. SSJID's Division 9 project charges a one-time fee to connect to the system and $30 per af for the first 3 af/ac $40 per af thereafter.	
Additional (Conditional) Efficient Water Management Practices				
10608.48.c(1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	"Lands with exceptionally high water duties or whose irrigation contributes to significant problems" are not known to exist within the SSJID service area. District Rule #10 in the rules and regulations governing the distribution of water within SSJID prohibit the wasteful use of water through the "...flood[ing] of certain portions of the land to an unreasonable depth or amount." Additionally, facilitation of alternative land use is beyond SSJID's jurisdiction; however, SSJID assists customers in implementing on-farm conservation measures, as described below.	
10608.48.c(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils	Being Implemented	1. M&I wastewater applied directly to SSJID irrigated lands.. 2. Ripon currently uses recycled water for irrigation of city parks and landscaping.	1. Continue existing use of recycled water within SSJID. 2. Consider requests from all qualifying permitted dischargers for additional use of recycled water.
10608.48.c(3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented	1. Cost sharing for irrigation improvements and services through On-Farm Conservation Program in 2011 through 2014. 2. Total financing of 2.8 million in 2011through 2014 with over 110 different landowners participating and 17,132 acres assisted.	1. SSJID will continue the On-Farm Conservation Program as soon as funds become available.
10608.48.c(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented	1. SSJID's volumetric charge promotes more efficient water use at the farm level and discourages excessive drainage (goals A and D). 2. Current pricing maintains low rates for surface water relative to groundwater pumping to promote conservation of groundwater through in lieu and direct recharge (goals B and C). 3. Division 9 project incentivizes more efficient irrigation systems and increases groundwater recharge in lieu and direct recharge (goals A through D). 4. Conservation Program increases use of surface water and efficient irrigation practices by encouraging growers who aren't District members to join to become eligible for incentives (goals A through D).	1. The District will review and assess its volumetric charge over time to ensure that identified water management objectives are being achieved.

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Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	1. Main Canal is unlined but provides beneficial groundwater recharge through seepage. 2. Maintain 312 miles of pipeline. 3. Maintain 38 miles of lined channel. 4. Maintain 18 miles of unlined channel. 5. Scheduled maintenance and/or replacement of infrastructure. 6. Constructed Van Groningen Reservoir in 1992. 7. Replaced a leaking 2,800 foot long flume with a 132-inch diameter siphon in 1992. 8. Constructed 5-acre SIDE reservoir and cross-lateral intertie pipeline in 2003. 9. Constructed 7-acre East Basin regulating reservoir as part of Division 9 project completed in 2012. 10. Constructed concrete lining of approximately 2,500 feet of the Main Distributary Canal (MDC) in the 2013 off season.	1. Connection of additional growers to Division 9 project. 2. Potential future construction of 7-acre West Basin reservoir within Division 9 based on determination of overall project benefit. 3. Replace approximately 4.5 miles of old pipeline and approximately1.6 miles of canal between 2015 and 2020. 4. SSJID continues to look for opportunities to expand their system capabilities and increase delivery flexibility through improvements.
10608.48.c(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented	1. Ongoing efforts to facilitate high frequency, low volume deliveries to pump customers using pressurized irrigation systems. 2. Division 9 project completed in 2012 provides pressurized water on an arranged demand basis to 90 customers irrigating 3,800 acres while also enhancing delivery service for remaining surface irrigators. 3. On-Farm Conservation Program helps improve District-grower coordination. 4. Construction of regulating reservoirs and intertie pipelines to increase flexibility and steadiness, especially to growers near the lower ends of the system.	1. Continue efforts to facilitate flexible delivery service to pressurized irrigation system through operational and infrastructure improvements. 2. Expansion of pressurized pipeline system in Division 9. 3. Evaluate continued funding of On-Farm Conservation Program on a year-to-year basis. 4. Evaluate and implement additional locally cost-effective actions to improve flexibility
10608.48.c(7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented	1. SCADA at all drop structures along the MDC provides real-time control to prevent spillage. 2. The Van Groningen Reservoir provides for collection and storage of spillage and re-regulation. 3. The East Basin Reservoir in Division 9 captures spillage from Divisions 7 and 8. 4. Campbell Drain (Division 2) collects operational spillage and tailwater and conveys it into the "B" lateral in Division 3 for reuse. 5. Where tailwater drains do not exist, growers may channel tailwater back into District pipelines for redistribution. 6. Intertie pipeline construction for redistribution of excess. 7. Accept tailwater at 36 locations along the upper portions of the MSC and MDC, including spillage and tailwater outflows from OID	1. Continued and expanded monitoring at spill sites to reduce spillage and develop representative data. 2. Continue to look for opportunities to expand tailwater and spillage prevention and recovery capabilities.

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Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented	1. Encourage use of available surface water supplies in lieu of groundwater through construction of pressurized irrigation systems. 2. Provide surface water at a lower cost than that of pumping groundwater. 3. Utilize 28 groundwater wells to augment surface water supplies and control shallow groundwater levels. 4. Constructed Division 9 project to provide pressurized surface water for irrigation to 90 customers through 19 miles of pipelines serving 3,800 acres. 5. Active Participation in local groundwater entities and initiatives including SGMA.	1. SSJID anticipates refining conjunctive management by further evaluating the underlying groundwater system through update of their groundwater management plan and/or other activities. 2. Finish constructing two groundwater wells to supplement water supply for East Basin.
10608.48.c(9)	Automate canal control structures	Being Implemented	1. Automation of all 24 lateral headings and all control structures on the MSC and MDC to improve customer service while reducing system losses. 2. Automation of the SIDE reservoir to maintain steady water supply to three adjacent laterals. 3. Implementation of an extensive SCADA system to provide communication, monitoring, and control of automated sites, including remote on/off control of 28 groundwater wells. 4. Automation of 19 miles of pipelines and deliveries to 90 customers farming 3,800 acres in Division 9.	1. SSJID will continue to evaluate opportunities for additional automation to increase delivery flexibility and steadiness and to reduce operational spillage.
10608.48.c(10)	Facilitate or promote customer pump testing and evaluation	Being Implemented	1. SSJID facilitates and promotes customer pump testing and evaluation by providing links on its website to programs that provide these services, such as offered by PG&E (http://www.pumpefficiency.org/).	1. Consider cost sharing for pump efficiency testing as part of its On-farm Water Conservation Program.
10608.48.c(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	1. SSJID added a permanent, full time water conservation coordinator in 2011.	1. Continue to employ a full time water conservation coordinator.
10608.48.c(12)	Provide for the availability of water management services to water users.	Being Implemented	1. SSJID provides for the availability of water management services through scientific irrigation scheduling and soil moisture monitoring conservation measures, for example, as part of its On-Farm Water Conservation Program. 2. Additionally, SSJID provides links to CIMIS and other water management information on its website and produces a periodic irrigation newsletter. 3. Historical water use data is available to growers in the Division 9 project. 4. In 2015 Drought Task Force to aid growers in improving on-farm irrigation efficiencies.	1. Continue current activities. 2. Provide regular water usage information as part of implementing volumetric billing. 3. Add SCADA monitoring to 100 magnetic flow meters measuring farm deliveries.
10608.48.c(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented	1. SSJID actively evaluates the effect of supplier (Reclamation) and Tri-Dam Project policies and operational practices and seeks policy changes to alleviate water supply constraints.	1. Continue current activities.

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Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented	1. Periodic evaluation and improvements of pumps by performing periodic pump efficiency tests to identify cost effective energy and/or water conservation improvements. 2. Replaced four of the 28 GW remediation pumps in the last 4 years 3. Maintain 7 pumps at the East Basin Reservoir and 5 at the SIDE Reservoir.	1. Continue testing and periodic refurbishment or replacement of pumps and motors. 2. Add any new pumps to the existing testing program.

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1. INTRODUCTION

This Agricultural Water Management Plan (AWMP or Plan) has been prepared by the South San Joaquin Irrigation District (SSJID or District) to describe the District's agricultural water management activities. This section provides a description of the District's rich history of regional water management over more than 100 years, a description of legislative requirements related to the contents of the Plan, and a summary of previous water management activities. The District's primary water management objective is to maintain a reliable, affordable, high quality water supply for agriculture and other uses. Water for irrigation is foundational to supporting agriculture, the economic engine of San Joaquin County. In 2013, $3.0 billion in agricultural commodities were produced in the County, providing a total economic impact of over $18 billion[2]. Key strategies employed by SSJID to support overall water management objectives are the conjunctive management of surface and groundwater supplies and water conservation.

Section 2 describes the process of preparing the Plan, including public outreach efforts. Section 3 provides a detailed background describing SSJID, its facilities, and the irrigation service area. Section 4 provides an inventory of SSJID's water supplies, which is followed in Section 5 with presentation of detailed water balances for the 1994 to 2014 period. Water balances are presented for five primary accounting centers as follows:

- Upper Main Supply Canal and Woodward Reservoir
- Lower Main Supply Canal and Main Distributary Canal
- District Laterals
- Irrigated Lands
- Drainage System

Potential climate change effects on weather and hydrology, impacts on water supplies, and adaptation strategies are discussed in Section 6. Section 7 describes SSJID's implementation of Efficient Water Management Practices (EWMPs) and includes an evaluation of EWMP implementation relative to SSJID's water management objectives and Water Use Efficiency (WUE) improvements in general.

This AWMP has been prepared in accordance with the requirements of the Water Conservation Act of 2009 (SBx7-7), which modifies Division 6 of the California Water Code (CWC), adding Part 2.55 (commencing with §10608),replacing Part 2.8 (commencing with §10800), and incorporating drought management plan satisfying requirements of Executive Order B-29-15.

[2] San Joaquin County Agricultural Commissioner's 2013 Crop Report. The estimated total economic value of $18 billion is based on the agricultural commissioner's estimated economic multiplier of 6.

1.1 SSJID HISTORY

SSJID was formed in 1909 and in 1910 purchased half interest in certain Stanislaus River water rights and facilities from two existing water companies. SSJID's sister district, Oakdale Irrigation District (OID) held the options on the rights and deeded half to SSJID through mutual agreement. Thereafter, the districts initiated expansion of their shared storage and respective distribution systems. OID and SSJID hold pre-1914 water rights for diversion of 1,816.6 cfs from the Stanislaus River at Goodwin Dam. Construction of New Melones Reservoir and Dam (completed in 1979, Figure 1-1) replaced the original Melones Dam, and operation was transferred to USBR, impacting the ability of the districts to store and divert water despite their senior water rights. In 1988 SSJID and OID entered into an operational agreement with USBR recognizing and protecting the rights of the districts. This agreement sets season limits on the quantity and timing of diversions by SSJID. The agreement provides the districts with the first 600,000 acre-feet (af) of inflow to New Melones annually as a first priority with special provisions in dry years, representing one of the most abundant and reliable water supplies in California.

Figure 1-1. New Melones Dam

With this secure and abundant water supply and revenues from power generation SSJID has accomplished infrastructure improvements and maintained the District's facilities over the last 100 years. Leadership and action by the Board of Directors and staff have maintained the integrity of the District's operational philosophy of providing high quality water for irrigation at affordable prices and have proactively sought physical and operational improvements to enhance irrigation service. SSJID is embarking on efforts to plan for the actions necessary to maintain and continue to enhance service while protecting local water supplies for generations to come.

Over the long history of irrigation in SSJID, cropping patterns have shifted from forage and feed crops grown to support dairy and livestock operations in the region to permanent orchard and vine crops. Although permanent crops, particularly almonds, represent approximately 72 percent of the irrigated acreage within SSJID, a variety of other crops continue to be grown. Double-cropped winter grains and corn represent approximately 9 percent of the irrigated acreage, and pasture represents 7 percent. Other crops include alfalfa, rice, berries, melons, tomatoes and clover. The SSJID distribution system infrastructure and operating policies evolved primarily to satisfy the needs of orchard crops, and are still generally adequate to meet those needs.

However, improved water delivery strategies are needed to satisfy the evolving irrigation needs of orchards and other specialty crops, particularly as they transition from surface irrigation to pressurized irrigation (microirrigation and sprinklers).

The SSJID Board and management recognize that continued assessment and update of the District's policies, procedures and facilities is needed. As a result, SSJID has initiated and completed several foundational efforts to support long term infrastructure planning. These efforts include the following:

- Hydraulic Study and Design of Improvements for the Main Canal in 1986, resulting in automation of the Main Supply Canal and the Main Distributary Canal;
- Water Management and Conservation Report in 1989, providing information on the sources, uses and disposition of surface and groundwater in the District along with current and planned conservation measures;
- Inland Surface Water Plan in 1992, describing the SSJID surface water system;
- Groundwater Management Plan in 1994, prepared in accordance with the California Water Code as amended by Assembly Bill 3030 (AB3030);
- Development and implementation of the System Improvements for Distribution Efficiency (SIDE) project in 2003, resulting increased flexibility for system operations and deliveries in the surrounding area;
- Development of the South County Water Supply Program (SCWSP) through a collaborative and cooperative effort between SSJID, Manteca, Escalon, Lathrop and Tracy to provide treated surface water to supplement the City's existing groundwater supply through the construction of the Nick C. DeGroot Water Treatment Plant (WTP), including a 35-mile concrete-lined steel supply pipeline to supply Manteca, Lathrop and Tracy. From 2005 to 2010, the WTP delivered a combined average of 15,700 af annually. The opportunity to provide supplemental water to municipalities was made .possible through SSJID's extensive conservation and water management efforts in the 1980's and 90's that resulted in significant reductions in spillage and increased system efficiency. These improvements increased flexibility and reliability in the delivery of water for irrigation;
- Development of a 15 year water balance for 1994 to 2008 in 2009, providing a benchmark of recent historical water use within the District to allow for assessment of current water management and planning and evaluation of future improvements;
- Preparation of a Joint Canal hazard study and completion of tunnel improvements on the Joint Canal and Upper Main Supply Canal between 2005 and 2010 totaling approximately $5 million;
- Development and implementation of a Flow Measurement Plan in 2010, including phased measurement improvements at boundary outflows, delivery measurement accuracy assessment, and pilot testing of delivery measurement alternatives;

- Acceleration of capital improvement projects from 2008 through 2010 to create local jobs and to take advantage of reduced construction costs;
- Installation and implementation of TruePoint water ordering software in 2009 to improve accounting of individual customer deliveries and support volumetric water charges.
- In 2011, the District licensed its own Federal Communications Commission (FCC) frequency and built eight (8) microwave towers to support the enhancement of its Supervisory Control and Data Acquisition (SCADA) system.
- Development and implementation of SSJID's On-Farm Water Conservation Program in 2011, providing direct incentives to SSJID irrigators to utilize available surface water supplies while implementing water conservation practices;
- Division 9 Project Completion in 2012, resulting in the availability of pressurized water for irrigators with arranged demand and online ordering, also reducing reliability on groundwater of lesser quality.
- District-wide Pressurization Feasibility Study beginning in 2014 to study feasibility of expanding the Division 9 pressurized system to all growers in the District.

Additionally, the District has completed several projects related to Woodward reservoir, including hydrologic, capacity, and dam safety studies as well as various improvements to reduce reservoir losses.

1.2 REQUIREMENTS OF SBX7-7

The Water Conservation Bill of 2009 (SBx7-7 or Bill) amends the California Water Code (CWC) Division 6 with regards to agricultural and urban water management by adding Part 2.55 (commencing with §10608) and replacing Part 2.8 (commencing with §10800). In particular, SBx7-7 requires all agricultural water suppliers to prepare and adopt an AWMP as set forth in the Bill on or before December 31, 2012. The plan must be updated by December 31, 2015 and then every 5 years thereafter (§10820 (a)).

Additionally, the Bill requires suppliers to implement certain efficient water management practices (EWMPs). Specifically, under §10608.48 of the CWC, all agricultural water suppliers are required to implement the following "critical" (i.e., mandatory) EWMPs:

(1) Measure the volume of water delivered to customers with sufficient accuracy to comply with subdivision (a) of §531.10.
(2) Adopt a pricing structure for water customers based at least in part on quantity delivered.

Further, suppliers are required to implement the following "additional" (i.e., conditional) EWMPs, if they are locally cost effective and technically feasible:

(1) Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.

(2) Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.
(3) Facilitate financing of capital improvements for on-farm irrigation systems.
(4) Implement an incentive pricing structure that promotes one or more of the following goals:
    (A) More efficient water use at the farm level.
    (B) Conjunctive use of groundwater.
    (C) Appropriate increase of groundwater recharge.
    (D) Reduction in problem drainage.
    (E) Improved management of environmental resources.
    (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.
(5) Expand or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance, and reduce spillage.
(6) Increase flexibility in water ordering by, and delivery to, water customers within operational limits.
(7) Construct and operate supplier spill and tailwater recovery systems.
(8) Increase planned conjunctive use of surface water and groundwater within the supplier service area.
(9) Automate canal structures.
(10) Facilitate or promote customer pump testing and evaluation.
(11) Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress reports.
(12) Provide for the availability of water management services to water users. These services may include, but are not limited to, all of the following:
    (A) On-farm irrigation and drainage system evaluations.
    (B) Normal year and real-time irrigation scheduling and crop evapotranspiration information.
    (C) Surface water, groundwater, and drainage water quantity and quality data.
    (D) Agricultural water management educational programs and materials for farmers, staff, and the public.
(13) Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.
(14) Evaluate and improve the efficiencies of the supplier’s pumps.

Agricultural water suppliers not in compliance with the Bill are not eligible for state water grants or loans.

A compliance checklist has been prepared that provides cross reference of Sections in this AWMP to applicable sections in the CWC to ensure compliance. This is included at the beginning of the Plan following the resolution of adoption, just before the executive summary.

1.3 OTHER WATER MANAGEMENT ACTIVITIES

SSJID is involved in a variety of other water management activities at local, regional, and state levels. These activities include the following:

- **San Joaquin County & Delta Water Quality Coalition (www.sjdeltawatershed.org).** The District is a member of the San Joaquin County and Delta Water Quality Coalition under the Irrigated Lands Regulatory Program of the State Water Resources Control Board. The San Joaquin County & Delta Water Quality Coalition was established to help irrigated agriculture meet the requirements of the California Regional Water Quality Control Board's (RWQCB) Irrigated Lands Regulatory Program (ILRP) in San Joaquin County, Calaveras County and Contra Costa County. Under the ILRP that was originally adopted in July of 2003, farmers and ranchers that irrigate their land and have runoff from that irrigation or rainfall must belong to a coalition or apply for an individual discharge permit from the Regional Board directly. Prior to joining the coalition in 2010, SSJID filed as an individual discharger under the program and collected its own water quality information beginning in 2004.
- **Tri-Dam Project and Power Authority (www.tridamproject.com).** The Tri-Dam Project is a partnership between SSJID and OID that developed and now operates and maintains two reservoirs above New Melones Lake and one reservoir below the Lake on the Stanislaus River. The reservoirs are operated for irrigation water supply and power generation, as well as for recreation and water sports. Tri-Dam Power Authority is a joint powers authority of SSJID and OID that owns and operates the Sand Bar power generation plant above New Melones Lake.
- **Save the Stan (savethestan.org). '**Save the Stan' is a public education and outreach program of SSJID and OID to gain support to minimize unimpaired flows and pulse flows in the Stanislaus River. The purpose of the program is to inform the public about the NOAA Biological Opinion (BO) for the protection of Central Valley steelhead from the operations of New Melones Reservoir. Sponsors of the website state increasing pulse flows and unimpaired flows in the Stanislaus River reduces available water supply for surrounding agriculture and municipalities with little benefit for fish.
- **San Joaquin Tributaries Authority (calsmartwater.org).** The San Joaquin Tributaries Authority is a coalition of SSJID with Merced Irrigation District, Modesto Irrigation District, Oakdale Irrigation District, Turlock Irrigation District, and the City and County of San Francisco with the mission of promoting sound, environmentally responsible solutions to water supply management within a framework that recognizes the historic rights of its member agencies and the concerns of ratepayers.

Prior to adopting the 2012 AWMP, SSJID prepared a Water Management/Conservation Information Report in 1989 in accordance with the Agricultural Water Management Planning Act of 1986, Assembly Bill 1658, Part 2.8 added (commencing with Section 10800) to Division

6 of the California Water Code. Various other water management activities are listed and described in Section 1.1.

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2. PLAN PREPARATION

2.1 AWMP PREPARATION

As described previously, this AWMP has been prepared in accordance with SBx7-7.

2.2 PUBLIC PARTICIPATION

Public participation in the development of this Plan included:

- Notification of the County of San Joaquin, the City of Manteca, the City of Ripon, and the City of Escalon of SSJID's intent to prepare an AWMP on November 10, 2015;
- Publication in the Manteca Bulletin on November 10, 2015 and November 17, 2015 of the time and place of a hearing to review the draft Plan;
- Posting of the draft Plan on the District's web page on November 10, 2015, including instructions for reviewers to submit comments;
- Posting of the draft AWMP for public review on November 10, 2015;
- Review of the publicly noticed presentation of the draft Plan at a regularly scheduled Board of Directors meeting on November 24, 2015;
- Adoption of the final AWMP at a regularly scheduled Board of Directors meeting on December 16, 2015; and
- Provision of copies of the adopted AWMP to the following parties within 30 days of adoption:
    - Cities of Manteca, Ripon, and Escalon
    - County of San Joaquin
    - San Joaquin County Library
    - Local Agency Formation Commission (LAFCO) of San Joaquin County
    - California Department of Water Resources
    - California State Library

The public is invited to attend all Board meetings with time reserved on each agenda for public comments. The Board members are accessible to the public. The District has a web site (www.ssjid.com) where the agendas of all Board meetings are published along with the most recent Board minutes, newsletters and other important information. Comments can be submitted via e-mail.

The District distributes a newsletter periodically to publicize important issues. The District maintains an open exchange of information with local newspapers and issues press releases on matters of importance to the public. The District also relies on its Division Managers (DMs) to keep customers informed of the latest water management information.

2.3 REGIONAL COORDINATION

The District coordinates operation of the Tri-Dam Project cooperatively with OID and coordinates with neighboring agencies, as appropriate; however, SSJID does not plan to develop a regional AWMP at this time due to differences in the institutional, physical, and operational characteristics of each district.

3. BACKGROUND AND DESCRIPTION OF SERVICE AREA

3.1 FORMATION

SSJID was organized in 1909 under the California Irrigation District Act – originally called the "Wright Act" – which provided for the organization of irrigation districts, for the acquisition or construction of irrigation facilities, and for the distribution of water for irrigation purposes. The Wright Act was approved March 31, 1897, (Statutes 1897, p. 254 et seq.).

The ditch system that later gave birth to SSJID and OID was developed by miners in 1855 as means to divert water from just above the current location of Goodwin Dam for mining and domestic water supply in areas around Knights Ferry (Marvin 2006). The San Joaquin County Water Company later acquired the diversion rights and the existing "Knights Ferry Ditch" and made efforts to expand the ditch system to the west for irrigation. Foreclosure prompted the sale of the rights to a local landowner named Abraham Schell in 1856. In 1888, Mr. Schell relinquished ownership to the newly formed San Joaquin Land and Water Company who, as early as 1864, had planned to extend the ditches and build a county-wide distribution system that would supply both water and power. Construction and funding for the enterprise proved to be difficult. With approximately $170,000 already spent on construction, tensions amongst the Company prompted the stockholders to relinquish ownership to H.W. Cowell and his partner, N.S. Harrold who both owned the Stanislaus and San Joaquin Water Company. Being large landowners, Cowell and Harrold were self-interested in developing a reliable water supply for irrigation and other uses and had the necessary capital to undertake the massive project of tunnel, ditch, dike, and flume construction.

Between 1888 and 1905 the ditch system was extended southwesterly towards modern-day Lathrop, in part by way of Lone Tree Creek, and northerly through Little Johns Creek toward Farmington and irrigated approximately 6,000 acres in what is now SSJID as well as small landholdings near Oakdale (Greene 1895). Although there were many important figures in the system development, much of the system's expansion and eventual success can be traced back to Mr. Charles Tulloch.

In the early 1860's the Tulloch Family, who owned a flour mill in Knights Ferry, acquired the upper portions of the original Knights Ferry Ditch to power their mill and constructed a new diversion dam just below the existing Tulloch Dam. Charles Tulloch was an early member of the San Joaquin Land and Water Company and saw the great potential in controlling the water supply for irrigation and electrical generation. With the ownership of the Knights Ferry Ditch, Mr. Tulloch built the first hydroelectric powerhouse on the Stanislaus River and incorporated the Stanislaus Water and Power Company to supply power to Knights Ferry, Oakdale, and rural Modesto. In 1899, Mr. Tulloch and three other prominent local businessmen and landowners organized the Stanislaus Water Company and purchased the entire Knights Ferry Ditch, including all water rights and partially completed facilities, from the financially troubled

Stanislaus and San Joaquin Water Company at auction for $27,300. The Company expanded the ditch length to reach near Lathrop, increased its capacity, and installed improved concrete infrastructure. Under the Tulloch Family interests, the ditch system continued to supply irrigation and domestic water services under the South San Joaquin Canal and Irrigation Company and the Consolidated Stanislaus Water and Power Company.

The limited capacity of the "Tulloch Ditch" was not enough to supply the growing demand, and landowners were not willing to fund the construction of a larger system if the water rights were privately held. In March of 1909, local landowners Joshua Cowell, F.A. West and P.E. Lunstrom petitioned the San Joaquin County Board of Supervisors to form the South San Joaquin Irrigation District under the Wright Act and to authorize a bond issue of $1,875,000 to purchase the Tulloch Ditch and to start the construction of new, larger infrastructure to supply the roughly 70,000 acres that the District would encompass. An election was held on May 11, 1909 and voters overwhelmingly supported formation of the District (396 to 67) and elected the first Board of Directors (German 1942).

After the task of legal formation was complete, the Board of Directors adopted a plan for constructing the necessary canals and works and acquiring the necessary property and rights to carry out the provisions of the act under which it was created. Additional bond issues were called for by the Board during the initial construction of the system and again during the first few years of operation. The Board also had the power to levy taxes and land assessments within the service area to pay for expenses and to repay the bonds.

A more detailed description of the history of the development of the District's surface water supply is provided in Section 4: Inventory of Water Supplies.

3.2 DISTRICT ORGANIZATION

The District is organized into five divisions with each division being represented by a director who is elected for a four-year term by the landowners residing within the division. Elections are held every two years so that terms are staggered and only two or three of the directors' seats are subject to election at any one time. The Board of Directors elects a Board President to run the meetings and a Vice-President to serve if the Board President is unavailable. The Board President serves for a two-year term. The five Directors of the SSJID also serve as board members on the "Joint Board of Directors" for the Tri-Dam Project and as commissioners of the Tri-Dam Power Authority Board together with the OID board of directors.

The General Manager is appointed by the directors and is principal administrative officer of the District, additionally serving as Secretary to the Board of Directors. The Assistant General Manager, Engineering Department Manager, Utility Systems Director, Operations and Water Superintendent, and Water Treatment Plant Manager report to the General Manager. Currently, there are 87 full-time District employees with six employees in Administration, four employees in Accounting, six employees in Engineering, 25 in Water Operations, 21 in Operations and Maintenance and 19 that operate the water treatment plant[3] . An organizational chart of the District is provided in Figure 3-1.

3.3 SIZE AND LOCATION OF SERVICE AREA

The District is located in the northeastern portion of the San Joaquin Valley, approximately 15 miles southeast of Stockton and 11 miles north of Modesto, encompassing the cities of Manteca, Escalon and Ripon (Figure 3-2). All irrigated lands are located north of the Stanislaus River in southeastern San Joaquin County. Woodward Reservoir, approximately 6.5 miles of the Lower Main Supply Canal, and 10.5 miles of the Upper Main Supply Canal are located in Calaveras County. The remaining 2.5 miles of the Joint Supply Canal (to Goodwin Diversion) are located in Tuolumne County. Modesto Irrigation District (MID) lies to the south, OID lies to the east, the South Delta Water Agency lies to the west, and the Central San Joaquin Water Conservation District (CSJWCD) and Stockton East Water District (SEWD) lie to the north.

The District encompasses approximately 72,000 acres, of which approximately 53,000 acres were irrigated in 2014, the last year for which the SSJID water balance was updated.

[3] Number of employees from 2015 SSJID Organization Chart.

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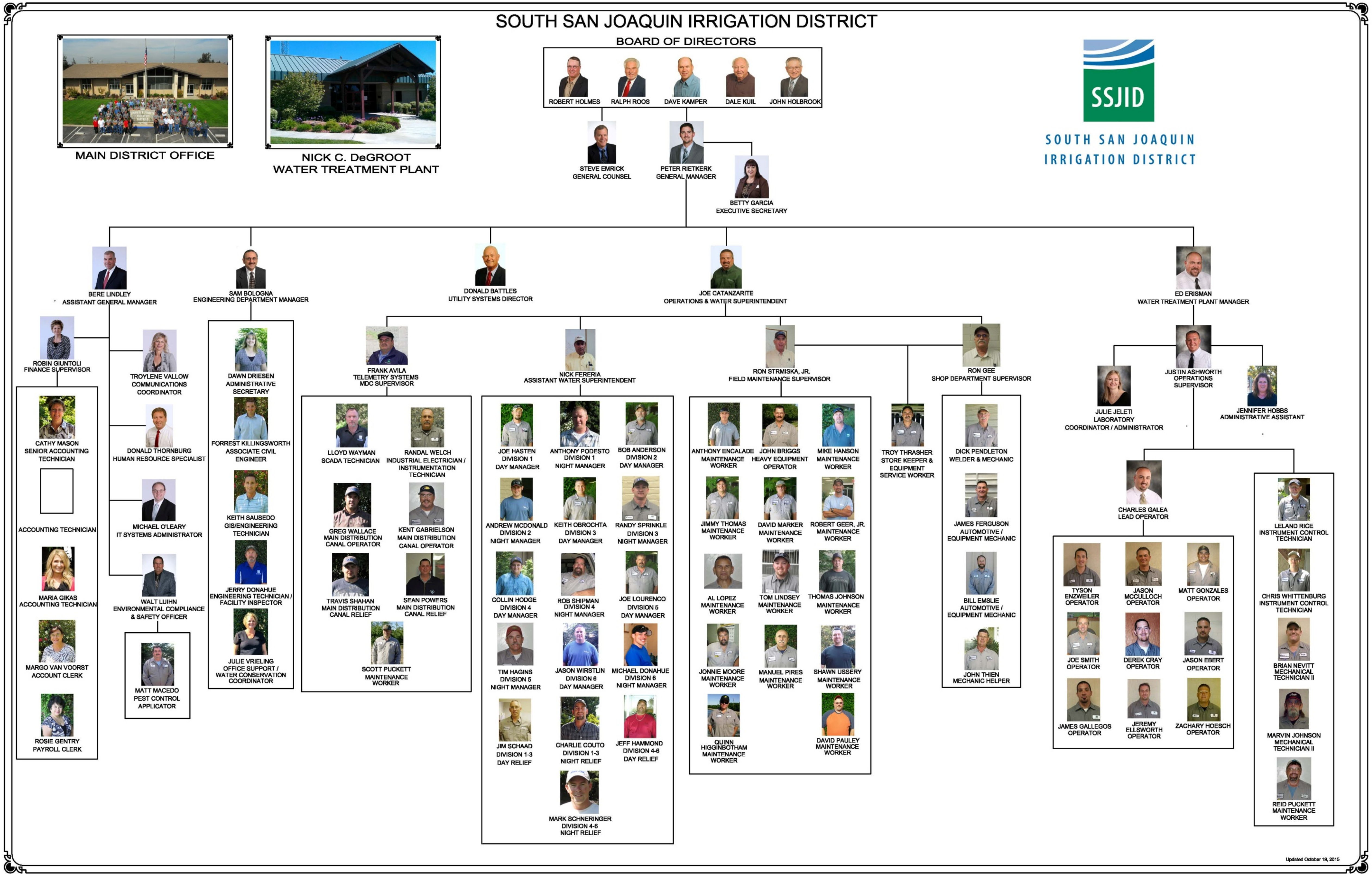

Figure 3-1. SSJID Organizational Chart

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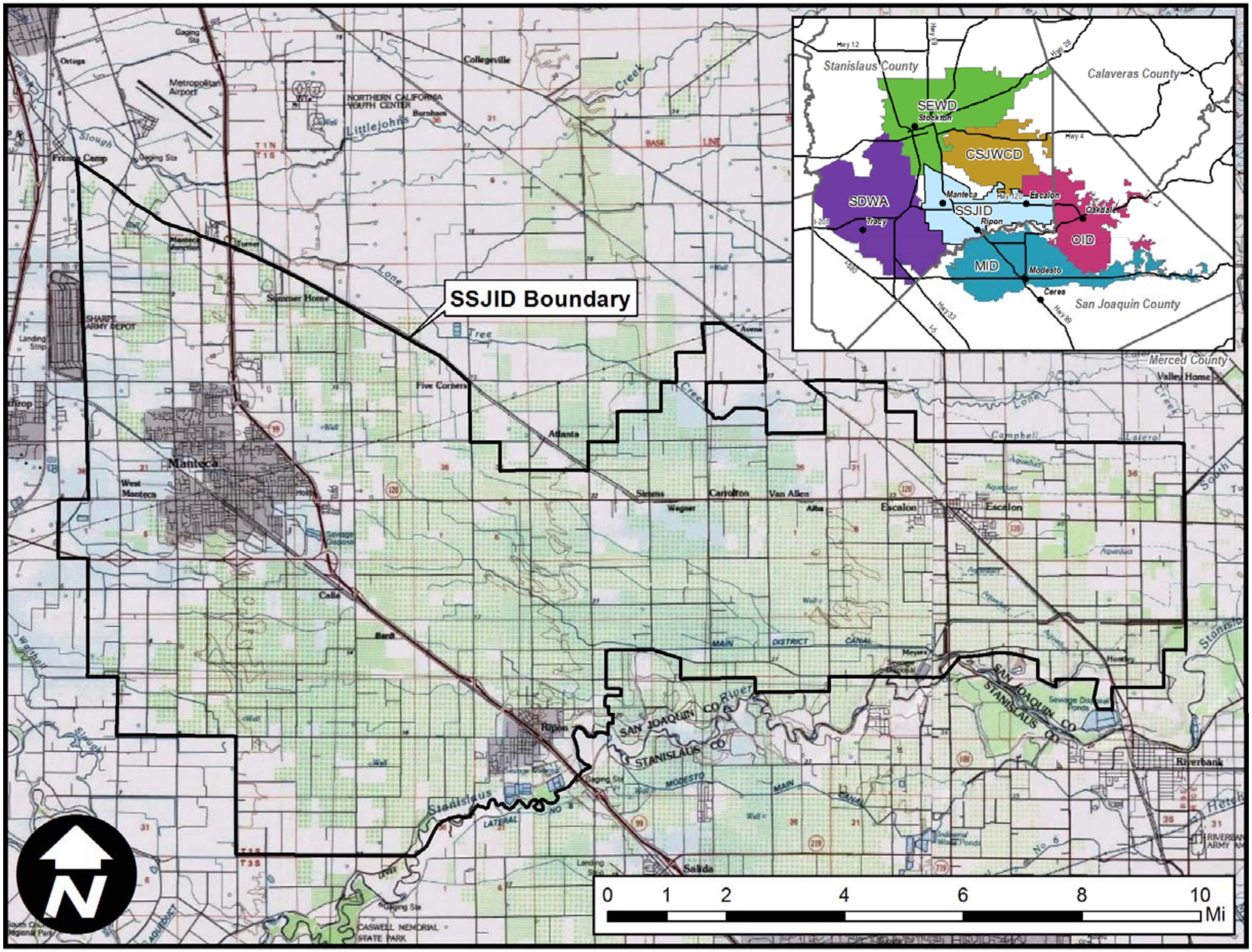

Figure 3-2. SSJID Location Map

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3.4 SSJID DISTRIBUTION SYSTEM

SSJID diverts water from the Stanislaus River at Goodwin Dam into the Joint Main Canal on the north side of the River. The Joint Main Canal was constructed and is owned and operated by SSJID and OID with 72 percent of the capacity intended for SSJID and 28 percent intended for OID. OID also has a second diversion channel on the south side of the River. Approximately 3.5 miles downstream of Goodwin Dam, the Joint Main Canal bifurcates into OID's North Main Canal and SSJID's Upper Main Supply Canal (UMSC, Figure 3-3). The UMSC is the sole conveyance serving Woodward Reservoir, all of SSJID's irrigated area, and the Nick C. DeGroot water treatment plant (dedicated in 2005 and currently serves the cities of Manteca, Tracy, and Lathrop). After the split with the OID's North Main Canal, the UMSC continues westward, traveling through 11 tunnels and siphons for approximately 10 miles. The largest of these siphons, Hilts' Sag, was originally a 2,200-foot long wooden flume structure that bridged a natural gap at a maximum height of 68 feet from the ground and also crossed OID's North Canal. A fire in 1917 and mud slide in the early 1920's damaged the wooden truss and flume, temporarily delaying service (German 1942). Shortly thereafter the flume was replaced with a precast concrete structure that stood until 1993 when it was replaced with an underground siphon for earthquake safety concerns.

Figure 3-3. SSJID Upper Main Supply Canal

The UMSC terminates at Woodward Reservoir (Figure 3-4). The District constructed the 36,000 acre-foot Walter J. Woodward Reservoir in 1916 to provide much needed storage and regulation of diversions and as a safeguard against drought. Today, the reservoir continues to serve these purposes and has been a key feature allowing delivery flexibility and enhancing SSJID's water conservation capabilities.

Figure 3-4. Woodward Reservoir

Controlled discharges from the reservoir are channeled in the Lower Main Supply Canal (LMSC) which travels first westward for two miles and then south for an additional two miles before turning southwest and traveling 2.2 miles to the headings of laterals A, B, and B15 and the first of 14 automated check structures (locally referred to as "drop structures"). At this point the canal enters the irrigation service area and the LMSC becomes the Main Distribution Canal (MDC), travelling south for 2.2 miles and creating the eastern-most boundary of the District. The MDC supplies four more lateral headings before turning west for the final 10 mile stretch and supplying the remaining 17 lateral headings. The MDC is capable of handling flow rates up to 900 cfs.

Water is delivered to 1,400 landowners and 3,500 parcels through more than 1,500 delivery points served by approximately 350 miles of laterals off of the main canals. Originally, the entire lateral system consisted of open, unlined ditches. Over time, selected laterals and lateral reaches have either been concrete lined or placed in low-head, cast-in-place (CIP) concrete or PVC pipelines. To reduce maintenance requirements, erosion, and seepage losses below Woodward Reservoir, many canals and ditches in the distribution system were lined with concrete in the 1920's with funding from a $550,000 bond measure passed in 1923. In the 1960's a low interest loan obtained through the USBR's P.L. 984 program allowed the replacement of 210 miles of open channel with buried concrete pipe. The majority of replacement pipe was cast-in-place (CIP). Additionally, related standpipes and water control structures were replaced to enhance operability and conserve additional water. The pipeline system is considered an "open" system meaning that it has open control and junction boxes that minimize pressurization of the line.

At the present time, approximately 312 miles of the District's laterals are pipelines and 38 miles are open, concrete-lined ditches. The only unlined open channel is the 18-mile length of the MDC. Although seepage from the unlined MDC generates beneficial groundwater recharge, concerns over embankment erosion prompted the construction of approximately 2,500 feet of concrete lining between drop structures 1 and 3 completed before the start of 2013 irrigation season.

The main canal and lateral distribution system remains upstream controlled as originally constructed, although completion of the Van Groningen Regulating Reservoir in 1992 near the terminus of the MDC; the Northwest Reservoir, constructed in 2003 on the R Lateral as part of the System Improvements for Distribution Efficiency (SIDE) Project; the complete automation of the Main Distributary Canal; and the East Basin (part of the 2012 Division 9 Project) enable flow changes to be made more readily than before. The reservoirs are operated to increase delivery flexibility to water users while also reducing operational spillage by reducing mismatches in diversion and delivery volumes. Additionally, the reservoirs provide for steadier flow to downstream laterals, improving the steadiness of farm deliveries and allowing efficiency improvements on-farm, including installation of pressurized irrigation systems that utilize surface water. Reservoir storage fluctuates daily with the objective of operating within the middle one third of the capacity. To achieve the highest operational benefit from the reservoirs SSJID installed six Rubicon Water FlumeGates® (Figure 3-5) and four AquaSystems2000

LOPAC® gates that can be set to maintain a specific passing flow rate or to maintain constant upstream water level. The automated gates were installed at select lateral headings to help propagate flow changes and excess water to the SIDE and East Basin reservoirs and to improve delivery service. The technologically advanced gates are designed to integrate seamlessly into the District's SCADA system and provide real-time monitoring and remote control.

Figure 3-5. Flume Gates at Lateral Heading

After years of faithful service, the MDC and its structures underwent a major overhaul that started in 1986 and was largely completed by 1989. SSJID has continued its commitment to MDC modernization as demand changes and new technologies emerge. Old concrete and wooden grade board structures were replaced with state-of-the-art concrete structures fitted with new electrically-operated gates allowing automation and monitoring of the upstream water level through a supervisory control and data acquisition (SCADA) system. MDC check structures were replaced with drop-leaf overshot gates, and lateral headings were replaced with undershot sluice gates. The simultaneous addition of physical and operational tools has provided system operators with real-time monitoring of operational pools, water travel times, and lateral delivery flow rate that has reduced tailend spillage and increased the quality of delivery service.

Four subsequent SCADA upgrades and projects were completed from 1999 through 2003 including remote control and improved flow measurement at all 27 lateral headings to better control irrigation deliveries, to reduce spillage, and to simplify operations. Automated upstream water level control in the MDC near the lateral headings maintains constant upstream head pressure on lateral heading gates and, assuming downstream conditions are not changing, makes positioning undershot gates at the lateral headings and direct deliveries from the MDC a function of the desired flow rate. A SCADA base station and master control center was constructed in 1996 near the Van Groningen Reservoir to house the control computers and MDC/SCADA operation staff (Figure 3-6). The control center serves as the central hub for monitoring, control, communications, and operational coordination. In recent years SSJID expanded the SCADA system to include 18 newly constructed flow measurement devices in boundary drains. Detailed, real-time records of system inflows and outflows is an invaluable resource in furthering SSJID's water management goals and enabling irrigation performance improvement. In 2011, In the District licensed its FCC frequency and built eight (8) microwave towers to enhance the SCADA system.

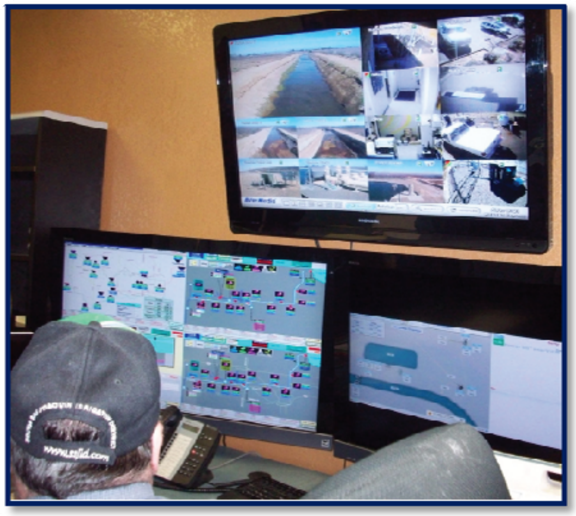

Figure 3-6. SCADA Control Center

With precise control of system inflows, SSJID has concentrated recent efforts more heavily on the lateral distribution system. Most notable is the Division 9 Surface Water Supply Project initiated in 2008 and completed in time for the 2012 irrigation season. The project is the first pressurized pipeline network as part of the District's distribution system and incorporates state-of-the-art technologies and water management features. The project provides pressurized surface water to a portion of the District west of Ripon (Division 9) that has a high frequency of permanent crops and micro irrigation systems but was predominately irrigating using groundwater. The project alleviated concerns of saline groundwater being used for irrigation and increased direct and in-lieu groundwater recharge thus helping to prevent overdraft of the underlying aquifer. The system includes a regulating reservoir, termed the East Basin (Figure 3-7); a pumping plant with seven pumps; 19 miles of pipeline that serves 90 customers and 3,800 acres; automatic flow control valves and magnetic flow meters at each turnout; soil moisture sensors in growers' fields; and online water ordering. The district is in the process of drilling two supplemental wells to supply the East Basin. Each well will be screened at different depths to withdraw water from two different aquifer layers. At the pump station, variable frequency drive (VFD) pump controllers allow precise flow rates to be provided without wasting energy. The pumps pressurize water from the East Basin, providing 50 to 60 pounds per square inch (psi) at the turnouts, eliminating the need for booster pumps to operate pressurized irrigation systems. SSJID plans to expand the Division 9 project, including the construction of a second reservoir to be called the West Basin. As mentioned earlier, the District is studying the feasibility of expanding pressurization to the entire District; however, the District is currently unable to finance the expansion due to DWR not approving water transfers.

The pressurized network provides obvious benefits, especially with the growing number of pressurized irrigation systems, and the District will evaluate whether it is feasible to construct other networks in the future. Originally, the distribution system was designed to provide irrigation water to growers using graded border, graded furrow, and level basin surface irrigation methods. As such, delivery structures to individual fields commonly consist of large valves spaced evenly on a pipeline running

Figure 3-7. Division 9 East Basin

along the head of the field (Figure 3-8). In many cases, the valves are installed directly in the SSJID lateral pipeline. A downstream control structure or "check box" allows the Division Manager to deliver all or a portion of the flow out of the upstream irrigation valves. Where the field heading is not aligned with the lateral pipeline, an orifice gate in a check box is typically used to deliver to a private pipeline that serves the field. In this configuration, surface irrigators typically apply irrigation water directly to their field via irrigation valves installed in the private pipeline, while pump irrigators use a concrete sump box to provide limited storage to help compensate for mismatches between the delivery flow and the pump flow. The system has been successfully adapted to provide service to pump deliveries, mainly through off-lateral sumps, but does have restrictions and has required the continual evolution of the District's delivery and flow measurement policies and practices. Measurement of deliveries is described in detail in Section 3.8.

Figure 3-8. Surface Irrigation Valves

The District maintains 60 miles of dedicated drainage ways of which 23 miles are buried pipelines, and the remainder are unlined or lined open ditches. There is only one main drain entering the District, Lone Tree Creek. Drainage generally flows westerly to the San Joaquin River or northerly to Lone Tree Creek. Any southerly drainage flows into the Stanislaus River. The French Camp Outlet Canal (FCOC) runs south to north along the District's western boundary and is the main collector of drainage flows (Figure 3-9). SSJID often redirects drain water back into the distribution system to augment water supply and to improve service through increased flexibility. Two emergency spill sites exist on the MDC near Ripon and Escalon that discharge to the Stanislaus River, if needed. In the past these spills have served as operational balancing tools on occasion when OID tailwater entered the system, but more recently the construction of regulating reservoirs, increased automation, and expanded control has limited the need for these spills. The FCOC is used, in addition to the Escalon Spillway, to make releases for maintenance of in-stream flows in coordination with USBR.

In addition to providing drainage to agricultural lands, SSJID has entered into contractual agreements with the cities of Manteca and Escalon to discharge urban storm run-off to the drains both by gravity flow into the open ditches and via drainage pumps that discharge into SSJID distribution pipelines or canals. Urban expansion has left some SSJID conveyance facilities running unused though developments and under neighborhoods. These facilities are decommissioned by SSJID or relinquished to the city for stormwater use. An example is the Tb lateral that runs through the western portion of Manteca and used almost exclusively by the City to collect runoff.

Figure 3-9. French Camp Outlet Canal

SSJID owns and operates 28 groundwater production wells predominately located in the western half of the District. The wells are operated for control of the high groundwater table that exists in this portion of District and to provide supplemental water supply.

In addition to providing water for irrigation, SSJID also provides treated surface water to the cities of Manteca, Lathrop and Tracy for domestic use. Phase I of the Nick C. DeGroot Water Treatment Plant (WTP) was completed in 2005 just below the Woodward Reservoir Dam and receives water directly from the lower Main Supply Canal (Figure 3-10). Water allotments for each city were established for Phase I and for Phase II. Phase II of the project will extend service to Escalon. Ripon currently receives raw untreated surface water from SSJID and is negotiating for treated water service.

Figure 3-10. Nick C. DeGroot Water Treatment Plant and Robert O. Schulz Solar Farm

The WTP is part of the larger South County Water Supply Project which includes the pipeline distribution system. Domestic water outtakes are measured by an electromagnetic flow meter. The sale of surface water for domestic uses was made possible because of the loss of agricultural land to urbanization and through SSJID's investment in system improvements (described in preceding sections) which resulted in water conservation. Because of these improvements irrigation deliveries are not affected by the additional water demands of the WTP, and agreements with the Cities are such that domestic deliveries receive the same percentage of allocation reductions during drought years.

SSJID completed the Robert O. Schulz Solar Farm at the WTP in 2008. The solar project, including nearly 7,000 photovoltaic panels installed on 14 acres of land offsets the power used to operate the WTP, reducing electrical costs by approximately $400,000 per year.

A map of the District's water management facilities is provided in Figure 3-11 on the following page.

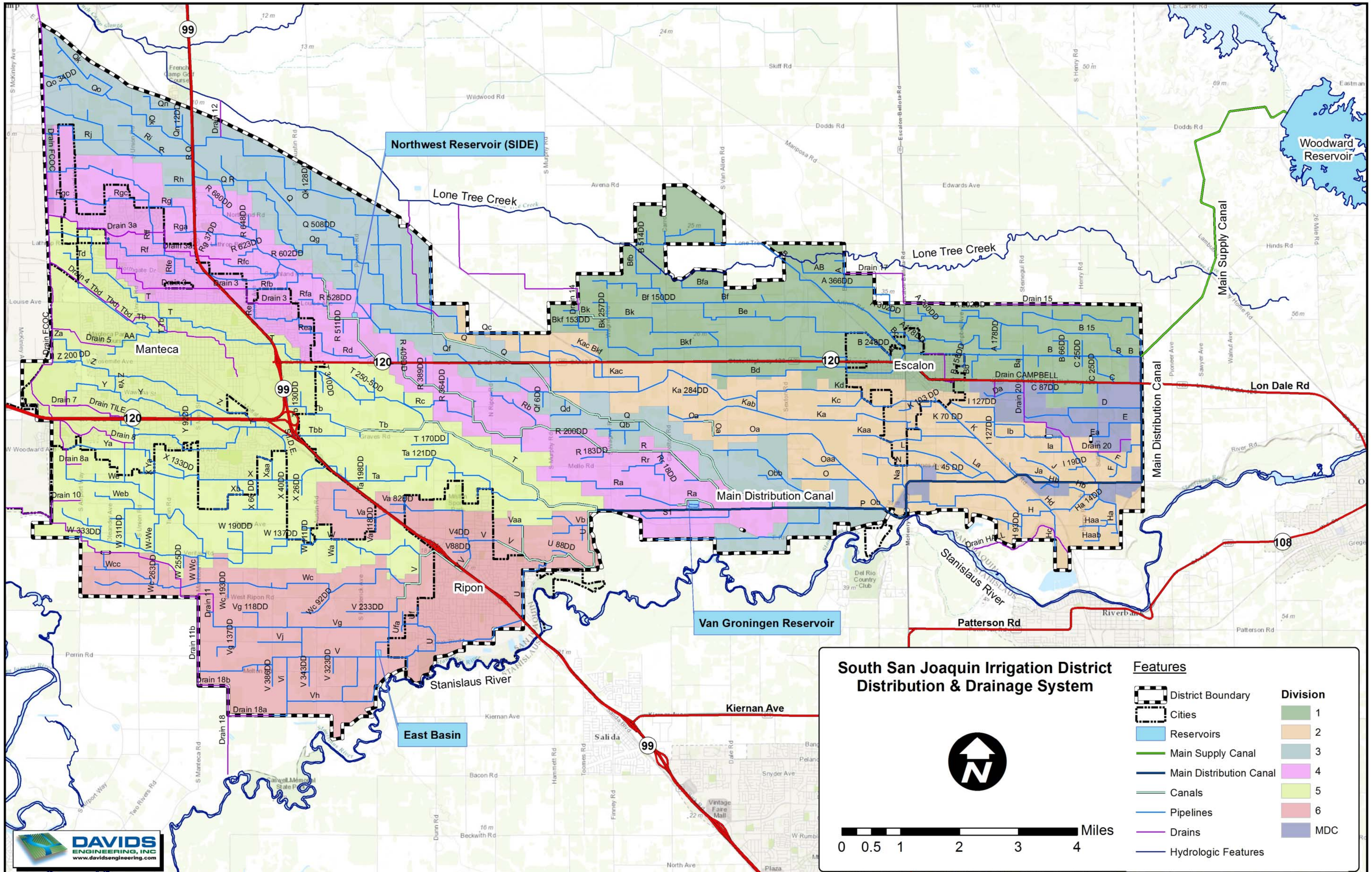

Figure 3-11. SSJID Irrigation and Drainage Facilities

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The District is currently divided into seven operational divisions. The divisions operate under the supervision of the Assistant Water Superintendent, who reports to the Operations and Water Superintendent. Within divisions, actual field operations are executed by Division Managers (DMs) (Figure 3-12). SSJID currently employs a total of 22 DMs, including eight to cover the regular day shift, three for relief day shift, eight to cover the regular night shift, and three for the relief night shift.

Based on the District's TruePoint electronic delivery tracking data for 2011 (described in greater detail below), division size ranges between 4,786 acres and 6,075 acres and averages 5,300 acres. The number of parcels per division ranges between 183 and 394 and averages 260. The average parcel size ranges between 15 and 27 acres and averages about 21 acres. The divisions have been delineated to achieve uniform division of workloads among DMs. To the extent possible, divisions are organized so that DMs have control of their water from the main lateral heading to the tail of their respective laterals. There are cases, however, where water is passed through one division to the next, rather than being delivered directly from the Main Canal. In these cases, the upstream DM provides a steady flow rate to the downstream DM according to the daily operations plan.

Figure 3-12. SSJID Division Manager Measuring Flow

SSJID has historically delivered water on a rotational basis. The distribution system and operating procedures are designed around a 10 day average rotation[4]. The season begins typically in mid-March to early April and continues until early to mid-October. The rotation frequency may vary slightly by division based on crop types, irrigation methods or user requests. DM's may operate two separate rotation frequencies to cater to specific needs.

Historically, DMs have used "rotation sheets" to organize water deliveries. One rotation sheet is prepared for each lateral (or rotational unit), with the customers listed on the sheet in the order in which they will receive water. This order is referred to as the delivery "run". Important information about each customer is also provided on the sheet, including the customer's name, address, phone number, customer name and phone number, crop type, assessor's parcel number, irrigated acreage, number of hours to receive irrigation water, and delivery flow rate. As part of the modernization process, SSJID transitioned to TruePoint data collection software program in 2010 to digitally record delivery flow rate and start and stop times (duration) on laptop computers mounted in the DM's pickup

[4] Rotations of 14 or 20 days are provided by some DMs in some divisions as warranted based on customer needs.

trucks. The data is downloaded to a central computer at the main office once per day. The TruePoint water ordering and tracking system is discussed further in Section 3.8.

Each division has a cellular phone that is used to notify customers of when they will receive irrigation water and to whom to pass the water when their turn is complete, if applicable. The cellular phones are passed back and forth between the day shift and night shift DMs so that customers have only one number to call per division, any time of the day or night. Customers typically call to request schedule changes or to report unusual conditions such as delivery interruption. Prior to the start of a rotation, the DM calls each customer in the rotation to see if they would like water. Users can confirm their order or pass until the next rotation. The rotation schedule is adjusted accordingly. Permanent crops are often irrigated throughout the irrigation season while irrigation for field crops, alfalfa, etc. may begin later based on crop-specific water needs.

Each DM is responsible for determining how much water their division will need on at least a daily basis and requesting that amount from the control room operators. Typically the required flow rate is predetermined due to the nature of a rotational delivery system or is limited by the lateral capacity. However, the control room schedules two times during the day that flow rate changes can be made at the lateral headings off of the MDC and prefers that the DMs make their requests accordingly; however, automated gates and remote control allow changes to be made more frequently during the height of the season based on changes in customer demand. Communication between DMs and with headquarters is facilitated by a two-way radio system and cell phones.

The control room operators total the division requests, calculate the change from the current flow rate and initiate changes in diversions at Woodward Reservoir. The releases from Woodward Reservoir and many of the lateral headings off the MDC are remotely controlled through the District's SCADA system by staff in the control room. Based on the DM's request, and accounting for travel time from the dam, the control room will remotely adjust the lateral heading to deliver the requested flow rate at the requested time. Gates not on the MDC are typically adjusted by the DMs. The DMs may also cooperatively transfer water between divisions to manage their rotations, if water is available. For example, if one division is cutting 10 cubic feet per second (cfs) and the adjoining division is adding 10 cfs, the water can be transferred between the two, thereby avoiding routing two flow changes along the main canal.

At the 10-day rotation interval, the DM will begin a "run" either at the top end or bottom end of the division and deliver a "head" of water from one delivery point to the next, based on an established schedule, the capacity of the lateral, and the quantity ordered from the control room. The standard flood head is 25 cfs. Each delivery point receives the water for a predetermined duration that is established, in part, by the acreage and crop type served, although some flexibility in the delivery duration does exist to accommodate changes in the required delivery duration over the course of the irrigation season. SSJID laterals are typically sized to convey one, two or three heads for rotational delivery to growers. With multiple heads available in a lateral the DM has ability to deliver to multiple delivery points at the same time and to allow alternative rotation schedules along the length of the lateral and/or its sub branches. The full head of water is delivered to a single owner at 77 percent of the delivery locations. When more than one owner is served by a delivery location, the full head is either split between customers or passed (rotated) from parcel to parcel by customers with the delivery duration varying according to parcel size and other factors.

To better meet the needs of specialty crops and high-frequency, long duration, low flow rate irrigation systems, such as microirrigation and sprinklers, SSJID DM's consider and attempt to accommodate delivery requests from growers desiring to irrigate outside of their scheduled rotation. Ultimately, requests are considered and approved at the discretion of the DM and vary from division to division based on operational constraints. Delivery start times are arranged, and shutoff times are scheduled at the same time that the water order is placed. Shutoff times may be modified by the irrigator in coordination with the DM, subject to the capacity and operational constraints of the distribution system. Divisions with high concentrations of pressurized irrigation systems are often able to provide arranged-demand delivery. Division Managers may also schedule two separate rotations within the same lateral pipeline; one for flood irrigators (25 cfs) and one for micro irrigators (typically 2 to 6 cfs, often referred to as a "pump head"). Often times this is not possible, and the DM delivers a pump head to micro- or sprinkler-irrigators and delivers the remaining partial head to a user who may flood irrigate. This requires additional coordination and effort by the DM. In some cases, particularly in the upper reaches, laterals are able to convey two flood heads (50 cfs).

As the amount of pressurized irrigation has increased, it has become increasingly difficult to provide the desired flexibility to sprinkler- and micro-irrigators while maintaining existing levels of service to surface irrigators without system modernization. In response, SSJID has and continues to modernize its distribution system and update operational procedures to provide flexibility and equity to its customers. Conjunctive use of water through installation of private groundwater wells and operation of SSJID wells is common in SSJID. Advantages of private wells to growers include complete flexibility in providing water for frost protection, chemigation, and fertigation, and to better align irrigations with crop water demands, field activities and harvest.

Woodward Reservoir is a key component of the ability to offer flexible service. The Reservoir is operated to maintain a specific downstream flow rate. SSJID operators coordinate with the Tri-Dam project personnel to adjust Goodwin diversions as needed to maintain target storage amounts. If demand increases, and an increase in releases at the Reservoir is required, the Superintendent checks whether the change can be made within the operational limits described below. Unless constrained by operational limits, the Superintendent requests the operator at the

Tri-Dam Project to divert the additional water. Because the reservoir is located nearly 15 miles closer to the irrigated lands than the river diversion, it serves as a re-regulation point that can be called upon for flexible changes in service that are not possible at the river diversion. It provides buffer storage to absorb excess diversions and provides localized supply for increases in MDC flows, improving service levels, minimizing spillage, and minimizing operational changes at Goodwin Dam.

Per the District's Rules and Regulations, growers are required to notify the District of their planned water needs (crop(s), acreage, etc) between January 1st and June 1st of each year they plan to irrigate so that the superintendent can develop a crop report and water usage records can be updated or developed.

Current daily use is determined from flow measurement sensors or rated gates at each of the lateral headings and relayed back to the Control Room using telemetry. All this information is tracked using the SCADA system and reports generated by the Control Room. Monitoring devices installed along the MDC within the Divisions and at spill sites allow the Control Room to regulate daily water use and provide DM's with helpful management information.

3.5 TERRAIN AND SOILS

The topography and soils within the District are typical of the San Joaquin Valley floor. Land surface is gently sloped westerly with elevations that vary from 150 feet in the east near Escalon to about 50 feet near Manteca with a relatively constant land slope. Surface water drainage generally flows southwesterly towards the San Joaquin River.

Historical flooding of the region's major rivers left layers of sediments and silts in the San Joaquin Valley floor, creating a unique soil profile that is well suited to implementation of irrigated agriculture, particularly for deep rooted tree crops such as walnuts and almonds. Soils in SSJID are typically deep and well drained with soil textures ranging from fine silts and sands in lower areas to medium in the low alluvial fan and terrace areas, with deposits of coarse-grained sands and gravels. SSJID does not contain expansive soils, and the erosion hazard rating is slight, indicating that erosion is unlikely under ordinary climatic conditions (NRCS 2007).

3.6 CLIMATE

The climate statistics presented in this section are based on the California Irrigation Management Information Station at Manteca (#70), established in 1987. This station was also used for the water balance analysis presented in Section 5.

SSJID has a climate typical of the San Joaquin Valley with mild winters with moderate precipitation and warm, dry summers. Average daily maximum temperatures range from a low of about 56°F in December and January to a high of 83°F in July (Table 3-1). Mean daily minimum temperatures range from a low of 37°F in December to a high of about 66°F in July. Average annual reference evapotranspiration (ET_o) is approximately 52 inches, ranging from a low of approximately one inch in December and January to a high of approximately eight inches in July. Approximately three quarters of the annual ET_o occurs in the six-month period from April through September.

Table 3-1. Mean Daily Weather Parameters by Month at Manteca CIMIS Station (1994 through 2014)

Month	Total ETo (in)	Total Precip. (in)	Daily Temperature (F)			Relative Humidity (%)			Average Wind Speed (mi/hr)
			Avg.	Min.	Max.	Avg.	Min.	Max.	
January	1.1	2.9	46.5	38.2	55.6	86.1	68.1	98.0	4.2
February	1.8	2.3	50.2	42.9	57.5	79.8	58.2	94.5	4.6
March	3.5	1.7	54.4	46.6	62.0	72.8	50.6	89.6	4.8
April	5.0	1.0	58.0	49.3	68.6	66.1	45.8	85.6	5.5
May	6.8	0.6	64.4	56.0	75.4	60.0	40.9	81.6	5.9
June	7.7	0.1	69.9	61.3	81.5	56.2	39.8	73.7	5.8
July	7.9	0.0	73.5	66.1	82.8	57.0	44.9	69.4	4.9
August	7.1	0.1	72.4	65.7	81.3	58.3	43.6	71.8	4.5
September	5.2	0.1	69.0	62.0	77.2	60.6	44.0	76.7	4.1
October	3.4	0.7	60.8	52.8	70.0	66.2	38.6	84.8	3.7
November	1.6	1.3	52.0	43.6	60.0	79.4	56.5	94.4	3.6
December	1.0	2.5	46.3	37.4	55.8	84.3	59.3	96.7	4.3
Annual	52.2	13.2	59.8	37.4	82.8	68.9	38.6	98.0	4.7

Average annual precipitation is 13.2 inches, with 10.6 inches, or approximately 80 percent, occurring in the five month period from November through March.

Even during the peak summer period, the average maximum relative humidity reaches approximately 74 percent, which is indicative of an irrigated area, and exceeds 95 percent between November and March. Minimum relative humidity ranges between approximately 45 percent during August and September and roughly 60 to 70 percent during the wet winter months.

Average wind speed is lowest in November (3.6 miles per hour) and highest in May and June (5.8 to 5.9 miles per hour).

There are no significant microclimates within the district that affect water management or operations.

3.7 OPERATING RULES AND REGULATIONS

The District maintains Rules and Regulations for control of system facilities, employee conduct, apportionment of water, rotation of water, time limits, continuous use of water, deliveries, control, waste of water, access to land, breaks, use of rights-of-way, unlawful acts, and enforcement and modification of rules. The intention of the rules and regulations is summarized as follows:

> *"It is the desire and intention to carry on the business of the District in a businesslike and economical manner and to distribute the water equitably, and, as near as may be satisfactory to all water users. No two individuals have exactly the same requirements and while these individual requirements will be met as far as possible, yet there must be general rules and general practices to secure the greatest good to the greatest number." (SSJID 1919)*

The District "Rules and Regulations for Governing the Distribution of Water in the South San Joaquin Irrigation District" are currently being reviewed and revised to address changing conditions. The rules and regulations prescribe conditions that ensure distribution of irrigation water to users in an orderly, efficient and equitable manner; they are available to water users and the public in pamphlet form. The existing rules are attached to this report for convenient reference (Attachment B).

3.8 WATER DELIVERY MEASUREMENT AND CALCULATION

In recent years, SSJID has made substantial efforts to improve flow measurement to support efficient management of the District's water resources and planning. The general approach to improving water measurement within SSJID has been to focus efforts on the improved measurement of inflows and outflows at the District boundaries (where needed), and to progress inward with upstream to downstream priority. This approach enabled development of a District-wide water balance and increasingly supports development of water balances for subdivisions of the District. The following sections will describe boundary and system flow and then delivery measurement.

3.8.1 Boundary and System Flow Measurement

Water diverted from the Stanislaus River into the Joint Main Canal is measured by stream gage stations operated and maintained by the Tri-Dam Authority to U.S. Geological Survey (USGS) standards. Releases to the MDC below Woodward Reservoir are controlled through SCADA on a daily basis. A SonTek acoustic Doppler device was installed in a rated section below Woodward Dam (USGS Station 11300700) that provides accurate measurement of distribution system inflows. As a result of periodic flow measurements (Figure 3-13) completed by outside professional services engaged by SSJID, this rating has recently been refined. Deliveries from the MDC to laterals have historically been measured by various means, including rated orifice gates, weirs, flumes, and rated canal sections. Over the last two years, state-of-art SonTek Pipe IQ acoustic Doppler devices have been installed at the heads of laterals branching from the MDC. Lateral inflows are remotely monitored from the control room via SCADA. Additionally, SSJID has installed six Rubicon Water FlumeGates® and four AquaSystems2000, Inc. LOPAC® automated flow control and measurement gates at selected lateral headings to provide accurate measurement as well as to help route flow changes and excess water smoothly to the SIDE project and East Basin reservoirs.

Figure 3-13. Woodward Release Gaging Station

DMs perform flow measurements at internal division points using a variety of measurement methods, including weir sticks, measuring tapes, and stilling wells with staff gauges. Additionally, SonTek and ISCO acoustic Doppler flow meters (ADFM) have been selectively installed at critical division points, where flow rate can be locally viewed on a digital screen and is transmitted and recorded through the SCADA system for remote access. For rated gates, weirs, and rated sections, water stage is measured by various means including pressure transducers, ultrasonic water level sensors, and stilling wells and floats.

System spillage and on-farm tailwater are collected by a system of private and District drains that flow out of SSJID at various locations. Some of this drainage is used by downstream irrigators and some contributes to stream flows in the Stanislaus River and the San Joaquin River, either directly or through small tributaries.

SSJID undertook and completed a systematic evaluation and ranking of boundary flow measurement sites in 2010 for the purpose of identifying and prioritizing potential site improvements. Since that time, SSJID has established improved flow measurement and remote monitoring at four operational spillage sites and 12 drainage outflow sites including four new sites added in 2013 and 2014. The 12 drainage outflow sites collectively measure approximately 97 percent of the total SSJID boundary outflow. The district plans to continue to increase the number of operational spills equipped with measurement. Gradually, obsolete measurement equipment is being replaced with modern, state of the art equipment.

3.8.2 Water Delivery Measurement and Calculation

One example of improved delivery measurement is SSJID's ongoing and very popular Division 9 pressurized service pilot project, where all deliveries are measured by magnetic flow meters that have a manufacturer's laboratory accuracy certification of ±1 percent. Additionally, the magnetic meters are connected to the SSJID SCADA system to enable real time access to measurement data by growers as well as SSJID operators. Another example is the requirement to include magnetic flow meters on all new drip and sprinkler irrigation systems installed with assistance from SSJID's on-farm water conservation program (described in Attachment A). These examples of improved delivery measurements are described in greater detail later in this section. Additionally, SSJID has prepared a plan to comply with the delivery measurement accuracy standards of §597 of Title 23 of the California Code of Regulations (CCR). The plan is included as Attachment A of this AWMP.

Because SSJID is studying the feasibility of expanding pressurized service District-wide, similar to Division 9, including magnetic flow meters on SCADA at every turnout, the District limited implementation of the corrective action plan in 2014 to only those actions that would not be wasted if District-wide pressurized service is implemented. The feasibility study is scheduled for completion by the end of 2015 at which time the District will decide whether to pursue District-wide pressurized service with measurement, or to resume implementation of the corrective action plan. In the meantime, SSJID continues to install magnetic flow meters at selected pump deliveries through its on-farm water conservation program. More than 100 magnetic meters have been installed to date and are compatible with district-wide pressurized service should the decision be made to implement it. As noted in the previous section, SSJID has installed new, more accurate Sontek Pipe IQs at lateral headings and is planning to install these flow measurement devices at 10 spillage locations in 2016.

SSJID incorporated improved delivery measurement into its Division 9 pressurization pilot project. Magnetic flowmeters were installed on 78 turnouts serving approximately 3,800 acres in the pilot project. The meters were connected to SCADA to provide real-time access to flow data by growers and SSJID operators. Implementation of the Division 9 pressurized surface water project included the installation of magnetic flow meters at all turnouts to support volumetric billing, track water usage, and provide growers with real time and historical data that can be used for planning and evaluation. These magnetic flow meters, accurate to within ±1 percent, comply with the accuracy standards of CCR 23 §597.

Additionally, growers wishing to install a magnetic flow meter for their pump deliveries are eligible for a cost share of 80 percent of the purchase and installation cost, up to $4,500 through the SSJID On-farm Water Conservation Program. Growers who install drip or sprinkler irrigation systems as part of the program are required to install a magnetic flow meter in order to be eligible for the cost share for the irrigation system. The on-farm water conservation program was implemented in 2011 and continued through 2013. The program was suspended in 2014 and 2015, so that the funds could be used to support the SSJID District-wide pressurization study. The program has resulted in the installation of 116 magnetic meters serving 4,916 acres. Together, the on-farm water conservation program and Division 9 project have installed 194 highly accurate magnetic flow meters to measure water deliveries to 8,731 acres (Table 3-2).

Table 3-2. Summary of Magnetic Flow Meters installed in SSJID.

Year	Number of Meters Installed	Area, Acres	Program/Project
2011	22	913	On-farm Water Conservation Program
2012	21	818	On-farm Water Conservation Program
2012	78	3,800	Division 9 Project
2013	28	1,118	On-farm Water Conservation Program
2014	29	1,414	On-farm Water Conservation Program
2015	16	668	On-farm Water Conservation Program
Total:	194	8,731	

SSJID is currently installing SCADA on all magnetic flow meters installed at farm turnouts to provide real-time access for DMs and improved record keeping.

Due to the drought, SSJID implemented a 36-inch (acre-inch per acre) delivery limit in 2015. In response to grower questions and concerns over water delivery measurement, the District purchased two Hach current meters which they have used to check customer flow rates when questions arise. The District has budgeted to purchase an additional six Hach current meters for use in the 2016 irrigation season. During the 2015 irrigation season, District staff conducted 376 current meter measurements on 22 of the 24 main laterals branching from the MDC.

SSJID implemented TruePoint data management and reporting software in 2010 to better track water use by individual customer delivery and to support reporting of aggregated water deliveries and volumetric billing. Each water delivery is represented by a separate data entry within the software that includes the DM's record of the delivery start and stop times. The DM also inputs the delivered flow rate. The delivery record also includes attributes such as: Assessor's parcel number (APN), rotation number, landowner name, crop, acres, lateral (i.e. delivery point) and irrigation method (e.g. flood, sprinkler, drip, micro). The TruePoint software calculates delivery event duration, delivery volume, and applied water depth based on the DM's inputs (Figure 3-14).

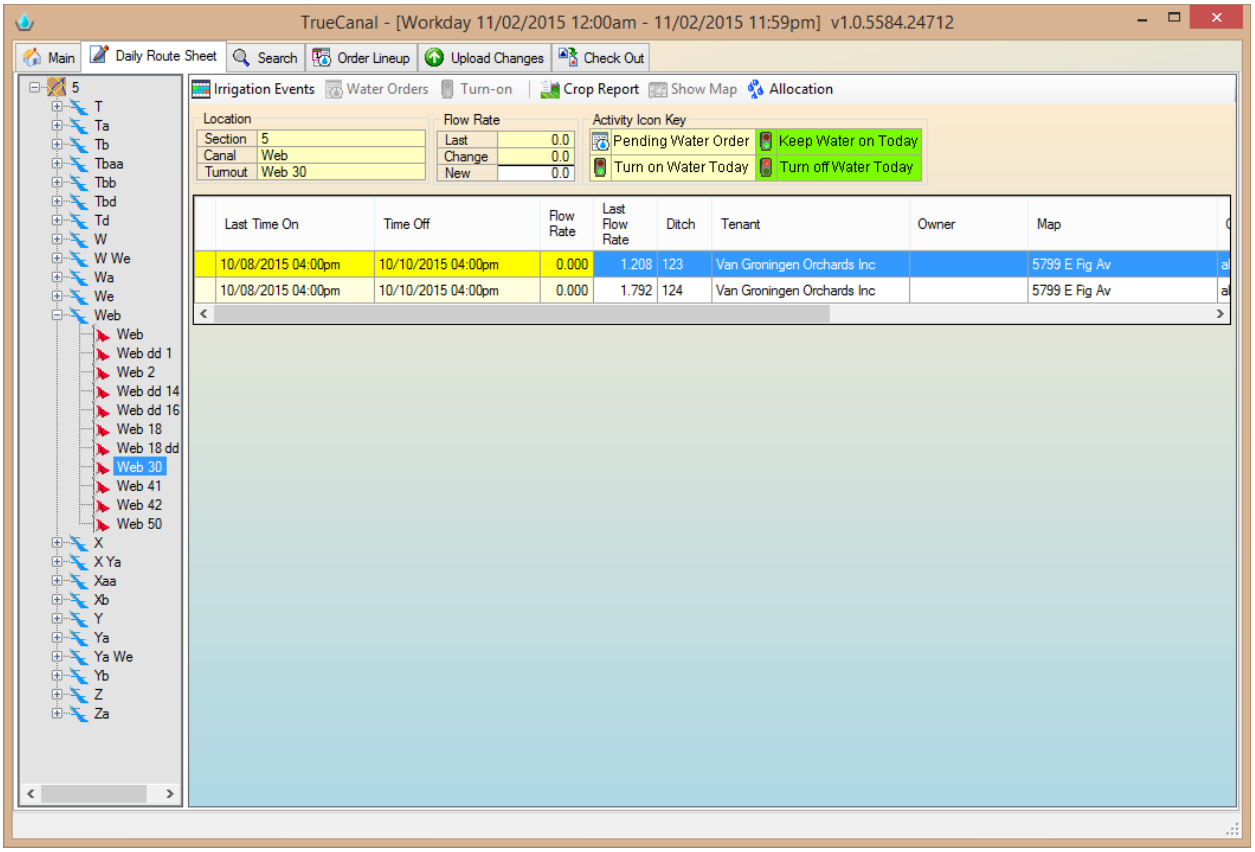

Figure 3-14. TruePoint Water Order Entry Screen

Figure 3-15. Orchard Valve Installed on SSJID Pipeline

Outside of the Division 9 areas, farm deliveries without magnetic meters are currently measured by rated gates or, in some cases, by determining the difference in flow between stand structures in the lateral upstream and downstream of the farm turnout. Direct measurement of deliveries to some individual fields is not technically feasible because multiple irrigation valves serving the field have been installed directly in the SSJID lateral pipeline (Figure 3-15). This tends to occur where the pipeline runs along the head of the field. The only technically feasible solution in these cases is to measure delivery volumes using a volume differential method. DMs read in-line flow meters where present and use manufacturer-provided pump capacities for estimating pump delivery flow rates where flow meters are not present. SSJID has approved a budget and plan to install SCADA on all magnetic flow meters installed at farm turnouts to provide real-time measurement data access to DMs and to improve record keeping.

For these deliveries, SSJID engaged the professional services of an outside consultant in 2010 to perform a thorough analysis of existing delivery measurement within the District and to prepare a pilot measurement improvement program that would adapt the existing methods or adopt new methods for compliance with SBx7-7. Initial field testing and analysis suggested that few existing measurement methods would likely comply. A pilot delivery measurement improvement project was initiated on the Qk Lateral in 2012 to test the feasibility of installing acoustic Doppler flow meters (ADFMs) at strategic locations within the lateral pipeline to divide it into measurement reaches such that only one delivery is likely to occur within the reach at any given time, allowing the delivered flow rate to be measured by difference through subtraction of the flow rate at the downstream end of the reach from the flow rate at the upstream end of the reach.

Figure 3-16. Magnetic Flow Meter

The nine-mile long Qk was segmented into two delivery reaches, and all reach inflows and outflows were bounded using five SonTek IQ ADFM's and magnetic flow meters (Figure 3-16) installed on eight pump deliveries. Two sub branches (Qo and Qn) and one drain site (Drain 12) were included in the reach balance. Delivery volumes were calculated by combining delivery durations based on start and stop times recorded by the DM's (recorded in TruePoint) and the flow rates calculated through difference. The Qk pilot project measures water deliveries to 69 customers who irrigate 1,853 acres. SSJID initiated the work of expanding the measurement approach to the remainder of the District service area not already measuring deliveries with magnetic flow meters. In 2014, SSJID suspended implementation of most of the plan pending the outcome of the District-wide pressurization study.

3.9 WATER RATE SCHEDULES AND BILLING

Prior to 2013, SSJID billed for irrigation deliveries on a per-acre basis. Growers were charged $24 per acre with a $50 minimum charge. In accordance with SBx7-7, SSJID has implemented a new pricing structure based in part on the volume of water delivered. This pricing structure complies with SBx7-7 and includes a $3 per af charge in addition to the $24 per acre flat rate charge. The per-acre rate does not vary depending on the size of the parcel irrigated. On September 22, 2015 SSJID's Board of Directors adopted and implemented a new rate designed to encourage prudent use of limited water resources. The new rate structure has two tiers. Growers using less than 48 inches per year will remain in 'Tier 1'and the water rate will not change. The new rate establishes a 'Tier 2' that charges an additional $7 per acre-foot (totaling $10 per af) for water use which exceeds 48 inches per year.

Rates and payment due dates are established annually by the Board of Directors. Typically, water charges for the coming season are billed annually in early November and may be paid in two installments in December and June. Water rates are kept low for affordability and to encourage the use of available surface water supplies in lieu of groundwater as part of SSJID's overall strategy of conjunctive management of surface water and groundwater supplies to maintain long term water supply.

SSJID's Division 9 project currently is operated using a volumetric-based pricing structure. Water users are charged $30 per af for the first three acre-feet per acre and $40 per acre-foot thereafter[5]. All original Division 9 customers additionally paid a $2,500 one-time fee to connect to the pressurized system. The connection fee for new users of Division 9 is the District's actual connection cost.

SSJID also charges a groundwater recharge fee of $12 per acre for all parcels greater than 10 acres, subject to an Irrigation Service Abandonment Agreement with a minimum charge of $25.

3.10 WATER SHORTAGE ALLOCATION POLICIES AND CONTINGENCY PLAN

For a detailed explanation of SSJID's operational management strategies during water short years, refer to the Drought Management Plan (Appendix E), which discusses the 2011 through 2015 drought. This section provides a broad overview of the Districts water shortage allocation policies.

SSJID recognizes that there may be times when available surface water supplies are insufficient to meet the water demands of the crops grown. In response, the Board has developed and adopted a set of special rules to be implemented in case of a water supply emergency. The rules are intended to maintain equitable service even in the event of a water shortage. The rules were first developed and adopted by the Board in the spring of 1991. In the winter of 2012, the Board once again faced a possible water shortage. Based on the 1991 rules, the District's Agricultural Water Committee summarized a set of contingency options for Board consideration should the shortage be realized. The contingency plan and "special rules" are not permanent documents and may vary in specific provisions over time based on Board policies.

Current and past surface water shortage contingency actions are summarized in nine measures that have been implemented by SSJID in past shortages while still upholding its obligation to manage and deliver water in a reasonable and beneficial manner and its desire to provide equitable water delivery service. The District found the 36 inch per parcel drought allocation adopted in 2015 to be an effective method to limit irrigation water deliveries and preserve

[5] During 2012, the $40 per acre-foot charge was not applied. Rather, a flat rate of $30 per acre-foot was charged regardless of use.

available surface water supply. Thus, the District may opt to use only selected operational alternatives from the list of actions taken in current and past droughts summarized as follows:

- Establish a per parcel drought allocation limit given the available supply
- Reduce the maximum water surface elevation of Woodward Reservoir to minimize surface evaporation and seepage
- Extend the start date of the irrigation season
- Implement a variable water delivery rotation schedule
- Implement maximum time limits for flood irrigation
- Implement irrigation quantity limits for pressurized systems
- Implement alternative supply sources (e.g. lease private pumps, use District wells, or possibly drill additional wells)
- Allow for inter-parcel transfers/fallowing with a cut-off date for transfers. Those requesting transfers must apply before the start of the year's irrigation season.
- Enforce Tier 2[6] service agreement provisions

3.11 POLICIES ADDRESSING WASTEFUL USE OF WATER

SSJID actively prohibits the wasteful use of water, as described in Rule No. 10 in its Rules and Regulations which states:

> *"Persons wasting water on roads or vacant land, or land previously irrigated, either willfully, carelessly, or on account of defective ditches or inadequately prepared land, or who shall flood certain portions of the land to an unreasonable depth or amount in order to properly irrigate other portions, will be refused the use of water until such conditions are remedied." [Rule no. 10, pg. 6, SSJID Rules and Regulations]*

Enforcement actions include withholding water for willful wasteful use. The District's policies regarding unauthorized uses of water and enforcement are described in detail in the Rules and Regulations (Attachment B).

[6] Customers who have filed a service abandonment agreement with the District in the past are considered Tier 2 customers if they petition the Board to amend the abandonment agreement and reinstate District service. Under the contingency plan the District has no obligation to provide water to Tier 2 customers during times of shortage. Newly annexed land is also subject to Tier 2 restrictions.

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4. INVENTORY OF WATER SUPPLIES

4.1 INTRODUCTION

The District has a highly reliable Stanislaus River surface water supply that serves as the primary supply source. In addition, both the District and private landowners have constructed groundwater production wells that serve primarily to supplement surface water supplies. Precipitation also provides additional soil moisture for agricultural purposes but, because of its unpredictability and limited quantity, is not considered a primary source. Surface water and groundwater supplies are discussed in the following sections.

4.2 SURFACE WATER SUPPLY

The Stanislaus River is the primary source of water supply for the District. The District's use of water is based on pre-1914 adjudicated and post-1914 appropriative rights that are shared with OID with the exception of rights applicable to Woodward Reservoir, which is solely owned by the District. "Pre-1914 water rights" are titled as such due to their establishment prior to the California Water Commission Act in 1914 and are only acquired by certain actions to protect the beneficial use of water prior to 1914. With these rights, SSJID and OID may change the place and/or purpose of use as long as it does not injure other users, is not being unreasonably used, or impacting public trust uses. A 1929 judgment from the San Joaquin County Superior Court adjudicated the districts' pre-1914 water rights and established a summary response for any future challenges of the water rights.

After the construction of New Melones Reservoir by the U. S. Bureau of Reclamation (USBR), the District entered into an agreement with the USBR on how water was to be allocated between the Districts and the USBR. Under the 1988 Agreement, the District's are entitled to receive the first 600,000 acre-feet per year and in years when inflow to New Melones is less than 600,000 acre-feet, are entitled to receive the actual inflow plus one-third of the difference between 600,000 and the actual inflow, as explained below. Water that is unused in any one year may be stored at New Melones in a "conservation account," up to a total of 200,000 acre-feet and can be used in certain water short years.

In 1858, Mr. Charles Tulloch, visionary and entrepreneur, built a small diversion dam immediately downstream of the current site of Tulloch Dam to distribute water to the Knights Ferry area. The system was extended down to the valley to serve 6,000 acres reaching as far downstream as Manteca (an area now served by SSJID) and a small area around Oakdale.

Wielding their newly authorized power from formation in 1909, the South San Joaquin Irrigation District entered into a deal with the OID, who had an option on the "Tulloch Rights", to equally split the purchase of the complete rights from the San Joaquin Canal and Irrigation Company and the Consolidated Stanislaus Water and Power Company for the sum of $650,000 on April 28th, 1910.

After purchasing the “Tulloch Rights”, the districts abandoned the old miners’ diversion dam and began construction of Goodwin Dam (Figure 4-1) in 1912. Goodwin Dam was completed in April of 1913 with a finished height of 80 feet above the bed of the Stanislaus River and a crest length of 500 feet. Main canals were constructed by both districts to deliver water to customers in the valley. A Joint Main Canal was constructed on the north side of the river to supply 850 cfs to SSJID and 260 cfs to OID with construction costs being in proportion to their respective diversion allotments. The two Districts separate at a bifurcation point approximately 3.6 miles from the Dam, with SSJID’s diversion continuing to the west and OID’s diversion channeled into Little John Creek.

Figure 4-1. Goodwin Dam

Severe water shortages in 1914-1915 prompted a meeting of landowners who approved the use of funds allocated in a 1913 bond issue specifically for construction of a reservoir. In 1916, the District completed construction of an earthen dam on the Main Supply Canal that stretched 3,400 feet long and 60 feet high and created the 36,000 acre-feet Woodward Reservoir to provide much needed storage and water regulation.

During dry years, the additional storage provided by Woodward afforded SSJID additional rotations as compared to neighboring Districts with little or no storage. However, expansion of irrigated acreage and changing crop patterns increased water demand, and in the early 1920’s the Board and the farmers agreed to allocate funding for an additional reservoir, primarily for winter water storage. In 1925, the two districts began construction on Melones Reservoir with a storage capacity of 112,500 af. This dam was completed by the end of 1926, and each District was provided with 51,250 af of stored water. This was a post 1914 appropriation. At the time the water supply from Melones Reservoir was sufficient for the needs of SSJID, but increasing irrigated acreage and changes in cropping patterns, along with concern over deficiency in dry years, would prompt the Board of Directors to actively seek supplemental water. Some of this supplemental water was already supplied through the installation of groundwater wells by the District in the early 1920’s to control high groundwater tables, primarily in the western portions of SSJID.

By the mid 1940's SSJID and OID were again searching for additional reservoir storage capacity to serve their constituents. In 1948, the Districts jointly formed the Tri-Dam organization and selected three reservoir sites to be collectively named the Tri-Dam Project. Donnells and Beardsley Reservoirs were constructed on the Middle Fork of the Stanislaus River with storage capacities of 64,500 and 97,500 af, respectively. Tulloch Reservoir was constructed above Goodwin Diversion Dam with a storage capacity to 68,400 af. The Tri-Dam facilities – including hydropower – became operational in 1957. Goodwin Diversion Dam was also raised 7 feet in 1955 to bring its total storage capacity to 500 af. Donnells and Beardsley Reservoirs have post-1914 rights to store water.

Prior to the construction of the New Melones Dam and Reservoir by the USBR, and as part of the condemnation of the (Old) Melones Reservoir, the joint districts entered into a 1972 Stipulation and Agreement, whereby the exercise of the joint districts' water rights was modified by an allocation agreement between the USBR and the districts for 654,000 af per year. In 1988, the joint districts renegotiated the 1972 Stipulation and Agreement with the USBR. In the 1988 Agreement, the districts receive a maximum of 600,000 af per year. Based on an even split of the available supply, this equates to 300,000 af that are available to both SSJID and OID each year. In reaching this Agreement, the joint districts agreed to relinquish 54,000 af per year of water in exchange for an obligation from the USBR to make up 33 percent of any deficiency below 600,000 af per year. In years when the inflow into New Melones Reservoir is less than 600,000 af, the District's available water supply under the 1988 Agreement is determined as set forth in Equation 4-1:

$$\text{Annual SSJID + OID Supply} = \text{Inflow} + [600{,}000 \text{ af} - (\text{inflow})] \times 0.33 \quad [4\text{-}1]$$

To determine the probability that SSJID's available water supply under the 1988 Agreement will be less than 300,000 af, an analysis was performed based on historical water year inflows for the period from 1895 to 2014. New Melones inflows over this period varied from 129,300 af in water year 1977 to 2,800,000 af in water year 1907 with an average of 1,136,000 af over the full 120-year record (Figure 4-2). The running 30-year average varies from 996,000 af for 1985 through 2014 to 1,300,000 af for 1895 through 1924. Based on the analysis, it is estimated that SSJID will receive its full supply in 79 out of 100 years and will receive at least 267,000 af in 90 out of 100 years (Figure 4-3). The minimum supply SSJID will likely receive in any year is approximately 225,000 af assuming there are sufficient supplies in the District's conservation account at New Melones (established by the 1988 Agreement) to make up the difference between the result of equation 4-1 and 225,000 af.

Considering only the last 30 years (1985 through 2014) as representative of current hydrology, SSJID is expected to receive its full supply in 60 out of 100 years and at least 253,000 af in 90 out of 100 years. In spite of this decrease in reliability, the minimum supply SSJID will likely receive in any year is still approximately 225,000 af.

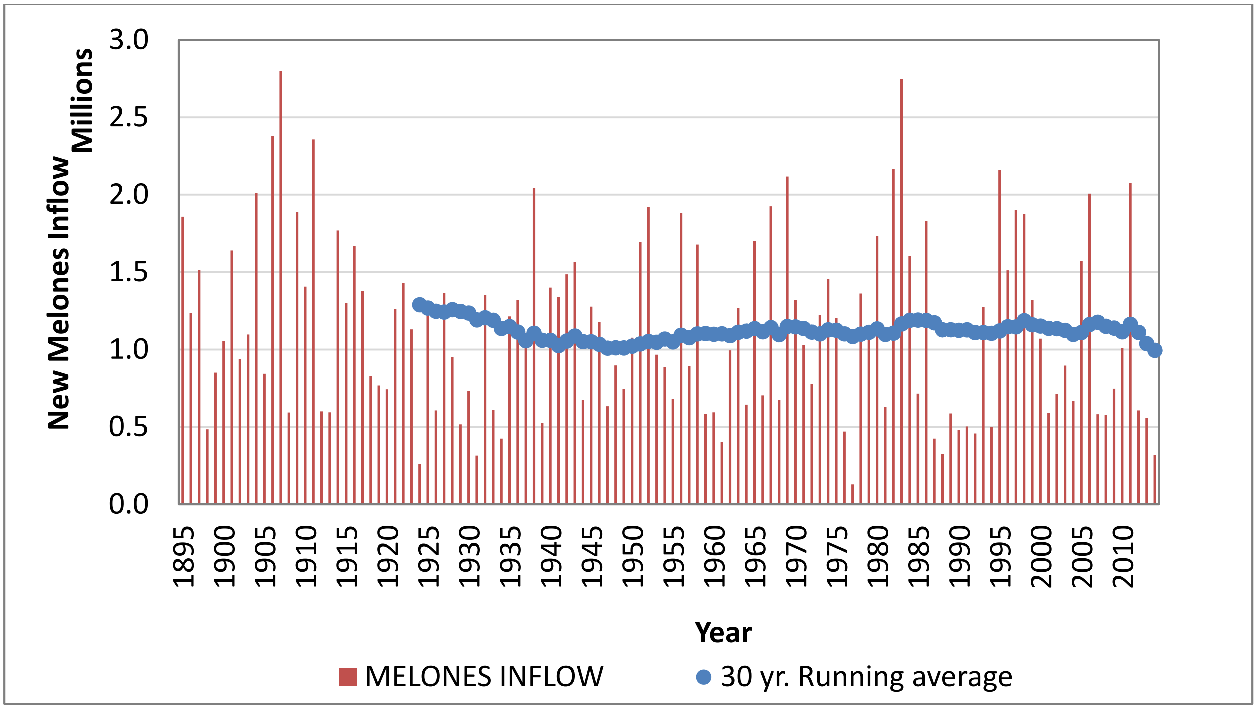

Figure 4-2. New Melones Inflow (1895 through 2014 Water Years)

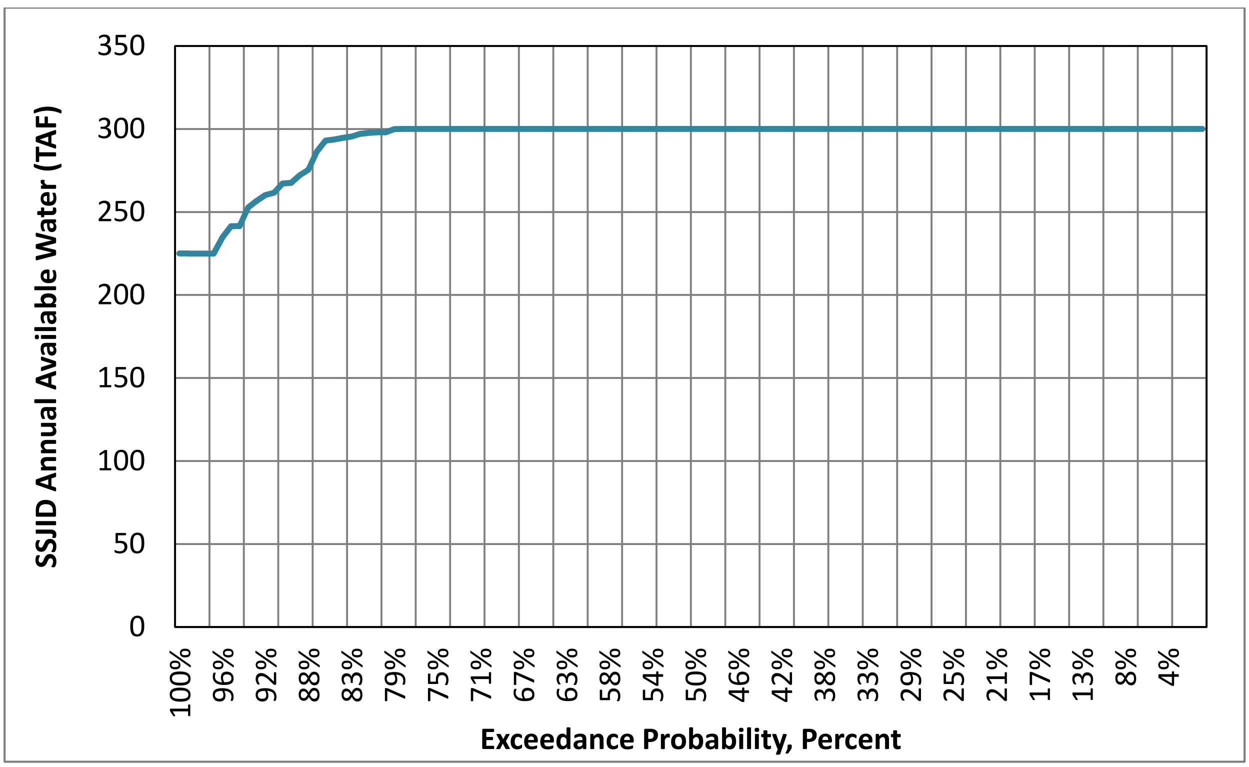

Figure 4-3. Exceedance Probability of SSJID Stanislaus River Water Supply

4.3 GROUNDWATER SUPPLY

SSJID overlies the southern portion of the Eastern San Joaquin Subbasin (Basin 5-22.01 under California's Bulletin 118) of the San Joaquin Valley Groundwater Basin which is bounded by the Mokelumne River to the north, the Stanislaus River to the south, the San Joaquin River to the west and the Sierra Nevada foothills to the east.

The Eastern San Joaquin Subbasin underlies the urban areas of Manteca, Lathrop, and Stockton which utilize groundwater for a large portion of their drinking water supply (Figure 4-4). Historical pumping from urban, rural and agricultural wells, primarily outside of SSJID, has been above the safe yield of the underlying basin.

The subbasin has groundwater levels that are dropping at an average rate of 1.7 feet per year (DWR 2006). Losses from SSJID, primarily deep percolation of applied surface water and seepage from District canals, serve as a source of beneficial recharge in the subbasin. Based on groundwater elevation contours that indicate groundwater flows northward away from SSJID, it is clear that this recharge provides regional as well as local benefits to groundwater pumpers. During the irrigation season recharge from seepage, deep percolation of applied water, and deep percolation is 97,000 acre-feet, on average, while District and private groundwater pumping is about 40,000 acre-feet. The conjunctive management of surface water and groundwater resources in the subbasin is an important consideration in evaluating the SSJID water balance and opportunities and potential impacts related to water conservation at the farm, district, and basin scales.

The subbasin formation is generally characterized by stream deposited sands, gravels, silts and clays. In the western portion of the District, localized layers of clay and silt result in zones of perched water (Kreinberg 1994). Four permeable water bearing formations are found to exist within the district's boundaries all at varying depths and thicknesses. Water for agricultural use is typically extracted from the first and second layers. These formations are formally known as the Alluvium and Modesto/Riverbank Formations, the Laguna Formation, and the Mehrten Formation and produce yields ranging from 650 – 1,500 gpm (DWR 2006). Irrigation and municipal well depths range from approximately 80 to 800 feet with an average depth of 350 feet.

To address the water supply needs of the urban areas of the District and the Region, SSJID contracted with neighboring cities to supply approximately 43,000[7] af per year of treated surface water from Woodward Reservoir to the cities of Escalon, Manteca, Lathrop and Tracy. The net benefit to the Basin is expected to be approximately 30,000 af per year (San Joaquin County 2004).

[7] Based on Manteca 2000 Amendment to Water Supply-Appended Exhibit E to Water Supply Development Agreement and in Replacement of Exhibit A, Phase II: Project Allotment.

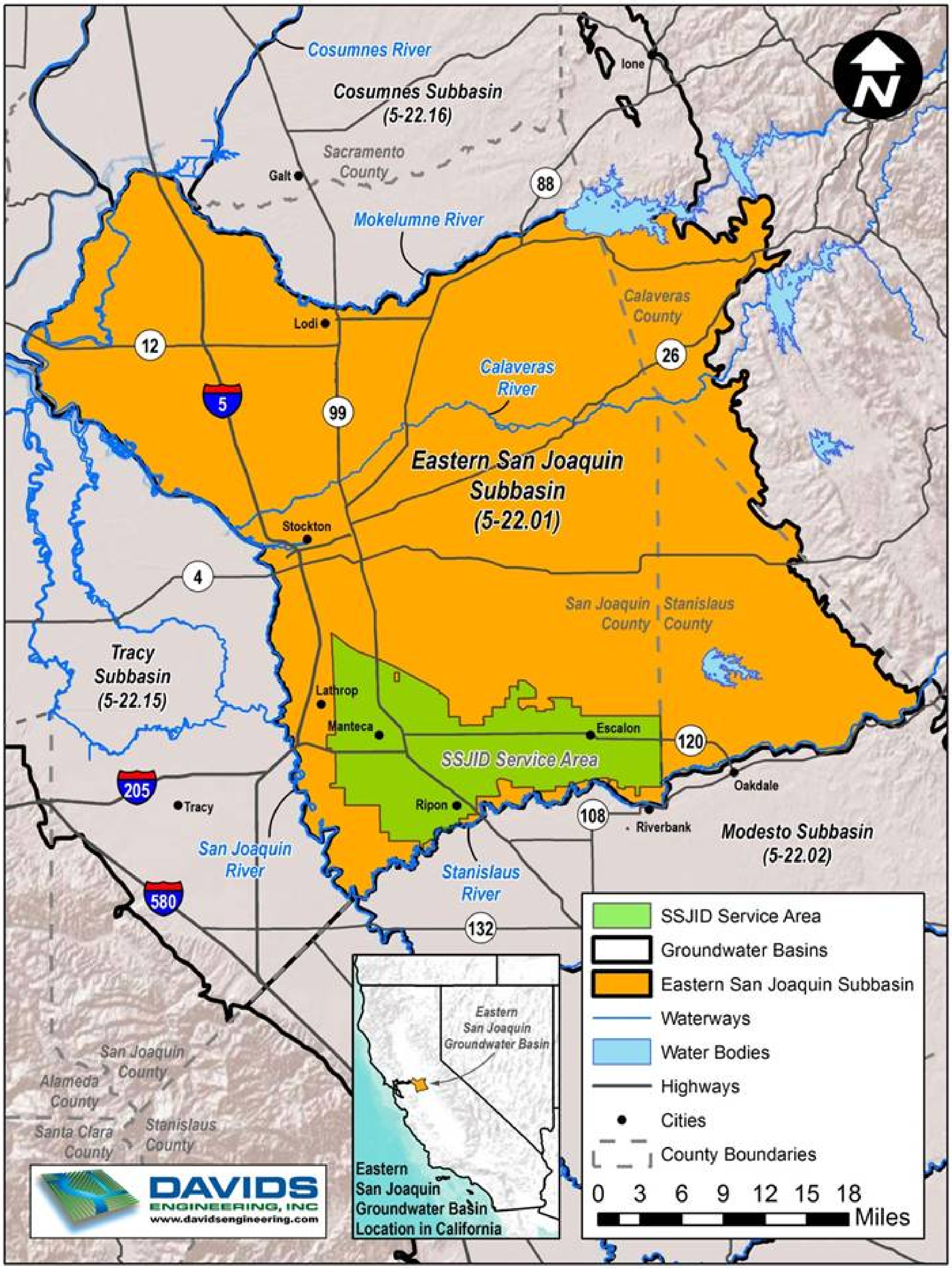

Figure 4-4. Eastern San Joaquin Groundwater Subbasin

Figure 4-5. SSJID Groundwater Well

The District has twenty-eight deep wells located mainly in the southwestern portion of the service area that are operated to alleviate shallow groundwater conditions there (Figure 4-5). The water is discharged into laterals, mixed with surface water, and delivered to growers in the area. The pumps reduce shallow groundwater levels and provide increased water supply flexibility by allowing operators to access additional flow by turning on one or more pumps.

The pumps have a combined output of approximately 96 cfs and a maximum annual production capacity of approximately 37,800 af based on a 200-day irrigation season. Actual annual production ranges between approximately 2,600 and 6,300 af because the wells are not operated continuously. All deep well pumps are remotely monitored.

SSJID production wells are tested for pump efficiency on an annual basis or if a pump falls significantly below its design capacity. The need for replacement or rehabilitation of each well is periodically assessed, and improvement actions are prioritized to provide the greatest benefit relative to the cost.

Recent drought conditions reemphasize the importance of recharge from surface water supplies for the Eastern San Joaquin Groundwater Subbasin to achieve sustainability, as envisioned by the recent enactment of the Sustainable Groundwater Management Act of 2014 (SGMA). Analysis shows that seepage and deep percolation from SSJID's surface water supply serves as the primary source of recharge to the groundwater system. Thus, a significant portion of the water used by others within the Eastern San Joaquin Groundwater Subbasin is derived from management of surface water resources by SSJID and its irrigation customers. Even with the seepage and deep percolation from SSJID, groundwater levels continue to decline in area to the east of Stockton and north of SSJID where surface water supplies are limited. A large cone of depression has formed there, so that groundwater flow under SSJID now flows northerly rather than to the west. Extended drought or other circumstances which limit surface water supplies are likely to exacerbate this condition. SSJID will continue to work with others within the Eastern San Joaquin Groundwater Subbasin to comply with SGMA. In addition to its own water management practices, SSJID will work with local interests to develop the tools needed to achieve long-term groundwater sustainability by identifying additional ways to maximize local water supplies, enhance conjunctive management practices, and recharge the groundwater system.

The Sustainable Groundwater Management Act (SGMA) was signed into law on September 16, 2014. The new law requires local agencies within groundwater management plans to work together to achieve sustainability within a defined period of time. SGMA requires a series of intermediate steps be achieved to demonstrate SGMA compliance, including formation of Groundwater Sustainability Agencies (GSAs) by June 30, 2017 to manage groundwater supplies, Groundwater Sustainability Plans (GSPs) be developed by January 2022 to identify actions needed to achieve groundwater sustainability. Recognizing these new requirements, SSJID will work with local interests to develop the tools needed to achieve long-term groundwater sustainability and work cooperatively toward developing GSA(s), a GSP, and the technical data and/or tools needed to comply with SGMA.

4.4 OTHER WATER SUPPLIES

In addition to Stanislaus River water and groundwater supplies, the District is receptive to the reuse of municipal and industrial effluent[8] and accepts tailwater from irrigators who produce tailwater but do not have access to a drain.

SSJID captures boundary outflows from OID and individual irrigators in the MDC and MSC. Based on the water balance analysis and OID boundary outflow measurement and estimates, these inflows are approximately 5,000 af per year.

4.5 WATER QUALITY MONITORING

SSJID historically has performed monitoring of surface water and groundwater quality within its service area and the surrounding areas under a combination of District and regional water management activities. These activities are described in greater detail below.

4.5.1 Surface Water

Historically, SSJID has performed in-house water quality monitoring. In recent years, as a result of new state regulations, SSJID has begun representative monitoring. Specifically, monitoring has been performed in compliance with the Central Valley Regional Water Quality Control Board's Irrigated Lands Program – known as the Ag Waiver – through membership in the San Joaquin County and Delta Water Quality Coalition, which the District joined in March of 2011. Prior to joining the Coalition, SSJID monitored and reported drain water quality directly. Starting in 2004, SSJID measured electrical conductivity, dissolved oxygen, pH, temperature and turbidity in three different drains including: three locations in Drain 11 before its discharge to Walthall Slough, one location in Drain 12, and one location in Drain 14, both which drain to Lone Tree Creek. Additionally, the District monitored levels of potassium, phosphorus, total nitrogen, total organic carbon, and for traces of herbicides. In addition to the Ag Waiver, the

[8] There is currently no known source of M&I effluent within SSJID's service area that is not otherwise beneficially used.

District monitors for aquatic pesticides as required by the Statewide General National Pollutant Discharge Elimination System (NPDES) Permit for the Discharge of Aquatic Pesticide for Aquatic Weed Control in Waters of the United States.

Testing of inflow surface water quality is performed on a regular basis as part of the District's operation of the water treatment plant. The District's surface water supply is of excellent quality for irrigation.

4.5.2 Groundwater

The District monitors electrical conductivity for its 28 production wells using permanently installed sensors. All information is available real-time through the telemetry system.

In addition, annual monitoring of groundwater quality is performed in 26 wells throughout San Joaquin County, including SSJID, by the San Joaquin County Flood Control and Water Conservation District (SJCFCWD). Parameters measured include total dissolved solids (TDS), turbidity, chloride, and electrical conductivity (EC). SJCFCWCD produces semi-annual groundwater reports and is in the process of developing a web-based interactive tool to make historical groundwater information readily available in individuals and public entities, such as SSJID.

Groundwater pumped for irrigation in SSJID is generally of good quality, with a few localized areas of TDS values as high as 700 to 800 mg/L.

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5. WATER BALANCE

5.1 INTRODUCTION

This section describes the various uses of water within SSJID, followed by a detailed description of SSJID's water balances for key accounting centers within the District. For each accounting center, a detailed, multi-year water balance covering the period from 1994 to 2014 is presented. The water balance quantifies all significant inflows and outflows of water to and from the SSJID service area during the irrigation season. The irrigation season varies from year to year based on water needs, but approximately covers the period from March through October.

The water uses and water balances are discussed in relation to hydrologic conditions within SSJID, which vary from year to year. Key hydrologic drivers of water management in a given year include available surface water supply under the 1988 agreement with USBR, which is based on New Melones Reservoir inflows; precipitation within the SSJID service area; and atmospheric water demand.

5.2 WATER BALANCE OVERVIEW

The 1994 through 2008 water balance reported in SSJID's 2012 AWMP was revised to incorporate improved flow measurement and estimates developed over the last three years, improved estimates of evapotranspiration and deep percolation and updated by extending it to include the period 2009 through 2014. The improved flow path measurements and estimates were based on the data collected through SSJID's Flow Measurement Plan adopted by the District in 2011. The next three sections describe the development of improved water balance flow path estimates based on the Flow Measurement Plan, the improved root zone model and crop coefficients and the general water balance methodology.

5.2.1 Flow Measurement Plan Impacts on Water Balance Methodology

The SSJID Flow Measurement Plan adopted in 2011 has two main goals: (1) increase the accuracy of boundary outflow measurement by improving existing flow measurement sites and adding new flow measurements sites where needed and (2) validate the Woodward Reservoir Release rating curve and boundary flow measurements by conducting independent, validation measurements. These actions resulted in more and improved information for the SSJID water balance for boundary outflows and the Woodward Reservoir Releases. The remainder of this section describes revisions made to the boundary outflow estimates and the stage-discharge rating for Woodward Reservoir Releases.

The Flow Measurement Plan added four new boundary outflow measurement sites and improved measurements at seven sites. Additionally, two outflows to Lone Tree Creek on the District's northern boundary had measurement sites added in August 2014. Just one SSJID outflow remains unmeasured. This is to the Stanislaus River on the district's southern boundary. Based on available measured data from these sites and revised estimates prepared based on earlier data and these new measurements, the average irrigation season outflow from the SSJID service area averaged slightly less than 27,000 acre-feet from 2003 through 2014. Improvement in the accuracy of the outflow estimate resulted in reduced uncertainty in the lateral spillage estimates.

During the 2010 through 2013 irrigation seasons, 14 validation measurements were completed at the Woodward Reservoir Release measurement location, a rated canal section. On two different occasions, two measurements were completed on the same day, one immediately following the second. These measurements on the same day were less than one percent different confirming the repeatability of the validation measurements.

Review of the validation measurement data indicated that a new stage-discharge rating would improve flow measurement accuracy. All 14 validation flows were more than the corresponding flow calculated and recorded by the SCADA system using the existing stage-discharge rating. The existing current meter rating was developed in 1989 by the USGS[9]. The percent difference between the validation and existing measurements, using the validation measurement as the standard, ranged from -4.6 to -18.6 percent with an average percent difference of -10.6. Measurements at higher flows were closer to the existing stage-discharge rating curve, with percent differences for flows greater than or equal to 500 cfs ranging from -4.6 to -12.8 percent with an average of -7.5 percent. Percent differences for flows less than 500 cfs ranged from -7.2 to -18.6 percent with an average of -15.6. Differences between the validation measurement and the existing rating curve may be explained by changes in channel roughness.

5.2.2 Root Zone Water Balance and Improved Crop Coefficients

A daily root zone water balance model and improved crop coefficients derived from ET estimated by a remotely sensed energy balance that reflect water use reductions due to crop stressors were used to develop an accurate and consistent calculation of historical crop ET (ET_c) and ET from applied water (ET_{aw}). A daily root zone water balance is a generally accepted and widely used method to estimate effective rainfall (ASCE, 2015 and ASABE, 2007). The water balance reported in the District's 2012 AWMP used a monthly, volume-based root zone water balance to parse the ET_a into ET_{aw} and ET from precipitation (ET_{pr}). The District's updated water balance was improved by using the daily, physical-based Integrated Water Flow Model Demand Calculator (IDC) version 2015.0.0036 (DWR, 2015). IDC is the root zone component of the California Department of Water Resources Integrated Water Flow Model (IWFM). In this application, IDC is independent of IWFM. An advantage of using IDC as the District's root zone model is that it can be used as the foundation for coupling the SSJID water balance to a groundwater model and, perhaps, eventually an integrated hydrologic model in the future.

[9] http://waterdata.usgs.gov/nwis/measurements?site_no=11300700&agency_cd=USGS&format=rdb_expanded accessed on August 22, 2014.

Additionally, improved crop coefficients were derived from actual ET (ET_a) estimated by Mapping EvapoTranspiration at high Resolution with Internalized Calibration (METRIC) for two recent years. Remotely sensed energy balance ET results account for the effect of salinity, deficit irrigation, disease, poor plant stands, and other stress factors on crop ET. Studies by Bastiaanssen, et al. (2005), Allen, et al. (2007 and 2011), Thoreson, et al. (2009) and others have found that when performed by an expert analyst, seasonal ET_a estimates by these models are within plus or minus five percent of actual ET.

5.2.3 General Water Balance Methodology

For the water balance update, the District Laterals and Irrigated Lands accounting center was divided into separate District Lateral and Irrigated Lands accounting centers. This makes it possible to separate District and on-farm performance indices. With this improvement, the District water balance has five accounting centers. These include three separate accounting centers for the SSJID distribution system, the irrigated lands within the SSJID boundary, and the SSJID drainage system. A total of 32 individual flow paths are quantified as part of the water balance. A schematic of the water balance structure is provided in Figure 5-1. The accounting centers for SSJID are:

1. Upper Main Supply Canal (UMSC) and Woodward Reservoir
2. Lower Main Supply Canal (LMSC) and Main Distributary Canal (MDC)
3. District Laterals
4. Irrigated Lands
5. Drainage System

For the SSJID Distribution and Drainage system accounting centers, flow paths are quantified on a monthly basis for the irrigation season (March – October). For improved estimates of flow exchanges with the groundwater system, the irrigated lands accounting center is completed on an annual time step. This results in more complete estimates of flow exchanges with the groundwater system compared to the monthly time step used in the water balance reported in SSJID's 2012 AWMP. For each accounting center, all but one flow path is determined independently based on measured data or calculated estimates, and the remaining flow path is then calculated based on the principal of conservation of mass (Equation 5-1), which states that the difference between total inflows and outflows to an accounting center for a given period of time is equivalent to the change in stored water within that accounting center. Over the course of a year, it is assumed that the change in storage is zero (Equation 5-2).

$$\text{Inflows} - \text{Outflows} = \text{Change in Storage (monthly time step)} \qquad [5\text{-}1]$$

$$\text{Inflows} - \text{Outflows} = 0 \text{ (annual time step)} \qquad [5\text{-}2]$$

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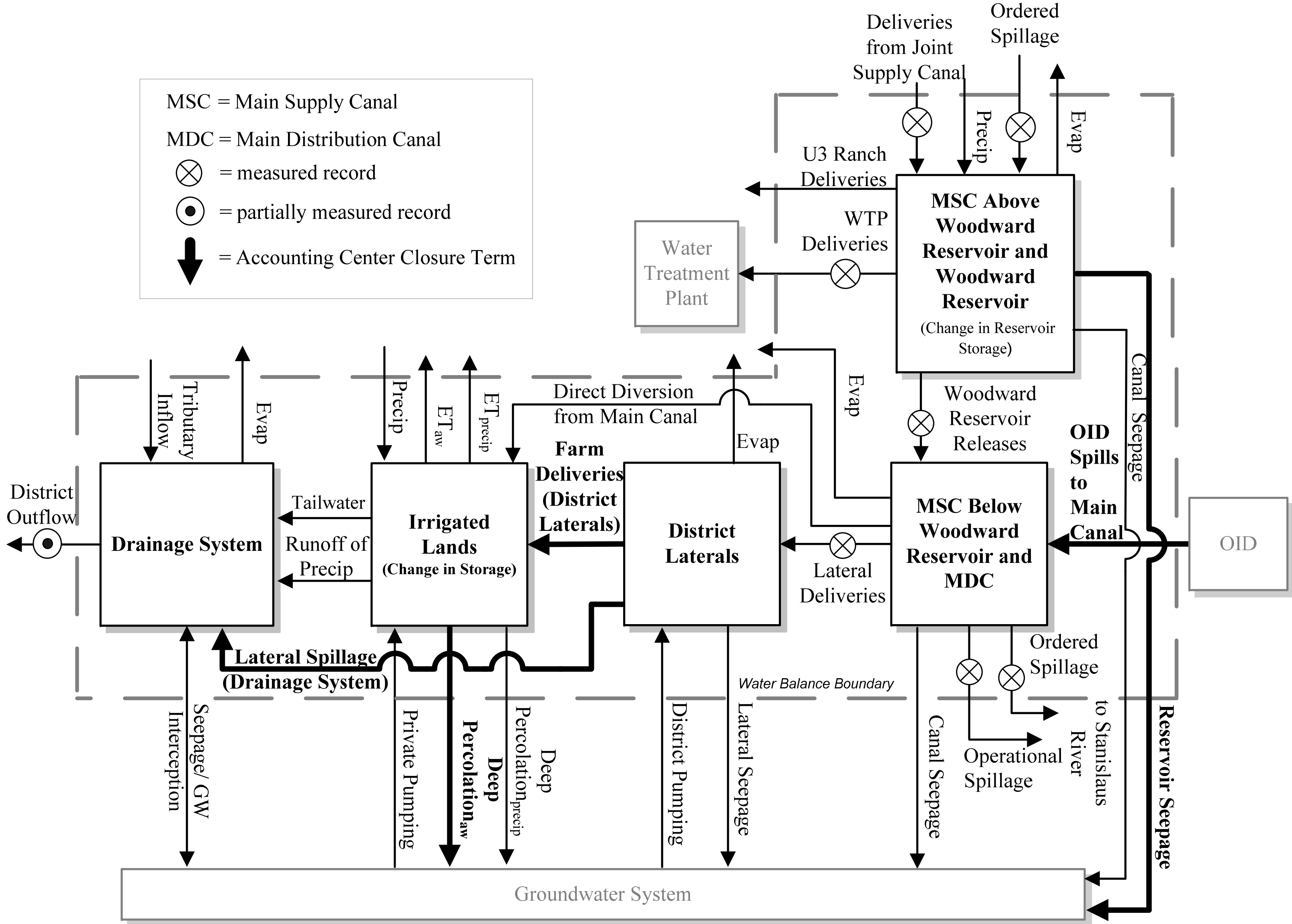

Figure 5-1. SSJID Water Balance Structure

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The flow path that is calculated using Equation 5-2 is referred to as the "closure term" because the mass balance equation is solved or "closed" for the unknown quantity. The closure term is selected based on consideration of the availability of data or other information to support an independent estimate of each flow path as well as the volume of water representing the flow path relative to the size of other flow paths. Generally speaking, the largest, most uncertain flow path is selected as the closure term.

5.3 FLOW PATH ESTIMATION AND UNCERTAINTY

Individual flow paths were estimated based on direct measurements or based on calculations using measurements and other data. As described previously, those flow paths not estimated independently were calculated as the closure term of each accounting center.

For the UMSC and Woodward Reservoir accounting center, the closure term for 1994 through 2004 was the change in Woodward Reservoir storage and for 2005 through 2014 was reservoir seepage. Actual water level data from the reservoir for 2005 through 2014 were used to estimate the monthly change in reservoir storage and close on reservoir seepage. Average seepage coefficients from this time period were calculated and used to close on the change in reservoir storage from 1994 through 2004.

Drainage outflows from Oakdale Irrigation District discharge into the MDC canal at numerous locations, serving as a secondary water supply for the MDC. This inflow is unmeasured and is the closure term for the LMSC and MDC accounting center. OID measures outflow at some sites and estimates outflow at others, together these estimates reported by OID in its AWMP are in general agreement with closure of the LMSC and MDC account center water balance.

District laterals are a single accounting center. Lateral seepage, evaporation, and district pumping are estimated and farm deliveries are calculated as the closure term. District pumping is estimated from electrical records. Seepage is based on the wetted area and assumed seepage coefficient 0.05 feet per day for concrete lining (USBR 1994) Irrigated lands are another accounting center with precipitation, ET of applied water (ET_{aw}), ET of precipitation (ET_{pr}), private pumping, tailwater, runoff of precipitation, and deep percolation of precipitation as inputs while deep percolation of applied water is the closure term. The primary outflow from irrigated lands is crop evapotranspiration (ET). Crop ET may be derived from applied irrigation water or from precipitation. The Integrated Water Flow Model – Demand Calculator (IDC), developed by the DWR, is a root zone water balance model, which partitions total crop ET into ET_{aw} and ET_{pr}. The IDC can be incorporated into the Integrated Water Flow Model (IWFM), which is a groundwater modeling program. IWFM is used commonly in groundwater models in California, such as the California Central Valley Groundwater – Surface Water Simulation Model (C2VSim), which models groundwater and surface water interactions across California's Central Valley.

Primary inputs into the IDC model include: crop evapotranspiration, precipitation, and soil parameters, such as hydraulic conductivity, field capacity, permanent wilting point, etc. Nine crop groups were modeled: alfalfa, almonds, corn, grapes, idle, other crops, pasture, peaches, and walnuts. Soil parameters were based on two soil types: sandy loam and loamy sand, resulting in eighteen unique crop-soil combinations. ET_a was estimated from 1994 to 2014 based on Mapping EvapoTranspiration at high Resolution with Internalized Calibration (METRIC) derived grass reference crop coefficients and grass reference evapotranspiration from the Manteca CIMIS station. Combining IDC model outputs with annual crop acreage summaries provided by the District, volume of precipitation, ET_{aw}, ET_{pr}, runoff, and deep percolation of precipitation was incorporated into the water balance.

For the SSJID drainage system accounting center, lateral spillage was calculated as the closure term. Increased measurement of district outflows improved water balance estimates.

The results of the water balance for each flow path are reported with a high level of precision (nearest whole acre-foot) that implies a higher degree of accuracy in the values than is actually justified. While a detailed uncertainty analysis has not been conducted to assess potential error in the data and computed values, an estimated percent uncertainty (approximately equivalent to a 95 percent confidence interval) in each measured or calculated flow path has been estimated. Then, based on the relative magnitude of each flow path, the resulting uncertainty in each closure term can be estimated by assuming that errors in estimates are random (Clemmens and Burt 1997). Errors in estimates for individual flow paths may cancel each other out to some degree, but the net error due to uncertainty in the various estimated flow paths is ultimately expressed in the closure term.

Table 5-1 lists each flow path included in the water balance, indicating which accounting center(s) it belongs to, whether it is an inflow or an outflow, whether it was measured or estimated, the supporting data used to determine it, the 2014 flow volume, and the estimated confidence interval, expressed as a percent. As indicated, estimated confidence intervals vary by flow path from 5 to over 100 percent of the estimated value, with uncertainties generally being less for measured flow paths and greater for estimated flow paths. The estimated uncertainty of each closure term is provided, calculated based on the concept of propagation of random errors as described above.

The confidence intervals for the inflows and outflows from the UMSC and Woodward Reservoir ranged from five to six percent on the measured inflows and outflows, respectively (Table 5-1). The individual confidence intervals for each inflow and outflow were combined statistically, resulting in a confidence interval of plus or minus 132 percent on reservoir seepage, the closure term.

Table 5-1. Water Balance Flow Paths, Supporting Data, and Estimated Uncertainty

		Flow Path	Data Source	2014 Volume, AF	Confidence Interval	Confidence Interval Source
SSJID Main Supply Canal Above Woodward Reservoir	Inflows	Deliveries from Joint Main Canal	Measured--Rated Section	213,017	6%	DE estimate.
		Increase in Reservoir Storage	Water levels and capacity-stage relation	8,205	100%	DE estimate based on reservoir water elevations.
		Precipitation	Manteca CIMIS	323	100%	DE estimate.
		Ordered Spillage	Measured--Rated Section	43	6%	DE estimate.
		Total	Computed	221,587	7%	Computed
	Outflows	Woodward Releases	Measured--Rated Section	167,063	6%	DE estimate.
		WTP Deliveries	KROHNE INFL meter - FIT-1320-1 & FIT-1320-2	11,282	5%	DE estimate.
		U3 Ranch Deliveries	One slide gate and one weir	4,320	100%	Computed based on estimated accuracy of measurement method used for spillage location.
		Reservoir Seepage	Closure Term	15,452	76%	DE estimate.
		Main Supply Canal Seepage	Estimate	419	50%	DE estimate.
		Decrease in Reservoir Storage	Water levels and capacity-stage relation	0	100%	DE estimate.
		Evaporation	Estimate--surface area, K_c and ET_o	6,642	30%	Based on 20 percent estimate of K_c*ET_o process plus 10 percent allowance for surface area estimate.
		Total	Computed	205,178	11%	Computed.
SSJID Main Supply Canal Below Woodward Reservoir and Main Distributary Canal System	Inflows	Woodward Releases	Measured--Rated Section	167,063	6%	DE estimate.
		OID Spills	Closure	9,888	217%	Computed
		Total	Computed	176,951	10%	Computed
	Outflows	Lateral Deliveries	ISCO meters in pipes	153,051	10%	DE estimate.
		Direct Diversions from MDC	Estimated	1,069	50%	DE estimate.
		Ordered Spillage	One slide gate and one weir	43	9%	Computed based on estimated accuracy of measurement method used for spillage location.
		Operational Spillage	Long crested weir	0	9%	Computed based on estimated accuracy of measurement method used for spillage location.
		Seepage	Closure	22,288	50%	DE estimate.
		Evaporation	Estimate--surface area, K_c and ET_o	501	30%	Based on 20 percent estimate of K_c*ET_o process plus 10 percent allowance for surface area estimate.
		Total	Computed	176,951	11%	Computed.
District Laterals	Inflows	Lateral Deliveries	***SonTek IQ meters in pipes***	153,051	5%	Computed
		District Pumping	*Estimate*	5,388	50%	Estimated
		Total	Computed	158,439	5%	Computed
	Outflows	Farm Deliveries	***Closure (District Laterals)***	140,810	6%	Computed
		Lateral seepage	Estimate	4,574	50%	DE estimate.
		Lateral spills	Closure (Drainage System)	12,373	17%	DE estimate.
		Total	Computed	157,757	6%	Computed
Irrigated Lands	Inflows	Farm Deliveries	***Closure (District Laterals)***	140,810	6%	Computed
		Precipitation	Manteca CIMIS	60,032	30%	Clemmens, A.J. and C.M. Burt, 1997
		Direct Diversions from Main Canal	Efficiency Estimate	1,069	50%	DE estimate.
		Precipitation removed from root zone storage	DE Root Zone Model	0	30%	Root zone simulation model (IDC).
		Private Pumping	Efficiency Estimate	63,223	50%	DE Estimate.
		Total	Computed	265,134	15%	Computed
		Total applied water	Computed	205,102	17%	Computed
	Outflows	ET applied water	Irrigated area/crops/K_c/ET_o/monthly water balance	137,896	10%	CIMIS reference ET, estimated crop coefficients from METRIC analysis, cropped area by crop, root zone simulation model (IDC) to divide ET in applied water and precipitation components.
		Deep Percolation applied water	Closure of applied water	64,251	58%	Difference of total inflows and measured/estimated outflows for Irrigated Lands accounting center
		ET precipitation	Irrigated area/crops/K_c/ET_o/monthly water balance	23,202	10%	CIMIS reference ET, estimated crop coefficients from METRIC analysis, cropped area by crop, root zone simulation model (IDC) to divide ET in applied water and precipitation components.
		Deep Percolation precipitation	Closure of precipitation root zone water balance	25,529	25%	Root zone simulation model, NRCS soils characteristics, CIMIS precipitation data
		Evaporation/Runoff of precipitation	Estimate	340	35%	Root zone simulation model, CIMIS precipitation data, and NRCS curve number method.
		Precipitation added to root zone storage	IDC model results	10,961	30%	Root zone simulation model (IDC)
		Total	Computed	240,258	17%	Computed

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The confidence intervals for the inflows and outflows from the LMSC and MDC below Woodward Reservoir ranged from six to 50 percent on the measured and estimated flows, respectively (Table 5-1). The individual confidence intervals for each inflow and outflow were combined statistically, resulting in a confidence interval of plus or minus 217 percent on the inflows from OID, the closure term. The relatively small volume of OID inflows leads to a large percent uncertainty in the value. The main contributors to the uncertainty in the OID inflows are lateral deliveries (61 percent of the uncertainty), the Woodward Reservoir Release (21 percent of the uncertainty), and the reservoir and canal seepage (18 percent of the uncertainty). The remaining terms have a negligible effect on the accuracy of the OID spills.

The confidence intervals for the inflows and outflows from the District laterals ranged from 10 to 50 percent for the measured and estimated flows (Table 5-1). The individual confidence intervals for each inflow and outflow were combined statistically, resulting in a confidence interval of plus or minus 6 percent on the farm deliveries, the closure term.

The confidence intervals for the inflows and outflows from the irrigated lands ranged from 10 to 50 percent for the measured and estimated flows (Table 5-1). The individual confidence intervals for each inflow and outflow were combined statistically, resulting in a confidence interval of plus or minus 58 percent on the deep percolation of applied water, the closure term. Typically for water balances of irrigated lands, the confidence interval on deep percolation of applied water is in the range of 35 to over 100 percent.

The general increase in flow volume confidence intervals (increase uncertainty) as the water flows from the distribution system accounting centers to the irrigated lands accounting center is typical of agricultural water suppliers. Increased uncertainty for the irrigated lands accounting center results chiefly from estimates of tailwater and deep percolation flow paths as these flows are difficult and expensive to accurately measure. Despite appreciable uncertainty in some flow path quantities, the water balance provides useful insights into SSJID's water management.

5.4 HYDROLOGIC YEAR TYPES IN SSJID

Development of a multi-year water balance allows for evaluation of water management impacts of surface water supply variability, precipitation variability, and other changes in the hydrology of SSJID and its surrounding area over time. Specifically, a multi-year water balance that includes both dry and wet years is essential to evaluate and plan for "planned conjunctive use of surface water and groundwater", an EWMP included in the CWC and discussed in Section 7. To support review and interpretation of water uses and overall water balance results over time, USBR surface water allocation, total water year precipitation[10], and total water year reference evapotranspiration (ET_o) are presented, and year types are assigned.

As discussed previously, SSJID has a reliable source of surface water supply under its 1988 agreement with USBR which is based on inflows into New Melones Reservoir. During the 1994 to 2014 period, a partial allocation was provided in 2001, 2007, 2008, 2013, and 2014 with full allocations in the remaining 16 years.

Reduced inflows into New Melones due to reduced precipitation in the watershed typically correspond to years with reduced precipitation and increased atmospheric water demand in the SSJID service area. Based on allotment, total water year precipitation, and irrigation season reference evapotranspiration, the years 1994 to 2014 have been assigned to wet or dry year types for purposes of discussion of water uses in SSJID over time and the corresponding water balances. These factors along with the year types by year are listed in Table 5-2. Nine years between 1994 and 2014 were assigned to wet year types, and twelve years were assigned to dry year types. The wet years of 1995, 1996, 1997, 1998, 2000, 2005, 2006, 2010, and 2011 each had a full allotment and precipitation greater than the average of 12.9 inches. March to October ET_o was less for the wet years, averaging approximately 50.8 inches.

The dry years of 2001, 2007, 2008, 2013, and 2014 had a partial allotment, while 1994, 1999, 2000, 2002, 2003, 2004, 2009, and 2012 had full allotments. Each of the dry years had below normal precipitation, averaging approximately 10 inches. The dry years exhibited average ET_o of 54 inches, more than three inches greater, on average, than wet years. In addition to having below normal precipitation often leading to reduced surface water supplies, dry years experience increased ET_o, resulting in increased crop irrigation requirements and corresponding irrigation demands. These increased demands are coupled with reduced surface water supply in partial allocation years.

Future updates of the water balance may include additional years with partial allocations potentially leading to increased understanding of the implications of partial allocations on SSJID's water resources. This in turn, may support the identification and implementation of management actions to increase the reliability of surface water and groundwater supplies while maintaining or improving levels of service to the water users.

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[10] Total water year precipitation refers to precipitation falling within SSJID during the period from October through September. Precipitation beginning around October at the end of the irrigation season in a given year runs off or accumulates in the soil during the fall to winter to early spring period and is available to support crop ET in the following irrigation season. Thus, for example, the period from October 2004 to September 2005 is referred to as the 2005 water year, and precipitation occurring between October 2004 and September 2005 is referred to as 2005 total water year precipitation.

5.5 WATER USES

The District supplies irrigation water for agriculture as well as treated domestic drinking water for the cities of Manteca, Tracy and Lathrop; future plans also include supplying Escalon and Ripon. SSJID currently supplies raw untreated water to Ripon. The District constructed the Nick C. DeGroot Water Treatment Plant in 2005 to treat surface water extracted from the MDC just below Woodward Reservoir. SSJID supplied approximately 16,800 acre-feet of treated water in 2008 (P&P 2011).

Table 5-2. 1994 to 2014 SSJID Allotment, Water Year Precipitation, Irrigation Season ETo, and Hydrologic Year Type

Year	Irrigation Start	Irrigation End	Number of Days	USBR Allotment	Precipitation, in	ET_o, in	Hydrologic Year Type
1994	3/8	10/14	221	Full	7.8	53.6	Dry
1995	4/3	10/27	208	Full	16.8	50.7	Wet
1996	3/24	10/23	214	Full	16.8	53.1	Wet
1997	3/8	10/15	222	Full	14.5	54.2	Wet
1998	3/16	10/29	228	Full	26.7	46.6	Wet
1999	3/15	10/27	227	Full	11.6	50.5	Dry
2000	3/20	10/19	214	Full	13.1	52.3	Wet
2001	3/17	10/18	216	Partial	11.5	54.8	Dry
2002	3/4	10/17	228	Full	12.1	53.6	Dry
2003	3/26	10/18	207	Full	8.9	52.1	Dry
2004	3/7	10/16	224	Full	12.7	55.6	Dry
2005	3/13	10/22	224	Full	19.5	49.7	Wet
2006	3/21	10/21	215	Full	16.9	51.3	Wet
2007	3/11	10/17	221	Partial	5.8	55.3	Dry
2008	3/9	10/16	222	Partial	10.3	55.8	Dry
2009	3/11	10/20	224	Full	8.5	53.1	Dry
2010	3/15	10/24	224	Full	14.1	49.9	Wet
2011	3/13	10/29	231	Full	17.5	49.0	Wet
2012	3/11	10/19	223	Full	8.2	53.9	Dry
2013	3/8	10/19	226	Partial	9.3	55.6	Dry
2014	3/17	10/1	199	Partial	7.6	56.3	Dry
Wet Year Average					17.3	50.8	
Dry Year Average					9.5	54.2	
Overall Average					12.9	52.7	

The District co-owns three reservoirs with OID that are managed by the Tri-Dam Project and Power Authority for water supply, power generation, recreation, and water sports. The Authority also owns and operates a separate hydro-power generation facility known as Sand Bar. All of these reservoirs lie outside of SSJID's service area. SSJID also owns the Frankenheimer and Woodward power generation facilities at the inlet and outtake of Woodward Reservoir, respectively. Turlock Irrigation District provided the financial capital for the installation of these sites in the early 1980's and operates and maintains the projects. Through the District's water conservation efforts, SSJID's water has been made available for environmental enhancement through water transfers and in-lieu groundwater recharge. These water uses are described in greater detail in the remainder of this section.

5.5.1 Agricultural

Agricultural irrigation is by far the dominant water use in SSJID (Figure 5-2). Total water required to meet the evapotranspiration need of the crops grown varied from about 147,000 to 178,000 acre-feet per water year during the period of analysis. An estimated 19,000 to 45,000 acre-feet of the demand was supplied by rainfall stored in the root zone with the remaining 105,000 to 147,000 acre-feet supplied by irrigation.

Figure 5-2. Young Almond Orchard in SSJID

Between 1994 and 2014, there was an average of 54,156 acres of irrigated crop land, including an average of 1,997 acres of fallow or idle lands.

The dominant crop in SSJID is almonds, which was grown on an average of 32,380 acres while other permanent tree and vine crops were grown on an average of 7,113 acres. Annual and semi-permanent crops were grown on an average of 12,666 combined acres. Permanent crops in SSJID, including almonds, fruit trees, grapes and walnuts account for 73 percent of the total cropped area. Corn makes up approximately 10 percent of the irrigated acreage, and pasture makes up 7 percent. Other crops include alfalfa, rice, berries, melons, tomatoes and clover.

The acreage planted to permanent crops varied between 37,902 and 40,961 acres over the 21-year period as indicated in Table 5-3 and Figure 5-3. Permanent crops represent a firm base demand for District water. Pasture and alfalfa declined from a peak of about 8,066 acres in 1995 to a low of about 4,465 acres in 2014. Corn increased slightly from about 4,000 to about 5,500 acres.

Table 5-3. SSJID Crop Acreages, 1994 to 2014.

Year	Permanent			Annual	Semi-Permanent	Idle	Total
	Almonds	Others	Subtotal				
1994	31,072	8,313	39,385	7,454	7,307	4,134	58,281
1995	30,847	8,506	39,353	6,832	8,066	3,247	57,497
1996	31,420	8,429	39,849	6,802	7,936	1,828	56,414
1997	29,862	8,416	38,278	8,626	7,277	1,660	55,842
1998	30,343	8,069	38,412	7,326	7,972	1,565	55,276
1999	32,730	8,045	40,776	6,733	6,274	1,974	55,757
2000	31,550	8,040	39,589	6,555	5,316	2,105	53,565
2001	32,574	7,464	40,038	6,586	6,054	1,962	54,640
2002	32,934	8,027	40,961	6,085	6,185	1,617	54,848
2003	33,031	7,363	40,395	6,144	6,165	1,840	54,544
2004	32,799	7,325	40,124	6,417	5,900	1,919	54,361
2005	32,774	7,041	39,815	6,240	5,944	1,903	53,901
2006	32,976	6,550	39,525	6,495	5,600	1,915	53,535
2007	32,855	6,235	39,091	6,420	5,440	1,943	52,893
2008	31,768	6,134	37,902	6,925	4,992	1,876	51,695
2009	32,923	5,929	38,851	6,758	4,757	1,759	52,127
2010	32,923	5,929	38,851	6,758	4,757	1,759	52,127
2011	32,923	5,929	38,851	6,758	4,757	1,759	52,127
2012	34,077	5,723	39,800	6,592	4,523	1,643	52,558
2013	33,731	5,865	39,596	6,591	4,550	1,669	52,406
2014	33,868	6,049	39,917	6,653	4,465	1,857	52,892
Average	32,380	7,113	39,493	6,750	5,916	1,997	54,156
Minimum	29,862	5,723	37,902	6,085	4,465	1,565	51,695
Maximum	34,077	8,506	40,961	8,626	8,066	4,134	58,281

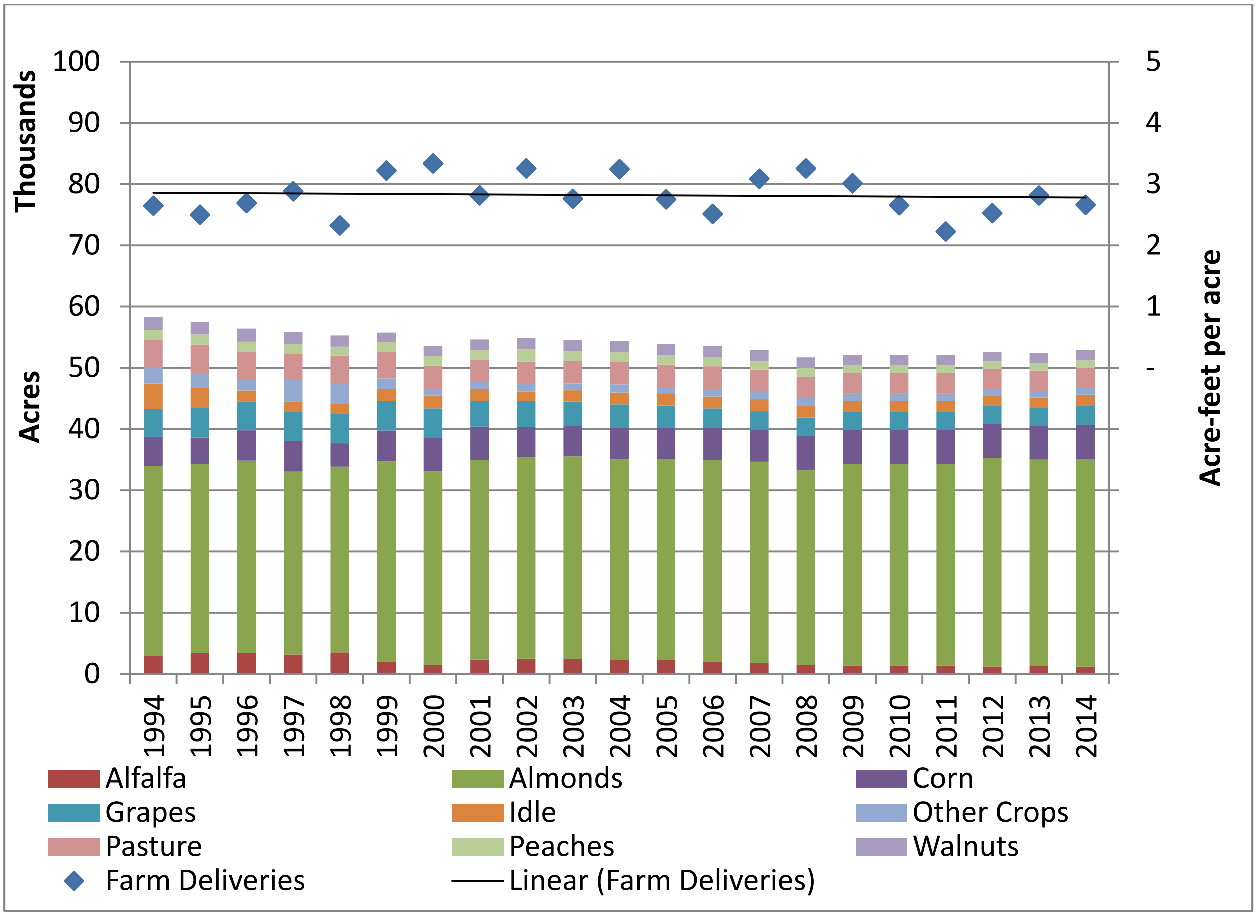

Figure 5-3. SSJID Cropping, 1994 to 2014.

Improved crop coefficients that reflect water use reductions due to crop stressors were developed for the water balance update. These crop coefficients were derived from actual ET (ET_a) estimated from remotely sensed surface energy balance results from Mapping EvapoTranspiration at high Resolution with Internalized Calibration (METRIC) for two recent years and CIMIS reference ET. Remotely sensed energy balance results account for the effects of salinity, deficit irrigation, disease, poor plant stands, and other stress factors on crop ET. Studies by Bastiaanssen, et al. (2005), Allen, et al. (2007 and 2011),Thoreson, et al. (2009) and others have found that when performed by an expert analyst, seasonal ET_a estimates by these models are within plus or minus five percent of actual ET. For crops grown in the SSJID service area, growing season ET computed using CIMIS reported reference evapotranspiration (ET_o) and crop coefficients are provided in Table 5-4.

The resulting ET_a is input to the IDC version 2015.0.0036 (DWR, 2015) to parse the ET_a between ET_{aw} and ET_{pr}. This approach provides an accurate and consistent calculation of historical crop ET (ET_c) and ET_{aw} and improves the reliability of the water balance and related performance indicators. Unit ET values for each crop were multiplied by the corresponding cropped acres in each year to compute total water volumes consumed for agricultural purposes.

The consumptive use of water by crops in SSJID ranges from approximately 23 inches of total crop ET for vineyards to approximately 38 inches for almonds, walnuts, and pasture (Table 5-4)[11]. ET_{aw} ranges from approximately 17 inches to 31 inches for the cropped area. Average total crop ET for almonds, SSJID's primary crop, is 38 inches with approximately 31 inches derived from applied irrigation water. On average, total crop ET in SSJID is 36 inches, with approximately 30 inches derived from applied irrigation water. The remainder of the crop ET is derived from precipitation, as described previously.

Table 5-4. Average Acreages and Annual Evapotranspiration Rates for SSJID Crops

Crop	Average Acres	Average Evapotranspiration (in)		
		ET_c	ET_{aw}	ET_{pr}
Alfalfa	2,138	36.4	29.2	7.3
Almonds	32,380	38.3	31.5	6.8
Corn	5,156	33.0	26.8	6.2
Grapes	3,828	22.7	17.1	5.6
Idle	1,997	27.3	22.3	5.0
Other Crops	1,594	35.5	30.1	5.4
Pasture	3,778	37.9	31.4	6.5
Peaches	1,507	36.5	29.9	6.6
Walnuts	1,778	38.0	31.0	7.0
Totals	54,156	36.0	29.5	6.6

ET_c and ET_{aw} vary substantially between wet and dry years due to differences in overall evaporative demand and differences in the amount of accumulated rainy season precipitation available to support crop growth and offset crop irrigation requirements. For the 1994 to 2014 period, wet year ET_c averaged approximately 35 inches while dry year ET_c averaged nearly 37 inches. Wet year ET_{aw} averaged nearly 27 inches while dry year ET_{aw} averaged over 31 inches.

Additional information describing crop ET over time is included in Section 5.7. Total annual crop ET varied between approximately 147,000 af and 178,000 af during the 1994 to 2014 period, with an average annual volume of 163,000 af. Approximately 133,000 af were derived from applied irrigation water (82%) and 30,000 af were derived from precipitation (18%).

Other uses of applied irrigation water include leaching of salts and frost protection for orchards and vineyards. Due to the low salinity of SSJID surface water, the required leaching fraction is small for the crops grown in the District and has not been estimated as part of this Plan.

[11] Crop ET values are presented in Table 5-4 and Section 5.6 on a calendar year basis to capture total ET_c, ET_{aw}, and ET_{pr} within SSJID. The vast majority of ET_c and ET_{aw} occur during the March to October irrigation season, with some residual ET occurring following cessation of irrigation in November, particularly on pasture and orchard ground.

Additionally, water applied for frost protection is typically applied outside of the irrigation season and has not been estimated at this time.

5.5.2 Environmental

The District is a member of the San Joaquin River Group Authority along with Merced Irrigation District (Merced ID), Modesto Irrigation District (MID), Turlock Irrigation District (TID), Oakdale Irrigation District (OID), Friant Water Users Authority (FWUA), the San Joaquin River Exchange Contractors Water Authority (Exchange Contractors) and its member districts, and the Public Utilities Commission of the City and County of San Francisco. The San Joaquin River Agreement is a cooperative effort developed by urban, agricultural, environmental and governmental agencies to meet flow obligations at Vernalis on the San Joaquin River southeast of Tracy. Under the Agreement, the Vernalis Adaptive Management Plan (VAMP) was developed as an experimental adaptive management program designed to protect juvenile Chinook salmon during migration through the River while also evaluating the effects of flows on salmon survival. VAMP was initiated in 2000 and ended in 2011.

Under VAMP, SSJID and other member agencies were responsible for releasing supplemental water to provide spring (April – May) pulse flows to encourage outmigration of young fall run Chinook salmon. The required supplemental pulse flows varied from year to year depending on existing flow conditions in the River and previous year conditions.

In certain years, SSJID's VAMP obligation was made available to USBR at New Melones Reservoir to be used at the Bureau's discretion for authorized purposes. Typically USBR released the additional water during other times of the year or carried it over in storage to the following year and then released it. Objectives of releases of the additional water included various fish and wildlife benefits such as additional instream flows on the Stanislaus River during the months when fish are present, ramping of flow changes on the River following high flow periods, implementing pre-VAMP and post-VAMP ramping objectives during the spring flow period, water for fall attraction flows, temperature control in the lower Stanislaus River during the summer and fall periods, and/or storage in New Melones Reservoir for the purpose of using the additional water to augment flows in subsequent dry years.

The total volume of water provided by SSJID for pulse flows or to USBR for other environmental purposes on the Stanislaus and San Joaquin rivers from 2000 to 2010 is summarized in Table 5-5. As suggested by the table, the need for SSJID supplemental water to increase river flows is correlated to years with partial allotments due to reduced inflow into New Melones Reservoir. During the 2005 to 2011 period, the two years in which SSJID provided supplemental water were the partial allocation years of 2007 and 2008.

Table 5-5. Annual SSJID Supplemental Water under VAMP, 2000 to 2010[12]

Year	SSJID Supplemental Water (af)
2000	7,300
2001	7,365
2002	3,795
2003	5,039
2004	5,880
2005	-
2006	-
2007	2,185
2008	7,260
2009	-
2010	-
Average	3,529

5.5.3 Recreational

The District co-owns three reservoirs with OID that are managed by the Tri-Dam Project for water supply, power generation, recreation and water sports. These reservoirs include the Beardsley Reservoir and Donnells Reservoir (Figure 5-4) above New Melones Reservoir and Tulloch Reservoir below New Melones. All of the reservoirs lie outside of SSJID's service area.

Woodward Reservoir is owned by SSJID with the adjoining lands and water surface managed for recreational purposes by the Stanislaus County Parks and Recreation Department. The Woodward Regional Park offers established campsites and recreational activities including; hunting, fishing, boating and swimming.

Water stored in the reservoirs is not "used" for recreation, per se, as it is not consumed to support recreation activities. Rather, the storage of water in the reservoirs supports recreation activities.

Figure 5-4. Donnells Reservoir

5.5.4 Municipal and Industrial

SSJID currently provides domestic water to several municipalities in southern San Joaquin County under the District's existing surface water rights. The South County Water Supply Program (SCWSP) was developed through a collaborative and cooperative effort of the SSJID,

[12] Based on San Joaquin River Group Authority annual technical reports from 2000 through 2010, available at www.sjrg.org/technicalreport/default.htm.

Manteca, Escalon, Lathrop and Tracy to provide treated surface water to supplement the City's existing groundwater supply. Funds provided by the supplied cities supported the construction of the Nick C. DeGroot Water Treatment Plant (WTP) just west of Woodward Reservoir Dam on Dodds Road. Phase I of the project included a 35-mile concrete-lined steel supply pipeline ending in the City of Tracy to supply Manteca, Lathrop and Tracy. Phase II will supply the city of Escalon and potentially the city of Ripon which currently purchases raw untreated water from SSJID with discussions continuing regarding a purchase of treated water in the future. Escalon currently sells its water allotment to the City of Tracy (P&P, 2011). Contractual allotments for the supplied cities are listed in Table 5-6.

Table 5-6. SCWSP Phase I and II Allotments by City (acre-feet)

Phase	City				Total
	Escalon	**Lathrop**	**Manteca**	**Tracy**	
Phase I Allotment	2,015	8,007	11,500	10,000	31,522
Phase II Allotment	2,799	11,791	18,500	1,000	34,090

Source: Water Supply Development Agreements between the cities and SSJID

From its commissioning in 2005 to 2010 the WTP has delivered a combined average of 15,700 af annually to the three cities currently under contract. Phase II will expand the sustained capacity of the system from 36 million gallons per day (MGD) to 57 MGD (P&P, 2011). Annual use is listed in Table 5-7. A map of the water systems and participating cities is provided in Figure 5-5.

Table 5-7. SCWSP Annual Water Usage by City (acre-feet)

Year	City				
	Escalon	**Lathrop**	**Manteca**	**Tracy**	**Total**
2005	0	777	2,861	2,855	6,493
2006	0	1,620	6,666	8,477	16,763
2007	0	2,014	6,344	8,781	17,139
2008	0	1,412	6,817	8,587	16,816
2009	0	1,650	6,970	11,126	19,746
2010	0	1,090	5,745	10,595	17,430
2011	0	1,054	5,803	11,459	18,316
2012	0	669	5,875	12,462	19,006
2013	0	615	7,032	12,714	20,361
2014	0	443	7,761	11,059	19,263

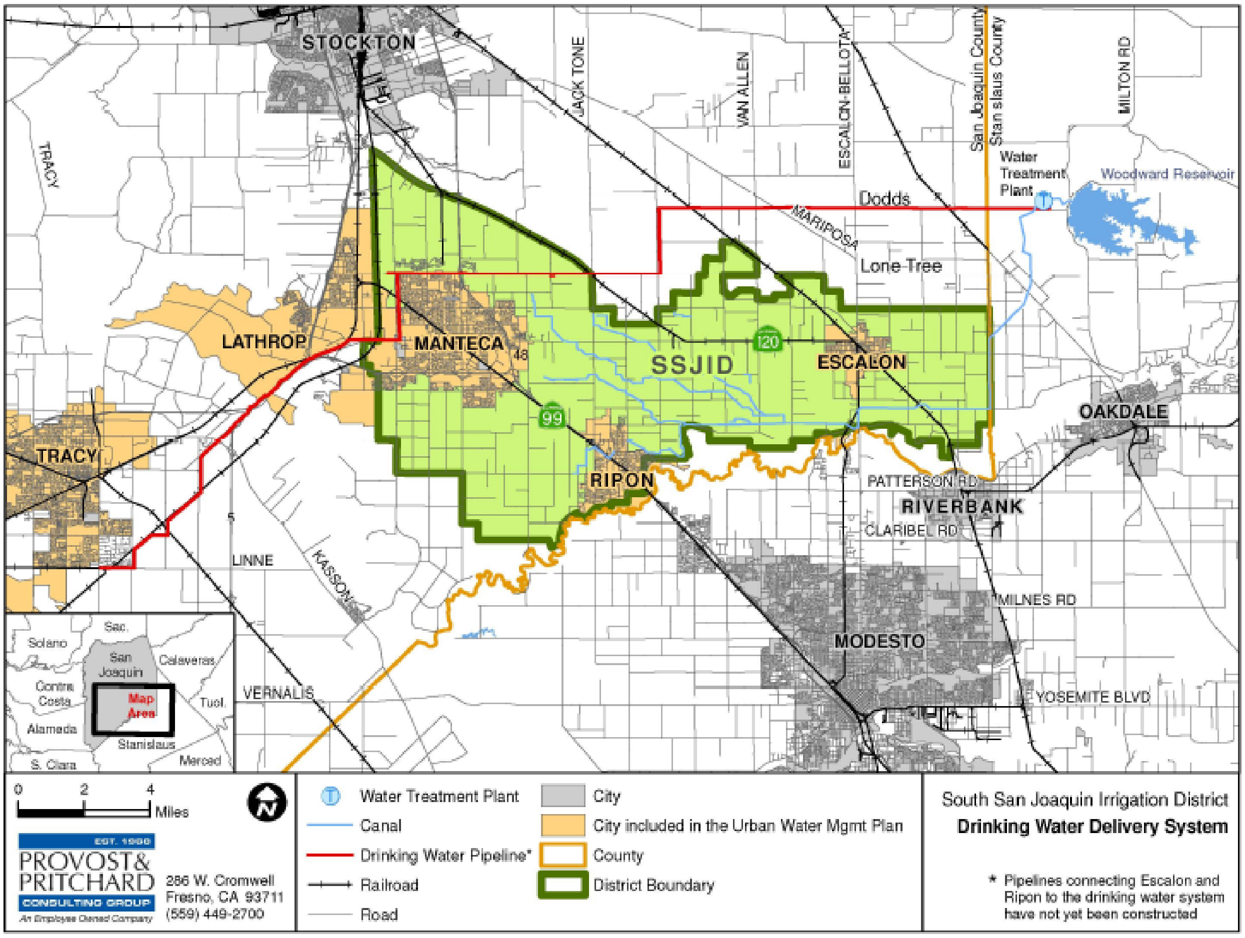

Figure 5-5. SCWSP Phase I Water System

Surface water is supplied to the WTP through an intake facility just below Woodward Reservoir and is filtered using state-of-the-art membrane filtration and mild chemical treatment technologies.

As discussed briefly in previous sections, the opportunity to provide supplemental water to municipalities was made possible through SSJID's extensive conservation and water management efforts in the 1980's and 90's that resulted in significant reductions in spillage and increased system efficiency. These improvements increased flexibility and reliability in the delivery of water for irrigation. Sale of conserved water generates revenues that can be used to further modernize and enhance the distribution system to the benefit of the District's customers. The SCWSP is an example of SSJID's active role in regional groundwater management and its commitment to maintaining local water supply reliability. The SCWSP also provides high quality drinking water to benefit local communities.

To offset the power used by the Water Treatment Plant and to maintain low water rates for both agricultural and municipal customers, SSJID constructed a seven-acre solar array utilizing thin-film solar modules mounted on frames instrumented to provide solar tracking—a first for the solar industry. The construction was initiated in two phases with the first featuring almost seven thousand 175-Watt crystalline modules with a maximum power production of 1.2 megawatts. Phase II was completed in March of 2009 and incorporated almost 6,000 additional 72.5 watt thin-film modules to bring the total production potential to almost 1.4 megawatts. Phase I of the solar field came on-line on May 15, 2008 and was dedicated as the Robert O. Schulz Solar Farm on July 18. The solar farm provides nearly all of the power used by the WTP.

5.5.5 Groundwater Recharge

Groundwater recharge that occurs within SSJID consists of seepage from SSJID canals and reservoirs and deep percolation of precipitation and applied irrigation water. Soil conditions conducive to direct artificial recharge do exist but are not cost effective for the District, and distributed recharge from canals and ditches provides recharge to maintain water levels in the East San Joaquin subbasin underlying SSJID to the benefit of SSJID water users, communities within SSJID, and surrounding areas that share the groundwater resource. Inflows to the groundwater system and pumping volumes for the 1994 to 2014 period are shown in Figure 5-6, along with the net annual volume of groundwater recharge.

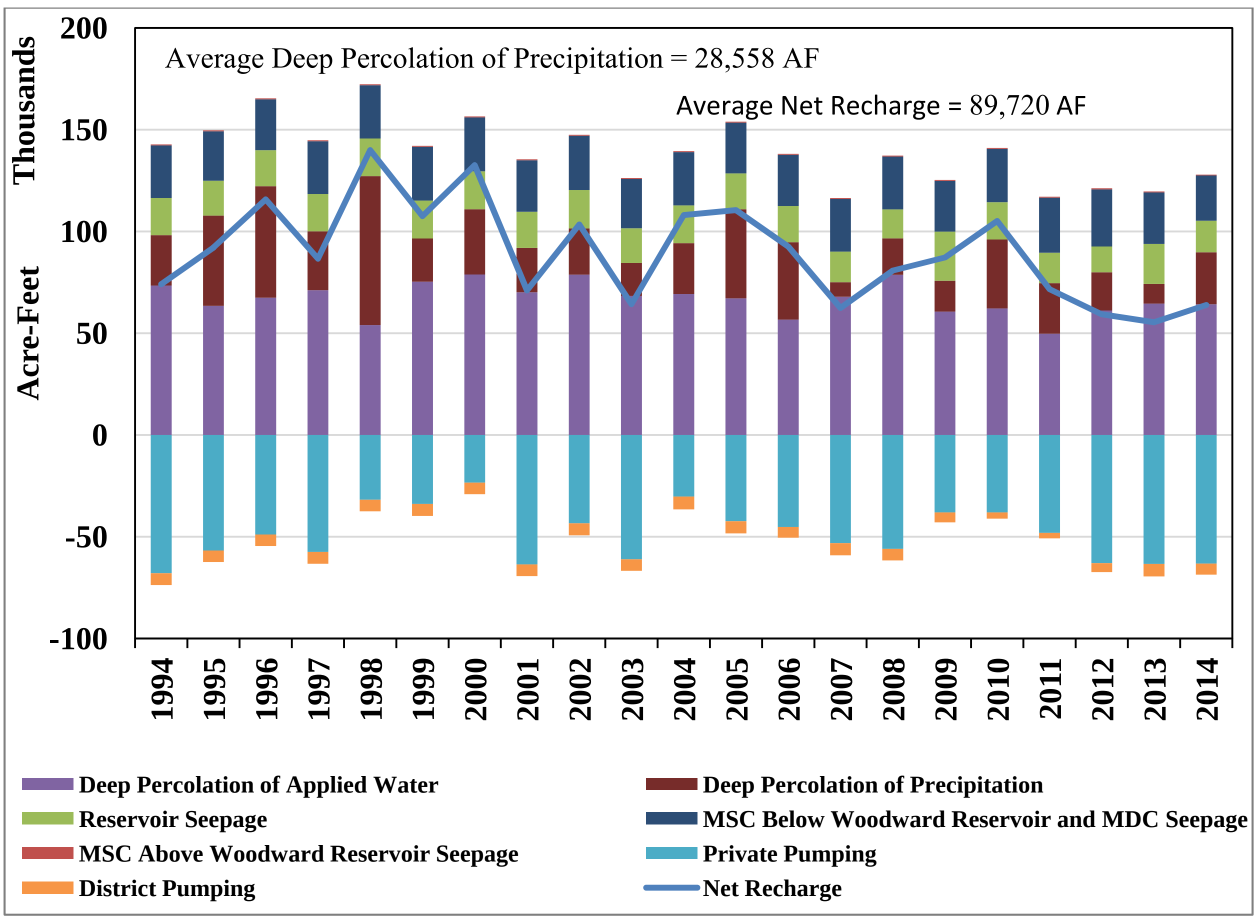

Figure 5-6. Groundwater System Inflows, Outflows, and Net Recharge, 1994 to 2014

Estimates of recharge were derived from the water balance analysis. As described previously in section 5.2, three main refinements have improved the completeness and accuracy of the water balance. The improved crop coefficients result in less ET_{aw} and correspondingly more deep percolation of applied water. Extending the irrigation season water balance to an annual water balance includes deep percolation that occurs during the winter season. These refinements together result in an increase in net recharge compared to the values presented in the 2012 AWMP.

Lateral seepage was calculated based on soil characteristics along with estimated lateral wetted perimeters, overall lengths, and wetting frequency. Seepage from Woodward Reservoir was calculated as the closure term of the MSC above Woodward Reservoir and Woodward Reservoir water balance accounting center. Seepage from the Lower MSC and Main Distributary Canal (MDC) was calculated as the closure term of the Lower MSC and MDC water balance accounting center. Drain seepage is small and was estimated as zero at this time. Seepage and deep percolation volumes for 1994 to 2014 are provided in Table 5-8, along with total recharge expressed as a volume and as a depth of water relative to the cropped area in each year.

Total recharge between 1994 and 2014 ranged from approximately 122,000 af to 177,000 af per year, or from 2.3 af to 3.2 af per cropped acre per year. On average, total recharge was estimated to be approximately 144,000 af per year (2.7 af/ac-yr), with approximately 34 percent of recharge originating from canal seepage and 66 percent of recharge originating from deep percolation. Seepage from drains was assumed negligible in the water balance.

Groundwater recharge net of well pumping[13] was calculated by subtracting estimated SSJID and private pumping volumes from total recharge volumes. Net recharge estimates for the analysis period are provided in Table 5-9.

Annual recharge from seepage, deep percolation of applied water, and deep percolation of precipitation is 144,000 acre-feet, on average, while District and private groundwater pumping is about 54,000 acre-feet. Thus, the net effect of District, landowner operations and annual precipitation is recharge of nearly 90,000 acre-feet each year. During the water balance analysis period, net recharge varied from a low of 55,000 acre-feet (1.1 af/ac) in 2012 and 2013 to a high of about 140,000 acre-feet (2.5 af/ac) in 1998.

Net groundwater recharge tends to be greater in wet, full allocation years. Net recharge was relatively large in 1998, primarily due to precipitation and the abundance of surface water, which resulted in reduced groundwater pumping and additional seepage and deep percolation of applied surface water, as compared to other years. Net wet year groundwater recharge averaged approximately 105,000 af between 1994 and 2014, while net dry year recharge averaged approximately 78,000 af.

[13] Total groundwater pumping includes SSJID and private pumping for irrigation.

Table 5-8. SSJID Total Groundwater Recharge, 1994 to 2014

Year	USBR Allotment	Hydrologic Year Type	Lateral, MDC and Reservoir Seepage (af)	Drain Seepage (ac-ft)	Deep Percolation (af)	Total Recharge	
						(ac-ft)	(ac-ft/ac)
1994	Full	Dry	49,634	0	98,172	147,806	2.5
1995	Full	Wet	46,715	0	107,742	154,457	2.7
1996	Full	Wet	48,062	0	122,257	170,319	3.0
1997	Full	Wet	49,859	0	100,042	149,901	2.7
1998	Full	Wet	50,308	0	127,156	177,465	3.2
1999	Full	Dry	50,757	0	96,503	147,260	2.6
2000	Full	Wet	50,757	0	110,934	161,691	3.0
2001	Partial	Dry	48,512	0	91,875	140,386	2.6
2002	Full	Dry	51,207	0	101,510	152,716	2.8
2003	Full	Dry	46,490	0	84,488	130,978	2.4
2004	Full	Dry	50,308	0	94,291	144,599	2.7
2005	Full	Wet	47,838	0	110,950	158,787	2.9
2006	Full	Wet	48,287	0	94,739	143,026	2.7
2007	Partial	Dry	46,392	0	75,114	121,507	2.3
2008	Partial	Dry	45,773	0	96,614	142,387	2.8
2009	Full	Dry	54,412	0	75,760	130,172	2.5
2010	Full	Wet	50,125	0	96,083	146,208	2.8
2011	Full	Wet	47,723	0	74,640	122,364	2.3
2012	Full	Dry	46,768	0	79,951	126,720	2.4
2013	Partial	Dry	50,651	0	74,202	124,853	2.4
2014	Partial	Dry	42,733	0	89,780	132,513	2.5
Wet Year Average			48,853	0	104,949	153,802	2.8
Dry Year Average			48,636	0	88,188	136,825	2.5
Overall Average			48,729	0	95,372	144,101	2.7

Table 5-9. SSJID Net Groundwater Recharge, 1994 to 2014

Year	USBR Allotment	Hydrologic Year Type	Total Recharge (ac-ft)	Groundwater Pumping (ac-ft)	Net Recharge	
					(ac-ft)	(ac-ft/ac)
1994	Full	Dry	147,806	73,720	74,086	1.3
1995	Full	Wet	154,457	62,378	92,079	1.6
1996	Full	Wet	170,319	54,577	115,742	2.1
1997	Full	Wet	149,901	63,303	86,598	1.6
1998	Full	Wet	177,465	37,509	139,956	2.5
1999	Full	Dry	147,260	39,734	107,526	1.9
2000	Full	Wet	161,691	29,093	132,598	2.5
2001	Partial	Dry	140,386	69,321	71,066	1.3
2002	Full	Dry	152,716	49,315	103,402	1.9
2003	Full	Dry	130,978	66,729	64,249	1.2
2004	Full	Dry	144,599	36,555	108,045	2.0
2005	Full	Wet	158,787	48,328	110,460	2.0
2006	Full	Wet	143,026	50,446	92,580	1.7
2007	Partial	Dry	121,507	59,126	62,381	1.2
2008	Partial	Dry	142,387	61,619	80,768	1.6
2009	Full	Dry	130,172	42,930	87,242	1.7
2010	Full	Wet	146,208	41,081	105,127	2.0
2011	Full	Wet	122,364	50,737	71,627	1.4
2012	Full	Dry	126,720	67,378	59,341	1.1
2013	Partial	Dry	124,853	69,500	55,353	1.1
2014	Partial	Dry	132,513	68,611	63,902	1.2
Wet Year Average			153,802	48,606	105,196	1.9
Dry Year Average			136,825	58,711	78,113	1.4
Overall Average			144,101	54,380	89,720	1.7

5.5.6 Transfers and Exchanges

Voluntary transfers of water provide a source of funding for improvements to the SSJID distribution system. SSJID has participated in several water transfers in the past, and continues to seek opportunities for mutually beneficial transfer agreements with water users outside of the District. Parties to whom SSJID has transferred water include Stockton-East Water District (SEWD), VAMP, USBR, Central San Joaquin Water Conservation District (CSJWCD), San Luis-Delta Mendota Water Agency (SLDMWA), and South Delta Water Agency (SDWA).

In 1997, SSJID entered a 10-year contract with SEWD to provide a maximum of 15,000 ac-feet (adjusted based on annual inflows to New Melones) of surface water annually primarily for municipal and industrial use by the City of Stockton and the Lincoln Village and Colonial Heights Maintenance Districts. Deliveries commenced in 2000 and ended in 2010.

The VAMP and USBR transfers were primarily for environmental uses, such as to encourage outmigration of fall run Chinook salmon smolt (Figure 5-7), as described previously in Section 5.2.2. In addition to environmental uses, transfers to USBR are integrated into the Central Valley Project (CVP) operations, enabling USBR to meet contractual water supply obligations more reliably and to comply with Delta outflow and water quality requirements.

Figure 5-7. Chinook Salmon Smolt

From 1994 to 2014, SSJID transferred a total of 445,000 af, or about 23,400 af per year, on average (Table 5-10).

Table 5-10. SSJID Water Transfers, 1997 to 2014

	Transfer Recipient						
Year	**SEWD**	**VAMP**	**CSJWCD**	**USBR**	**SLDMWA**	**SDWA**	Total
1994	0	0	0	32,777	0	0	32,777
1997	0	0	0	40,000	0	0	40,000
1998	0	0	0	25,000	0	0	25,000
1999	0	0	0	25,000	0	0	25,000
2000	15,000	0	0	0	0	0	15,000
2001	23,750	7,365	0	0	0	0	31,115
2002	15,000	3,795	20,000	0	0	0	38,795
2003	15,000	5,039	15,000	0	0	0	35,039
2004	15,147	3,834	10,000	0	0	0	28,981
2005	15,117	0	0	0	0	0	15,117
2006	15,298	0	0	0	0	0	15,298
2007	15,820	0	0	10,000	0	0	25,820
2008	18,200	7,260	1,600	0	0	0	27,060
2009	20,000	0	0	0	25,000	0	45,000
2010	4,089	0	0	0	0	0	4,089
2011	0	0	0	0	0	130	130
2012	0	0	0	0	0	130	130
2013	0	0	0	0	40,000	150	40,150
2014	0	0	0	0	0	325	325
Totals	172,421	27,293	46,600	132,777	65,000	735	444,826

5.5.7 Other Water Uses

Other incidental uses of water within SSJID may include watering of roads for dust abatement, agricultural spraying, and stock watering by SSJID water users. The volume of water used for such purposes is small relative to other uses and has not been quantified as part of this AWMP.

5.6 DRAINAGE

5.6.1 SSJID Boundary Outflows

As previously discussed, SSJID undertook and completed a systematic evaluation and ranking of boundary flow measurement sites in 2010 for the purpose of identifying potential improvements needed at each site and prioritizing the sites. Since that time, SSJID has established improved flow measurement and remote monitoring and is currently monitoring twelve of fourteen boundary outflow sites. The monitored drainage outflow sites represent approximately 97 percent of the total boundary outflows from SSJID. The district plans to continue to increase the number of operational spill sites measured over time and, in 2016, has budgeted for the installation of Sontek IQs on all 10 laterals that spill to the FCOC drain.

The increased monitoring and measurement of drainage flows have allowed SSJID to better evaluate potential projects to reduce or recover boundary outflows for reuse within SSJID, effectively increasing the District's available surface water supply.

Estimated total boundary outflows from SSJID for 2003 to 2014 are summarized in Table 5-11. Total boundary outflows for the irrigation season ranged from approximately 15,498 af in 2014 to 37,368 af, in 2011 with an overall average of 26,847 af. In 2011, the USBR requested SSJID to pass New Melones flood releases through the SSJID distribution system leading to the high drainage outflows seen in that year. Drainage outflow estimates were not available prior to 2003 and are thus not presented.

Based on the period from 2003 to 2014, boundary outflows vary between wet and dry years averaging 30,390 af and 25,075 af, respectively. Flow path differences in wet and dry years are summarized qualitatively in Table 5-12.

The quality of SSJID drainwater is discussed in Section 4.

Table 5-11. Estimated SSJID Boundary Outflows During Irrigation Seasons, 2003 to 2014.

Year	USBR Allotment	Hydrologic Year Type	Seasonal Drainwater Outflow (ac-ft)
2003	Full	Dry	29,156
2004	Full	Dry	27,968
2005	Full	Wet	27,747
2006	Full	Wet	30,029
2007	Partial	Dry	25,910
2008	Partial	Dry	23,790
2009	Full	Dry	21,584
2010	Full	Wet	26,417
2011	Full	Wet	37,368
2012	Full	Dry	29,942
2013	Partial	Dry	26,750
2014	Partial	Dry	15,498
		Wet Year Average	30,390
		Dry Year Average	25,075
		Overall Average	26,847

Table 5-12. General Effects of Hydrologic Year Type on SSJID Drainage System Inflows

Drainage System Flowpath	Wet Year Effect	Dry Year Effect	Notes
Lateral Spillage (Inflow)	More	Less	Operational spillage is related to hydrologic year type based on currently available data. Spill in dry years is reduced due to more careful operation of the distribution system.
Tributary Inflows	More	Less	Greater precipitation tends to occur during the irrigation season of wet years, resulting in increased tributary inflows.
Farm Tailwater (Inflow)	Little or No Change	Little or No Change	Tailwater production is limited in SSJID due to the predominance of level-basin irrigation and ongoing conversion to pressurized irrigation.
Runoff of Precipitation and Direct Precipitation (Inflow)	More	Less	Greater precipitation tends to occur during the irrigation season of wet years, resulting in increased runoff or precipitation and direct precipitation in the drains.

5.7 WATER ACCOUNTING (SUMMARY OF WATER BALANCE RESULTS)

The SSJID water balance structure was shown previously in Figure 5-1. The water balance was prepared for five accounting centers: (1) Main Supply Canal, including Woodward Reservoir; (2) Main Supply Canal below Woodward Reservoir and the Main Distribution Canal; (3) District Laterals (4) SSJID Irrigated Lands; and (5) SSJID drainage system. Additionally, the water balance can be summarized for the SSJID service area as a whole ("District Water Balance Boundary" shown in Figure 5-1). An accounting center representing the groundwater system is also included in Figure 5-1 to account for exchanges between the vadose zone and the aquifers underlying SSJID; however, a complete balance for the underlying aquifer is not calculated because not all subsurface inflows and outflows have been estimated. Tabulated water balance results for each accounting center are provided in Tables 5-13, 5-14, 5-15, 5-16, and 5-17.

The water balance is presented on an annual time step for the irrigation season (approximately March through October) for the canal system and drainage system and a complete annual balance for the irrigated lands. Underlying the annual time step is a more detailed water balance in which all flow paths are determined on a monthly time step. The winter months are excluded from the canal and drainage system because the non-irrigation season water balance is influenced by unmeasured intercepted stormwater, and the information provided does not pertain to SSJID water management activities.

5.7.1 Upper Main Supply Canal and Woodward Reservoir

Over the1994 to 2014 water balance period, the District distribution system had total inflows from Goodwin Dam ranging from 204,500 af to 262,500 af for the irrigation season with a wet year average of 220,000 af and a dry year average of 237,000 af. The overall average for the 21 year period was 230,000 af. When reservoir storage is sufficient, diversions are greater in dry years due to the fact that less precipitation is available to support crop water demands in SSJID and evaporative demands tend to be greater. As a result, additional irrigation deliveries are needed to maintain crop production.

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Table 5-13. Upper MSC and Woodward Reservoir Irrigation Season Water Balance

Year	Hydrologic Year Type	Irrigation Seasons Number of Days	Inflow (af) Diversions from Joint Supply Canal[1]	Inflow (af) Ordered Spillage	Inflow (af) Precipitation	Outflow (af) U3 Ranch Deliveries[2]	Outflow (af) WTP Deliveries	Outflow (af) Woodward Reservoir Releases	Outflow (af) Evaporation	Outflow (af) Canal Seepage	Outflow (af) Reservoir Seepage	Change in Reservoir Storage	Performance Indicators Delivery Fraction[3]	Performance Indicators Water Management Fraction[4]
1994	Dry	221	224,971	19,464	385	4,495	0	207,071	6,959	465	18,232	7,597	0.90	0.97
1995	Wet	208	210,514	20,430	252	3,687	0	202,365	6,411	438	17,160	1,135	0.90	0.97
1996	Wet	214	235,062	21,610	370	4,211	0	215,657	6,745	451	17,655	12,324	0.90	0.97
1997	Wet	222	229,837	24,665	160	3,840	0	234,138	7,001	468	18,315	-9,099	0.90	0.97
1998	Wet	224	208,307	18,661	1,137	4,713	0	190,354	6,074	472	18,480	8,012	0.89	0.98
1999	Dry	226	235,598	0	268	4,298	0	230,778	6,735	476	18,645	-25,065	0.89	0.98
2000	Wet	226	229,632	0	602	4,385	0	230,545	6,662	476	18,645	-30,478	0.89	0.98
2001	Dry	216	217,940	0	206	4,276	0	198,585	7,219	455	17,820	-10,209	0.88	0.97
2002	Dry	228	249,271	99	330	4,385	0	230,092	7,021	480	18,810	-11,089	0.90	0.97
2003	Dry	207	228,117	1,803	235	3,796	0	200,042	6,590	436	17,077	2,214	0.90	0.97
2004	Dry	224	262,500	10,479	337	4,516	0	219,778	7,274	472	18,480	22,796	0.91	0.97
2005	Wet	213	204,501	260	817	3,949	706	193,686	6,667	449	17,572	-17,451	0.88	0.97
2006	Wet	215	222,390	10,358	788	3,971	9,087	192,116	6,425	453	17,737	3,747	0.90	0.98
2007	Dry	221	249,569	1,081	222	4,407	11,633	208,085	7,125	465	14,990	4,166	0.91	0.97
2008	Dry	222	252,483	277	22	4,473	11,977	213,400	7,191	468	14,228	1,045	0.91	0.97
2009	Dry	213	244,059	280	371	4,320	12,913	194,560	6,718	449	24,146	1,604	0.87	0.97
2010	Wet	224	223,202	260	760	4,364	12,011	184,904	6,462	472	18,296	-2,284	0.89	0.97
2011	Wet	231	219,289	9,103	916	4,407	12,490	181,810	6,487	487	14,900	8,728	0.91	0.97
2012	Dry	240	225,684	181	737	4,822	13,327	187,830	6,976	505	12,666	475	0.91	0.97
2013	Dry	226	239,670	30	253	4,516	13,838	191,012	7,232	476	19,668	3,210	0.89	0.97
2014	Dry	199	213,017	43	323	4,320	11,282	167,063	6,642	419	15,452	8,205	0.90	0.97
Minimum		199	204,501	0	22	3,687	0	167,063	6,074	419	12,666	-30,478	0.87	0.97
Maximum		240	262,500	24,665	1,137	4,822	13,838	234,138	7,274	505	24,146	22,796	0.91	0.98
Wet Year Average		220	220,304	11,705	645	4,170	3,810	202,842	6,548	463	17,640	-2,819	0.90	0.97
Dry Year Average		220	236,907	2,811	307	4,385	6,247	204,025	6,973	464	17,518	412	0.90	0.97
Overall Average		220	229,791	6,623	452	4,293	5,203	203,518	6,791	463	17,570	-972	0.90	0.97

1. The SSJID Diversions from the Joint Supply Canal in the water balance are for the SSJID irrigation season or calendar year and will be close to, but in most years will not match SSJID official diversion records which are kept on a water year (October 1 through September 30) basis.
2. U3 Ranch Deliveries estimated as 11 cfs (24 hour) delivery when the flow in the Main Supply Canal is greater than 100 cfs based on operations reports provided by the District
3. (U3 Ranch Deliveries + WTP Deliveries + Woodward Releases) / Diversions from Joint Supply Canal
4. (U3 Ranch Deliveries + WTP Deliveries + Woodward Releases + Canal Seepage + Reservoir Seepage) / (Diversions from Joint Supply Canal - Change in Reservoir Storage)

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Table 5-14. Lower MSC and MDC Irrigation Season Water Balance

			Inflow (af)			Outflow (af)							
Year	Hydrologic Year Type	Irrigation Seasons Number of Days	Woodward Reservoir Releases	Spills to Main Canal	Total Supply	Lateral Deliveries	Ordered Spillage	Operational Spillage	ET	Canal Seepage	Direct Diversion From MDC	Delivery Fraction[1]	Water Management Fraction[2]
1994	Dry	221	207,071	17,597	224,669	177,331	19,464	467	525	25,857	1,026	88%	0.998
1995	Wet	208	202,365	8,883	211,249	165,064	20,430	0	483	24,336	935	88%	0.998
1996	Wet	214	215,657	6,950	222,606	174,488	21,610	0	509	25,038	961	89%	0.998
1997	Wet	222	234,138	3,211	237,349	185,103	24,665	0	528	25,974	1,080	89%	0.998
1998	Wet	224	190,354	3,629	193,984	147,880	18,661	0	458	26,208	777	86%	0.998
1999	Dry	226	230,778	3,668	234,446	206,502	0	0	508	26,442	994	89%	0.998
2000	Wet	226	230,545	3,091	233,636	205,742	0	0	502	26,442	949	88%	0.998
2001	Dry	216	198,585	5,220	203,806	176,905	0	0	544	25,272	1,085	87%	0.997
2002	Dry	228	230,092	3,668	233,760	205,396	99	0	529	26,676	1,059	88%	0.998
2003	Dry	207	200,042	3,668	203,710	176,131	1,803	0	497	24,219	1,060	88%	0.998
2004	Dry	224	219,778	18,832	238,610	200,341	10,479	0	549	26,208	1,033	89%	0.998
2005	Wet	213	193,686	4,904	198,590	171,989	260	0	503	24,921	918	87%	0.997
2006	Wet	215	192,116	5,757	197,873	160,958	10,358	0	485	25,155	917	87%	0.998
2007	Dry	221	208,085	6,154	214,239	185,642	1,081	0	537	25,857	1,122	88%	0.997
2008	Dry	222	213,400	3,668	217,069	189,130	277	0	542	25,974	1,146	88%	0.998
2009	Dry	213	194,560	8,078	202,638	175,894	280	0	507	24,921	1,036	87%	0.997
2010	Wet	224	184,904	7,041	191,945	164,093	260	0	487	26,208	896	86%	0.997
2011	Wet	231	181,810	8,958	190,768	153,271	9,103	0	489	27,027	878	86%	0.997
2012	Dry	240	187,830	2,819	190,649	160,821	181	0	526	28,080	1,041	85%	0.997
2013	Dry	226	191,012	6,656	197,668	170,661	30	0	545	25,312	1,120	87%	0.997
2014	Dry	199	167,063	9,888	176,951	153,051	43	0	501	22,288	1,069	87%	0.997
Minimum		199	167,063	2,819	176,951	147,880	0	0	458	22,288	777	85%	0.997
Maximum		240	234,138	18,832	238,610	206,502	24,665	467	549	28,080	1,146	89%	0.998
Wet Year Average		220	202,842	5,825	208,667	169,843	11,705	0	494	25,701	923	87%	0.998
Dry Year Average		220	204,025	7,493	211,518	181,484	2,811	39	526	25,592	1,066	88%	0.997
Overall Average		220	203,518	6,778	210,296	176,495	6,623	22	512	25,639	1,005	87%	0.998

1. (Lateral Deliveries + Direct Diversions from Main Canal + Ordered Spillage) / (Total Supply)
2. (Lateral Deliveries + Direct Diversions from Main Canal + Ordered Spillage + Operational Spillage + Canal Seepage) / (Total Supply)

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Table 5-15. District Laterals Irrigation Season Water Balance

Year	Hydrologic Year Type	Irrigation Seasons Number of Days	Inflows (af)		Outflows (af)				Performance Indicators	
			Lateral Deliveries	District Pumping	Lateral Seepage	Lateral Evaporation	Farm Deliveries	Lateral Spillage	Delivery Fraction[1]	Water Management Fraction[2]
1994	Dry	221	177,331	5,822	5,080	714	154,306	23,053	0.842	0.996
1995	Wet	208	165,064	5,612	4,781	658	143,778	21,458	0.842	0.996
1996	Wet	214	174,488	5,707	4,919	692	151,900	22,684	0.843	0.996
1997	Wet	222	185,103	5,831	5,103	719	161,049	24,063	0.843	0.996
1998	Wet	224	147,880	5,708	5,149	624	128,592	19,224	0.837	0.996
1999	Dry	226	206,502	5,831	5,195	691	179,602	26,845	0.846	0.997
2000	Wet	226	205,742	5,678	5,195	684	178,795	26,747	0.846	0.997
2001	Dry	216	176,905	5,749	4,965	741	153,950	22,998	0.843	0.996
2002	Dry	228	205,396	5,895	5,241	721	178,629	26,702	0.845	0.997
2003	Dry	207	176,131	5,641	4,758	676	150,657	25,681	0.829	0.996
2004	Dry	224	200,341	6,306	5,149	747	176,394	24,358	0.854	0.996
2005	Wet	213	171,989	5,974	4,896	684	148,335	24,047	0.834	0.996
2006	Wet	215	160,958	5,239	4,942	660	134,590	26,006	0.810	0.996
2007	Dry	221	185,642	6,024	5,080	731	163,339	22,515	0.852	0.996
2008	Dry	222	189,130	5,656	5,103	738	168,319	20,626	0.864	0.996
2009	Dry	213	175,894	4,917	4,896	690	157,106	18,120	0.869	0.996
2010	Wet	224	164,093	3,078	5,149	663	138,467	22,893	0.828	0.996
2011	Wet	231	153,271	2,601	5,310	666	116,059	33,837	0.745	0.996
2012	Dry	240	160,821	4,399	5,517	716	132,789	26,198	0.804	0.996
2013	Dry	226	170,661	6,120	5,195	742	147,495	23,349	0.834	0.996
2014	Dry	199	153,051	5,388	4,574	682	140,810	12,373	0.889	0.996
	Minimum	199	147,880	2,601	4,574	624	116,059	12,373	0.745	0.996
	Maximum	240	206,502	6,306	5,517	747	179,602	33,837	0.889	0.997
	Wet Year Average	220	169,843	5,048	5,049	672	144,618	24,551	0.825	0.996
	Dry Year Average	220	181,484	5,646	5,063	716	158,616	22,735	0.848	0.996
	Overall Average	220	176,495	5,389	5,057	697	152,617	23,513	0.838	0.996

1. (Farm Deliveries) / (Lateral Deliveries + District Pumping
2. (Farm Deliveries + Lateral Spillage + Lateral Seepage) / (Lateral Deliveries + District Pumping)

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Table 5-16. Irrigated Lands Annual Water Balance

			Applied Water Balance								Precipitation Balance				
			Inflows (af)			Outflows (af)			Performance Indicators		Inflows (af)	Outflows (af)			
Year	Hydrologic Year Type	Irrigation Seasons Number of Days[1]	Farm Deliveries	Direct Diversion from Main Canal	Private Pumping	ETaw	Tailwater	Deep Percolation of Applied Water	Surface Water Supply Fraction[1]	Crop Consumptive Use Fraction[2]	Precipitation	Deep Percolation of Precipitation	ETpr	Runoff and Evaporation of Precipitation	Change in Storage Precipitation
1994	Dry	221	154,306	1,026	67,897	146,678	3,143	73,408	0.71	0.66	47,547	24,763	32,056	20	-9,293
1995	Wet	208	143,778	935	56,766	135,104	2,895	63,480	0.73	0.67	82,987	44,262	32,711	333	5,681
1996	Wet	214	151,900	961	48,870	131,461	2,817	67,454	0.76	0.65	101,263	54,803	40,825	604	5,031
1997	Wet	222	161,049	1,080	57,472	145,360	3,115	71,126	0.75	0.66	50,583	28,916	26,441	78	-4,851
1998	Wet	224	128,592	777	31,801	104,887	2,248	54,035	0.80	0.65	116,079	73,121	45,080	426	-2,549
1999	Dry	226	179,602	994	33,902	136,285	2,920	75,293	0.84	0.64	45,953	21,209	26,988	17	-2,261
2000	Wet	226	178,795	949	23,416	121,707	2,608	78,845	0.88	0.60	67,447	32,089	32,051	225	3,082
2001	Dry	216	153,950	1,085	63,572	145,385	3,115	70,107	0.72	0.67	65,522	21,768	30,094	134	13,526
2002	Dry	228	178,629	1,059	43,420	141,327	3,028	78,752	0.81	0.63	43,284	22,758	26,628	206	-6,307
2003	Dry	207	150,657	1,060	61,088	141,429	3,031	68,345	0.73	0.66	43,135	16,143	24,495	4	2,493
2004	Dry	224	176,394	1,033	30,248	135,499	2,904	69,273	0.85	0.65	65,732	25,018	34,105	258	6,350
2005	Wet	213	148,335	918	42,354	121,865	2,611	67,130	0.78	0.64	78,157	43,820	36,096	98	-1,857
2006	Wet	215	134,590	917	45,207	121,447	2,602	56,664	0.76	0.67	66,919	38,075	34,843	253	-6,252
2007	Dry	221	163,339	1,122	53,102	146,497	3,139	67,927	0.76	0.67	28,077	7,187	19,145	9	1,737
2008	Dry	222	168,319	1,146	55,963	143,635	3,078	78,715	0.76	0.64	37,005	17,899	20,903	87	-1,884
2009	Dry	213	157,106	1,036	38,013	132,706	2,844	60,605	0.80	0.68	47,696	15,155	24,814	187	7,540
2010	Wet	224	138,467	896	38,002	112,788	2,417	62,160	0.80	0.64	79,971	33,923	36,780	102	9,166
2011	Wet	231	116,059	878	48,135	112,904	2,419	49,750	0.75	0.68	47,652	24,891	34,391	93	-11,723
2012	Dry	240	132,789	1,041	62,979	132,770	2,845	61,195	0.71	0.67	55,274	18,756	22,914	54	13,550
2013	Dry	226	147,495	1,120	63,380	144,331	3,093	64,571	0.71	0.68	20,133	9,631	19,881	19	-9,398
2014	Dry	199	140,810	1,069	63,223	137,896	2,955	64,251	0.69	0.67	60,032	25,529	23,202	340	10,961
Minimum		199	116,059	777	23,416	104,887	2,248	49,750	0.69	0.60	20,133	7,187	19,145	4	-11,723
Maximum		240	179,602	1,146	67,897	146,678	3,143	78,845	0.88	0.68	116,079	73,121	45,080	604	13,550
Wet Year Average		220	144,618	923	43,558	123,058	2,637	63,405	0.78	0.65	76,784	41,544	35,469	246	-475
Dry Year Average		220	158,616	1,066	53,066	140,370	3,008	69,370	0.76	0.66	46,616	18,818	25,436	111	2,251
Overall Average		220	152,617	1,005	48,991	132,950	2,849	66,814	0.77	0.66	59,545	28,558	29,735	169	1,083

1. (Lateral Deliveries + Direct Diversion from Main Canal) / (Lateral Deliveries + Direct Diversion from Main Canal + District Pumping + Private Pumping)
2. ET_{aw} / (Farm Deliveries + Direct Diversions from Main Canal + Private Pumping**)**

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Table 5-17. SSJID Drainage System Irrigation Season Water Balance (AF)

Year	Hydrologic Year Type	Irrigation Seasons Number of Days	Inflows (af)				Outflows (af)		
			Tailwater	Runoff of Precipitation	Lateral Spillage	Tributary Inflow	Seepage/GW Interception	ET	District Outflow
2003	Dry	207	3,031	2	25,681	442	0	0	29,156
2004	Dry	224	2,904	129	24,358	578	0	0	27,968
2005	Wet	213	2,611	49	24,047	1,039	0	0	27,747
2006	Wet	215	2,602	127	26,006	1,294	0	0	30,029
2007	Dry	221	3,139	4	22,515	252	0	0	25,910
2008	Dry	222	3,078	43	20,626	43	0	0	23,790
2009	Dry	213	2,844	93	18,120	527	0	0	21,584
2010	Wet	224	2,417	51	22,893	1,056	0	0	26,417
2011	Wet	231	2,419	47	33,837	1,065	0	0	37,368
2012	Dry	240	2,845	27	26,198	872	0	0	29,942
2013	Dry	226	3,093	9	23,349	299	0	0	26,750
2014	Dry	199	2,955	170	12,373	0	0	0	15,498
Minimum		199	2,417	2	12,373	0	0	0	15,498
Maximum		240	3,139	170	33,837	1,294	0	0	37,368
Wet Year Average		221	2,513	68	26,696	1,114	0	0	30,390
Dry Year Average		219	2,986	60	21,653	376	0	0	25,075
Overall Average		220	2,828	63	23,334	622	0	0	26,847

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Water diverted at Goodwin is delivered to the U3 Ranch, lost as seepage in the upper MSC, or stored in Woodward Reservoir. Water entering the Reservoir is used to provide municipal supply to the WTP, released to satisfy downstream demand, or lost to evaporation and seepage from the reservoir. U3 Ranch deliveries are relatively steady, ranging from 3,700 to 4,800 af between 1994 and 2014 with an annual average delivery of 4,200 af. Canal seepage in the Upper MSC is on the order of 400 af per year. WTP deliveries which began in 2005 were originally 700 af per year but quickly increased to more than 10,000 af per year by 2008. Releases to meet downstream irrigation demands ranged from 167,000 af to 234,000 af with a wet year average of 203,000 af and a dry year average of 204,000 af. The overall average during the period of analysis was 204,000 af. Irrigation demands are greater in dry years due to a longer irrigation season, less available stored precipitation in the root zone, and generally greater atmospheric water demand (i.e., ET_o). Reservoir seepage is approximately 18,000 af per year, and losses to evaporation are approximately 6,800 af per year.

Comparing total deliveries to meet demands to total water supply, a Delivery Fraction (DF) may be calculated to provide an indicator of distribution system performance. The DF is calculated on an annual (i.e., irrigation season) basis by dividing total deliveries to meet various objectives by total supply. The DF for the Upper MSC and Woodward Reservoir ranged from 0.87 to 0.91 between 1994 and 2014. The wet year, dry year, and overall average DF were 0.90, indicating that approximately 10 percent of water diverted at Goodwin is lost to seepage and evaporation. Seepage losses provide beneficial groundwater recharge and are recoverable within the basin. Losses to evaporation are irrecoverable.

Comparing total deliveries and recoverable losses to total water supply, a Water Management Fraction (WMF) may be calculated to provide an indicator of overall distribution system performance. The WMF for the Upper MSC and Woodward Reservoir ranged from 0.97 to 0.98 between 1994 and 2014. The wet year, dry year, and overall average WMF were 0.97, indicating that approximately 3percent of water is lost irrecoverably to canal and reservoir evaporation.

Changes in reservoir storage over the 1994 to 2014 period ranged from a decrease in storage of 30,000 af in 2000 to an increase in storage of 23,000 af in 2004. Over time, the average change in storage is essentially zero. Changes in storage in Woodward Reservoir between wet and dry years are similar, as the reservoir is operated to remain nearly full to provide a water supply for as long as possible should a failure occur in the main supply canal. A secondary reason to keep the reservoir full is for local recreation opportunities. Additionally in extremely dry years, the reservoir is operated at a lower elevation to reduce seepage as described in the Drought Management Plan (Attachment D).

5.7.2 Lower Main Supply Canal and Main Distributary Canal

Over the1994 to 2014 water balance period, Woodward Reservoir releases ranged from 167,000 af to 234,000 af with a wet year average of 203,000 af and a dry year average of 191,000 af. The overall average during the period of analysis was 204,000 af. Irrigation demands are greater in dry years due to a longer irrigation season, less available stored precipitation in the root zone, and generally greater atmospheric water demand (i.e., ET_o).

Water released from Woodward is complemented by inflows from OID to the MSC. These inflows ranged between approximately 3,000 and 18,800 af per year during the analysis period with a wet year average of 5.800 af, a dry year average of 7,500 af, and an overall average of 6,800 af. A result of the additional inflows from OID is that there were between 177,000 and 239,000 af of total surface water available to meet irrigation demands within SSJID between 1994 and 2014 with wet year, dry year, and overall averages of 209,000 af, 212,000 af and 210,000 af. The similarity in total supply across years reflects SSJID's operation of the system to maximize the use of inflows from OID, effectively reusing the OID boundary outflows.

Deliveries from the MDC include lateral deliveries, direct deliveries from the MDC, and ordered spillage[14]. Lateral deliveries ranged from 148,000 to 207,000 af during the period of analysis with a wet year average of 170,000 af, a dry year average of 181,000 af, and an overall average of 176,000 af. Ordered spillage ranged from zero to 25,000 af with a wet year average of 12,000 af, a dry year average of 3,000 af, and an overall average of 7,000 af. Direct deliveries from the MDC average approximately 1,000 af per year.

Losses from the MSC below Woodward and the MDC include canal seepage, evaporation, and operational spillage. Seepage ranged from 22,000 to 28,000 af between 1994 and 2014 with an average in wet years, dry years, and overall of 26,000 af. Evaporation is approximately 500 af per year. Unintentional operational spillage is essentially zero due to complete automation of the MSC below Woodward and the MDC.

The DF for the lower MSC and MDC ranged from 0.85 to 0.89 between 1994 and 2014. The wet year, dry year, and overall averages DF were 0.87, indicating that approximately 13 percent of water released from Woodward is lost to seepage, evaporation, and unintentional spill. Seepage losses provide beneficial groundwater recharge and are recoverable within the basin. Spillage losses are likewise recoverable by down gradient water users. Losses to evaporation are irrecoverable.

The WMF for the lower MSC and MDC ranged from 0.97 to 0.98 between 1994 and 2014, indicating that approximately 3 percent of water released from Woodward is lost irrecoverably to canal evaporation in this portion of the distribution system.

[14] Ordered spillage includes water routed through the distribution system to spill points as part of water transfers and deliveries for environmental enhancement in downstream waterways.

5.7.3 District Laterals

Water supplies for irrigation include lateral deliveries from the MDC and SSJID groundwater pumping. Over the1994 to 2014 water balance period, lateral deliveries ranged from 148,000 to 206,000 af with a wet year average of 170,000 af, a dry year average of 181,000 af, and an overall average of 176,000 af. SSJID groundwater pumping ranged from 2,600 to 6,300 af with a wet year average of 5,000 af, a dry year average of 5,800 af, and an overall average of 5,600 af.

The irrigation supply is lost from the lateral system as spillage, seepage, or evaporation. Between 1994 and 2014, lateral spillage ranged from 12,000 to 34,000 af with a wet year average of 25,000 af, a dry year average of 23,000 af, and an overall average of 24,000 af. Lateral seepage is approximately 5,000 af per year, and evaporation is estimated to be only about 700 af due to most of the lateral system consisting of pipelines.

The DF for the District Laterals ranged from 0.74 to 0.89 between 1994 and 2014. The wet year, dry year, and overall averages DF were 0.83, 0.85 and 0.84, respectively, indicating that approximately 16 percent of water diverted into the District laterals is lost to seepage, evaporation, and unintentional spill. Seepage losses provide beneficial groundwater recharge and are recoverable within the basin. Spillage losses are likewise recoverable by down gradient water users. Losses to evaporation are irrecoverable.

The WMF for the District Laterals ranged from 0.996 to 0.997 between 1994 and 2014, indicating that approximately 0.3 percent of water diverted into the District Laterals is lost irrecoverably to canal evaporation in this portion of the distribution system.

5.7.4 Irrigated Lands

The irrigated lands water balance was completed for the full calendar year. Water supplies for irrigation include farm deliveries from laterals, direct deliveries from the MDC, and private groundwater pumping. Over the 1994 to 2014 water balance period, farm deliveries ranged from 116,000 to 180,000 af with a wet year average of 145,000 af, a dry year average of 159,000 af, and an overall average of 153,000 af. Direct deliveries from the MDC average approximately 1,000 af per year. Private pumping ranged from 23,000 to 68,000 af per year with a wet year average of 44,000 af, a dry year average of 53,000 af, and an overall average of 49,000 af. Farm deliveries and private pumping are greater in dry years due to increased crop water requirements resulting from a longer irrigation season, less storage of precipitation in the root zone, and increased atmospheric water demand (ET_o).

The Surface Water Supply Fraction (SWSF), calculated as the sum of lateral and direct deliveries divided by the total irrigation supply, provides a relative measure of the amount of total irrigation supply met from surface water sources. Between 1994 and 2014, the SWSF ranged from 0.69 to 0.88 with a wet year average of 0.78, a dry year average of 0.76, and an overall average of 0.77.

The relatively greater portion of irrigation supply met by groundwater in dry years reflects the conjunctive management of available water supplies by SSJID irrigators.

The irrigation supply is consumed by crops as evapotranspiration; or lost as deep percolation or tailwater. Between 1994 and 2014, crop evapotranspiration of applied irrigation water (ET_{aw}) ranged from 105,000 to 147,000 af with a wet year average of 123,000 af, a dry year average of 140,000 af, and an overall average of 133,000 af. As discussed previously, crop ET of applied water is greater in dry years due to increased crop water requirements resulting from a longer irrigation season, less storage of precipitation in the root zone, and increased atmospheric water demand (ET_o). Deep percolation of applied water ranged from 50,000 to 79,000 af per year with a wet year average of 63,000 af, a dry year average of 69,000 af, and an overall average of 67,000 af. Tailwater is approximately 3,000 af per year.

The objective of irrigation is to meet crop consumptive demand (ET_{aw}), along with any other agronomic on-farm water needs. Comparing ET_{aw} to total applied irrigation water, a Crop Consumptive Use Fraction (CCUF) may be calculated to provide an indicator of on-farm irrigation performance. The CCUF is calculated on an annual basis by dividing total ET_{aw} by total applied irrigation water. For SSJID, the CCUF ranged from 0.60 to 0.68 between 1994 and 2014 with an average of 0.66. The CCUF has been similar in wet and dry years due to SSJID's reliable surface water supply that even in most dry years provides a full allocation.

5.8 WATER SUPPLY RELIABILITY

SSJID requires a firm water supply to meet crop irrigation demand. The primary crops grown in SSJID consist of almonds and other permanent crops that are typically high-value crops that supply increasing regional, national, and international food demands. Other primary crops include forage and feed crops to sustain beef cattle and dairy herds in surrounding areas. These critical food supplies additionally require a firm water supply. SSJID's water supply is considered very reliable and was discussed in detail previously in Section 4.

6. CLIMATE CHANGE

6.1 INTRODUCTION

Climate change has the potential to directly impact SSJID's surface water supply and to indirectly impact groundwater supplies. SSJID is committed to adapting to climate change in a manner that protects the District's water resources for the maximum benefit while continuing to maintain a reliable, affordable, high quality water supply for agriculture. This section includes a discussion of the potential effects of climate change on SSJID and its water supply, followed by a description of the resulting potential impacts on water supply and quality and on water demand. Finally, actions currently underway or that could be implemented to help mitigate future impacts are identified.

6.2 POTENTIAL CLIMATE CHANGE EFFECTS

Several potential effects of climate change have been identified by the scientific community, including reduced winter snowpack, more variable and extreme weather conditions, shorter winters, and increased atmospheric water demand. Additionally, climate change could affect water quality through increased flooding and erosion; greater concentration of contaminants, if any, in the water supply; and warmer water which could lead to increased growth of algae and other aquatic plants. Rising sea level and increased flooding are also potential effects of climate change. SSJID does not serve a flood management role and is not located in the Sacramento-San Joaquin River Delta. As a result, this discussion of climate change focuses on climate change effects and impacts related to SSJID water supply and demand and does not discuss potential effects of rising sea level and increased flooding.

6.2.1 Sources of Information Describing Potential Climate Change Effects

Existing historical records and projection of future hydrology can be used to evaluate potential climate change effects. For this AWMP, historical full, natural flow in Stanislaus River at Goodwin Dam from 1901 to 2014 is evaluated. Unimpaired Stanislaus River flows were obtained from the California Data Exchange Center (CDEC).

To provide additional information describing potential future changes in the hydrology of the Tuolumne River watershed, projected future flows in the Stanislaus River at New Melones Dam (north of the Tuolumne) and in the Merced River at Pohono Bridge near Yosemite National Park (south of the Tuolumne) are also presented. Projected future flows were obtained from recent projections developed using Global Climate Models (GCMs) reported by USBR (USBR 2011).

Finally, the study, West-Wide Climate Risk Assessment: Irrigation Demand and Reservoir Evaporation Projections (USBR 2015), developed by the USBR is presented to evaluate the potential effects of climate change on crop evapotranspiration (ET).

6.2.2 Summary of Potential Climate Change Effects

Changes in Timing of Runoff. Based on available historical data and projected future streamflow, the amount of annual runoff occurring during the spring-summer period from April through July has decreased over the past century and will continue to decrease in the next century.

Stanislaus River unimpaired flow (i.e., full, natural flow) from 1900 to 2014 at Goodwin Dam shows a decreasing trend in April to July runoff as a percentage of total water year runoff over the past century (Figure 6-1), demonstrating that increasingly more runoff has occurred during the fall-winter period, outside of the irrigation season.

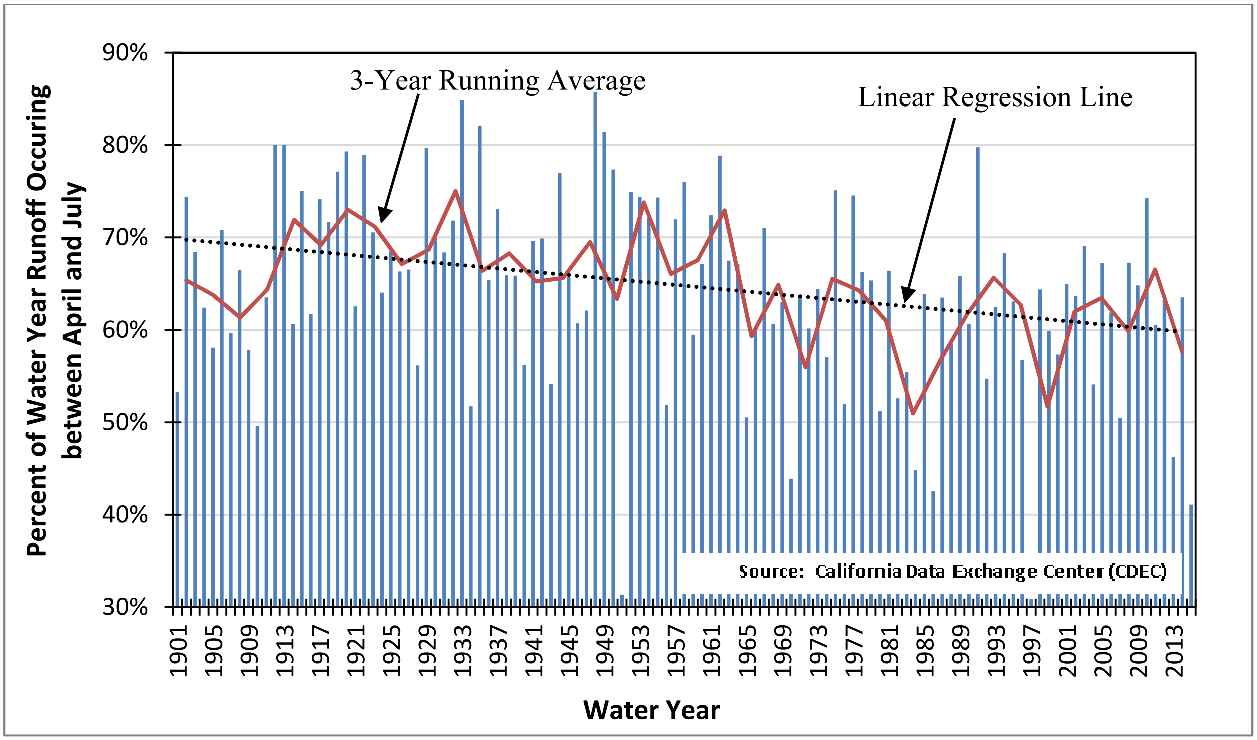

Figure 6-1. Annual April through July Unimpaired Runoff for Stanislaus River at Goodwin Dam

Changes in Total Runoff. Total water year runoff has not decreased substantially over the last century; however, recent projections reported by USBR suggest that total runoff could decrease over the next 100 years (USBR 2011), as shown in Figure 6-2. The figure shows the 5th percentile, median, and 95th percentile annual Stanislaus River runoff at New Melones Lake for 2010 to 2100 based on 112 separate hydrologic projections.

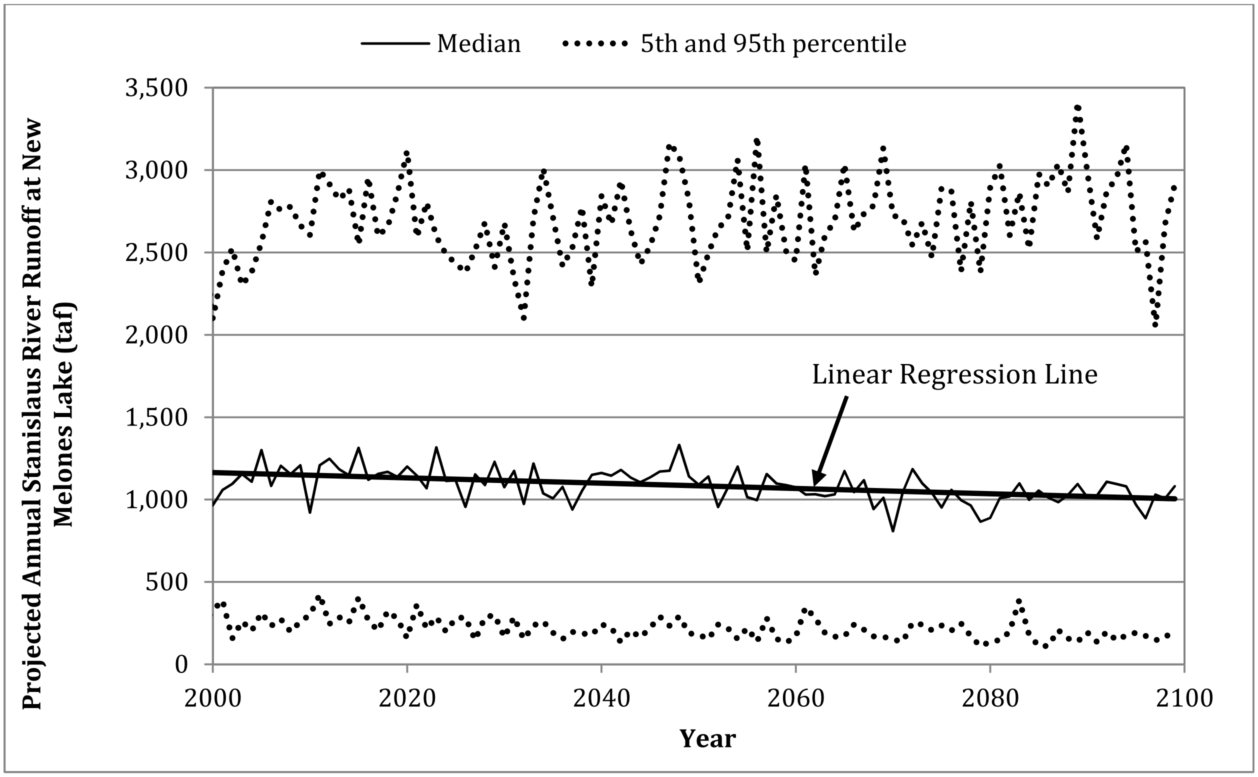

Figure 6-2. Annual Stanislaus River Runoff at New Melones Reservoir Based on 112 Hydrologic Projections (USBR 2011)

Changes in Crop Evapotranspiration. Climate change has the potential to affect crop evapotranspiration and resulting irrigation water demands within the District. Changes in precipitation, temperature, and atmospheric CO_2 affect crop evapotranspiration (ET) and net irrigation water requirements (NIWR). Global climate models (GCMs) have been used to project future climate change and impacts on crop water demands. In particular, the Bureau of Reclamation released a report entitled West-Wide Climate Risk Assessment: Irrigation Demand and Reservoir Evaporation Projections (USBR 2015) in February 2015. The study uses climate change projections to calculate future ET and NIWR throughout the Western U.S., including California's Central Valley. Projections for the Central Valley were developed for DWR planning units used to evaluate statewide water supplies and demands as part of the California Water Plan. SSJID's service area falls within Planning Unit 607 (PU607), as shown in Figure 6-3. This section describes potential changes in crop ET, a climate change effect, while impacts on NIWR are described in Section 6.4, below.

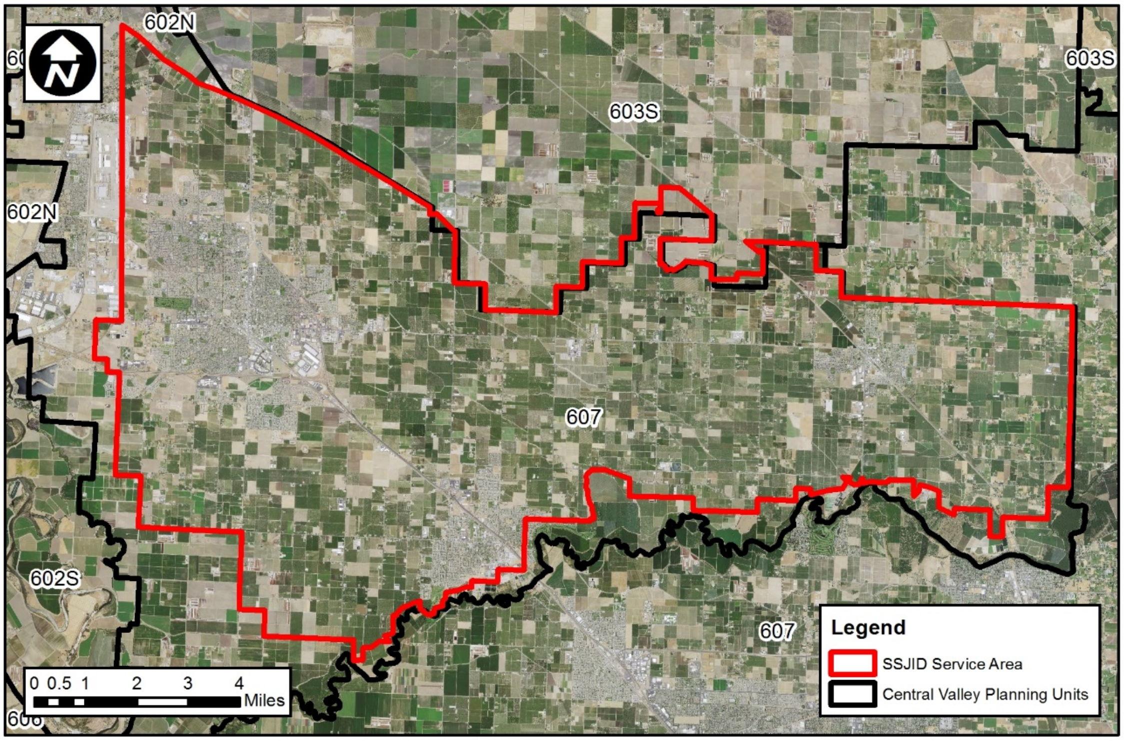

Figure 6-3. CMIP3 Planning Unit 607.

The Bureau of Reclamation's study utilizes future climate projections from GCMs to simulate crop evapotranspiration under climate change and to estimate resulting net irrigation requirements. The specific dataset selected for predicting future irrigation demands was the World Climate Research Program (WCRP) Coupled Model Intercomparison Project Phase 3 (CMIP3). Original GCM projections are developed at a spatial resolution of 100 to 250 km. In order to develop data on a usable scale to support local and regional planning, CMIP3 projections were downscaled to 12 km square sections using the statistical algorithm known as bias comparison and spatial disaggregation (BCSD). One hundred and twelve BCSD-CMIP3 projections were created based on combinations of GCM and potential future greenhouse gas emission scenarios.

Crop ET and NIWR were estimated using a model simulating crop growth and irrigation demands over time under baseline and modified climate scenarios. Specifically, the ET Demands model, a daily root zone water balance simulation applying the FAO56 dual crop coefficient approach, was used to estimate crop ET and NIWR. Reference ET was calculated based on climate projections for each of the five modeled climate scenarios using the FAO-56 reference ET approach. The GCMs climatic conditions were limited to only daily maximum and minimum temperature and daily precipitation. Therefore, other climate parameters needed to estimate reference ET, such as solar radiation, humidity, and wind speed, were approximated for baseline and future time periods using empirical equations (USBR 2015). In order to evaluate potential impacts of changes in temperature on the timing of crop growth and overall season length, simulations were conducted assuming both static and dynamic crop phenology. To simulate dynamic phenology, growing degree day (GDD) based crop curves were used. By incorporating GDD into the analysis, projected changes in temperature influence the timing and speed of crop growth. Increased temperatures result in earlier, shorter growing seasons for annual crops. Crop evapotranspiration is projected to increase in areas where perennial crops are grown and smaller increases are projected for areas where annual crops are grown.

Potentially, each of the 112 climate projections could be simulated in the ET Demands model to develop projections of future ET and NIWR; however, due to the wide variety of crop types and agricultural practices in the West this would create enormous computation and data handling requirements. Instead, five different climate change scenarios were created using the ensemble hybrid formed delta method. The future conditions of warm-dry, warm-wet, hot-dry, hot-wet and central tendency were used. Three future periods for these five conditions were selected to project climate change, including the 2020’s (2010-2039), 2050’s (2040-2069) and 2080’s (2070-2099).

Average air temperature in PU607 is projected to increase for each of the five scenarios for each future period as shown in Figure 6-4. Projected temperature increases range from 1.2 to 2.5 deg. F during the 2020’s period, 2.6 to 4.4 deg. F during the 2050’s period, and 3.8 to 6.6 deg. F during the 2080’s period.

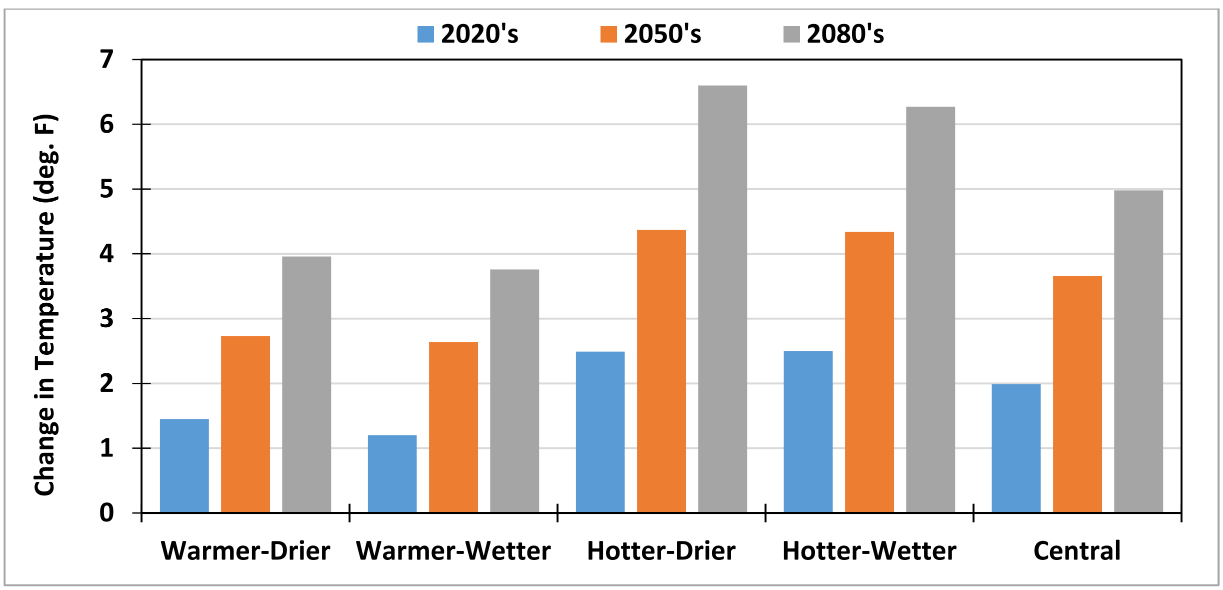

Figure 6-4. WWCRA Projected Temperature Change.

Potential changes in precipitation resulting from climate change are relatively uncertain for California’s Central Valley due to uncertainty in the future position of the jet stream. As a result, some GCMs and emission scenario combinations predict increased precipitation under climate change, while other combinations predict decreased precipitation. Percent changes in projected average annual precipitation for PU607 are shown in Figure 6-5. Under wetter conditions increases in precipitation of 3.9 to 9.5 percent between the 2020's and the 2080's are predicted, while under drier conditions, decreases in precipitation of 8.8 to 15.7 percent between the 2020's and the 2080's are predicted. The central tendency results in a predicted slight decrease in precipitation of 2.0 to 3.8 percent during the 2080's period.

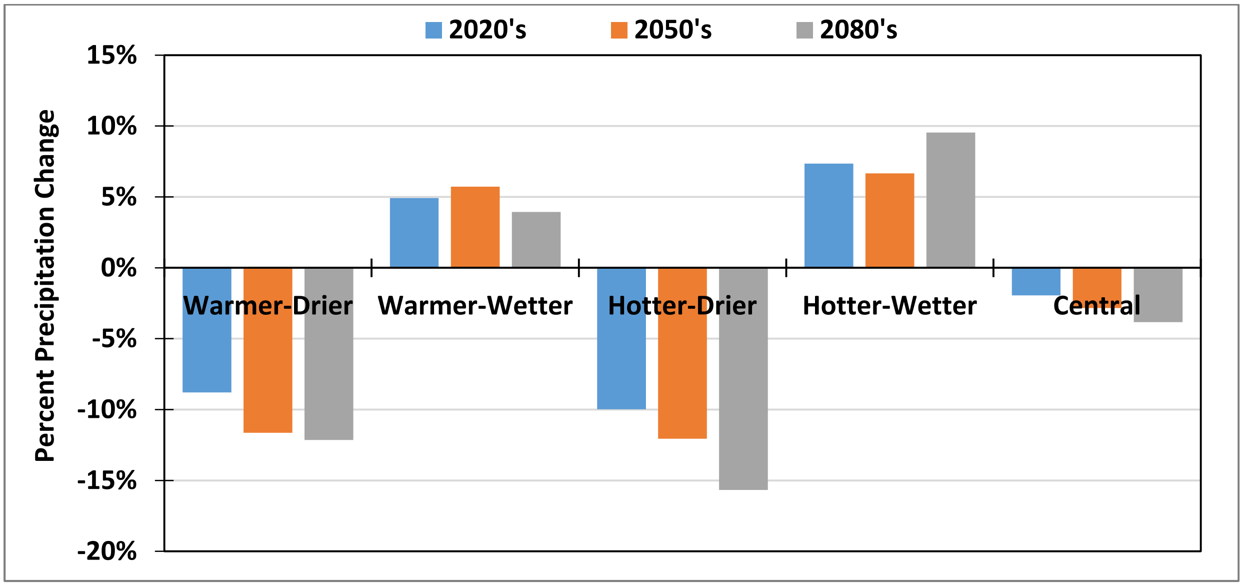

Figure 6-5. WWCRA Projected Precipitation Change.

From the projected temperature and precipitation results, WWCRA used impact models to develop projected reference ET and actual ET estimates. The results are shown below in Figures 6-6 and 6-7, respectively. Increases in both reference ET and actual ET are projected. Projected reference ET increases range from 1.7 to 3.6 percent during the 2020's period, 3.7 to 6.1 percent during the 2050's period, and 5.1 to 9.2 percent during the 2080's period. Projected actual ET increases range from 0.7 to 1.4 percent during the 2020's period, 1.3 to 2.1 percent during the 2050's period, and 1.7 to 2.6 percent during the 2080's period. Reference ET is expected to increase significantly more than actual ET due to changes in phenology of annual crops, discussed in the following paragraph.

Projected actual ET estimates assume non-static phenology for annual crops rather than static phenology. Non-static phenology is believed to be more accurate as plant growth depends heavily on temperature. With temperature expecting to increase, crop growing seasons are expected to be shorter, which is accounted for in non-static phenology by using growing degree days. There is less projected impact on actual ET with non-static phenology than when static phenology is assumed. If static crop phenology is assumed, percent changes in actual ET would be similar to the projected changes in reference ET. Reference ET is expected to increase significantly more due to the projected temperature increases.

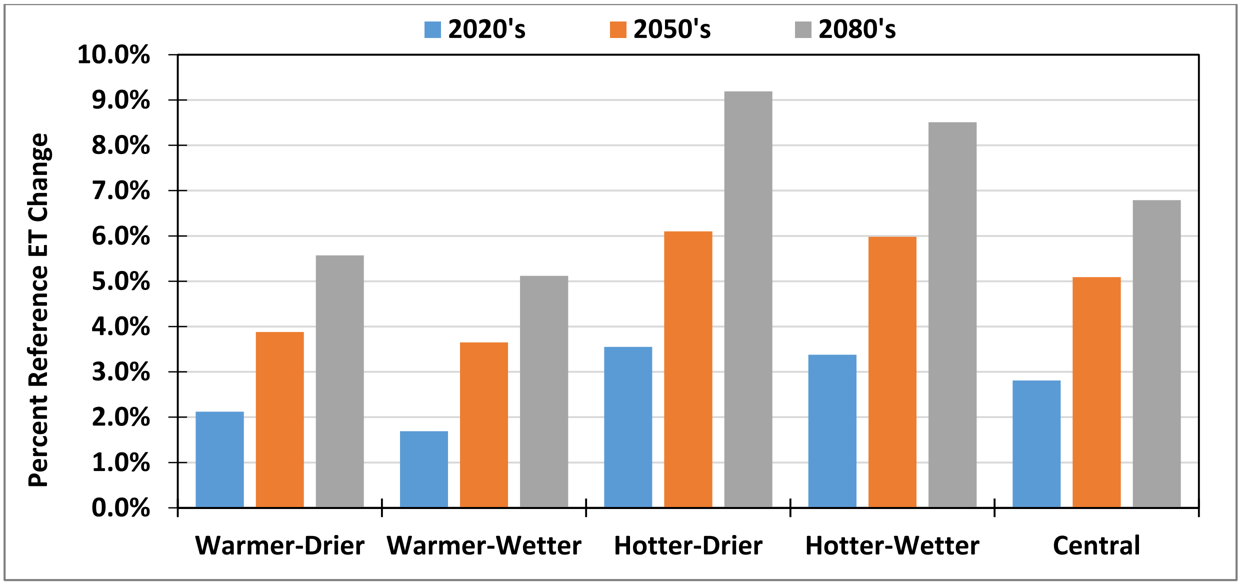

Figure 6-6. WWCRA Projected Reference ET Change.

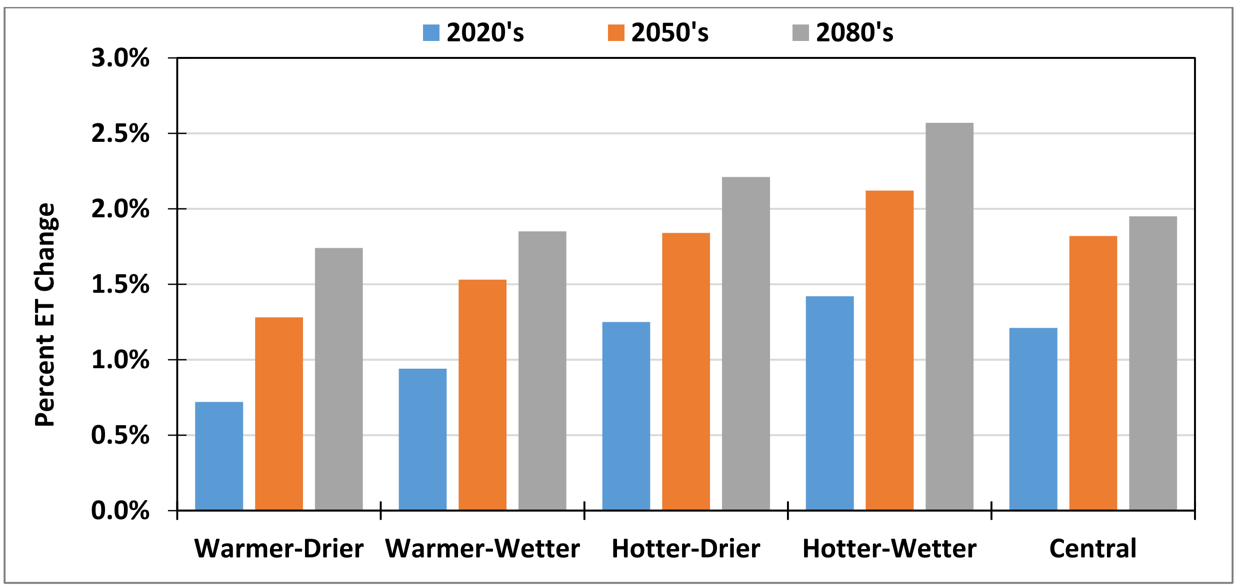

Figure 6-7. WWCRA Projected ET Change Assuming Non-Static Phenology.

6.3 POTENTIAL IMPACTS ON WATER SUPPLY AND QUALITY

The shift in runoff to the winter period and projected reduction in total runoff have the potential to impact surface water supply in the future if sufficient storage is not available to retain winter runoff until it is needed to meet irrigation demands and to provide additional carryover storage from wet years to dry years. SSJID's annual available supply under the 1988 Agreement is based on total annual inflows to New Melones Reservoir, so the timing of runoff will not affect SSJID's annual allotment.

Reduced total inflows to New Melones Reservoir in the future would increase the probability that total inflows to the reservoir would be less than 600,000 af in a given year, resulting in supplies less than 300,000 af more often than predicted based on analysis of historical data.

Increased erosion and turbidity under climate change would likely not significantly affect the water quality of the Stanislaus River as it affects agricultural irrigation. Additionally, there are no known contaminants that could be concentrated to levels that would affect agricultural irrigation if spring runoff were to decrease, particularly due to the dilution of such contaminants in reservoirs upstream of the District. Increased water temperature could result in additional challenges to SSJID in controlling aquatic plants in its distribution system to maintain capacity, to the extent that the increase is great enough to result in substantially increased plant growth. Increased turbidity and algae growth, if substantial, could pose challenges to filtering SSJID canal water for micro-irrigation.

According to the Eastern San Joaquin Integrated Regional Water Management Plan (ESJ IRWMP 2014) and other sources, climate change is expected to bring more frequent and more severe droughts in the future. With changing rainfall patterns, groundwater basins may experience less recharge in the long term. Groundwater pumping volumes are at their greatest during droughts because there is less surface water to meet water demands. This increases the difficulty of sustainably managing groundwater basins and preventing negative impacts to water quality.

6.4 POTENTIAL IMPACTS ON WATER DEMAND

The USBR publication, West-Wide Climate Risk Assessment: Irrigation Demand and Reservoir Evaporation Projections, showed crop ET is expected to increase, as discussed previously, due to effects of climate change, such as temperature increase and other climate factors (USBR 2015). Net irrigation water requirements (NIWR) is expected to increase for all climate scenarios presented in the USBR report, shown in Figure 6-8. Additionally, changes in precipitation timing and amounts could result in greater irrigation requirements to meet ET demands. Changes in the timing of crop planting, development, and harvest could also result in changes to the timing of irrigation demands during the year; all impacting the NIWR. Projected NIWR increases range from 1.5 to 3.2 percent during the 2020’s period, 1.8 to 4.7 percent during the 2050’s period, and 2.2 to 5.4 percent during the 2080’s period. Projected NIWR are based on non-static crop phenology for annual crops.

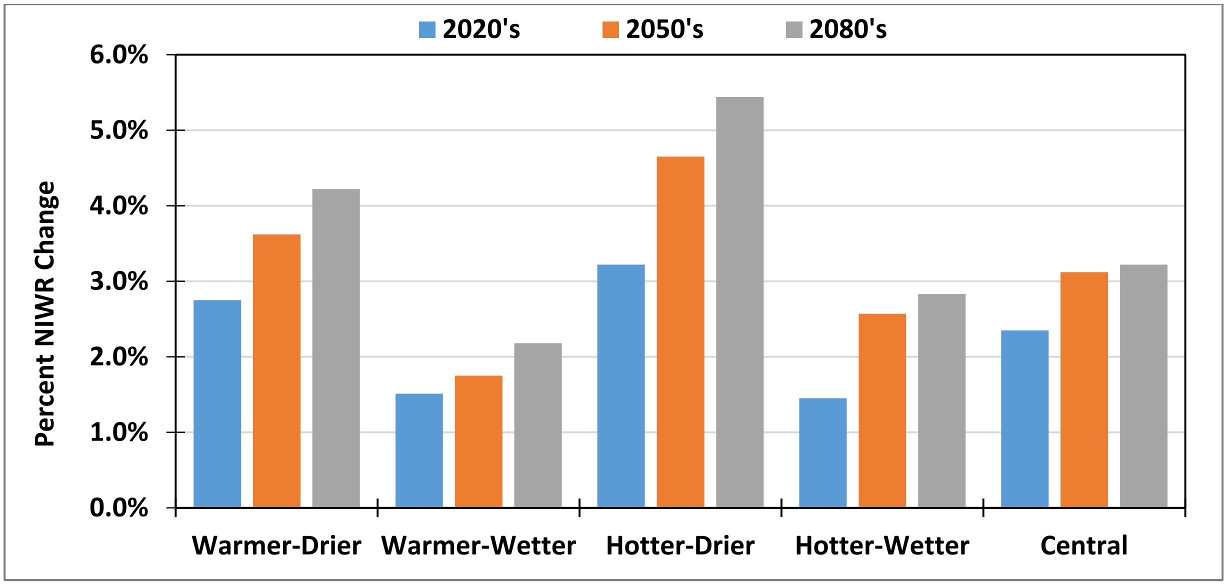

Figure 6-8. WWCRA Projected Net Irrigation Water Requirement Change Assuming Non-Static Phenology.

When interpreting results, several uncertainties must be accounted for. Estimating the effects of CO2 on irrigation demand requires the use of physiological crop growth models and was not included in the WWCRA. In general, increased atmospheric CO2 is expected to reduce stomatal conductance and transpiration, which would lead to reduced ET, all else equal. Changes in the types of crop grown, irrigated area, and irrigation efficiencies also affect the amount of irrigation water requirements. For further information, please refer to the West-Wide Climate Risk Assessment: Irrigation Demand and Reservoir Evaporation Projections (USBR 2015).

6.5 POTENTIAL STRATEGIES TO MITIGATE CLIMATE CHANGE IMPACTS

Although there is a growing consensus that climate change is occurring, and many scientists believe the effects of climate change are being observed, the timing and magnitude of climate change impacts remains uncertain. The District will mitigate climate change impacts with this uncertainty in mind through an adaptive management approach in cooperation with other regional stakeholders, including municipalities within the District, neighboring irrigation districts, and other interested parties. Under adaptive management, key uncertainties will be identified and monitored (e.g., April – July runoff as a percentage of annual runoff, total runoff, average temperature, and reference evapotranspiration), and strategies will be developed to address the related climate change impacts. As the impacts are observed to occur, the strategies will be prioritized, modified as needed, and implemented.

Several strategies for agricultural water providers and other water resources entities to mitigate climate change impacts have been identified (DWR 2008, CDM 2011). These strategies include those identified as part of the California Water Plan 2009 and 2013 Update (DWR 2010a and

2014) as well as strategies identified as part of the California Climate Adaptation Strategy (CNRA 2009). Many of these strategies applicable to irrigation districts are already being implemented by the District in an appropriate form and level to meet local water management objectives and will continue to serve the District well as climate change impacts occur.

Resource strategies that are being implemented or could be implemented by the District to adapt to climate change are summarized in Table 6-1.

Table 6-1. SSJID Position on Strategies to Mitigate Climate Change Impacts

Source	Strategy	Status
California Water Plan (DWR 2010a and 2014)	Reduce water demand	SSJID is implementing all technically feasible EWMPs identified by SBx7-7 to achieve water use efficiency improvements in SSJID operations and to encourage on-farm improvements. SSJID is evaluating the feasibility of a District-wide pressurized system to reduce water demand.
	Improve operational efficiency and transfers	As described above and elsewhere in this AWMP, SSJID is implementing improvements to increase operational efficiency within SSJID. Additionally, SSJID is an active participant in the TriDam Project and Authority as well as the San Joaquin Tributaries Authority and the San Joaquin River Group, which seek to maximize the efficiency of system operations at the regional scale. SSJID is evaluating the feasibility of a District-wide pressurized system to improve operational efficiencies.
	Increase water supply	SSJID is currently installing two groundwater wells to supplement surface water supply for the East Basin Reservoir. The District will consider additional opportunities to increase available water supply to compensate for reduced April through July runoff.
	Improve water quality	SSJID will continue to monitor groundwater and surface water quality internally and through its participation in the San Joaquin and Delta Water Quality Coalition. SSJID is evaluating the feasibility of a District-wide pressurized system. Should this system be implemented, it would likely lead to more pressurized systems on farm and better control of fertilizer applications.
	Practice resource stewardship	SSJID intrinsically supports the stewardship of agricultural lands within and surrounding its service area through its irrigation operations and resulting groundwater recharge. Additionally, SSJID actively supports protection of ecosystems through its participation in VAMP and by sustaining riparian habitat coincident with its irrigation and drainage systems.
	Improve flood management	SSJID does not serve a formal flood management role, although its irrigation and drainage systems provide a passive system to collect and convey winter runoff. If runoff characteristics change substantially within SSJID in the future, modifications to the irrigation and/or drainage system to increase capacity or mitigate other impacts may be considered.

Source	Strategy	Status
	Other strategies	Other strategies identified in the California Water Plan include crop idling, irrigated land retirement, and rainfed agriculture. Under severely reduced water supplies, SSJID could consider these strategies; however, it is anticipated that climate change impacts will be mitigated through the other strategies described.
California Climate Adaptation Strategy (CNRA 2009)	Aggressively increase water use efficiency	Described above under "Reduced water demand" and "Improve operational efficiency and transfers."
	Practice and promote integrated flood management	Described above under "Improve flood management."
	Enhance and sustain ecosystems	Described above under "Practice resource stewardship."
	Expand water storage and conjunctive management	Described above under "Increase water supply."
	Fix Delta water supply	Not directly applicable to SSJID; however, water transfers could be used to help meet Delta water supply objectives.
	Preserve, upgrade, and increase monitoring, data analysis, and management	Through implementation of SSJID's boundary flow measurement program, Division 9 water usage and soil moisture monitoring system, SCADA system and other SSJID water management activities, the amount of information and analysis available to support SSJID's water management continues to increase substantially. SSJID is evaluating the feasibility of a District-wide pressurized system which would include a water usage monitoring system providing growers real-time updates of water usage.
	Plan for and adapt to sea level rise	Projections indicate that sea levels could rise by 2 to 5 feet by 2100. Direct impacts on SSJID are not anticipated, although SSJID could consider a role to help mitigate impacts to affected areas through water transfers or other means.

6.6 ADDITIONAL RESOURCES FOR WATER RESOURCES PLANNING FOR CLIMATE CHANGE

Much work has been done at State and regional levels to evaluate the effects and impacts of climate change and to develop strategies to manage available water resources effectively under climate change. The following resources provide additional information describing water resources planning for climate change:

- Progress on Incorporating Climate Change into Planning and Management of California's Water Resources. California Department of Water Resources Technical Memorandum. July 2006. (DWR 2006b)
- Climate Change and Water. Intergovernmental Panel on Climate Change. June 2008. (IPC 2008)
- Managing An Uncertain Future: Climate Change Adaptation Strategies for California's Water. California Department of Water Resources Report. October 2008. (DWR 2008)
- 2009 California Climate Change Adaptation Strategy. California Natural Resources Agency Report to the Governor. December 2009. (CNRA 2009)
- Climate Change and Water Resources Management: A Federal Perspective. U.S. Geological Survey. (USGS 2009)
- Managing an Uncertain Future. California Water Plan Update 2009. Volume 1, Chapter 5. March 2010. (DWR 2010a)
- Climate Change Characterization and Analysis in California Water Resources Planning Studies. California Department of Water Resources Final Report. December 2010. (DWR 2010b)
- Climate Change Handbook for Regional Water Planning. Prepared for U.S. Environmental Protection Agency and California Department of Water Resources by CDM. November 2011. (CDM 2011)
- Climate Action Plan—Phase 1: Greenhouse Gas Emissions Reduction Plan. California Department of Water Resources. May 2012. (DWR 2012a)
- Climate Change and Integrated Regional Water Management in California: A Preliminary Assessment of Regional Perspectives. Department of Environmental Science, Policy and Management. University of California at Berkeley. June 2012. (UCB 2012)
- Managing an Uncertain Future. California Water Plan Update 2013. Volume 1, Chapter 5. October 2014. (DWR 2014)
- U.S. Bureau of Reclamation (USBR). 2015. West-Wide Climate Risk Assessments: Irrigation Demand and Reservoir Evaporation Projections. Technical Memorandum No. 86-68210-2014-01. Available at http://www.usbr.gov/watersmart/wcra/index.html. (USBR 2015)
- 2014 Eastern San Joaquin Integrated Regional Water Management Plan Update. Eastern San Joaquin County Groundwater Basin Authority. June 2014. Available at http://www.water.ca.gov. (ESJ IRWMP 2014)
- California Climate Adaption Planning Guide. 2012. California Natural Resources Agency. Available at http://resources.ca.gov/climate/.
- Perspectives and Guidance for Climate Change Analysis. August 2015. California Department of Water Resources Climate Change Technical Advisory Group.

7. EFFICIENT WATER MANAGEMENT PRACTICES

7.1 PROPOSED DISTRICT-WIDE PRESSURIZED SERVICE

This section describes the actions that SSJID has taken and is planning to take to meet its water management objectives and improve water use efficiency. These actions are organized with respect to the Efficient Water Management Practices (EWMPs) described in California Water Code §10608.48 (listed previously in Section 1.2). The Code lists two types of EWMPs: those that are critical (i.e., mandatory) for all agricultural water suppliers subject to the Code and those that are mandatory if found to be technically feasible and locally cost effective (i.e., conditional).

Recognizing the need to accelerate replacement of aging pipelines and improve service to growers, the District has focused recent EWMP implementation efforts on the potential expansion of its Division 9 pilot project, a state-of-the-art pressurized delivery system completed prior to the 2012 irrigation season. This award-winning project has been enthusiastically accepted by the customers it serves, due to the appreciable benefits the pressurized system has provided thus far.

Agriculture in general, and especially in SSJID due to its high concentration of high value crops, is evolving toward more precise application of inputs to improve farm production and profitability, while at the same time minimizing adverse effects on the environment. In SSJID, providing pressurized service to growers appears to be a logical step in this evolution toward more efficient and sustainable agriculture. The benefits that have been realized in the Division 9 pilot project and are driving interest in District-wide pressurized service include:

1) Enhanced on-farm economics and profitability through increased crop yields and reduced irrigation and other costs
2) Increased convenience for growers (increased service levels)
3) Increased pumping efficiency and related reduction in energy requirements and reduced air emissions
4) Reduction in the use of chemicals, such as Magnacide, to control weeds in the existing open canals and laterals
5) Enhanced ability to comply with current and possible future, more strict water quality initiatives as a result of the elimination of runoff and the ability to precisely and uniformly apply required water volumes
6) Enhanced ability to comply with current and possible future water delivery efficiency initiatives
7) Conservation of groundwater supplies due to reduced groundwater pumping as the increased quality of surface water prompts pumpers to convert to surface water
8) Protection of groundwater quality due to reduced leaching of fertilizers

9) Reduced District fleet mileage reducing District carbon emissions
10) Increased grower information for management
11) Lower maintenance costs in early years of the new system

These benefits experienced in the Division 9 pilot project area have prompted the District to fund a feasibility study to assess the costs and benefits of providing pressurized service District-wide. Initial feasibility study results indicate that benefits outweigh the costs if the District can transfer the water conserved by the project and use the transfer revenues to help cover the capital cost of the project. District-wide pressurization would implement all the EWMPs, except for one policy EWMP, as summarized in Table 7-1.

SSJID may elect to pursue conversion to District-wide pressurized service, which would eliminate or vastly narrow the need to replace aging pipe. However, if it is determined that conversion to pressurized service is not feasible, or may not be implemented relatively soon, then SSJID will develop a master plan for implementing EWMPs and accelerating replacement of its aging pipelines.

As SSJID is working towards expanding Division 9 pressurization project district-wide, the District has limited implementation of the delivery measurement EWMP to investments that will not be wasted if District-wide pressurized service is implemented. The feasibility study is scheduled for completion by the end of 2015 at which time the District will decide whether to continue to pursue District-wide pressurized service with measurement, or to resume implementation of the corrective action plan (Attachment A), or a refined version of it. In the meantime, SSJID continues to install magnetic flow meters at selected pump deliveries through its on-farm water conservation program. More than 100 magnetic meters have been installed to date and are compatible with district-wide pressurized service should the decision be made to implement it.

SSJID has adopted a pricing structure based at least in part on the quantity of water delivered. On July 31, 2012, SSJID's Board of Directors adopted a pricing structure based in part on the volume of water delivered, including a $3 per af charge, which began in 2014, in addition to the $24 per acre flat rate charge. On September 22, 2015 SSJID modified this pricing structure slightly to ensure prudent use of their limited water resources by raising the per af charge to $10 per af for growers using more than 48 inches.

SSJID has been implementing and plans to continue implementing all additional EWMPs that are technically feasible and locally cost effective. Table 7-2 describes each EWMP and summarizes SSJID's implementation status.

Table 7-1. Summary of EWMP Implementation in Proposed Pressurized Distribution System (Water Code Section 10608.48.c.)

Water Code Reference No.	EWMP Description	Implementation Status in Proposed Pressurized Distribution System
Critical (i.e., Mandatory) Efficient Water Management Practices		
10608.48.b(1)	Measure the volume of water delivered to customers with sufficient accuracy.	Magnetic flow meters are installed on all on-farm turnouts, capable of measuring delivered flow rate within ±1%.
10608.48.b(2)	Adopt a pricing structure based at least in part on quantity delivered.	Supports District pricing structure based partly on volume delivered.
Additional (i.e., Conditional) Efficient Water Management Practices		
10608.48.c(1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Promotes low flow, high frequency irrigation systems, which can minimize drainage problems.
10608.48.c(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Supports use of available recycled water that meets all health and safety criteria, and does not harm crops or soils.
10608.48.c(3)	Facilitate financing of capital improvements for on-farm irrigation systems.	Benefits achieved with increased delivery system flexibility on irrigation frequency and duration promote use of high frequency, low volume irrigation methods, such as drip and micro-sprinklers.
10608.48.c(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Supports volumetric pricing structure that can be used to promote on or more of the EWMP goals.

Water Code Reference No.	EWMP Description	Implementation Status in Proposed Pressurized Distribution System
10608.48.c(5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage.	Fully piped lateral distribution system with lined main canal and regulating reservoirs.
10608.48.c(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits.	Growers can request water deliveries nearly on-demand as needed to improve irrigation scheduling. On-line water ordering is available for growers.
10608.48.c(7)	Construct and operate supplier spill and tailwater recovery systems.	System eliminates spill and tailwater.
10608.48.c(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area.	The district is in the process of drilling two supplemental wells to supply the East Basin. Each well will be screened at different depths to withdraw water from two different aquifer layers.
10608.48.c(9)	Automate canal control structures.	Piped, pressurized system is fully automated.
10608.48.c(10)	Facilitate or promote customer pump testing and evaluation.	Customer pumps rarely used.
10608.48.c(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Continue to employ full-time water conservation coordinator.
10608.48.c(12)	Provide for the availability of water management services to water users.	Volumetric water use reports available on-line for growers from water ordering system.
10608.48.c(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Not applicable.

Water Code Reference No.	EWMP Description	Implementation Status in Proposed Pressurized Distribution System
10608.48.c(14)	Evaluate and improve the efficiencies of the supplier's pumps.	Pressurization system uses variable frequency drive (VFD) pump controllers allowing precise flow rates to be provided without wasting energy.

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Table 7-2. Summary of Additional EWMPs to be Implemented if Locally Cost Effective and Technically Feasible (Water Code Section 10608.48.c.)

Water Code Reference No.	EWMP Description	Implementation Status
Critical (i.e., Mandatory) Efficient Water Management Practices		
10608.48.b(1)	Measure the volume of water delivered to customers with sufficient accuracy.	Being Implemented
10608.48.b(2)	Adopt a pricing structure based at least in part on quantity delivered.	Being Implemented
Additional (i.e., Conditional) Efficient Water Management Practices		
10608.48.c(1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible
10608.48.c(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Being Implemented
10608.48.c(3)	Facilitate financing of capital improvements for on-farm irrigation systems.	Being Implemented
10608.48.c(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented
10608.48.c(5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage.	Being Implemented
10608.48.c(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits.	Being Implemented
10608.48.c(7)	Construct and operate supplier spill and tailwater recovery systems.	Being Implemented

Water Code Reference No.	EWMP Description	Implementation Status
10608.48.c(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area.	Being Implemented
10608.48.c(9)	Automate canal control structures.	Being Implemented
10608.48.c(10)	Facilitate or promote customer pump testing and evaluation.	Being Implemented
10608.48.c(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented
10608.48.c(12)	Provide for the availability of water management services to water users.	Being Implemented
10608.48.c(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented
10608.48.c(14)	Evaluate and improve the efficiencies of the supplier’s pumps.	Being Implemented

7.2 MANDATORY EWMPS

7.2.1 Delivery Measurement Accuracy (10608.48.b(1))

As described previously in Section 3.8. SSJID is implementing this EWMP by measuring deliveries to customers in the Division 9 project area using magnetic flow meters and by subsidizing the installation of magnetic flow meters for pump deliveries elsewhere in the District as part of the On-Farm Water Conservation Program. In 2014, the District limited implementation of the corrective action plan to only those actions that would not be wasted if District-wide pressurized service is implemented. The feasibility study is scheduled for completion by the end of 2015 at which time the District will decide whether to pursue District-wide pressurized service with measurement, or to resume implementation of the corrective action plan, or a refined version of it. The District's corrective action plan is included as Attachment A of this AWMP.

7.2.2 Volumetric Pricing (10608.48.b(2))

SSJID implemented this EWMP by first adopting revisions to its pricing structure on July 31, 2012 as described previously in Section 3.9. In accordance with SBx7-7, SSJID implemented a new pricing structure based in part on the volume of water delivered. This pricing structure ensures compliance with SBx7-7 and includes a $3 per af charge in addition to the $24 per acre flat rate charge. In 2013, growers were billed volumetrically, but the charge was waived for the first year. The new pricing structure officially started in the 2014 irrigation season. On September 22, 2015, SSJID's Board of Directors adopted and implemented immediately a modified rate design to encourage prudent use of their limited water resources by irrigators. The new rate structure is based on two tiers. For growers using less than 48 inches per year, remaining in 'Tier 1', water rate will not change from the previous structure. The new rate increase will charge growers in 'Tier 2' an additional $7 per acre-foot (totaling $10 per af) for water use which exceeds 48 inches per year.

SSJID's Division 9 project currently is operated using a volumetric-based pricing structure. Water users are charged $30 per af for the first three acre-feet per acre and $40 per acre-foot thereafter. All original Division 9 customers additionally paid a $2,500 one-time fee to connect to the pressurized system. The connection fee for new users of Division 9 is the District's actual connection cost.

7.3 ADDITIONAL EWMPS

CWC §10608.48.c requires agricultural water suppliers to implement 14 additional EWMPs "if the measures are locally cost effective and technically feasible." Historically, SSJID has been active in implementing various water management improvements to support the District's water management objectives. These improvements include water conservation improvements that also increase system efficiency and improve customer delivery service. SSJID is implementing all additional EWMPs with the exception of two that are not technically feasible, as described in the following sections.

7.3.1 Alternative Land Use (10608.48.c(1))

The facilitate alternative land use EWMP is not technically feasible for SSJID because lands with exceptionally high water duties or whose irrigation contributes to significant problems (required conditions for considering this EWMP) are not found within the District boundaries. Furthermore, SSJID's rules and regulations prohibit wasteful use of water, preventing exceptional water duties or significant problems from occurring (see Section 3.10). Additionally, facilitation of alternative land use is beyond SSJID's jurisdiction; however, SSJID assists customers in implementing on-farm conservation measures, as described below.

7.3.2 Recycled Water Use (10608.48.c(2))

The city of Manteca provides treated wastewater to irrigated lands within the SSJID service area. SSJID continues to work with the cities within its service area to gain access to recycled water for agricultural needs.

7.3.3 Capital Improvements for On-Farm Irrigation Systems (10608.48.c(3))

SSJID is implementing this EWMP by providing cost shares for capital improvements for on-farm irrigation systems through its On-Farm Water Conservation Program initiated in 2011 and continued in 2012. SSJID cost shares totaled approximately $1.14 million in 2011, providing improvements to 149 different parcels representing 5,350 acres. The On-Farm Water Conservation Program is currently inactive due to insufficient funds from the District. SSJID has recently increased funding for the Division 9 feasibility study and is experiencing increased expenditures due to the current drought. The District is open to reinstating the On-Farm Conservation Program as funds become available.

Conservation measures to be offered through the program were chosen in-part through a grower survey conducted in 2010 that gauged grower interest in a cost sharing program, identified which measures were the most attractive, and gained valuable information on irrigation methods and irrigation management within SSJID. The evaluation process resulted in the identification of six specific water conservation measures for inclusion in the Program for which the District defined probable and reasonable implementation costs and a cost share percentage (Table 7-3). In addition to the six specific measures, SSJID included a budget for grower-proposed measures, further increasing program flexibility.

Table 7-3. 2011 On-Farm Water Conservation Program Conservation Measures and Budget

Conservation Measure	District Share (% of Actual Cost)	Cost Share Budget	Max. per Grower
Delivery Measurement	80%	$190,000	NA (see below)
Sprinkler Conversion	50%	$168,044	$25,000
Drip Conversion	50%	$329,135	$25,000
Tailwater Recovery	50%	$178,040	$25,000
Irrigation Scheduling	75%	$49,500	$5,000
Moisture Monitoring	75%	$45,500	$5,000
Grower-Proposed Measures	50%	$179,781	$25,000
Total: $1,140,000			
Maximum Combined Payment per Grower: $50,000			

In January of 2011 the District released the program description and application to its irrigation customers. The package described the enrollment and eligibility requirements and described the eligible conservation measures, grouped into three categories: physical improvements, management practices, and District services. The program was again conducted in 2012 and continued at a similar level of funding. The 2013 program continued at similar levels of funding. The enrollment package for 2014 is included as Attachment C of this AWMP. Over four years, the program provided $2.8 million in cost share supporting grower investments totaling $4.1 million on 442 parcels for a total of 17,132 acres (Tables 7-4 and 7-5). An evaluation of the 2011 program prepared in 2012 is included with the District's 2012 AWMP as Attachment D.

The program was suspended in early 2014 and the funding was used to support the district-wide pressurization study. In the future, it is anticipated that SSJID will continue to evaluate annually whether to continue to facilitate financing or to provide funding directly for on farm capital improvements that are compatible with District water management objectives. The District currently actively plans and implements the program and evaluates additional conservation measures on a year-to-year basis. Other District actions facilitating on-farm capital improvements include active cooperation with SSJID water users and the NRCS to facilitate on-farm improvements through the NRCS EQIP program. The District often supplies technical assistance to facilitate these improvements.

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Table 7-4. General Statistics for 2011 through 2014 On-Farm Water Conservation Program

Year	Parcel Applications Received	Parcels Eligible	Parcels Selected	Measures Implemented	Parcels Receiving Cost Shares		Acres Receiving Cost Shares
					Total	% of Received	
2011	143	141	140	166	138	97%	5,450
2012	160	157	150	177	157	98%	5,520
2013	154	152	148	160	130	84%	5,352
2014	19	19	16	22	17	89%	810
Total:	476	469	454	525	442	93%	17,132

Table 7-5. Cost Share Amounts by Conservation Measure for 2011 through 2014

Conservation Measure	Parcels Receiving Cost Share*	Acres	Implementation Cost			SSJID Cost Share				Grower Cost Share			
			Total	Average	$/ac	Total	Average	$/acre	% of Total	Total	Average	$/acre	% of Total
Delivery Measurement	97	3,597	$178,394	$1,839	$50	$164,853	$1,700	$46	92%	$13,541	$140	$4	8%
Sprinkler or Drip/Micro Conversion	99	3,607	$4,860,403	$49,095	$1,348	$1,752,474	$17,702	$486	36%	$3,107,929	$31,393	$862	64%
Tailwater Recovery	3	228	$106,978	$35,659	$470	$41,871	$13,957	$184	39%	$65,107	$21,702	$286	61%
Irrigation Scheduling	74	3,126	$285,086	$3,853	$91	$144,929	$1,959	$46	51%	$140,157	$1,894	$45	49%
Moisture Monitoring	189	6,373	$127,846	$676	$20	$94,480	$500	$15	74%	$33,366	$177	$5	26%
Grower-Proposed	62	2,133	$1,346,617	$21,720	$631	$611,213	$9,858	$287	45%	$735,404	$11,861	$345	55%
Total:			$6,905,324			$2,809,820			41%	$4,095,504			59%

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7.3.4 Incentive Pricing Structures (10608.48.c(4))

SSJID is implementing this EWMP by promoting conjunctive use of groundwater by setting water rates below the cost of groundwater pumping to promote the use of available surface water supplies (goals B and C). By maintaining low water rates for surface water relative to groundwater pumping, SSJID is promoting conservation of precious groundwater resources through in lieu and direct recharge. In addition, the implementation of a volumetric charge per acre-foot delivered provides a modest incentive to increase water use efficiency at the farm level (goal A). The volumetric charge additionally discourages excessive drainage (goal D).

The District will review and assess its volumetric charge over time to ensure that identified water management objectives are being achieved. Additionally, SSJID's Division 9 project provides pressurized surface water to growers which incentivizes the installation of more efficient micro and sprinkler irrigation systems and increases groundwater recharge by encouraging growers who were pumping groundwater to now utilize the pressurized surface water. The cost share incentives offered through the District's On-Farm Conservation Program also encourage growers who have filed service abandonment agreements to rejoin the District to become eligible for incentives and utilize surface water in lieu of groundwater.

7.3.5 Lining or Piping of Distribution System and Construction of Regulating Reservoirs (10608.48.c(5))

SSJID is implementing this EWMP. The SSJID distribution system consists of 38 miles of lined canals and 312 miles of pipelines, with the exception of the 18 mile long Main Distribution Canal, which remains unlined to provide beneficial groundwater recharge through seepage. SSJID began lining earthen ditches and converting to pipelines in the 1960’s when they replaced 210 miles of open, earthen ditches with buried pipelines.

SSJID maintains its distribution system on a continuous basis, including replacement of canal lining and pipelines as they reach the end of their useful life. SSJID has also installed multiple pipeline interties on dead end lateral pipelines to increase delivery flexibility and reduce losses, especially for pumped irrigation deliveries.

SSJID lined approximately 2,500 ft of the MDC between Drops 1 and 3 during the winters of 2013 and 2014 to prevent embankment erosion and to increase capacity. From 2005 to 2011 (excluding the Division 9 Project), SSJID spent an average of $2.5 million annually on system maintenance, rehabilitation, and enhancement. The District’s 5-Year Capital Improvement Plan (from 2015 through 2020) identifies 4.5 miles of pipelines that need replacing, at a cost of approximately $2.39 million. In addition the Capital Improvement Plan identifies 1.6 miles of canal lining to be replaced at a cost of approximately $2.35 million.

In addition to concrete lining and pipeline conversion, the District has constructed three regulating reservoirs within its service area. In 1992 the Van Groningen Reservoir was constructed near the terminus of the MDC to provide 60 acre-feet of storage to capture excess canal inflows flows for re-regulation. The reservoir capacity was increased to 125 acre-feet in 2002. Due to the construction of the reservoir and automation of the MSC and MDC below Woodward Reservoir, SSJID has essentially eliminated spillage from the MDC.

In 2003, SSJID constructed the five-acre Northwest Regulating Reservoir and a cross-lateral intertie pipeline between the Q and R laterals as part of the System Improvements for Distribution Efficiency (SIDE) project in an effort to increase supply flexibility and absorb excess flows for redistribution and spillage reduction.

SSJID completed the construction of the Division 9 Project in 2012, providing pressurized surface water to 90 customers farming 3,800 acres through 19 miles of buried PVC pipeline. The project includes the seven-acre East Basin reservoir that buffers supply for the project and captures operational spillage from the V, U and W laterals for re-regulation and distribution. Future expansion of the pressurized system includes the possible addition of a second seven-acre West Basin regulating reservoir on the west side of Division 9. The Division 9 Project service area maintains the old low-head pipelines and open canals for flood irrigation deliveries and supplies pressurized water through the new PVC pipe network. This greatly increases flexibility and distribution efficiency both for micro- and sprinkler-irrigation and for surface irrigation.

7.3.6 Increased Water Ordering and Delivery Flexibility (10608.48.c(6))

The District is implementing this EWMP by maximizing the amount of flexibility in water ordering by, and delivery to, water customers within operational limits. In particular, SSJID works with customers on an ongoing basis to facilitate high frequency, low volume deliveries to pump customers using pressurized irrigation systems. The use of these systems has increased over time and is anticipated to continue to increase in the future.

The Division 9 project was completed in 2012 and provides pressurized water on an arranged demand basis to 90 customers irrigating 3,800 acres within SSJID's service area. Construction of the Division 9 project retains the original non-pressurized delivery infrastructure to supply flood irrigators. The dual system allows increased flexibility for both pressurized and flood irrigators by effectively increasing overall system capacity and providing a dual system that can cater to the distinct irrigation needs of the two different irrigation system types. Growers are able to order water through the Internet using personal computers or mobile devices and can check the status of water deliveries, past water orders, and delivery flow rates.

The On-Farm Conservation Program (active from 2011 to 2014) strengthened communications between irrigation customers and SSJID and helped identify the potential for further operational improvements to provide even greater levels of delivery flexibility and steadiness.

Construction of the Northwest, Van Groningen, East Basin and future West Basin regulating reservoirs and intertie pipelines have greatly increased flexibility, especially to growers near the lower ends of the system that typically receive the largest fluctuations in delivery steadiness.

Installation of SCADA during the late 1980's and early 1990's at all MDC drop structures and all lateral headings along with automation of many of the MDC control and lateral delivery structures has increased accuracy of deliveries to laterals, reduced measurement and gate adjustment effort required by the DM's, and increased monitoring and data collection for quality control and planning purposes. MDC control, combined with SCADA installations at boundary outflow sites, has provided valuable information and control to increase water ordering and delivery flexibility while controlling operational spillage.

SSJID implemented TruePoint water ordering software in 2010 to allow DM's to better track and manage water orders and to create permanent and consistent records of water usage. The streamlined recording process increases water ordering efficiency and allows additional customer ordering flexibility.

In the future, SSJID will continue to evaluate and implement locally cost-effective actions to further increase the flexibility and steadiness of irrigation deliveries.

7.3.7 Supplier Spill and Tailwater Recovery Systems (10608.48.c(7))

SSJID is implementing this EWMP through the operation of regulating reservoirs to capture and prevent spillage, through monitoring of spillage and boundary outflows, and through automation of the MDC and lateral headings to prevent spillage.

The Van Groningen Reservoir provides for the collection and storage of spillage for re-regulation of MDC outflows along with implementation of SCADA monitoring and control at drop structures and lateral headings along the MDC. Automation of the MDC provides SSJID operators with the real-time water levels and water travel times needed to anticipate and eliminate operational spillage. The newly constructed East Basin in Division 9 was designed and is operated to capture spillage from nearby laterals. The collection and utilization of operational spillage also occurs between Divisions 2 and 3 where the Campbell Drain collects operational spillage and tailwater and conveys it into the "B" lateral in Division 3 for reuse.

In efforts to provide sufficient water to pump irrigators on deadend laterals, SSJID supplies the growers with slightly more water than required to prevent any occurrences of pump cavitation or pump shutdown due to low water levels. Pump irrigators are billed for this additional water and, in the case of deadend lines, typically discharge this excess water onto their fields, often becoming tailwater, or directly into drains. Installation of intertie pipelines on deadend laterals has eliminated this requirement, thus reducing spillage and tailwater.

Tailwater production within SSJID is generally limited due to the level basin irrigation practices typically employed for surface irrigation and the expanding use of pressurized irrigation systems. Where tailwater drains do not exist, and when determined that irrigation and agronomic practices do not jeopardize water quality, SSJID allows growers to channel tailwater back into District pipelines. SSJID is increasing its real time monitoring of operational spillage as part of its customer delivery measurement program and plans to evaluate additional opportunities to reduce spillage once more information becomes available District-wide. The upper portions of the lower MSC and MDC (upstream of Drop 3) have 36 spill locations that receive tailwater and operational spillage from surrounding fields (mainly pasture) and OID for redistribution.

SSJID continues to evaluate and implement locally cost-effective actions to further increase the prevention, recovery, and reuse of operational spillage and tailwater.

7.3.8 Increase Planned Conjunctive Use (10608.48.c(8))

The District is implementing increased planned conjunctive use by encouraging the use of available surface water supplies, when available, in lieu of groundwater by facilitating delivery service to customers using pressurized irrigation systems and by providing surface water at a lower cost than that of pumping groundwater. These actions conserve groundwater for pumping in years of limited surface water availability and by neighboring water users such as the cities of Manteca, Lathrop, Ripon, and Escalon.

SSJID also maintains 28 groundwater wells and pumps in the western portion of the District to control shallow groundwater levels and to provide a supplemental water supply during dry years. Additionally, SSJID recently completed its Division 9 project which provides pressurized surface water for irrigation to 90 customers through 19 miles of pipelines serving 3,800 acres. Many of the parcels within the Division 9 project that were previously irrigated exclusively with groundwater have connected to the pressurized surface water, providing for conjunctive use. The district is in the process of drilling two groundwater wells to supply the East Basin to supplement Division 9 water supply. Each well will be screened at different depths to withdraw water from two different aquifer layers. In the future, SSJID anticipates refining conjunctive management of local surface water and groundwater supplies by further evaluating the underlying groundwater system through update of their groundwater management plan and other efforts. Deep percolation of applied SSJID surface water and seepage from SSJID canals and reservoirs are a critical source of groundwater recharge to maintain a sustainable groundwater supply for users within and surrounding SSJID.

7.3.9 Automate Canal Control Structures (10608.48.c(9))

SSJID is implementing this EWMP through the automation of all 24 of its lateral headings and all control structures on the MSC and MDC which improves customer service while reducing losses. The SIDE reservoir also is automated to maintain water supply to three of the adjacent laterals during deliveries. SSJID's extensive SCADA system provides communication and monitoring of all automated sites and also provides remote control of the 28 groundwater wells operated by the District. Additionally, the Division 9 project resulted in automation of 19 miles of pipelines and deliveries to 90 customers farming 3,800 acres. In the future, SSJID will continue to evaluate and when locally cost-effective implement opportunities for additional automation to increase delivery flexibility and steadiness while reducing operational spillage.

7.3.10 Facilitate Pump Testing (10608.48.c(10))

SSJID is implementing this EWMP. SSJID facilitates and promotes customer pump testing and evaluation by providing links on its website to programs that provide these services, such as offered by PG&E (http://www.pumpefficiency.org/). Additionally, SSJID will consider cost sharing for pump efficiency testing as part of its On-Farm Water Conservation Program.

7.3.11 Designate Water Conservation Coordinator (10608.48.c(11))

SSJID is implementing this EWMP by continuing to designate a designated Water Conservation Coordinator (to develop and implement the water management plan). SSJID added a permanent, full time water conservation coordinator in 2011.

7.3.12 Provide for Availability of Water Management Services (10608.48.c(12))

SSJID is implementing this EWMP by providing a link to CIMIS and other water management resources to growers on the District's website (Figure 7-1). SSJID provides for the availability of water management services through its On-Farm Water Conservation Program, including scientific irrigation scheduling and soil moisture monitoring conservation measures, for example. Additionally, SSJID produces a newsletter periodically (Figure 7-2) and will continue to provide links to CIMIS and other water management information on its website. Historical water use data is available to growers in the Division 9 project through an internet-based portal. Water usage is reported to all growers as part of implementing the District's volumetric water charge, which began in 2013.

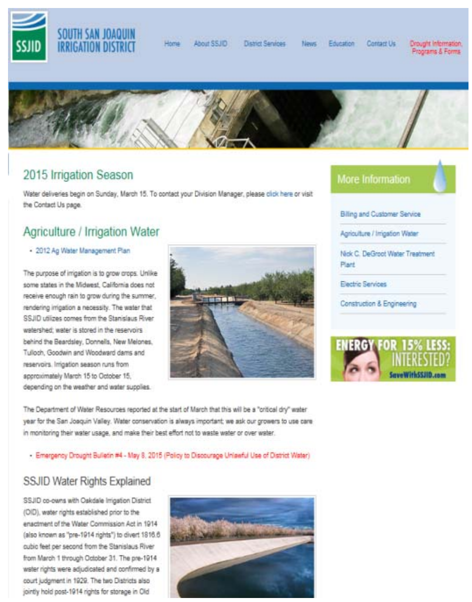

Figure 7-1. SSJID Website

7.3.13 Evaluate Supplier Policies to Allow More Flexible Deliveries and Storage (10608.48.c(13))

SSJID is implementing this EWMP through ongoing cooperation and discussion with USBR and other agencies that affect SSJID's flexibility in delivering and storing water. Although SSJID owns its own surface water rights, SSJID actively evaluates the effect of Reclamation and Tri-

Dam Project policies and operational practices on District operations and seeks policy changes to alleviate water supply constraints. SSJID actively participates in initiatives that affect its water users including the process to implement the Water Conservation Act of 2009 (SBx7-7).

SSJID will continue to participate in local, regional, and statewide water management initiatives that affect the District's ability to store and deliver water to ensure that SSJID is able to meet irrigation and other demands with the degree of flexibility required to maintain and enhance efficient water management.

SOUTH SAN JOAQUIN IRRIGATION DISTRICT
SSJID

SSJID Spring 2014 Irrigation Newsletter

March 12, 2014

Inside this issue:

Drought Concerns Affect SSJID customers and Recreation at Woodward Reservoir 1
Convenient Online Payment System Now Available 2
Water Department Contact Information 3
Consolidation of Divisions and Water Rotations 4

Drought Concerns Take Front and Center in 2014 Irrigation Season

During the worst drought in California, the District's goal is to make enough water available for the irrigation season to assure growers have a successful crop and that the municipal water users receive enough high quality water from the Water Treatment Plant to protect the health and safety of the community.

After state and federal officials declared this multi-year drought an emergency, the Board took the following actions:

- Notify cities that take our domestic water that their annual allotment may be reduced by 20% during 2014, in keeping with reductions to deliveries to farmers.
- The start of water season is Monday, March 17, after being held back from March 3 and March 10 due to recent rain and snowfall.
- Notify Stanislaus County that the level of Woodward Reservoir will be reduced for part or all of the irrigation season to conserve water. This will cause Woodward Reservoir Recreational Area to close for on-water recreation for this irrigation season, unless announced otherwise. By drawing down Woodward, the District believes it can save 9,000 AF.
- The initial length of irrigations runs will begin at 14/28 days, and could be changed later based on demand and supply. Your Division Manager will work with you if you have any questions or concerns about rotations.
- The District wells will run whenever possible in order to boost surface water supply.
- There will be no restrictions on "Tier 2" customers during this irrigation season.
- SSJID will rely on 77,000 AF of its conservation water in New Melones.

"Our core business is irrigating crops and we need to deploy every possible step to conserve water for 2015. Our real concern is for next year. The shape of next years water shed is precarious" said General Manager Jeff Shields.

Continued on Page 2

Drought Conditions have resulted in the closure of water recreation on Woodward Reservoir for at least the nearby future.

SSJID Assists Tuolumne County with Humanitarian Transfer

SSJID and the Chicken Ranch Rancheria of Me-Wuk Indians have agreed upon the terms of an emergency humanitarian water transfer that will assist the people of Tuolumne County to get through an unprecedented drought crisis. 2,400 acre-feet of water are being sold by the SSJID in a humanitarian effort to help the 44,000 people in Tuolumne County have enough water to get them through this extraordinarily dry year. The amount is about 1 percent of SSJID's expected supply from the Stanislaus River.

The Chicken Ranch Rancheria of Me-Wuk Indians of California near Jamestown is acting as the counterparty, providing the payment for the water at a price of $200 per acre-foot. The primary water retailer and wholesaler in Tuolumne County is the Tuolumne Utilities District. The TUD would be the party that the Tribe will re-sell the water to, at no profit to the Tribe.

The TUD's source of water is from Pinecrest Lake and Lyons Reservoir, which were severely depleted by drought conditions that were further exacerbated during the month-long battle to suppress the 250,000 acre Rim Fire in the Tuolumne Watershed of the Stanislaus National Forest. This year's unusually low snowfall along with the loss of water used for the campaign against the fire last year created a dire water situation for the communities of Twain Harte, Sonora, Tuolumne, Jamestown, Columbia and surrounding areas. This condition threatened the reliability of supplies to the Regional Hospital, the Columbia Air-Attack Base, the County Seat as well as other critical local government services.

The County of Tuolumne contains both the Stanislaus and Tuolumne Rivers and is the source of large amounts of water used in the San Joaquin Valley and Bay Area. However, neither the TUD nor any other water agency in the County holds water rights. Fortunately, the transfer should go smoothly as many years ago the pumps, which will be used to withdraw the water from New Melones, were installed in anticipation of just such a crisis.

Continued on page 4

Figure 7-2. SSJID Newsletter

7.3.14 Evaluate and Improve Efficiencies of Supplier's Pumps (10608.48.c(14))

SSJID is implementing this EWMP by evaluating and improving the efficiency of its pumps by performing periodic pump efficiency tests to identify cost effective energy and/or water conservation improvements. In addition to the 28 groundwater wells, SSJID maintains seven pumps at the East Basin Reservoir and five pumps at the SIDE Reservoir.

7.4 SUMMARY OF EWMP IMPLEMENTATION STATUS

SSJID has taken many actions throughout its history to promote efficient water management and continues to evaluate and implement additional measures to accomplish improved and more efficient water management, according to the District's water management objectives. For purposes of this AWMP, SSJID water management actions have been organized and are reported with respect to the Efficient Water Management Practices (EWMPs) listed in CWC §10608.48. A summary of the implementation status of each listed EWMP has been provided previously in Table 7-2. A summary of specific current and planned activities related to each EWMP is provided in Table 7-6.

Table 7-6. Summary of EWMP Implementation Status

Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
Critical (Mandatory) Efficient Water Management Practices				
10608.48.b(1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	Because SSJID is studying the feasibility of expanding pressurized service District-wide, similar to Division 9, including magnetic flow meters on SCADA at every turnout, the District limited implementation of the corrective action plan in 2014 to only those actions that would not be wasted if District-wide pressurized service is implemented. The feasibility study is scheduled for completion by the end of 2015 at which time the District will decide whether to pursue District-wide pressurized service with measurement, or to resume implementation of the corrective action plan, or a refined version of the plan. In the meantime, SSJID continues to install magnetic flow meters at selected pump deliveries through its on-farm water conservation program. More than 100 magnetic meters have been installed to date and are compatible with district-wide pressurized service should the decision be made to implement it.	
10608.48.b(2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented	SSJID adopted a pricing structure based in part on volume delivered on July 31, 2012. The new pricing structure includes a $3 per af charge to begin in 2014 in addition to the current $24 per acre flat rate charge. On September 22, 2015, the District modified the pricing structure by increasing the cost per af charge to $10 per af for volume used that is more than 48 inches. SSJID's Division 9 project charges a one-time fee to connect to the system and $30 per af for the first 3 af/ac $40 per af thereafter.	
Additional (Conditional) Efficient Water Management Practices				
10608.48.c(1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	"Lands with exceptionally high water duties or whose irrigation contributes to significant problems" are not known to exist within the SSJID service area. District Rule #10 in the rules and regulations governing the distribution of water within SSJID prohibit the wasteful use of water through the "...flood[ing] of certain portions of the land to an unreasonable depth or amount...". Additionally, facilitation of alternative land use is beyond SSJID's jurisdiction; however, SSJID assists customers in implementing on-farm conservation measures, as described below.	
10608.48.c(2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils	Being Implemented	1. M&I wastewater applied directly to SSJID irrigated lands. 2. No available recycled water exists within the District service area that is not already beneficially used. 3. Ripon currently uses recycled water for irrigation of city parks and landscaping.	1. Continue use of recycled water within SSJID. 2. Consider requests from all qualifying permitted dischargers for additional use of recycled water.
10608.48.c(3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented	1. Cost sharing for irrigation improvements and services through On-Farm Conservation Program in 2011 through 2014. 2. Total financing of $2.8 million in 2011 through 2014 with over 110 different landowners participating and 17,132 acres assisted.	1. Reinstate On-Farm Conservation Program as funds become available.
10608.48.c(4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented	1. SSJID's volumetric charge promotes more efficient water use at the farm level and discourages excessive drainage (goals A and D). 2. Current pricing maintains low rates for surface water relative to groundwater pumping to promote conservation of groundwater through in lieu and direct recharge (goals B and C). 3. Division 9 project incentivizes more efficient irrigation systems and increases groundwater recharge in lieu and direct recharge (goals A through D). 4. Conservation Program increases use of surface water and efficient irrigation practices by encouraging growers who aren't District members to join to become eligible for incentives (goals A through D).	1. The District will review and assess its volumetric charge over time to ensure that identified water management objectives are being achieved.

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Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	1. Main Canal is unlined but provides beneficial groundwater recharge through seepage. 2. Maintain 312 miles of pipeline. 3. Maintain 38 miles of lined channel. 4. Maintain 18 miles of unlined channel. 5. Scheduled maintenance and/or replacement of infrastructure. 6. Constructed Van Groningen Reservoir in 1992. 7. Replaced a leaking 2,800 foot long flume with a 132-inch diameter siphon in 1992. 8. Constructed 5-acre SIDE reservoir and cross-lateral intertie pipeline in 2003. 9. Constructed 7-acre East Basin regulating reservoir as part of Division 9 project completed in 2012. 10. Reconstruction and concrete lining of approximately 2,500 feet of the Main Canal in the 2013 and 2014 off seasons to prevent erosion.	1. Connection of additional growers to Division 9 project. 2. Potential future construction of 7-acre West Basin reservoir within Division 9 based on determination of overall project benefit. 3. Replace approximately 4.5 miles of old pipeline and line approximately 1.6 miles of canal between 2015 and 2020. 4. SSJID continues to look for opportunities to expand their system capabilities and increase delivery flexibility through improvements.
10608.48.c(6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented	1. Ongoing efforts to facilitate high frequency, low volume deliveries to pump customers using pressurized irrigation systems. 2. Division 9 project completed in 2012 provides pressurized water on an arranged demand basis to 90 customers irrigating 3,800 acres while also enhancing delivery service for remaining surface irrigators. 3. On-Farm Conservation Program helps improve District-grower coordination. 4. Construction of regulating reservoirs and intertie pipelines to increase flexibility and steadiness, especially to growers near the lower ends of the system.	1. Continue efforts to facilitate flexible delivery service to pressurized irrigation system through operational and infrastructure improvements. 2. Expansion of pressurized pipeline system in Division 9. 3. Evaluate continued funding of On-Farm Conservation Program on year-to-year basis. 4. Evaluate and implement additional locally cost-effective actions to improve flexibility
10608.48.c(7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented	1. SCADA at all drop structures along the MDC provides real-time control to prevent spillage. 2. The Van Groningen Reservoir provides for collection and storage of spillage and re-regulation. 3. The East Basin Reservoir in Division 9 captures spillage from Divisions 7 and 8. 4. Campbell Drain (Division 2) collects operational spillage and tailwater and conveys it into the "B" lateral in Division 3 for reuse. 5. Where tailwater drains do not exist, growers may channel tailwater back into District pipelines for redistribution. 6. Intertie pipeline construction for redistribution of excess. 7. Accept tailwater at 36 locations along the upper portions of the MSC and MDC, including spillage and tailwater outflows from OID	1. Continued and expanded monitoring at spill sites to reduce spillage and develop representative data. 2. Continue to look for opportunities to expand tailwater and spillage prevention and recovery capabilities.

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Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented	1. Encourage use of available surface water supplies in lieu of groundwater through construction of pressurized irrigation systems. 2. Provide surface water at a lower cost than that of pumping groundwater. 3. Utilize 28 groundwater wells to augment surface water supplies and control shallow groundwater levels. 4. Constructed Division 9 project to provide pressurized surface water for irrigation to 90 customers through 19 miles of pipelines serving 3,800 acres. 5. Active participation in local groundwater entities and initiatives including SGMA.	1. SSJID anticipates refining conjunctive management by further evaluating the underlying groundwater system through update of their groundwater management plan and/or other activities. 2. Finish constructing two groundwater wells to supplement water supply for East Basin.
10608.48.c(9)	Automate canal control structures	Being Implemented	1. Automation of all 24 lateral headings and all control structures on the MSC and MDC to improve customer service while reducing system losses. 2. Automation of the SIDE reservoir to maintain steady water supply to three adjacent laterals. 3. Implementation of an extensive SCADA system to provide communication, monitoring, and control of automated sites, including remote on/off control of 28 groundwater wells. 4. Automation of 19 miles of pipelines and deliveries to 90 customers farming 3,800 acres in Division 9.	1. SSJID will continue to evaluate opportunities for additional automation to increase delivery flexibility and steadiness and to reduce operational spillage.
10608.48.c(10)	Facilitate or promote customer pump testing and evaluation	Being Implemented	1. SSJID facilitates and promotes customer pump testing and evaluation by providing links on its website to programs that provide these services, such as offered by PG&E (http://www.pumpefficiency.org/).	1. Consider cost sharing for pump efficiency testing as part of its On-farm Water Conservation Program.
10608.48.c(11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	1. SSJID added a permanent, full time water conservation coordinator in 2011.	1. Continue to employ a full time water conservation coordinator.
10608.48.c(12)	Provide for the availability of water management services to water users.	Being Implemented	1. SSJID provides for the availability of water management services through scientific irrigation scheduling and soil moisture monitoring conservation measures, for example, as part of its On-Farm Water Conservation Program. 2. Additionally, SSJID provides links to CIMIS and other water management information on its website and produces a periodic irrigation newsletter. 3. Historical water use data is available to growers in the Division 9 project. 4. 2015 Drought Task Force to aid growers in improving on-farm irrigation efficiencies.	1. Continue current activities. 2. Provide regular water usage information as part of implementing volumetric billing. 3. Add SCADA monitoring to 100 magnetic flow meters measuring farm deliveries.
10608.48.c(13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented	1. SSJID actively evaluates the effect of supplier (Reclamation) and Tri-Dam Project policies and operational practices and seeks policy changes to alleviate water supply constraints.	1. Continue current activities.

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Water Code Reference No.	EWMP	Position	Implemented Activities	Planned Activities
10608.48.c(14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented	1. Periodic evaluation and improvements of pumps by performing periodic pump efficiency tests to identify cost effective energy and/or water conservation improvements. 2. Replaced four of the 28 GW remediation pumps in the last 4 years 3. Maintain 7 pumps at the East Basin Reservoir and 5 at the SIDE Reservoir.	1. Continue testing and periodic refurbishment or replacement of pumps and motors. 2. Add any new pumps to the existing testing program.

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7.5 EVALUATION OF WATER USE EFFICIENCY IMPROVEMENTS

CWC §10608.48(d) requires that AWMPs include:

> *… a report on which efficient water management practices have been implemented and are planned to be implemented, an estimate of the water use efficiency improvements that have occurred since the last report, and an estimate of the water use efficiency improvements estimated to occur five and 10 years in the future.*

A description of which EWMPs have been implemented has been provided previously in Section 7. This section provides an evaluation of EWMP implementation and an estimate of water use efficiency (WUE) improvements that have occurred in the past and are expected to occur in the future.

The value of evaluating water use efficiency (WUE) improvements (and EWMP implementation in general) from SSJID's perspective is to identify what the benefits of EWMP implementation are and to identify those additional actions that hold the potential to advance SSJID's water management objectives. The District's primary water management objective is to maintain a reliable, affordable, high quality water supply for agriculture and other uses. To that end, SSJID has taken action to develop and maintain reliable surface water and groundwater supplies, to prevent or reduce losses from the distribution system in order to increase operational efficiency, to promote the efficient use of water at the farm level, and to meet changing environmental and other demands that affect the flexibility with which the District can deliver and store water.

Recent examples of these actions include the SIDE project in 2003, the Division 9 Project in 2012, and the soon to be completed initial feasibility study on District-wide pressurization. The proposed District-wide Pressurization Project service will supply pressurized water through a new PVC pipe network. Should the project benefits exceed the cost, this will greatly increase flexibility and distribution efficiency both for micro- and sprinkler-irrigation and for surface irrigation. Growers will be able to order water through the Internet using personal computers or mobile devices and check the status of water deliveries, past water orders, and delivery flow rates. Full automation of all the pipelines and deliveries will be included in the project.

First and foremost among the issues that must be considered in any evaluation of the benefits of EWMP implementation and resulting WUE improvements is how water management actions affect the water balance (Davenport and Hagan, 1982; Keller, et al., 1996; Burt, et al., 2008; Clemmens, et al., 2008; Canessa, et al., 2011). Accordingly, any evaluation of EWMP implementation and WUE improvements for SSJID must consider how water balance changes relate to the District's mission and water management objectives. For example, flows to deep percolation and seepage that could be considered losses in some settings are critical to maintain the long-term sustainability of the underlying groundwater basin. Reductions in these flows resulting from EWMP implementation could be considered WUE improvements at the farm or District scale, but have the consequential effect of diminishing recharge of the underlying groundwater system. Other flows that could be considered losses at the District or farm scale such as spillage and tailwater, respectively, are also recoverable. For example, spillage from the SSJID distribution system is available for beneficial use by downgradient water users. The only distribution system or on-farm losses that are not recoverable within SSJID, the underlying groundwater basin, or the San Joaquin River Basin as a whole are canal and reservoir water surface evaporation and evaporation from irrigation application. These components represent a small portion of SSJID's water supply. An implication of this is that very little "new" water can be made available through water conservation in SSJID.

An essential first step in evaluating EWMP implementation and water use efficiency improvements is a comprehensive, quantitative, multi-year water balance (see Section 5). The quantitative understanding of the water balance flow paths enables identification of targeted flow paths for WUE improvements, along with improved understanding of the beneficial impacts and consequential effects of EWMP implementation at varying spatial and temporal scales. The water balance enables evaluation of potential changes in flow path quantities and timing for any given change in water management.

Even where comprehensive, multi-year water balances have been developed, evaluating water balance impacts and WUE improvements is not a trivial task. Issues of spatial and temporal scale and relatively small changes in flow paths resulting from many water management improvements (relative to day to day and year to year variation in water diversions and use) coupled with inaccuracies inherent in even the best water measurement greatly complicate the evaluation of water balance impacts. The implications of recoverable and irrecoverable losses at varying scales complicate the evaluation of WUE improvements, and consequential, potentially unintended consequences must be considered (Burns et al. 2000, AWMC 2004).

As part of assembling this AWMP, SSJID has identified the targeted flow paths associated with implementation of each EWMP and the water management benefits of each EWMP, along with the potential consequential effects of implementation. A brief discussion of the benefits associated with implementation of each EWMP is provided, along with a brief discussion of consequential effects that must be considered. A summary of targeted flow paths, beneficial impacts, and consequential effects associated with implementation of each EWMP by SSJID is provided in Table 7-7.

Table 7-7. Summary of WUE Improvements by EWMP

Water Code Reference No.	EWMP	Implementation Status	Targeted Flow Path(s)	Benefits	Consequential Effects	Notes (See End of Table)
10608.48.b (1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	None	Supports Evaluation of EWMPs	Not Applicable	1
10608.48.b (2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented	Farm Deliveries, Tailwater, Deep Percolation of Applied Water, System Inflows, Drainage Outflows	Volumetric pricing could create a modest incentive to reduce on-farm deliveries, primarily through reduced tailwater and deep percolation. In aggregate, reduced deliveries result in decreased system inflows and corresponding reductions in drainage outflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system. Reduced drainage outflows from tailwater result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	Not Applicable	Not Applicable	Not Applicable	3
10608.48.c (2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Not Technically Feasible	System Inflows, Farm Deliveries	Not Applicable	Not Applicable	3
10608.48.c (3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented	Farm Deliveries, Tailwater, Deep Percolation of Applied Water, System Inflows, Drainage Outflows	SSJID funding of on-farm improvements could result in reductions in on-farm deliveries through reduced tailwater and deep percolation. In aggregate, reduced deliveries result in decreased system inflows and corresponding reductions in drainage outflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system Reduced drainage outflows from tailwater result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented	Varies	Volumetric pricing will incentivize goals A and D, resulting in on-farm benefits as described for the volumetric pricing EWMP (10608.48.b(2)). Provision of surface water at lower rates than the cost of groundwater pumping incentivizes goals B and C and improves the reliability of regional water supplies.	Consequential effects of volumetric pricing are the same as described for the volumetric pricing EWMP (10608.48.b(2)).	2
10608.48.c (5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	System Inflows, Operational Spillage, Canal Seepage, Farm Deliveries, Tailwater, Deep Percolation of Applied Water, Drainage Outflows	SSJID regulating reservoirs allow for improved on-farm delivery steadiness and flexibility, potentially providing a modest reduction in on-farm deliveries due to reduced deep percolation and tailwater. Reservoirs allow operators to reduce operational spillage. Lining and pipeline conversion provide maintenance and operational benefits while also substantially reducing seepage in some areas. In aggregate, reduced recoverable losses at the farm and district scale result in decreased system inflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation and seepage result in reduced beneficial recharge of the underlying groundwater system. Reduced drainage outflows result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2

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Water Code Reference No.	EWMP	Implementation Status	Targeted Flow Path(s)	Benefits	Consequential Effects	Notes (See End of Table)
10608.48.c (6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented	System Inflows, Operational Spillage, Farm Deliveries, Tailwater, Deep Percolation of Applied Water, Drainage Outflows	Changes in ordering and delivery practices, coupled with improvements to the SSJID distribution system and operation result in increased control for DMs and improved farm delivery steadiness and flexibility. Farm deliveries could be reduced due to reduced deep percolation and tailwater. System improvements result in greater operational efficiency and, potentially, reductions in spillage. In aggregate, reduced recoverable losses at the farm and district scale result in decreased system inflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system. Reduced drainage outflows result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented	System Inflows, Drainage Outflows	Current levels of tailwater interception and spillage recovery and prevention will continue to reduce drainage outflows from SSJID. As a result, reduced outflows result in decreased system inflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer.	Reduced drainage outflows result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	
10608.48.c (8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented	System Inflows, District Groundwater Pumping	Increased conjunctive management benefits SSJID by improving long-term water supply reliability through reliance primarily on surface water to minimize withdrawals from the groundwater system and provide beneficial groundwater recharge.	Not Significant	2
10608.48.c (9)	Automate canal control structures	Being Implemented	System Inflows, Operational Spillage, Farm Deliveries, Tailwater, Deep Percolation of Applied Water, Drainage Outflows	Automation of the SSJID distribution system results in increased control for system operators and improved farm delivery steadiness and flexibility. Farm deliveries could be reduced due to reduced deep percolation and tailwater. System improvements result in greater operational efficiency and, potentially, substantial reductions in spillage. In aggregate, reduced recoverable losses at the farm and district scale result in decreased system inflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system. Reduced drainage outflows result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (10)	Facilitate or promote customer pump testing and evaluation	Being Implemented	None	Improved pumping efficiency by SSJID's customers does not affect the SSJID water balance but results in decreased energy demand and reduced pumping costs for customers. There are no direct benefits to SSJID.	Not Significant	
10608.48.c (11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	Varies	See Comment	See Comment	4
10608.48.c (12)	Provide for the availability of water management services to water users.	Being Implemented	Farm Deliveries, Tailwater, Deep Percolation of Applied Water, System Inflows, Drainage Outflows	Farm water management support by SSJID could result in reductions in on-farm deliveries through reduced tailwater and deep percolation. In aggregate, reduced deliveries result in decreased system inflows and corresponding reductions in drainage outflows. Available water not diverted could allow for service area expansion (annexation) or be available for transfer. Additionally, water quality benefits may occur through reduced tailwater and deep percolation.	Reduced deep percolation results in reduced beneficial recharge of the underlying groundwater system. Reduced drainage outflows from tailwater result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	2
10608.48.c (13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented	System Inflows	Changes in the policies of agencies that affect SSJID's flexibility and storage in using its surface water supply could allow for limited improvements in system operation and reductions in system losses. Available water not diverted could allow for service area expansion (annexation) or be available for transfer.	Reduced drainage outflows from operational spillage could result in reduced water available for beneficial use by downgradient agricultural or environmental water users.	
10608.48.c (14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented	None	Improved pumping efficiency of SSJID's pumps and prioritizing repairs and replacement based on pump evaluations results in decreased energy demand and reduced pumping costs for SSJID and increases pump reliability. There are no direct impacts to water balance flow paths.	Not Significant	

Notes:

1. Although delivery measurement does not directly affect any flow paths, it will provide the basis for improved understanding of the overall water balance in the future.
2. SSJID works to balance tradeoffs between incentivizing on-farm water conservation and maintaining long-term surface water and groundwater reliability for the region.
3. Such conditions do not exist in SSJID. As a result, it is not technically feasible to implement this EWMP.
4. Implementation of the AWMP by SSJID's Water Conservation Coordinator/Water Operations Supervisor, General Manager, District Engineer, and other staff as appropriate is the mechanism by which all EWMPs are implemented and targeted benefits are realized.

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WUE definitions vary. For purposes of evaluating WUE improvements associated with EWMP implementation by SSJID, specific WUE improvement categories or objectives, as described by CALFED and DWR (CALFED 2006, DWR 2012b), have been identified that correspond to each EWMP. Potential WUE improvements include reduction of irrecoverable losses, increased local supply, increased local flexibility, increased in-stream flow, improved water quality, and improved energy efficiency. Definitions for each of the WUE improvement categories have been developed and are provided in Table 7-8 along with an evaluation of improvement possible with the new District-wide pressurized system being considered. Note that the WUE improvement categories are not mutually exclusive in many cases. For example, reductions in irrecoverable losses could be used to increase local supply. The applicability of each EWMP to each WUE improvement category based on SSJID's water management activities has been identified and is presented in Table 7-9.

Table 7-8. WUE Improvement Categories

Water Use Efficiency Improvement Category	Definition	Potential Improvement with District-wide Pressurization[1]
Reduce Irrecoverable Losses	Reduce losses that cannot be recovered and used by the water supplier or downgradient users (e.g. evaporation and flows to salt sinks).	Limited
Increase Local Supply	Reduce losses and/or increase storage locally to increase supply available to meet demands, including both near-term (within an irrigation season) and long-term (over more than one year).	Substantial
Increase Local Flexibility	Improve the supplier's ability to divert, pump, convey, control, and deliver available water supplies to meet customer demands.	Substantial
Increase In-Stream Flow	Increase flow in natural waterways to benefit fisheries or meet other environmental objectives.	Substantial/Modest
Improve Water Quality	Increase the quality of targeted water bodies (i.e. streams, lakes, or aquifers).	Modest
Improve Energy Efficiency	Increase the efficiency of water supplier or customer pumps.	Substantial

1. The feasibility study, when complete, will provide quantitative estimates of improvements in WUE. Until it is complete, qualitative estimates are provided as follows, in increasing relative magnitude: None, Limited, Modest, and Substantial

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Table 7-9. Applicability of EWMPs to WUE Improvement Categories.

Water Code Reference No.	EWMP	Implementation Status	Water Use Efficiency Improvement Category					
			Reduce Irrecoverable Losses	Increase Local Supply	Increase Local Flexibility	Increase In-Stream Flow[1]	Improve Water Quality[2]	Improve Energy Efficiency
10608.48.b (1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	No Direct WUE Improvements					
10608.48.b (2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented		✓				
10608.48.c (1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	Not Applicable to SSJID					
10608.48.c (2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Being Implemented		✓				
10608.48.c (3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented		✓				
10608.48.c (4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented		✓				
10608.48.c (5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	✓	✓	✓			
10608.48.c (6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented		✓	✓			
10608.48.c (7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented		✓				
10608.48.c (8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented		✓				
10608.48.c (9)	Automate canal control structures	Being Implemented		✓	✓			
10608.48.c (10)	Facilitate or promote customer pump testing and evaluation	Being Implemented						✓
10608.48.c (11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	The activities of the Water Conservation Coordinator and other SSJID staff to achieve WUE improvements through implementation of the EWMPs are described individually by EWMP.					
10608.48.c (12)	Provide for the availability of water management services to water users.	Being Implemented		✓				
10608.48.c (13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented		✓	✓			
10608.48.c (14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented						✓

1. Increased in-stream flow could be a direct or indirect benefit water transfers between willing buyers and SSJID. For example, an objective of the VAMP program was to increase San Joaquin River flows at certain times and by certain amounts to improve fish habitat.
2. While many EWMPS could result in improved water quality through reduced diversions, reduced deep percolation, or reduced tailwater outflow, the potential for improved water quality in stream flows in particular is very uncertain as it depends on coordination with USBR and others.

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In order to more explicitly report an estimate of WUE improvements that have occurred since the last AWMP and an estimate of WUE improvements expected to occur five and ten years in the future, SSJID has estimated the qualitative magnitude (expressed as None, Limited, Modest, or Substantial in order of increasing relative magnitude) for the targeted flow paths associated with each EWMP relative to the applicable WUE improvement categories identified in Table 7-8. Past WUE improvements are estimated relative to no historical implementation. WUE improvements relative to the last AWMP are evaluated qualitatively with respect to the 2012 AWMP. Future WUE improvements are estimated for five years in the future (2020) relative to 2015 and for ten years in the future (2025) relative to 2015. The result of this evaluation is provided in Table 7-10.

Should DWR policies with regard to water transfers thwart the District's developing plan to fund District-wide pressurization through water transfers, SSJID will continue to seek out and implement water management actions that meet its overall water management objectives and result in WUE improvements. SSJID staff regularly attend water management conferences and evaluate technological advances in the context of SSJID's water management objectives and regional setting. The continuing review of water management within SSJID, coupled with exploration of innovative opportunities to improve water management will result in future management improvements by SSJID and additional WUE improvements.

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Table 7-10. Evaluation of Relative Magnitude of Past and Future WUE Improvements by EWMP.

Water Code Reference No.	EWMP	Implementation Status	Marginal WUE Improvements[1,2]			
			Past		Future	
			Relative to No Historical Implementation[3]	Since Last AWMP[4]	5 Years in Future[5]	10 Years in Future[5]
10608.48.b (1)	Measure the volume of water delivered to customers with sufficient accuracy	Being Implemented	No Direct WUE Improvements			
10608.48.b (2)	Adopt a pricing structure based at least in part on quantity delivered	Being Implemented	Limited	Limited	Limited to Modest, Depending on Structure	
10608.48.c (1)	Facilitate alternative land use for lands with exceptionally high water duties or whose irrigation contributes to significant problems, including drainage.	Not Technically Feasible	Not Applicable to SSJID			
10608.48.c (2)	Facilitate use of available recycled water that otherwise would not be used beneficially, meets all health and safety criteria, and does not harm crops or soils.	Being Implemented	Modest	None	None to Limited	
10608.48.c (3)	Facilitate financing of capital improvements for on-farm irrigation systems	Being Implemented	Substantial (Limited Reduction in Irrecoverable Losses)	Modest	Substantial (Limited Reduction in Irrecoverable Losses)	Substantial (Limited Reduction in Irrecoverable Losses)
10608.48.c (4)	Implement an incentive pricing structure that promotes one or more of the following goals: (A) More efficient water use at farm level, (B) Conjunctive use of groundwater, (C) Appropriate increase of groundwater recharge, (D) Reduction in problem drainage, (E) Improved management of environmental resources, (F) Effective management of all water sources throughout the year by adjusting seasonal pricing structures based on current conditions.	Being Implemented	Substantial (Goals B & C)	Limited	Limited to Modest (Goals A and D), Depending on Structure	
10608.48.c (5)	Expand line or pipe distribution systems, and construct regulatory reservoirs to increase distribution system flexibility and capacity, decrease maintenance and reduce seepage	Being Implemented	Substantial (Limited Reduction in Irrecoverable Losses)	Limited	Modest (Spillage Reduction from Reservoirs)	Modest (Spillage Reduction)
10608.48.c (6)	Increase flexibility in water ordering by, and delivery to, water customers within operational limits	Being Implemented	Substantial	Limited	Modest	Modest
10608.48.c (7)	Construct and operate supplier spill and tailwater recovery systems	Being Implemented	Substantial	Limited	Limited to Substantial, Depending on Specific Actions	
10608.48.c (8)	Increase planned conjunctive use of surface water and groundwater within the supplier service area	Being Implemented	Substantial	Limited	Limited to Modest, Depending on Specific Actions	
10608.48.c (9)	Automate canal control structures	Being Implemented	Substantial	Limited	Modest	Modest
10608.48.c (10)	Facilitate or promote customer pump testing and evaluation	Being Implemented	Limited	None	None to Modest, Depending on Customer Interest	
10608.48.c (11)	Designate a water conservation coordinator who will develop and implement the water management plan and prepare progress report.	Being Implemented	The activities of the Water Conservation Coordinator and other SSJID staff to achieve WUE improvements through implementation of the EWMPs are described individually by EWMP.			
10608.48.c (12)	Provide for the availability of water management services to water users.	Being Implemented	Substantial (Limited Reduction in Irrecoverable Losses)	Modest	Substantial (Limited Reduction in Irrecoverable Losses)	Substantial (Limited Reduction in Irrecoverable Losses)
10608.48.c (13)	Evaluate the policies of agencies that provide the supplier with water to identify the potential for institutional changes to allow more flexible water deliveries and storage.	Being Implemented	Substantial	Limited	None to Modest, Depending on Outcomes	
10608.48.c (14)	Evaluate and improve the efficiencies of the supplier's pumps.	Being Implemented	Substantial	Limited	Limited	Limited

1. As noted herein and throughout this analysis, reductions in losses that result in WUE improvements at the farm or district scale do not result in WUE improvements at the basin scale, except in the case of evaporation reduction. All losses to seepage, spillage, tailwater, and deep percolation are recoverable within SSJID or by downgradient water users within the basin.

2. In most cases, quantitative estimates of improvements are not available. Rather, qualitative estimates are provided as follows, in increasing relative magnitude: None, Limited, Modest, and Substantial.

3. WUE Improvements occurring in recent years relative to if they were not being implemented.

4. 2012 AWMP.

5. WUE Improvements expected in 2020 (five years in the future) and 2025 (ten years in the future), relative to level of implementation in recent years.

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9. SUPPLEMENTAL INFORMATION

The following attachments are included as part of this AWMP:

- Attachment A: 2012 Agricultural Water Measurement Corrective Action Plan
- Attachment B: Rules and Regulations Governing the Distribution of Water in the South San Joaquin Irrigation District
- Attachment C: On-Farm Water Conservation Program 2014 Program Description
- Attachment D: South San Joaquin Irrigation District Drought Water Management Plan

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ATTACHMENT A: 2012 AGRICULTURAL WATER MEASUREMENT CORRECTIVE ACTION PLAN

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Agricultural Water Measurement Corrective Action Plan
According to Requirements of the
California Code of Regulations
Title 23. Waters
Division 2. Department of Water Resources
Chapter 5.1. Water Conservation Act of 2009
Article 2. Agricultural Water Management

INTRODUCTION

The South San Joaquin Irrigation District (SSJID or District) recognizes the need for uniform standards and procedures for measuring and recording field water deliveries in order to: (1) provide cost-effective service to customers and (2) generate improved operational records for planning and analysis. Regulations requiring specified levels of delivery measurement accuracy were incorporated into the California Code of Regulations Title 23 Division 2 Chapter 5.1 Article 2 Section 597 (CCR 23 §597) in July 2012. Field investigations conducted over the last two years indicate that SSJID's existing measurement devices and methods are generally adequate for the aforementioned purposes, but that existing measurement devices at delivery points[15] (hereafter referred to as turnouts) are generally not capable of satisfying the new accuracy standards required by CCR 23 §597.

This document describes SSJID's plan to implement corrective actions over the next three years to comply with CCR 23 §597 by December 31, 2015, to the extent it is feasible to do so[16]. As implementation of the plan proceeds, SSJID will continually assess progress and adapt the plan as necessary to ensure that the corrective actions implemented will achieve timely compliance with the accuracy standards.

APPLICABILITY (CCR 23 §597.1)

Briefly summarized, CCR 23 §597 requires that on or before July 31, 2012 agricultural water suppliers that provide water to 25,000 irrigated acres or more measure the volume of water delivered to customers. Existing measurement devices must be certified to be accurate to within ±12 percent by volume (CCR 23 §597.3(a)(1)). New or replacement measurement devices must be certified to be accurate to within ±5 percent by volume in the laboratory if using a laboratory

[15] The "delivery point" is defined in CCR 23 §597 as "…the location at which the agricultural water supplier transfers control of delivered water to a customer or group of customers…." (CCR 23 §597.2(a)(6))
[16] See, for example, the section entitled "Multiple Valves."

certification or ±10 percent by volume in the field if using a non-laboratory certification (CCR 23 §597.3(a)(2)). The regulation includes specific requirements for certifying and documenting accuracy for existing and new devices (CCR 23 §597.4). Additionally, the District is required to report certain information in its 2012 and subsequent Agricultural Water Management Plans (AWMP) (CCR 23 §597.4(e)). If existing measurement devices are not sufficiently accurate, the District must include in its 2012 AWMP a plan to for taking corrective action by December 31, 2015 to achieve compliance (CCR 23 §597.4(e)(4)). SSJID serves more than 25,000 acres and is therefore subject to these regulations.

EXISTING MEASUREMENT FACILITIES AND PRACTICES

In 2011, under its Pilot Delivery Measurement Assessment Program (Program), SSJID initiated a preliminary assessment of field turnouts with respect to their ability to achieve the then pending measurement accuracy standards. . The Program inventoried SSJID turnout infrastructure and assessed existing measurement practices through:

1. Field accompaniment and interviews with Division Managers (DMs), who manage water deliveries, and
2. Data collection at selected turnouts and locations in the conveyance system.

Understanding District conveyance systems and operational practices are critical to understanding existing measurement practices. The SSJID conveyance system consists of an unlined, open main canal serving 350 miles of laterals, of which 38 miles are open lined canals and 312 miles are cast in place concrete pipelines. Water deliveries to parcels typically occur on a rotational schedule with one delivery point taking the full flow of water (or “head”) delivered at a given time. The standard basin-check flood head is 25 cubic feet per second (cfs). DMs manage the rotational delivery of water on each lateral in their division by scheduling deliveries and opening and closing water control gates according to the schedule. The full “head” of water (typically 25 cfs) is delivered to a single owner at 77 percent of the delivery points. When more than one owner is served by a delivery point, the full “head” is either split between the owners or passed (rotated) directly from one owner to the next without involving the DM. The delivery duration varies according to parcel size and other factors. SSJID laterals are generally sized to convey one head, although laterals serving large areas may be sized to convey two or even three “heads” to avoid excessive rotation intervals. Typically, multi-head laterals are segmented into reaches where one head is rotated among fields, with the upper lateral reaches passing one or two heads to lower reaches while rotating a head among fields within the reach.

District turnouts were grouped into three main types based on unique physical configurations pertaining to delivery volume measurement:

1. Pumps (Figure A-1) account for 282 (20 percent) of deliveries
2. Multiple valves (Figure A-2) account for 586 (42 percent) of deliveries
3. Orifice gates (Figure A-3) account for 524 (38 percent) of deliveries

A typical pipeline lateral includes all three types of turnouts interspersed along the lateral (Figure A-4) while a typical open canal lateral includes only orifice gates and pumps.

Figure A-1. Pump turnout on a District pipeline.

Figure A-2. Multiple valve turnout on a District pipeline.

Figure A-3. Orifice gate turnout in a concrete box on a District pipeline.

Flows into the laterals are controlled by maintaining pre-determined levels in the main canal at the location of the lateral head gate and setting the head gate opening to obtain the required flow. On laterals that convey only single heads, SSJID regards the lateral heading as the customer delivery point because the full flow is delivered to just one field at a time (Figure A-4). On laterals that convey multiple heads, the lateral headgates are operated as described above and additional measurement devices are placed between single head lateral reaches so that heads being passed through upper reaches to lower reaches can be measured. On such multiple head laterals, the downstream-most measurement device measures the flow to the lowest single head reach.

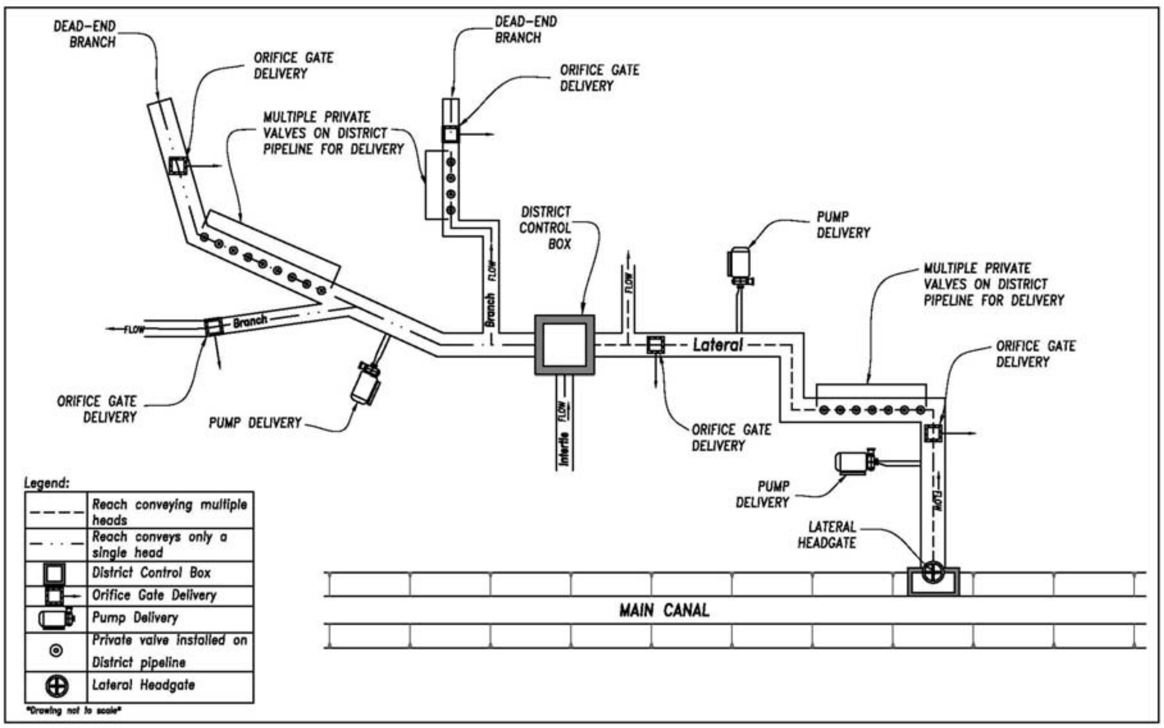

Figure A-4. Typical laterals conveying multiple and single heads with pump, multiple valve, and orifice gate turnouts.

EVALUATION OF DELIVERY MEASUREMENT DEVICES AND PRACTICES

Prior to the initial certification process (CCR 23 §597.4a), the District evaluated the applicability of three measurement devices at each of the three types of turnouts that exist in the District: pump, multiple valve, and orifice gate turnouts (Table A-1).

Table A-1. Applicability of Selected Measurement Devices at Different Types of Turnouts

Measurement Device	Turnout Type		
	Multiple Valve	Orifice Gate	Pump
Orifice Gate	Use existing orifice gate in center wall of District control box upstream and downstream of multiple valve delivery, or at spill in case of single head lateral that has a spill site.	Use existing farm delivery orifice gate. Requires continuous measurement of gate opening and upstream and downstream water levels. Downstream water level access tubes do not exist on all turnouts.	Not applicable in most situations observed.
Acoustic Doppler Meter	Install new acoustic Doppler meters in District pipelines at control boxes upstream and downstream of pipeline reaches from which just one delivery is made at a time, or at spill in case of single head lateral that has a spill site.	Install new acoustic Doppler meters in District pipelines at control boxes upstream and downstream of pipeline reaches from which just one delivery is made at a time, or at spill in case of single head lateral that has a spill site.	Not applicable in most situations observed.
Magnetic Meter	Not applicable.	Not applicable.	Install new permanent magnetic meter on existing pump discharge piping. May be possible to rate some pump deliveries with portable flow meter.

PUMPS

Magnetic flow meters (Figure A-5) have been installed at 54 turnouts serving about 2,400 acres in the District's Division 9 pilot project area[17]. The magnetic flow meters are laboratory certified to measure flows with ± 0.4 percent accuracy (Attachment A-1), exceeding the ±5 percent accuracy requirement for laboratory certified measurements (CCR 23 §597). In addition, through the District's ongoing on-farm conservation program and the pilot delivery measurement program, magnetic meters have been installed on 51 pump turnouts serving a combined 2,200 acres at various locations.

Pending installation of magnetic flow meters over the next three years, as specified in this corrective action plan, the remaining pump delivery volumes are determined by estimating pump flows based on the pump size and flow rate required by the irrigation system supplied with water. A small sample of measurements using magnetic flow meters and transit time strap on flow meters indicated that these estimated flows rarely meet the required 12 percent accuracy for existing devices. The District has elected to install magnetic flow meters at these pumps because they provide high measurement accuracy (better than 1% accuracy laboratory certified by the manufacturer) with minimal straight pipe length requirements[18], have minimal ongoing maintenance requirements and have been installed in both the Division 9 pilot project area and in the District On-Farm Conservation Program.

[17] The pilot project is to evaluate the feasibility of providing pressurized water delivery in areas of the District dominated by drip and micro-sprinkler application systems.
[18] Irrigation Training and Research Center. 2007. SeaMetrics Ag2000 Irrigation Magmeter Test Results and Summary. Technical Memorandum. Rev. 22 November 2007. California Polytechnic State University, San Luis Obispo, CA.

Figure A-5. Magnetic flow meter on delivery at Ra81.

MULTIPLE VALVES

No practical measurement device exists that can directly measure flow or volume through the multiple valve turnouts on District pipelines within the accuracy range required by the regulation[19]. However, two alternatives exist to measure the combined flow through all valves. For water delivered through multiple valve turnouts on a single head, dead end pipeline, measurement can be made at a single upstream point using either the orifice gate in the center wall of the District control boxes or an acoustic Doppler meter in the pipeline. System losses between the measurement point and delivery point are included in the measurement. Alternatively, for water delivered through multiple valve turnouts on multiple head reaches where one or more head is being passed through to a reach downstream, a volume differential[20] measurement approach is necessary to account for the water conveyed downstream of the multiple valve turnout. In this case also, any system losses between the measurement points are included in the measurement.

The existing orifice gates in the center wall of the District control boxes are typically operated either fully open (when passing water through) or fully closed (when water is being delivered at or just upstream of the control box) to keep the pressure on the pipelines below the pipeline

[19] Burt, C. and E Greer. 2012. SBx7 Flow Rate Measurement Compliance for Agricultural Irrigation Districts. ITRC Report No. R 12-002. Irrigation Training & Research Center (ITRC). California Polytechnic State University. San Luis Obispo, CA.

[20] "Volume differential," as used throughout this report, refers to the method of determining the volume delivered as the difference between measured volumes upstream and downstream of the delivery point. The volume differential measurement method is a key component of the recommended SSJID delivery measurement plan due to the presence of multiple on-farm irrigation valves being installed on District conveyance pipelines.

design pressure. The fully open position often does not allow for measurement due to the absence of, or an extremely small, head drop across the gate. Thus, the acoustic Doppler meter in the pipeline is the selected device for measurement at the point of delivery.

ORIFICE GATES

The existing orifice gate turnouts are fully opened so the full head is delivered to minimize pressure on pipelines. This operating practice, common among Districts practicing a rotational delivery system and necessary to prevent damage to conveyance pipelines, results in "small differentials in water levels" (less than 0.1 feet). Data collected for the delivery Q606 (on lateral Q at station 606), illustrates the gate opening (labeled as "goodstem_in") and water level difference across the gate (labeled as "head_ft") that occur during normal operation (Figure A-6). This sample data demonstrates the typical operating practice of operating the orifice gate to be either fully open or fully closed, and, when fully open, the extremely small water level difference (0.1 foot) across the gate is evident. These conditions are not conducive to flow measurement because even small inaccuracies in water level measurement can lead to large inaccuracies in calculated head differential and, ultimately, flow rates and volumes. Thus, these orifice gate turnouts cannot be used to measure deliveries "due to small differentials in water levels" (**CCR 23 §597.3b1B**).

These orifice gate turnouts are interspersed among the pump and multiple valve turnouts on the laterals. An alternative is to measure at a single upstream point using an acoustic Doppler meter in the pipeline or canal as described previously for a multiple valve turnouts. As for the multiple valve turnouts, there are the two cases one for turnouts on a single head pipeline and a second case for turnouts on a multiple head pipeline, or canal. As with the multiple valve turnouts, the second case requires a volume differential measurement.

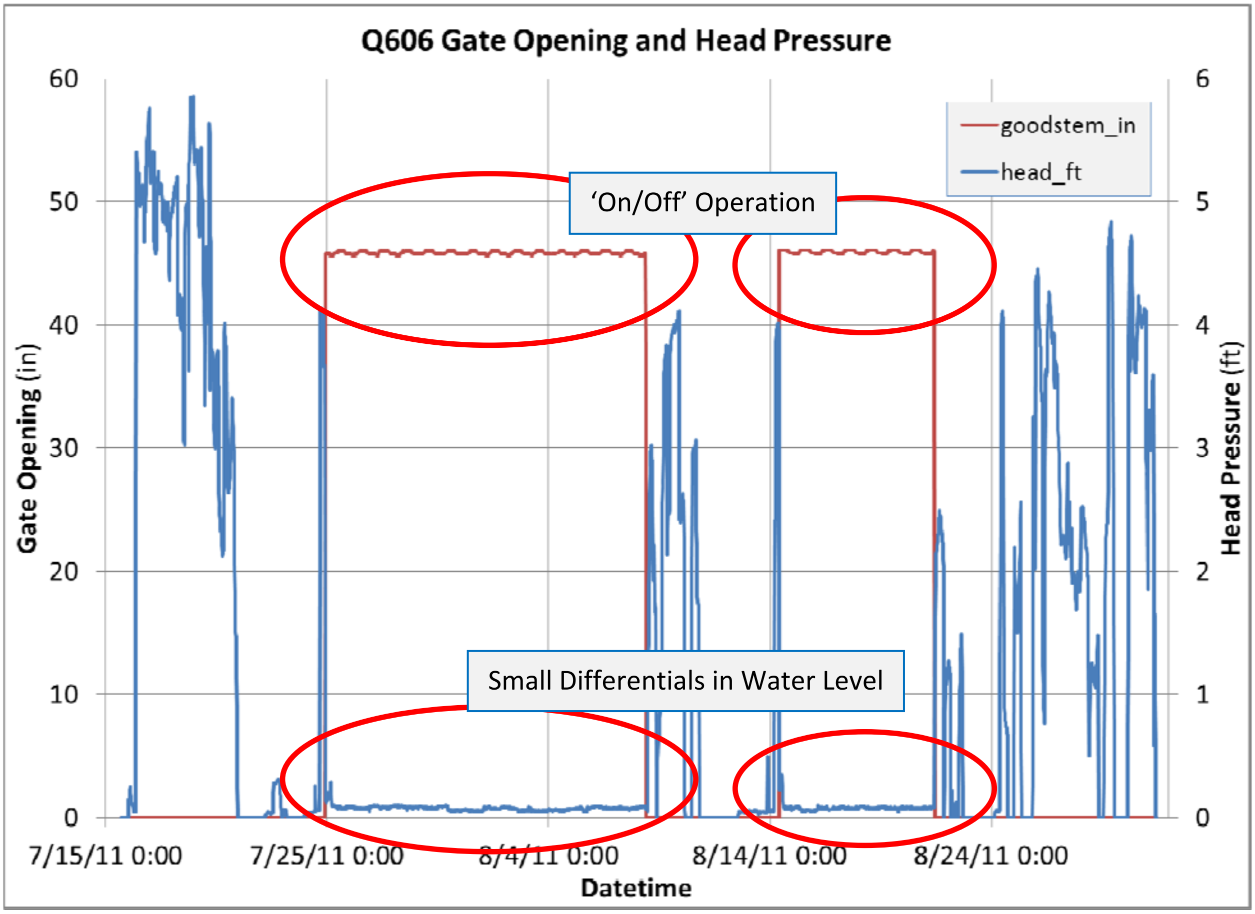

Figure A-6. Orifice gate water level differential measurements.

Three measurement devices were evaluated by the Program with respect to the three main turnout types at the District for improving delivery measurement accuracy to comply with **CCR 23 §597** (Table A-2). Figure A-7 shows a typical lateral with a reach conveying multiple heads and a reach conveying a single head segmented into measurement reaches with typical instrumentation.

Table A-2. South San Joaquin Irrigation District Farm Delivery Measurement Options by Delivery Type.

Measurement Device	Turnout Type		
	Multiple Valve	Orifice Gate	Pump
Orifice Gate	**NOT SELECTED.** Multiple valves cannot be measured directly and existing orifice gates (both in center wall of control boxes and to farms) cannot meet CWC § 597 accuracy requirements due to small level differentials. Additionally, numerous challenges involved with installing and maintaining necessary monitoring instruments make this option impractical.		Not applicable in most situations observed.
Acoustic Doppler Meters	**SELECTED.** Acoustic doppler meters meet CWC § 597 accuracy requirements. Install a network of these meters in District pipelines at strategically selected control boxes that isolate single farm deliveries under most operating conditions. Some deliveries would be measured directly (where only one delivery is made downstream); others indirectly (by differential measurement in cases where additional deliveries are being made downstream). Meter data will be combined with Division Manager records of delivery start and end times to calculate volumetric water deliveries to individual fields.		Not applicable in most situations observed.
Magnetic Meter	Not applicable.	Not applicable.	**SELECTED.** Only option that meets CWC § 597 accuracy requirements and is adaptable to existing on-farm pumps and piping installations.

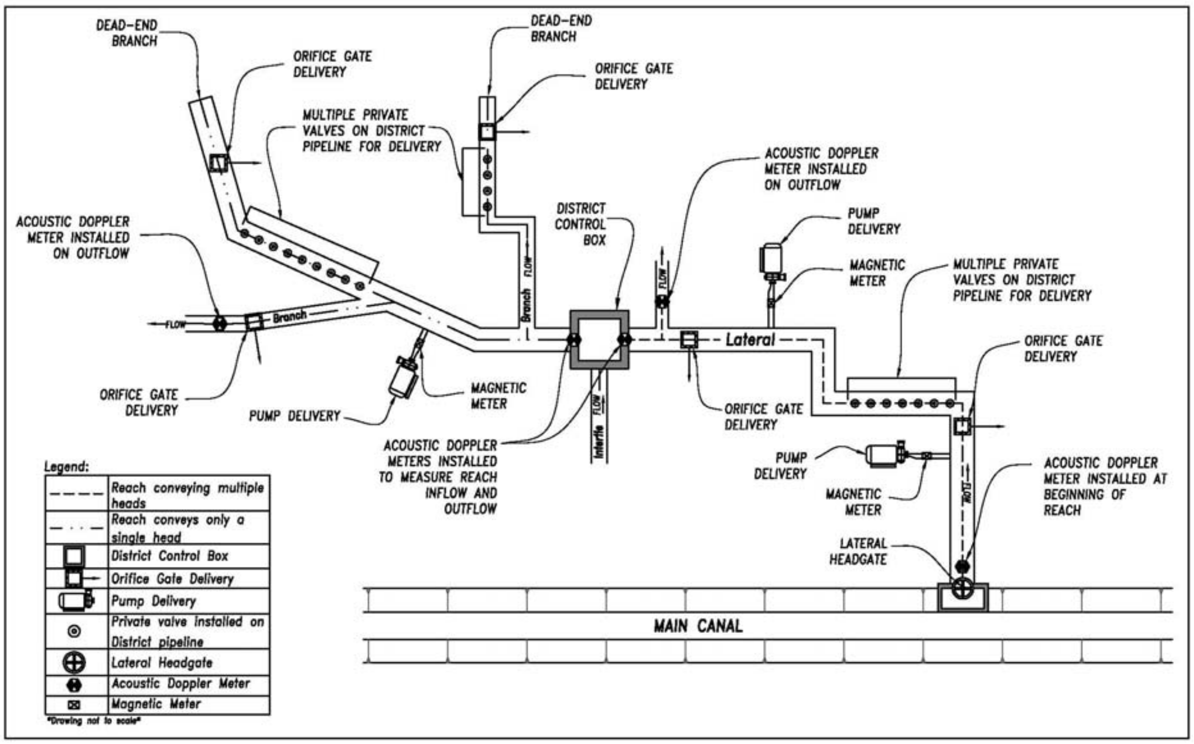

Figure A-7. Typical laterals conveying multiple and single heads with pump, multiple valve, and orifice gate turnouts and flow measurement network delivery measurement devices.

DELIVERY MEASUREMENT CORRECTIVE ACTION PLAN (CCR 23 §597.4(E)(4))

CORRECTIVE ACTION

Based on the results of the Program described in the preceding section, a corrective action plan has been formulated that relies predominantly on "volume differential measurement." This term, as used throughout this report, refers to the method of determining the volume of water delivered to customers as the difference between measured volumes upstream and downstream of customer delivery points (turnouts). A key factor necessitating volume differential measurement is the presence of multiple on-farm irrigation valves installed on District conveyance pipelines, as previously described.

The SSJID conveyance system was segmented into 52 delivery measurement reaches for volume differential measurement (Figure A-8). The reaches are whole laterals or portions of laterals where one head is typically rotated among the customers within the reach. On average, each measurement reach contains 18 flood turnouts (multiple valves or orifice gates), ranging from as few as two turnouts to as many as 53 (Table A-3). The reaches each serve an average of 37 parcels, ranging from five to 90 parcels per reach District-wide. In most cases, when multiple parcels are provided water through a single delivery point, the parcels have a single owner. The average reach has six pump turnouts. Six reaches have no pump turnouts, nine have more than 10 pump turnouts with one reach having 32 pump turnouts. As discussed previously, a magnetic flow meter will measure the flow and volume at each pump delivery. The average reach provides water deliveries to 753 acres using flood irrigation. The measurement reach with the smallest area of flood turnouts serves 75 acres while the largest serves an area of 2,134 acres.

The key practical consideration in the development of these delivery measurement reaches was to minimize the time that more than a one delivery, or head, was historically delivered in the reach. Thus, the operational changes required of the Division Managers to delivery only a single head from each measurement reach were minimized. Based on the 2011 irrigation season, more than one flood delivery was occurring during two percent of the time (Table A-3), or 4.5 out of 227 days. The maximum time more than one flood delivery was occurring was seven percent, or 15.9 out of 227 days. In 17 of the reaches, only one flood delivery was ever occurring at a given time.

SCHEDULE

CCR 23 §597.4(e)(4) requires an agricultural water supplier with existing water measurement devices out of compliance with **CCR 23 §597.3** to submit a schedule for taking corrective action in three years or less (i.e. prior to December 31, 2015). The delivery measurement plan consists of the following delivery measurement improvement tasks:

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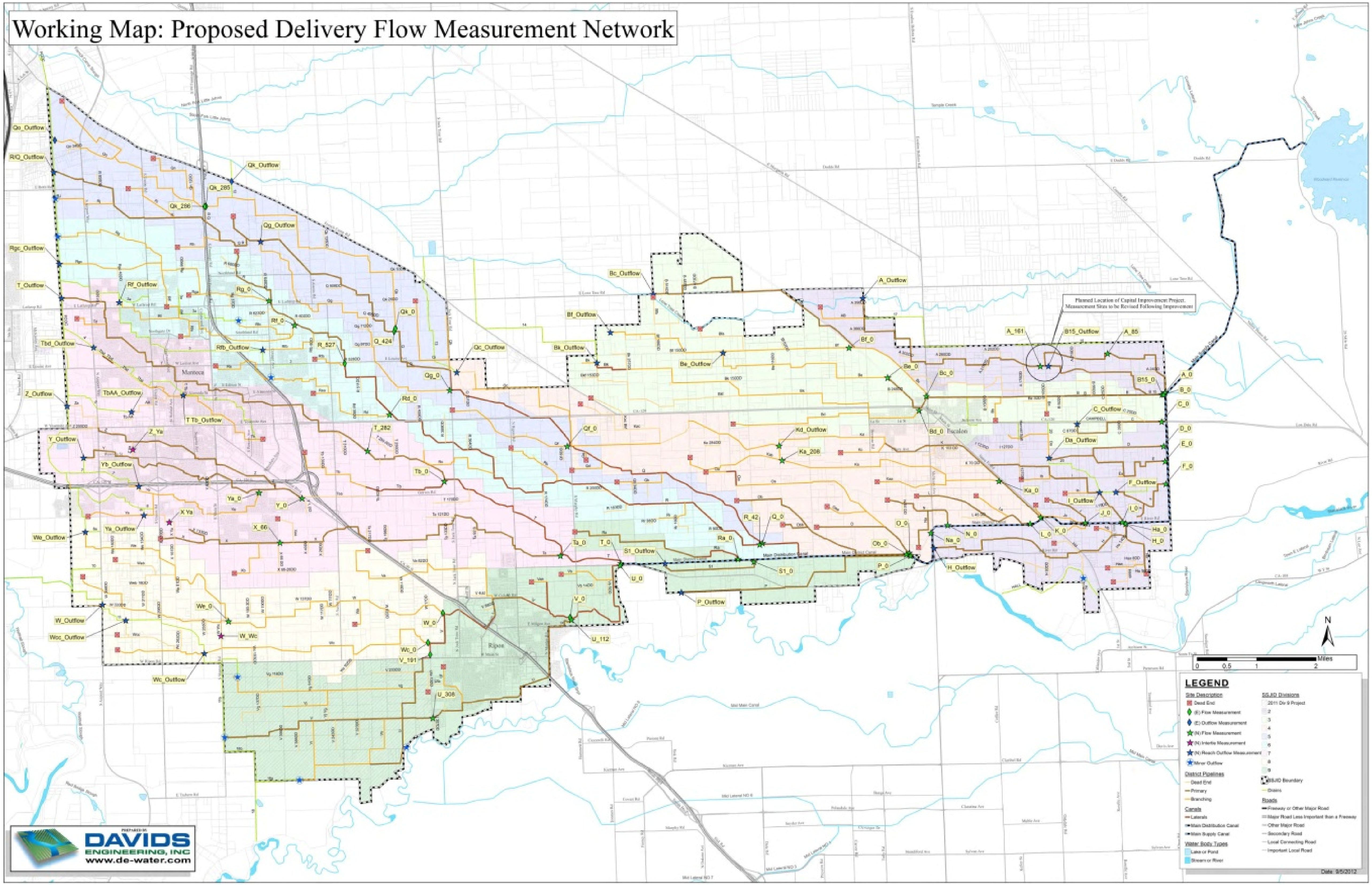

Figure A-8. SSJID delivery flow measurement network.

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Table A-3. Summary of number of flood delivery turnouts, area and related information for delivery flow measurement reaches.

Summary Statistics	No. of Fields	No. of Flood Delivery Turnouts	Fields/Turnout	Number of flood turnouts serving multiple owners	Irrigated Area per Turnout, Acres	No. Pump Delivery Turnouts	Total Area Served by Flood Irrigation, acres	Total Time Between First and Last Irrigations in Reach, days	Total time flood deliveries were on, days	% of irrig season flood deliveries were on[1]	Total time more than one flood delivery was on, days	% of irrig season with more than one flood delivery on[1]	Total Flood Deliv Vol, AF
Min	5	2	1.0	0	15	0	75	162	5	2%	0	0%	145
Max	90	53	6.5	17	164	32	2134	227	113	50%	16	7%	5984
Mean	37	18	2.4	4	48	6	735	202	44	19%	5	2%	1861
Total	1936	939		215		293	38212						96747

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1. Install acoustic Doppler sensors at specified measurement locations.
2. Install magnetic flow meters at pump deliveries.
3. Include newly instrumented measurement reach in delivery volume calculation database.

SSJID has developed a three-year schedule to complete the three tasks necessary to complete the required corrective action (Figure A-9). SSJID plans to install all devices during the winter season when the system is de-watered. Device installation shall be scheduled so that all required instrumentation is installed to complete entire divisions.

Additionally, the District will consider adopting a policy prohibiting the installation of multiple valves serving a single parcel on all newly installed District pipelines and sections of pipelines. Instead, delivery structures must be installed that would permit measurement in compliance with applicable requirements.

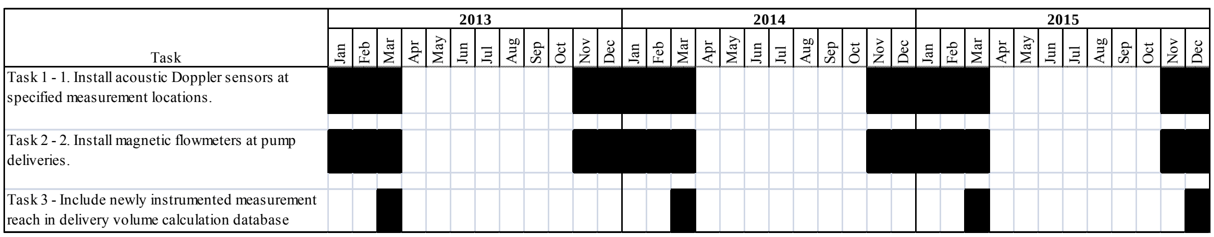

Figure A-9. Schedule for completing delivery measurement corrective action.

BUDGET

The total three year budget for delivery measurement corrective action plan to install SCADA-ready acoustic Doppler sites and SCADA-ready magnetic flow meters is $4.82 million dollars. The number of delivery points measured, planned acoustic Doppler measurement sites, and magnetic flow meters required together with the total estimated cost by division is provided in Table A-4. SSJID plans to complete Division 5 in 2013 as a final test of installation plans and procedures. The six divisions will be completed in 2014 and 2015. Current plans are to complete three divisions in 2014 and 2015, but these plans could be revised depending on the experience installing the delivery measurement network in Division 5 in 2013.

Table A-4. Estimated budget for delivery measurement corrective action plan.[1]

Estimated Year for Completion	Division	Delivery Points ("laterals")	Pump Deliveries	Area Flood Irrigated, Acres	Total Estimated Doppler Measurement Sites	Potential On-Farm Mag Meters	Existing Doppler Measurement Sites to be Retained	Existing SCADA Sites to be Retained	Total
2015	2	133	33	5355	15	33	0	0	$ 644,989
2015	3	168	44	5737	13	44	0	0	$ 732,841
2015	4	80	41	4126	9	41	0	1	$ 621,683
2013	5	173	37	6486	12	37	6	1	$ 552,519
2014	6	124	39	4968	8	39	1	1	$ 567,859
2014	7	144	46	5323	17	46	0	0	$ 828,073
2014	8	67	25	3539	8	25	2	0	$ 401,366
2014	9	50	28	2678	10	28	1	3	$ 470,291
	Totals=	939	293	38212	92	293	10	6	$4,820,000
	Min=	50	25	2678	8	25	0	0	$ 401,366
	Average=	117	37	4776	12	37	1	1	$ 602,452
	Max=	173	46	6486	17	46	6	3	$ 828,073

[1]Division 9 does not include the 3,100 acres included in the Division 9 pressurized system.

FINANCE PLAN

In July 2012, SSJID adopted a water pricing structure partially based on the quantity of water delivered as required by the California Water Code Section 10608.48. SSJID Resolution No. 12-12-B, Adopting Volumetric Charge states as one of the reasons the proposed volumetric charge is necessary:

> *"…additional costs will be incurred to operate and maintain the necessary new flow measurement facilities and to bill customers for the amount of water delivered, in order to comply with the new volumetric measurement and billing requirements."*

With funds at least partially provided by the new volumetric water charge, SSJID plans to include a budget line item in the 2013, 2014 and 2015 budgets to provide funds for the delivery measurement corrective action plan.

ATTACHMENTA-1

Flow Measurement
SITRANS F M

MAG 8000 for abstraction and distribution network applications (7ME6810)

Overview

Benefits

- Bury meters, IP 68
- Low cost of ownership
- Long-term stability
- Leak detection
- Low flow measurement

Technical specifications

Meter	
Accuracy	Standard calibration: ± 0.4% of rate ± 2 mm/s Extended calibration DN 50 ... DN 300 (2" ... 12"): ± 0.2 % of rate ± 2 mm/s
Media conductivity	Clean water > 20 µs/cm
Temperature	
Ambient	-20 ... +60 °C (-4 ... +140 °F)
Media	0 ... +70 °C (32 ... +158 °F)
Storage	-40 ... +70 °C (-22 ... +158 °F)
Enclosure rating	IP68/NEMA 6P; Cable glands mounted requires Sylgard potting kit to remain IP68/NEMA 6P, otherwise IP67/NEMA 4 is obtained; Factory-mounted cable provides IP68/NEMA 6P
Drinking water approvals	• NSF/ANSI Standard 61 (cold water) USA • WRAS (BS 6920 cold water) UK • ACS Listed France • DVGW W270 Germany • Belgaqua (B) • MCERTS (GB)
Custody transfer approval	• OIML R 49 approval
Conformity	• PED: 97/23EC • EMC: IEC/EN 61000-6-3, IEC/EN 61000-6-2
Sensor version	DN 25 ... 1200 (1" ... 48")

Measuring principle	Electromagnetic induction
Excitation frequency	
Basic version	
• Battery-powered	DN 25 ... 150 (1" ... 6"): 1/15 Hz DN 200 ... 600 (8" ... 24"): 1/30 Hz DN 700 ... 1200 (28" ... 48"): 1/60 Hz
• Mains-powered	DN 25 ... 150 (1" ... 6"): 6.25 Hz DN 200 ... 600 (8" ... 24"): 3.125 Hz DN 700 ... 1200 (28" ... 48"): 1.5625 Hz
Advanced version	
• Battery-powered	DN 25 ... 150 (1" ... 6"): 1/15 Hz (adjustable up to 6.25 Hz; reduced battery lifetime) DN 200 ... 600 (8" ... 24"): 1/30 Hz (adjustable up to 3.125 Hz; reduced battery lifetime) DN 700 ... 1200 (28" ... 48"): 1/60 Hz (adjustable up to 1.5625 Hz; reduced battery lifetime)
• Mains-powered	DN 25 ... 150 (1" ... 6"): 6.25 Hz DN 200 ... 600 (8" ... 24"): 3.125 Hz DN 700 ... 1200 (28" ... 48"): 1.5625 Hz
Flanges	
EN 1092-1 (DIN 2501)	DN 25 and DN 40 (1" and 1½"): PN 40 (580 psi) DN 50 ... 150 (2" ... 6"): PN 16 (232 psi) DN 200 ... 1200 (8" ... 48"): PN 10 or PN 16 (145 psi or 232 psi)
ANSI 16.5 Class 150 lb	1" ... 24": 20 bar (290 psi)
AWWA C-207	28" ... 48": PN 10 (145 psi)
AS 4087	DN 50 ... 1200 (2" ... 48"): PN 16 (232 psi)
Liner	EPDM
Electrode and grounding electrodes	Hastelloy C276
Grounding straps	Grounding straps are premounted from the factory on each side of the sensor.

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ATTACHMENT B: RULES AND REGULATIONS GOVERNING THE DISTRIBUTION OF WATER IN SSJID

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RULES AND REGULATIONS

Governing the Distribution of Water in the South San Joaquin Irrigation District

Adopted April 13, 1915
Amended May 20, 1919

TO THE TAXPAYERS AND WATER USERS OF THE
SOUTH SAN JOAQUIN IRRIGATION DISTRICT

These Rules and Regulations have been adopted under the authority of the Irrigation Act (Section 15) and have been passed by three successive readings and by being published and have now become a part of the law governing this District, with all the force of county or municipal ordinances.

It is the desire and intention to carry on the business of the District in a businesslike and economical manner and to distribute the water equitably, and, as near as may be, satisfactory to all water users. No two individuals have exactly the same requirements and while these individual requirements will be met as far as possible, yet there must be general rules and general practices to secure the greatest good to the greatest number.

It is expected that it will be found necessary to modify these rules from time to time to meet the changing conditions in the District, and the Board of Directors will always have an open mind for suggestions for modifications from water users. It is also understood that employees of the District may use a certain amount of judgment and discretion in enforcing the rules when an avoidable injury to any water user may thereby be prevented without doing an injustice to other water users.

Employees must be courteous and considerate in their dealings with the public and must understand that it is their duty to serve as effectively as possible the interests of water users and taxpayers, who in turn, are requested to extend the same courteous consideration to employees that employees will be required to show to them.

Every person in the District should feel a personal responsibility in helping to keep down expenses. This can be done by avoiding doing any damage to canals and structures, by stopping small leaks, reporting weak places and breaks and by NOT taking out or putting in flash boards or raising or lowering gates except under direct supervision of a ditch-tender and by following his directions carefully when so doing, and also by not turning the water loose at night or at other times after promising the ditch tender to keep it.

1

The office of the District and its records are public. All records are open to the inspection and examination of any taxpayer upon request and without assigning a reason for the request. All officials and employees will cheerfully furnish any information or answer any questions asked concerning the affairs of the District. Taxpayers are requested to avail themselves of this source of information.

This booklet is available for free distribution.

BOARD OF DIRECTORS

Reprint including amendments by order of the Board of Directors.
Dated May 20, 1919

Reprinted by order of the Board of Directors.
Dated October 28, 1986

RULES AND REGULATIONS

Governing the Distribution of Water in the South San Joaquin Irrigation District.

No. 1 - Control of System:

The canals and works of the District and all takeouts, checks, pipelines, pumps and other structures and devices placed in District canals, laterals, and ditches are under the exclusive control and management of the Superintendent, appointed by the Board of Directors, and no other person, except his employees and assistants, shall have any right to interfere with said canals and works in any manner.

No. 2 - Employees:

The Superintendent shall employ, under authority and subject to confirmation by the Board of Directors, such ditchtenders and other assistants as may be necessary for the proper operation of the system and distribution of the water. Each ditchtender shall have charge of his respective section and shall be responsible to the Superintendent. From the ditchtender's decision an appeal may be made to the Superintendent. From the action of the Superintendent, appeal may be made to the Board of Directors.

No. 3 - Apportionment of Water:

The water will be apportioned to each distributing section by the Superintendent, and in cases of controversy or shortage in water the apportionment shall be made upon the basis of the acreage irrigated from each section.

No. 4 - Rotation of Water:

The water will be furnished in rotation to each irrigator except by agreement between adjoining owners satisfactory to the Superintendent. The method of distributing water in any section shall be under the discretion of the Superintendent, except that if the Superintendent begin at either upper or lower end he must continue the routine as started.

No. 5 - Time Limit:

Each irrigator, with a head of 15 second feet of water will be allowed not to exceed thirty minutes to irrigate an acre of land requiring flooding; and with a larger or smaller head of water, will be required to irrigate more or less land in proportion to the amount of water furnished. But for gardens, trees and vines water will be furnished on request whenever available and will be kept available continuously as far as possible. The time will start when the diverting gate in the District canal is opened, and water must be used night and day continuously until the time limit expires. The head of water or time limit for gardens, trees and vines will not be fixed unless required in time of shortage.

No. 6 - Continuous Use of Water:

Before water is turned into a private individual or party ditch the same shall be in condition satisfactory to the Superintendent, and the water shall be used continuously day and night, and all land upon which water is not used loses its right to water until the next regular irrigation for that ditch.

Properly checked land to be flooded on regular time limit. On unimproved land water may be used up to July 1st for furrow irrigation, providing flooding is not attempted to such an extent as to become a waste of water; waste of water in this instance shall immediately accrue when water commences to collect in low swales, runs upon roads or adjacent lands. A time limit of thirty minutes per acre shall be placed on each acre with a fifteen second foot head of water or a limit of one and one-half hours per acre for five second feet, and if applicant is not in position to handle five second feet of water a time of one and one-half hours to the acre shall be charged against stream of water that applicant is able to handle in the same manner as though he was in a position to receive and handle five second feet.

4

No. 7 - Notice of Delivery:

Each irrigator will be notified at least 12 hours before water will be delivered to him and further notified of any change in time of delivery, and the irrigator who fails to use his allotment of water during an irrigation will not be entitled to any more water at any future irrigation than if he had used his full share at the time of allotment.

No. 8 - Control of Diverting Gates:

The District's employees alone will be allowed to open the diverting gates or pipelines, and they have full authority to close same as soon as the requisite amount of water for each irrigator has been discharged. When water user requests, or it is evident to District's employee that an extension of time is necessary to adequately irrigate a piece of land that is in all respects properly prepared, same shall be granted; provided, said extension does not materially interfere with schedule of other irrigators on same ditch or lateral, in which case said employee shall forthwith report to the Superintendent, and in case of his absence then to one of his assistants, who shall give final instructions for that particular irrigation.

No. 9 - Using Water Out of Turn:

Any person who uses the water out of his turn and without the permission of his ditchtender forfeits his right to water at the next regular irrigation and is also subject to criminal prosecution.

5

No. 10 - Waste of Water:

Persons wasting water on roads or vacant land, or land previously irrigated, either willfully, carelessly, or on account of defective ditches or inadequately prepared land, or who shall flood certain portions of the land to an unreasonable depth or amount in order to properly irrigate other portions, will be refused the use of water until such conditions are remedied.

No. 11 - Access to Land:

The authorized agents of the District shall have free access at all times to lands irrigated from the canal system for the purpose of examining the canals and ditches and the flow of water therein.

No. 12 - In Case of Breaks:

When a break or succession of breaks occur under any distributing section, the person to whom the water is last given while the break is being repaired, will be allowed to finish before the water is taken from him, and shall not claim another irrigation for that run. When the breaks are repaired the water will be returned to its original rotation as nearly as possible.

No. 13 - Diverting Gates and Checks:

All diverting gates, pipe lines, and checks are under the control of the District. All pipe takeouts from District canals are subject to exclusive control by the District employees and District padlocks to lock such takeout gates must be installed at the expense of the irrigator.

No. 14 - Acreage of Crops:

Between January 1st and June 1st of each year the Superintendent will obtain from each user of water a signed statement of the kinds of crops and numbers of acres of each which he intends to irrigate. Such other information as may be desirable may be obtained on the same forms.

No. 15 - Use of Right of Way:

Trees, vines and alfalfa must not be planted on the banks of the District canals. Trees and vines interfere with repairs and cleaning, and alfalfa brings gophers into the banks. Permission will be granted to raise cultivated crops on the banks whenever it can be done without injuring the canals or interfering with the distribution of water.

No. 16 - Paralleling of District Ditches:

Where private service ditches are constructed closely paralleling District ditches, a full and complete bank must be constructed adjacent to and in addition to the bank of the District ditch so paralleled.

No. 17 - Liability of Irrigators:

Every consumer of water shall be responsible to the District for all damages caused by his willful neglect or careless acts, and upon his failure to repair such damage after notification by the ditchtender, such repairs shall be made at his expense by the District.

No. 18 - Unlawful Acts:

Attention is called to the fact that any person draining water upon or permitting water to drain upon a public highway is liable to fine and damages. Any interference with the canals or structures under the control of the District is a penal offense.

No. 19 - Building Diverting Gates and Structures:

No openings shall be made or structures placed in any District canal until an application in writing has been made to the Board and permission granted therefore, and without the special permission of the Superintendent. All structures in District canals must be constructed according to requirements of the District and must be maintained in a condition satisfactory to the Superintendent, and must not be changed without the permission of the Superintendent.

No. 20 - Obstructions in Right of Way:

No fences or other obstructions shall be placed across or upon or along any canal bank or right of way of any canal or ditch belonging to the District without the special permission of the Board of Directors. Whenever such special permission shall be granted it shall always be with the distinct understanding that proper openings or passage ways for teams shall be provided, and that such fence or obstruction must be removed whenever requested by the Superintendent.

No. 21 - Preparation of Land for Irrigation:

All parties wishing to prepare land for irrigation may obtain data covering elevations of available water service, proper point on lateral from which to obtain service, and elevation of land which may be watered without endangering the canals, from the engineering department of the District. Before new land may receive water service, same must be inspected by the engineering department, which shall judge as to the feasibility of serving such land. - Amended January 10, 1922.

No. 22 - Enforcement of Rules:

Refusal to comply with the requirements hereof, or transgression of any of the foregoing rules and regulations, or any interference with the discharge of the duties of any official, shall be sufficient cause for shutting off the water, and water will not again be furnished until full compliance has been made with all requirements herein set forth.

No. 23 - Abatement of Nuisance:

No rubbish, swill, garbage, manure or refuse, or dead animal, or animal matter from any barnyard, stable, dairy or hog pen shall be placed in or allowed to be emptied into any ditch or canal of The South San Joaquin Irrigation District, and the Superintendent and ditchtenders of said District are hereby instructed to see that this rule is strictly enforced. All persons found guilty of violating the above rule will be prosecuted for maintaining a nuisance.

No. 24 - Modification of Rules:

These rules may be modified temporarily to meet special conditions.

Section 592, Penal Code of the State of California: Water Ditches, etc., Penalty for Trespass or Interference With.

Every person who shall, without authority of the owner or managing agent, and with intent to defraud, take water from any canal, ditch, flume or reservoir used for the purpose of holding or conveying water for manufacturing, agricultural, mining, irrigating, or generation of power, or domestic use, or who shall without like authority, raise, lower or otherwise disturb any gate or other apparatus thereof, used for the control or measurement of water, or who shall empty or place, or cause to be emptied or placed, into any such canal, ditch, flume or reservoir any rubbish, filth or obstruction to the free flow of the water, is guilty of a misdemeanor.

Section 607, Penal Code of the State of California: Destroying or Injuring Bridges, Dams, Levees, Etc.

Every person who willfully and maliciously cuts, breaks, injures, or destroys any bridge, canal, flume, aqueduct, levee, embankment, reservoir, or other structure erected to create hydraulic power, or to drain or reclaim any overflowed tide or swamp land, or to store or conduct water for mining, manufacturing, reclamation, or agricultural purposes, or for the supply of the inhabitants of any city or town, or any embankment necessary to the same, or either of them, or willfully or maliciously makes, or causes to be made, any aperture in such dam, canal, flume, aqueduct, reservoir, embankment, levee or structure, with intent to injure or destroy the same; or draws up, cuts, or injures any piles fixed in the ground for the purpose of securing any sea bank or sea walls, or any dock, quay, jetty, lock or sea wall; or who, between the first day of October and the fifteenth day of April of each year, plows up or loosens the soil in the bed or on the sides of such natural watercourse or channel, without removing such soil within twenty four hours from such watercourse or channel; or who, between the fifteenth day of April and the first day of October of each year, shall plow up or loosen the soil in the bed or on the sides of such natural watercourse or channel, and shall not remove therefrom the soil so plowed up or loosened before the first day of October next thereafter, is guilty of a misdemeanor, and upon conviction, punishable by a fine not less than one hundred dollars and not exceeding one thousand dollars, or by imprisonment in the county jail not exceeding two years, or by both; provided, that nothing in this section shall be construed so as to in any manner prohibit any person from digging or removing soil from any such watercourse or channel for the purpose of mining.

10

ATTACHMENT C: PROGRAM DESCRIPTION FOR 2014 ON-FARM WATER CONSERVATION PROGRAM

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ON-FARM WATER CONSERVATION PROGRAM

2014 PROGRAM DESCRIPTION

SOUTH SAN JOAQUIN IRRIGATION DISTRICT

TABLE OF CONTENTS

BACKGROUND AND OBJECTIVES

In the early 1900's, the South San Joaquin Irrigation District's system was built for flood irrigation. Over the years, the practices of growers have changed as they work to conserve water and to improve crop yields with the installation of more efficient irrigation systems and implementation of advanced farming practices. In recognition of the farmers' efforts, and to comply with State law regarding agricultural water use, SSJID provides financial incentives to accelerate improvements to the existing distribution system, enhance farm irrigation practices and provide for measurement of water usage. The intent of this Program is to engage as many growers as possible.

SSJID has developed an on-farm water conservation program (Program) to promote and incentivize on-farm physical improvements, irrigation management practices and water measurement (together referred to as Conservation Measures) that promote water conservation. From a Program perspective, water conservation is defined as use of less water to accomplish the same purpose by encouraging the efficient use of District surface water to meet crop water requirements.

SSJID's goal is to ensure that water is being used efficiently and that it is being put to beneficial use. The District has implemented the on-farm water conservation program in order to work together to achieve the shared water management goals of the growers and the District. The Program also supports ongoing efforts to preserve existing water rights and to comply with current and emerging regulations.

This Program helps the District satisfy the new regulatory requirements of California Senate Bill SBx 7-7, which took effect January 1, 2010 and mandates measurement of individual farm deliveries and implementation of Efficient Water Management Practices (EWMPs) including both District and on-farm improvements. Additionally, it is anticipated that this Program will enhance the control of available surface water and groundwater supplies while promoting improved crop production within SSJID. This program, along with other initiatives the District is evaluating, will provide improved farm delivery measurement and support compliance with SBx 7-7.

A focused set of conservation measures have been included in the Program. In future years, additional conservation measures may be added based on experience with the Program.

Cost shares made available by the Program have been approved for the 2014 growing season. This document provides a detailed description of the 2014 Program to be implemented in November 2013. Cost share offerings for implementation of conservation measures for 2015 will be the subject of future Board decision. For the 2014 Program, participants will be eligible for cost share payments for conservation measures implemented after the Program start date of Monday, November 12, 2013. Applications will be available and accepted on the start date.

ENROLLMENT PROCESS

SOLICITATION AND APPLICATION PROCESS

The program will be launched in November 2013 through an announcement on the SSJID web site and through the SSJID Newsletter mailed to SSJID water users.

Growers are invited to submit applications for one or more fields (Appendix A). For each field, the grower will select one or more conservation measures for implementation from a pre-approved list. Fields will be selected by the District for implementation individually from each application provided that they are complete, pass minimum eligibility requirements, and provided that funding is available, as described in the following sections. Additionally, for some conservation measures (conversion from flood to sprinkler or drip/micro irrigation) the application will be reviewed to ensure compatibility with the SSJID distribution system and operations. The District reserves the right to restrict the amount of participation by a particular grower or a particular field.

As mentioned above, each application must be complete to be considered for inclusion in the Program. A complete application will have all applicable portions of the application filled in and will include sufficient documentation to support evaluation of the conservation measure by the District.

For additional information, contact Program Manager Julie Vrieling at (209) 249-4675 or email jvrieling@ssjid.com.

ELIGIBILITY REQUIREMENTS

The following eligibility requirements apply to all fields applying to enter the Program.

- Minimum Field Size – The minimum field size for inclusion in the Program is 10 acres, based on the net irrigated acreage of the field. The 10-acre threshold is additionally the acreage above which the recharge fee applies to fields within the District.

  Growers with fields less than 10 acres in size may submit an application. The District will evaluate whether there is sufficient potential for water conservation to be achieved to warrant the administrative time required to include the field in the Program. Proposals to enroll fields less than 10 acres in size will be evaluated on a case by case basis.

- Current SSJID Water User – For a field to be eligible for the Program, it must be or become a current SSJID surface water user as a condition to approval of any funding. For physical improvements, the participant agrees to use SSJID surface water for a period of not less than 5 years.

- Water Charges Current – At the time of enrollment, all of the grower's SSJID water charges must be or become current.

- On-Farm Measurement – For fields entering the Program with pumped deliveries, the participant agrees to install a meter to measure farm deliveries, in accordance with the conservation measure Delivery Measurement for Pumped Deliveries, as described in this document, including any reconfiguration of the pump discharge needed to facilitate accurate measurement while maintaining the pump flow rate. The participant will agree to perform repairs, maintenance, or replacement of water measurement devices as needed to ensure accurate measurement into the future.

  The participant agrees to allow SSJID to periodically record flow rate and delivery amounts using the meter and, at the District's option, to perform repairs, maintenance, or replacement as needed to ensure accurate measurement into the future. Additionally, all participants agree to allow meters to be installed by the District on a case-by-case basis for flood deliveries, if the District determines that site conditions support accurate delivery measurement.

- Satisfactory Performance in Prior Programs – If applicable, applications may be denied due to less than satisfactory performance in prior District programs.

- Cost Share – The District's maximum share of cost will be a set percentage of the participant's implementation cost, with maximums put in place.

- Program Award/Modification – the District will review and select applications for participation in the Program based on its determination of which applications best meet the Program objectives. The District may modify the terms for participation in the Program at any time, but will not reduce its commitment applicable to a particular field after a participant has received notice of approval from the District.

SELECTION PROCESS

Fields will be considered on a first-come, first-served basis. An application will be considered approved when the District issues written notice of approval to the applicant at the mailing address or e-mail address specified on the application. The terms of approval and the conditions for District payment will be stated in the notice. Fields will be considered for approval until available funds allocated to each conservation measure of the Program are fully committed for each year, based on the assumption that actual reimbursement costs for cost share payments, as described later in this document, will be the maximum allowable payment per field. If after actual payments are made remaining funds are available, additional fields will be considered in the order in which their applications were received.

In order to encourage adoption of a variety of conservation measures, a total budget will be allocated for each conservation measure as described in the Budget Tracking section of this document.

Approved conservation measures must be completed within 1 calendar year of the date of approval to be considered eligible for cost share payments. Requests for reimbursement must be submitted to the District within the 1 year period. Conservation measures started prior to the approval date are not eligible for cost share payments.

CONSERVATION MEASURES

Conservation measures as described herein are classified as either physical improvements or management practices. Physical improvements include conservation measures involving substantial physical changes to a field. Management practices include collection of information and development of recommendations to aid in improved irrigation management to meet crop water needs.

All measures must be constructed or implemented according to Program standards prior to receiving reimbursement. For physical improvements, all measures must have been inspected and approved by SSJID staff prior to reimbursement. For management practices, payment will be made following the receipt of operational reports (soil moisture monitoring data and/or irrigation scheduling recommendations) under the provision that service provider will provide these data for the full irrigation season for which the field is enrolled in the Program. For both physical improvements and management practices, documentation of costs must be provided to the District's satisfaction prior to reimbursement.

As described in the Background and Overview section of this Program Description, for the 2014 Program, participants will be eligible for cost share payments for conservation measures implemented after the Program start date of November 12, 2013.

PHYSICAL IMPROVEMENTS

Delivery Measurement for Pumped Deliveries

Delivery measurement for pumped deliveries consists of installing a flow meter to measure SSJID water deliveries for existing or new pumped SSJID deliveries. In some cases, the existing pump discharge piping may need to be reconfigured to provide an adequate straight section of pipe without bends or other obstructions to allow for accurate flow measurement using a flow meter.

This conservation measure is applicable to any case in which SSJID water is delivered to a pump that pressurizes irrigation water for application via a sprinkler, drip, or micro system. Minimum standards for the measure are:

- Seametrics AG2000 Irrigation Magmeter, McCrometer Ultra Mag flow meter, or approved equal
  - Installed with at least 3 diameters of straight pipe upstream of meter and 2 diameters of straight pipe downstream of meter (see Figure 1)
  - Provided with continuous power supply
  - Equipped with telemetry hardware allowing integration to the District's Supervisory Control and Data Acquisition (SCADA) System
  - Equipped with an internal datalogger[21]
- The participant agrees to perform repairs, maintenance, or replacement of water measurement devices as needed to ensure accurate measurement into the future.
- The participant agrees to allow the District to record delivery flow rates and volumes periodically for the life of the meter and to allow the District, at its option, to perform any repair, maintenance, or replacement, as needed to ensure accurate measurement into the future.
- The land owner must sign an SSJID agricultural Meter Service Agreement (Appendix C) as part of implementation of this conservation measure.
- The participant agrees to allow the District, at its option, to install telemetry, including but not limited to a solar panel, mast, antenna and other necessary equipment to remotely monitor delivery flows using the flow meter.

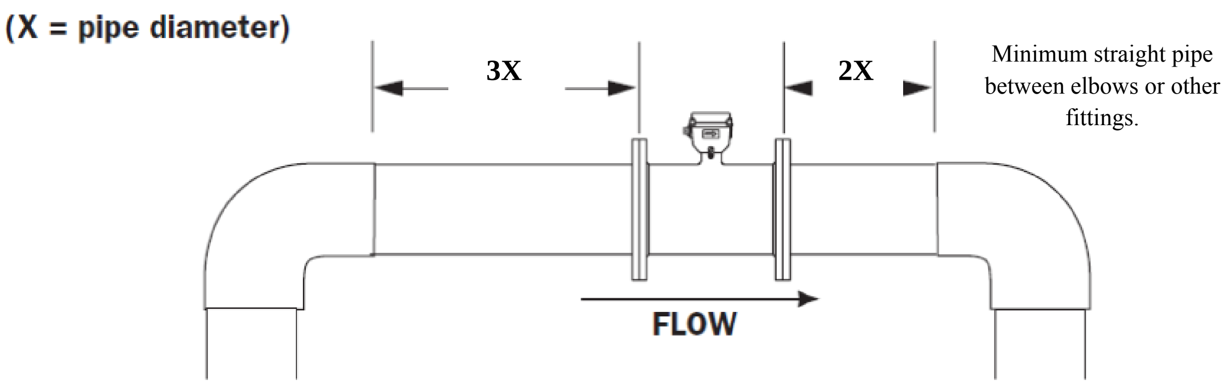

Figure 1. Example Magnetic Flow Meter Installation.

This measure will be included with any participating fields installing a sprinkler or drip irrigation system as described under the following conservation measure. All growers implementing this measure are required to agree to allow the District to read the flow meter periodically for purposes of delivery record keeping for the life of the device.

The estimated cost for planning purposes is $5,650 per location based on the estimated purchase and installation cost of a 12" mag meter, plus a contingency to allow for re-plumbing of pipe discharge to allow for adequate length of straight pipe to install the meter in some cases.

[21] An external datalogger is required and is subject to approval by SSJID.

The District's cost share for delivery measurement of pumped deliveries will be 80 percent of the actual cost, not to exceed $4,500.

Conversion from Flood to Sprinkler or Drip/Micro Irrigation

Conversion from flood to sprinkler or drip irrigation consists of installing a sprinkler, drip, or microspray irrigation system on an existing field that is currently flood irrigated. The conservation measure includes installation of the pump, filtration, mainlines, laterals, and emitters for the system. Adoption of this conservation measure additionally includes and requires installation of an SSJID approved sump to allow for pumping of canal water along with adoption of the conservation measure Delivery Measurement for Pumped Deliveries, described previously.

Conversion from flood to sprinkler or drip irrigation is generally applicable throughout SSJID, except where delivery system physical and operational constraints limit the District's ability to meet the delivery needs of sprinkler or drip/micro systems. Although the primary crops currently irrigated using sprinkler or drip irrigation are trees and vines, this conservation measure could also apply to the installation of a sprinkler system to irrigate pasture or field crops, for example. **Applications for conversion to sprinkler or drip/micro irrigation will be evaluated on a case by case basis to determine whether the District can continue to provide canal water to meet crop water needs following irrigation system conversion. Only fields located such that the District can supply surface water at the flow rate and irrigation intervals required after conversion will be approved.**

Minimum standards for this measure have been identified based on the NRCS Conservation Practice Standards listed in Table 1, below. These standards are included in Appendix B of this document.

Table 1. NRCS Conservation Practice Standards Applicable to Conversion from Flood to Sprinkler or Drip Irrigation.

NRCS Conservation Practice Standard	Applies to Conversion from Flood to:	
	Sprinkler	Drip or Micro
Irrigation System, Sprinkler (442)	□	
Irrigation System, Microirrigation (441)		□
Pumping Plant (533)	□	□
Irrigation Pipeline (430)	□	□

Additionally, the following requirements developed by SSJID shall apply:

- No filters may back flush to District pipelines or open canals
- Each system must be designed by an Irrigation Association Certified Irrigation Designer
- Design Distribution Uniformity must be at least 75 percent for sprinkler systems and at least 90 percent for drip or micro systems
- Participants are responsible for submitting an Application for Structure Permit and constructing a District-approved sump prior to receiving reimbursement for system installation costs under this conservation measure.

The estimated cost for conversion from flood to sprinkler or drip/micro for planning purposes is $1,650 per cropped acre based on estimated materials and installation costs of a complete system including pump, filtration, mainlines, laterals, and emitters. The estimated costs are based on discussion with local irrigation suppliers and review of NRCS EQIP cost estimates. Sump costs are considered inclusive to the irrigation system and will be reimbursed through this Conversion conservation measure. Reimbursement for flow meter costs will be made separately under the Program based on the Delivery Measurement for Pumped Deliveries conservation measure, described previously.

The District's cost share for conversion from flood to sprinkler or drip irrigation will be 50 percent of the actual cost, not to exceed $825 per cropped acre. Additionally, the cost share payment will be limited to a maximum of $25,000 per grower for each measure. As described, this cost share does not include delivery measurement for pumped deliveries, which will be treated separately.

Drainage Relief Option

This conservation measure includes tailwater recovery systems, land leveling, and the modifying of discharge valves.

Tailwater Recovery Systems to Prevent Runoff consist of systems to collect and convey tailwater to the head of the field from which the tailwater was generated or another nearby field for the purpose of recovering and reapplying the tailwater to supplement irrigation deliveries. For this Program, tailwater recovery systems are targeted at fields that periodically drain tailwater back into the SSJID distribution system where it currently is delivered to a downstream user or spills from the system. SSJID discourages and in the future may no longer allow drainage of tailwater into the distribution system. This conservation measure applies to any field for which tailwater is produced during irrigation that drains back to the SSJID irrigation system. It is anticipated that this only occurs for flood irrigated fields.

Minimum standards for tailwater recovery systems have been identified based on the NRCS Conservation Practice Standards for Irrigation System, Tailwater Recovery (447), Pumping Plant (533), and Irrigation Pipeline (430), included in Appendix B of this document.

The estimated cost of tailwater recovery systems for planning purposes is $1,200 per cropped acre based on estimated materials and installation costs of a complete system including tailwater pond, tailwater return pipeline, and pump. The estimated costs are based on estimated quantities and unit costs for system components and based on review of NRCS EQIP cost estimates.

The District will also consider laser land leveling, deep ripping, as well as the modification of discharge valves to reduce drainage into the SSJID distribution system. Minimum standards for laser land leveling and deep ripping have been identified based on the NRCS Conservation Practice Standards for Irrigation System, Precision Land Forming (462), Irrigation Land Leveling (464), Land Smoothing (466) and Deep Tillage (324), included in Appendix B of this document.

The District's cost share for drainage relief options will be 50 percent of the actual cost, not to exceed $600 per cropped acre. Additionally, the cost share payment will be limited to a maximum of $10,000 per grower for this measure.

MANAGEMENT PRACTICES

Scientific Irrigation Scheduling & Soil Moisture Monitoring

Scientific Irrigation Scheduling consists of the determination of the frequency, rate, and duration of irrigation application needed to meet crop water requirements while minimizing excess tailwater and deep percolation. Typically, this determination is based on a combination of soil moisture monitoring and root zone water balance calculations based on estimates of crop water use (evapotranspiration, or ET). Scientific irrigation scheduling is applicable to all irrigated crops, regardless of irrigation system type or soil conditions.

In most cases, the optimum frequency, rate, and/or duration of irrigation is constrained by available water supply, the delivery system, the soil, or the irrigation system itself. In the case of SSJID, the delivery frequency and flow rate are generally fixed under current system operation, providing flexibility almost exclusively in the duration of irrigation.

Soil Moisture Monitoring consists of tracking the moisture content of the crop root zone over the course of the growing season to evaluate whether irrigation practices are sufficient to maintain adequate soil moisture content while limiting excess deep percolation. Soil moisture monitoring is a key component of scientific irrigation scheduling and is applicable to all irrigated crops, regardless of irrigation system type or soil conditions. For the Program soil moisture monitoring is offered to assist growers in tracking soil water content, or it may be implemented as part of scientific irrigation scheduling, described previously.

Under the Program, the District requires that scientific irrigation scheduling and soil moisture monitoring be conducted by approved service providers using proven technologies. Additionally, the District requires that irrigation recommendations and/or duplicate soil moisture monitoring reports be submitted to both the participating grower and to the District by the service provider. To request a list of preapproved service providers, contact Julie Vrieling at (209) 249-4675 or email jvrieling@ssjid.com.

The estimated cost of scientific irrigation scheduling for planning purposes is $3,000 per field per season. The estimated cost of soil moisture monitoring for planning purposes is $1,500 per field per season. These costs represent the average seasonal cost for a consulting service to provide irrigation recommendations or provide soil moisture monitoring reports for an individual field based on discussion with consultants serving the San Joaquin Valley. The difference in cost between consultants depends largely on whether continuously recording soil moisture monitoring equipment is installed in the field; costs will likely be substantially less for weekly field visits using portable soil moisture monitoring equipment.

Unlike physical improvements, the District will pay a portion of the total cost of the scientific irrigation scheduling service and/or soil moisture monitoring service directly to the service provider. The portion that the District is willing to pay will be a one-time payment of 50 percent of the actual cost, not to exceed $1,125 per field. The maximum payment for Scientific Irrigation Scheduling and/or Soil Moisture Monitoring will be limited to $2,500 per grower.

DISTRICT SERVICES

Valve Packing

Valve packing is a service that was traditionally provided by the District to repack irrigation valves to reduce valve leakage. Valve packing is applicable wherever large flood irrigation valves installed on District pipelines are used. Growers are to make arrangements to have their valves packed by contacting Julie Vrieling at (209) 249-4675 or e-mail jvrieling@ssjid.com. District staff will repack the valves. Valves will be packed according to manufacturer specifications, if applicable.

Growers will be charged a fee for valve packing to cover District labor and materials costs for repacking the valves. Additionally, the grower is responsible for the removal and reinstallation of the valve, as well as delivery to and pickup from the District. The District may restrict the availability of this service depending on the availability of personnel.

MAXIMUM COST SHARE PAYMENT PER GROWER

In addition to the payment limitations described previously for each conservation measure, the total cost share for 2014 for all fields enrolled by a grower will be limited to $25,000.

INTERACTION WITH OTHER, NON-DISTRICT PROGRAMS

Other Programs may provide cost share payments for implementing conservation measures included in this Program. For example, programs offered by the Natural Resources Conservation Service of the USDA, such as the Environmental Quality Incentives Program (EQIP), offer cost share of 50 percent (or more in some cases) to cover the cost of installing sprinkler systems, drip/micro systems, tailwater recovery systems, or other on-farm improvements.

Participation in the SSJID On-Farm Water Conservation Program does not prevent growers from participating in EQIP or other Federal programs. Similarly, participation in EQIP or other Federal programs does not prevent participation in the SSJID On-Farm Water Conservation Program.

BUDGET TRACKING

The total budget for cost share payments is $738,000 for 2014. Initially, cost share amounts will be allocated for each conservation measure as described in Table 2.

Table 2. Initial 2014 Budget Amounts by Conservation Measure Category.

Conservation Measure Category	2014 Budget by Conservation Measure
Physical Improvements	
Delivery Measurement for Pumped Deliveries	$ 63,000
Conversion from Flood to Sprinkler or Drip/Micro	$ 500,000
Drainage Relief	$ 125,000
Management Practices	
Scientific Irrigation Scheduling & Soil Moisture Monitoring	$ 50,000
TOTAL	$ 738,000

The budget amounts will be reviewed periodically and may be adjusted based on the number of applications received for each conservation measure at the discretion of the Program Manager.

As applications for participation are received, they will be added to a list in the order they are received. At any given time, the applications subject to review and approval will be limited to those for which the total potential cost share is less than the total available budget by conservation measure category. If upon review, the District does not approve an application, the associated cost share will be released to fund applications received later within that category. As documentation of actual costs is received by the District from participating growers, the difference between the cost share limit and the actual cost share amount paid for each category, if any, will likewise be released to fund applications received later in the order in which they were received.

PAYMENT APPROVAL AND PROCESSING

Upon receipt of a request for payment and documentation showing actual payment of the incurred conservation measure implementation costs from an approved applicant, the District will verify that the measure has been implemented (as described in the following section) and payment will be issued based on the Program cost share percentage for the measure or measures implemented and based on the actual cost, not to exceed the cost share limit for the measure or measures.

Requests for reimbursement must be accompanied by documentation of implementation costs, including invoices and receipts from equipment and service providers, along with proof of payment. Costs incurred by the grower internal to his or her operation that are associated with the installation of the conservation measure are not considered eligible for reimbursement.

Payments will be issued as a separate check to the participating grower, rather than as a reduction in water charges. It is anticipated that payment will be made within 30 days of the District's verification that the measure was implemented.

MONITORING AND VERIFICATION

Monitoring and verification of implementation of conservation measures will be accomplished through a combination of documentation of implementation costs (receipts and payments) and operational reports (flow measurement records, soil moisture monitoring reports, and irrigation recommendations), along with field visits to verify that physical improvements are implemented according to Program standards. Additionally, the District will seek feedback from participating growers in the form of interviews or questionnaires with the objective of evaluating the Program and documenting changes to irrigation practices resulting from conservation measure implementation.

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APPENDIX A: APPLICATION FOR PROGRAM PARTICIPATION

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For District Use Only
Date Received: ___

APPLICATION FOR ON-FARM WATER CONSERVATION PROGRAM

1. Applicant/Landowner name ____________________________ email __________________
2. Mailing address ____
3. Telephone # ____

Complete one application for each field to be included in the Program. All measures must be implemented after the application approval date and completed within 1 year to be eligible for reimbursement.

SUBMIT COMPLETED APPLICATION TO SSJID

1. A detailed design plan and cost estimate must be submitted with applications including physical improvements to a field.
2. Your application will be reviewed and processed according to District policy and as described in the Program Description. A determination will be made as to the eligibility and potential effectiveness of the proposed conservation measure or measures for each field, and a recommendation will be made to the General Manager, Jeff Shields.
3. Following review, you will be sent a letter or e-mail summarizing the conservation measures approved for implementation for each field application and providing explanation of why any fields or conservation measures were not approved, if applicable.
4. **COST SHARE PAYMENTS ARE NOT GUARANTEED UNTIL YOUR APPLICATION HAS BEEN APPROVED.**
5. If you have any questions concerning your Application please feel free to contact Julie Vrieling at (209) 249-4675 or email jvrieling@ssjid.com.
6. By signing below, you agree to implement the conservation measures described in this application and to abide by all Program requirements as described in the Program Description.

APPLICANT/LANDOWNER SIGNATURE _______________________________________

DATE ________________________

APPLICATION FOR ON-FARM WATER CONSERVATION PROGRAM (CONTINUED)

BASIC INFORMATION

1. Applicant/Landowner name ____________________
2. Assessor's Parcel Number (APN) ____________________
3. SSJID Delivery Location (example: Lat. Wc, St. 120) ____________________
4. Field size[1] (acres) ____________________ 6. Crop ____________________

PROPOSED PHYSICAL IMPROVEMENTS

1. Delivery Measurement for Pumped Deliveries _______
2. Conversion from Flood to Sprinkler or Drip/Micro Irrigation[22] _______
3. Drainage Relief Option _______

PROPOSED MANAGEMENT IMPROVEMENTS

1. Scientific Irrigation Scheduling and/or Soil Moisture Monitoring _______

Have you applied for funding for these conservation measures under any other programs, such as NRCS EQIP? Yes ___ No ___

APPLICANT/LANDOWNER SIGNATURE ____________________ DATE ____________

Preferred method of contact: E-mail __________ Postal Mail __________

[1] Fields less than 10 acres in size will be considered for participation on a case-by-case basis based on the potential to achieve water conservation as described in the Program Description.
[22] Conversion from flood to sprinkler or drip/micro must include the delivery measurement for pumped deliveries conservation measure.

APPENDIX B: APPLICABLE NRCS CONSERVATION PRACTICE STANDARDS

The following NRCS Conservation Practice Standards are attached:

1. Irrigation System, Sprinkler (442)
2. Irrigation System, Microirrigation (441)
3. Pumping Plant (533)
4. Irrigation Pipeline (430)
5. Irrigation System, Tailwater Recovery (447)
6. Precision Land Forming (462)
7. Irrigation Land Leveling (464)
8. Land Smoothing (466)
9. Deep Tillage (324)

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APPENDIX C: CONSENT TO SOUTH SAN JOAQUIN IRRIGATION DISTRICT'S ENTRY OF PROPERTY TO READ AND OWNER'S AGREEMENT TO MAINTAIN FLOW METER

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AFTER RECORDING RETURN TO:

SOUTH SAN JOAQUIN IRRIGATION DISTRICT
P.O. Box 747
Ripon, CA 95366

CONSENT TO
SOUTH SAN JOAQUIN IRRIGATION DISTRICT'S
ENTRY OF PROPERTY TO READ
AND OWNER'S AGREEMENT TO MAINTAIN FLOW METER

The undersigned owner of the property ____, located at ____, APN ____________________("Property") and further described in the attached Exhibit "A", has, with the financial assistance of South San Joaquin Irrigation District ("District"), installed a flow meter to measure deliveries of District surface water to the Property. The District will use flow meter measurements to implement state law that requires the District to base its water charges, at least in part, on the quantity of water it delivers.

Owner consents to the entry of District officers, employees or agents ("District Personnel") on the Property for the purposes of inspecting and reading the flow meter installed to measure deliveries of District surface water to the Property. District Personnel may enter the Property at any reasonable hour and on a monthly basis or at such other time as District reasonably determines to be necessary, to inspect the working condition of the meter and to record water usage. District shall also be permitted to enter the Property for the purpose of installing telemetry control hardware to the meter such that the meter can be read remotely. District Personnel may enter the Property outside any District easement area using marked District vehicles on available access roads, on foot or as Owner and District may otherwise agree. District shall use reasonable care to avoid interfering with Owner's farming operations.

Owner agrees to take no action that would prevent the meter from accurately measuring the volume of District surface water delivered to Owner's Property. If District determines that the meter is nonfunctioning, Owner agrees to repair or replace the meter at Owner's expense.

This Consent shall remain in effect until such time as deliveries of District surface water to the Property shall terminate as evidenced by recordation of an Irrigation Service Abandonment Agreement signed by District and Owner or Owner's success or in interest.

This Consent shall run with the land described above and be binding on Owner and Owners' heirs, successor and assigns.

SOUTH SAN JOAQUIN IRRIGATION DISTRICT
"DISTRICT"

By______________________ Date:________
Ralph Roos, President
Board of Directors

By______________________ Date:______
Jeff Shields, Secretary
Board of Directors

"OWNER(S)"

By______________________ Date:________

By______________________ Date:______

Mailing Address: ____

____

Phone Number:__________________

SIGNATURES MUST BE NOTARIZED AND BE PER RECORDED DEED

ATTACHMENT D. SOUTH SAN JOAQUIN IRRIGATION DISTRICT DROUGHT MANAGEMENT PLAN

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SSJID DROUGHT MANAGEMENT PLAN

BACKGROUND AND OVERVIEW

On April 1, 2015 Governor Brown issued Executive Order B-29-15, mandating agricultural water suppliers to include a detailed Drought Management Plan (DMP) describing actions and measures taken to manage water demand during drought. South San Joaquin Irrigation District (District or SSJID) has historically faced variability in surface water supplies due to drought and recognizes that there may be times when available surface water supplies are insufficient to fully meet crop water demands. SSJID adopted a special set of rules to be implemented in times of surface water shortage in 1991. In 2012, the District recognized the potential to once again face a reduction in available surface water. Based on the 1991 rules, the District's Agricultural Water Committee summarized a set of contingency options for Board consideration, should the shortage be realized. The contingency plan and "special rules" are not permanent documents and may vary in specific provisions over time based on Board policies.

In response to the Governor's Executive Order, SSJID has developed a detailed description of existing policies and extraordinary actions undertaken in response to drought conditions. This DMP supplements SSJID's shortage allocation policies and describes a broad range of actions undertaken during periods of supply shortage to manage available water supplies and meet customer demands to the maximum extent possible. The DMP includes components recommended by DWR in its 2015 AWMP Guidebook for inclusion (DWR 2015). SSJID's DMP describes the determination of available water supply, drought responses, and water shortage impacts. The description of water shortage impacts includes a summary of 2012 to 2015 supply and demand conditions available at the time of preparation of this DMP.

DETERMINATION OF AVAILABLE WATER SUPPLY

Monitoring of hydrologic conditions to assess available water supplies is at the core of SSJID's water management across the full range of hydrologic conditions experienced, including drought. To inform decisions related to available water supply, SSJID actively monitors water supply conditions, including inflow projections from the Bureau of Reclamation (Reclamation) for New Melones Reservoir.

SSJID's surface water supply depends primarily on water year inflow to New Melones as stipulated in a 1988 agreement with Reclamation. SSJID and neighboring Oakdale Irrigation District entered into an agreement with Reclamation on how water was to be allocated between the districts and Reclamation. Under the 1988 Agreement, the Districts are entitled to receive the first 600,000 acre-feet per year, and in years when inflow to New Melones is less than 600,000 acre-feet, the Districts are entitled to receive the actual inflow plus one-third of the difference between 600,000 and the actual inflow. Water that is unused in any one year may be stored at New Melones in a "conservation account," up to a total of 200,000 acre-feet and can be used in certain water short years.

The District receives daily morning reports from Tri-Dam summarizing current water supply availability, weather conditions, and power generation. SSJID utilizes these reports to develop a projected water budget. An example Tri-Dam report and projected water budget is provided in Attachment D.1. As of September 21, 2015 New Melones is critically low at 12 percent capacity. There are 276,593 AF stored in the reservoir and 200,000 AF of which belong to OID and SSJID in their joint "conservation account".

SSJID additionally tracks groundwater conditions through the San Joaquin County Flood Control and Water Conservation District, which has monitored groundwater levels and groundwater quality on a semi-annual basis since 1971 in Eastern San Joaquin County. The Conservation District samples over 300 wells, and data from an additional 200 wells are stored in a groundwater level database. Groundwater levels are published for both spring and fall measurements. Groundwater quality measurements are sampled once per year in the fall months and are made available in the Fall Groundwater Report. Further information on groundwater trends and regional water management practices can be found in the 2014 Eastern San Joaquin Integrated Regional Water Management Plan available at http://www.gbawater.org/IRWMP.

DROUGHT RESPONSES

This section describes actions and activities undertaken by SSJID to address surface water shortage and incorporates the shortage allocation policies described in Section 3.10 of the District's AWMP, coordination and collaboration, supply management, and demand management.

Declaration of Water Shortage and Shortage Allocation Policies

During periods of surface water shortage, the District's Board of Directors determines and implements a strategy to reduce surface water diversions based on staff recommendations. In a reduced water supply year, SSJID Board sets specific water allocation policies and implements other management actions based on current conditions.

As described above, the Board of Directors historically developed and adopted a set of special rules to be implemented in case of a water supply emergency. The rules, first developed and adopted by the Board in the spring of 1991, were intended to maintain equitable service even in the event of a water shortage. In 2012, the District's Agricultural Water Committee reviewed the 1991 rules and summarized a set of contingency actions for Board consideration. The resulting contingency plan and "special rules" are not permanent documents and may vary in specific provisions over time based on Board policies.

The surface water shortage contingency actions established in 2012 are summarized in eight measures that have been implemented by SSJID in past shortage and can be implemented in the event of a future shortage while still upholding its obligation to manage and deliver water in a reasonable and beneficial manner and to provide equitable service. These contingency actions are summarized as follows:

- Reduce the maximum water surface elevation of Woodward Reservoir to minimize surface evaporation and seepage
- Delay the start date of the irrigation season
- Implement a variable water delivery rotation schedule
- Implement maximum time limits for flood irrigation
- Implement irrigation quantity limits for pressurized systems
- Implement alternative supply sources (e.g. lease private pumps, use District wells, or possibly drill additional wells)
- Allow for inter-parcel transfers with a cut-off date for transfers. Those requesting transfers must apply before the start of the year's irrigation season.
- Enforce Tier 2[23] service agreement provisions

The District's water supply from New Melones decreased over the four consecutive years 2012 to 2015 due to decreasing reservoir inflow. In 2015, the District adopted a 36 inch per parcel drought allocation to limit irrigation water deliveries and preserve available surface water supply.

Coordination and Collaboration

SSJID coordinates and collaborates extensively with others to coordinate operations in all years. The District meets monthly with the USBR, U.S. Fish and Wildlife, California Water Resources Control Board, California Wildlife Conservation Board, and others to coordinate efforts. Additional examples of collaboration and coordination activities include the following:

- Coordination with the State office of Emergency Services to respond to local drought emergencies.
- Reporting of information to the California Energy Commission, the California Departo of Water Resources, and other governmental entities as necessary
- Coordination with OID and Reclamation with regard to Stanislaus River water supplies and demands

[23] Customers who have filed a service abandonment agreement with the District in the past are considered Tier 2 customers if they petition the Board to amend the abandonment agreement and reinstate District service. Under the contingency plan the District has no obligation to provide water to Tier 2 customers during times of shortage. Newly annexed land is also subject to Tier 2 restrictions.

- Cooperation with OID as part of the Tri-Dam Project to operate and maintain the Donnells, Beardseley, and Tulloch reservoirs

Additionally, the District meets with local cities regarding groundwater resources, water conservation and recycling, and public education and outreach. The District General Manager makes numerous presentations to various local groups in the area discussing the droungt and SSJID's responses and water management.

Supply Management

Extraordinary Operational Measures

Having historically achieved precise control of system inflows, SSJID has concentrated recent efforts on increasing operational efficiency of the lateral distribution system. Most notable is the Division 9 Surface Water Supply Project initiated in 2008 and completed in time for the 2012 irrigation season. The project involved the design and construction of the first pressurized pipeline network as part of the District's distribution system and incorporates state-of-the-art technologies and water management features. The project provides pressurized surface water to a portion of the District west of Ripon (Division 9) that has a high frequency of permanent crops and pressurized irrigation systems that was predominately irrigated using groundwater. The project alleviated concerns of saline groundwater being used for irrigation and increased direct and in-lieu groundwater recharge, thus helping to prevent overdraft of the underlying aquifer. The system includes a regulating reservoir, termed the East Basin; a pumping plant with seven pumps; 19 miles of pipeline that serves 90 customers and 3,800 acres; automatic flow control valves and magnetic flow meters at each turnout; soil moisture sensors in growers' fields; and online water ordering. The District is in the process of drilling two supplemental wells to supply the East Basin. Each well will be screened at different depths to withdraw water from two different aquifer layers. At the pump station, variable frequency drive (VFD) pump controllers allow precise flow rates to be provided without wasting energy. The pumps pressurize water from the East Basin, providing 50 to 60 pounds per square inch (psi) at the turnouts, eliminating the need for booster pumps to operate pressurized irrigation systems. SSJID is studying the feasibility of expanding the Division 9 project across the District. Initial cost benefit results indicate that the income from transferring conserved water will be critically important to the feasibility of the project. The District has also applied for grants to construct a second reservoir to be called the West Basin.The District offers programs to its customers to allow them to transfer district and well water with the District's boundaries, requiring extensive coordination between office staff, district operators, and growers. In addition to the magnetic flow meters measuring deliveries in the Division 9 project area, SSJID currently has approximately 116 magnetic meters installed throughout the district monitoring deliveries. The Board recently approved installing supervisory control and data acquisition (SCADA) systems on all meters to monitor deliveries more closely. In addition, each division manager will begin carrying around portable flow meters to verify on-farm deliveries. Increased flow measurement will allow the

District to improve matching inflows into the system with on-farm deliveries, minimizing system spills and improved volumetric billing.

In addition, the District operated Woodward Reservoir at lower surface elevations in 2015 to reduce seepage and evaporation.

Supply Augmentation

In 2015, the District developed several programs to augment grower's 36 inch water allotment for a given field. SSJID established a 'Master Account' for allotments that essentially tells each grower, based on acreage farmed and the 36 inch water allotment, how much district water (in acre-feet) they have to irrigate with and then growers decide when and where to apply the water. In other words growers can apply more than the 36" allotment to a single field, but must account for the extra water by applying less than the allotment on another field so the overall allotment does not exceed 36 inches. Growers also have the ability to transfer water by making a transfer agreement with another farmer. In addition, growers can transfer water from a private well to any location in the district. The recipient of the water transfer is charged $3 per acre-foot for conveyance fee.

The District is open to receiving recycled wastewater for irrigation purposes if it is technically feasible and locally cost effective for all stakeholders.

Demand Management

SSJID encourages on-farm water conservation to reduce demand don an ongoing basis. During shortage years, these efforts are enhanced through several extraordinary actions, which may include the following:

- Additional Education and Outreach
- Allocation of Available Water Supplies
- Enhanced Enforcement of SSJID Rules and Regulations
- Increased Cost per Unit of Water Delivered

These actions are summarized in the remainder of this section.

Additional Education and Outreach

SSJID regularly provides educational resources and conducts outreach activities to support efficient water management by its irrigation customers. During drought, SSJID increases these efforts to further encourage on-farm water conservation and to keep growers informed of changes to the District's policies and practices to manage limited water supplies.

An example of SSJID's extraordinary drought efforts is the Districts implementation of the District's Drought Task Force, consisting of two employees from both the engineering and water operations department. The Drought Task Force worked with more than 550 customers and evaluated water usage on 756 parcels that used more than 36” in 2014 in order to check the accuracy of the District’s water use measurement methods. They also answered ‘Consumption Review’ requests from growers asking for evaluations and suggestions. The task force offered helpful suggestions to growers for ways to adjust irrigation practices in order to get through the difficult season; also informing them of the District’s transfer and master account programs as well the online account services. When necessary they would physically go out to a grower’s field while irrigating to measure flows and verify accuracy. Also, when necessary, the task force corrected data entry errors, credited parcels where data errors were found, evaluated sprinkler system flow rates and measured pipeline flows.

Growers are able to view their water use on their monthly bill or online, which tracks daily water consumption. If a grower wants a more formal review of their water consumption, they can apply for a water consumption review by the Drought Task Force. The review consists of five steps:

1. Task Force member prepares a 2014 water consumption report based on 2014 delivery records.
2. Send consumption report and allotment notification to grower.
3. Set a time to review consumption report and, if applicable, request information on irrigation system.
4. Inspect grower’s parcel(s) and consumption checklist.
5. Review and update SSJID delivery records, as needed.

In addition, SSJID published six ‘Emergency Drought Bulletins’ to inform growers and the general public about actions the District is enacting to combat the drought. These bulletins are included as Attachments to this DMP.

SSJID Emergency Drought Bulletins (Attachment D.2.)

- Emergency Drought Bulletin 1 – March 15, 2015
- Emergency Drought Bulletin 2 – April 6, 2015
- Emergency Drought Bulletin 3 – April 27, 2015
- Emergency Drought Bulletin 4 – May 8, 2015
- Emergency Drought Bulletin 5 – June 8, 2015
- Emergency Drought Bulletin 6 – July 8, 2015

Allocation of Available Water Supplies

As discussed earlier, SSJID adopted a 36 inch allotment for the 2015 irrigation season. In addition to agricultural water supply curtailments, surrounding municipalities which receive water from SSJID were cut back a minimum of 20 percent from their usual supply in 2015. The District also stopped supplying all water trucks for construction and dust control.

Enhanced Enforcement of SSJID Rules and Regulations

SSJID has released six 'Emergency Drought Bulletins' to inform the general public and customers regarding the severity of the drought, actions the District is taking to conserve water, and potential consequences for 'unlawful' use of District water. SSJID updated its policy for unlawful use of district water and released an 'Urgent Drought Bulletin' on May 8, 2015 containing amended rules and regulations. The updated policy gives the District authority to remove facilities used by a grower if the grower is in violation of the policy two times after their allocation expires.

Increased Cost per Unit of Water Delivered

On September 22, 2015 SSJID's Board of Directors adopted and implemented immediately a new water rate to further encourage prudent use of their limited water resources by irrigators. The Board wishes to accomplish the following:

1. To continue the increased efficiencies due to drought into future years where allotments are not reduced.
2. To encourage investments in improved on-farm irrigation efficiencies and conservation measures that might not be justifiable due to infrequency of droughts.
3. To position the District and irrigators better for future water short years.

The new rate structure is based on two tiers. For fields using less than 48 inches per year, a per-acre charge of $24 is applied, plus $3 per acre-foot. For fields using more than 48 inches, a charge of $10 per acre-foot of additional use is applied. This represents an increase of $7 per acre-foot for usage above 48 inches. Table D-1 summarizes the previous and new water rates.

Table D-1. Previous and Current SSJID Water Rates.

	Previous Rates per Year	Current Rates per Year
Parcel Charge	$24 per acre	$24 per acre
Tier 1 - up to 48 inches per year	$3 per acre-foot	$3 per acre-foot
Tier 2 - over 48 inches per year	$3 per acre-foot	$10 per acre-foot

WATER SHORTAGE IMPACTS

Supplier Revenues and Expenses

SSJID jointly operates the Tri-Dam Project with Oakdale Irrigation District. Facilities include Beardsley, Donnells, and Tulloch reservoirs and dams, which provide both districts with storage and electrical generation. During droughts there is less water to release from the reservoirs, limiting power generation considerably. Power generation is the biggest loss in revenue for the district.

To mitigate the decrease in revenues from water sales, the District reduces capital funds spent on district maintenance and places more emphasis on water conservation programs. The District's rate structure also bases a majority of water charges on a fixed (per-acre) component, which helps maintain revenue stability across years despite variability in water sales. Water transfer and power generation revenues also decreased due to drought.

Increase expenditures include the following increased staff time;

- Direct irrigation customer service and outreach to the public through increased grower meeting, public outreach programs, and drought workshops
- Two dedicated staff members to form the Drought Task Force to assist growers to stay within the 36-inch allocation. Impacts on Water Supplies

To illustrate actions by SSJID and its customers to manage available water supplies during drought, water supplies for 2012 to 2015 (contingent on availability of data) are summarized. 2012 represent a normal supply year with full USBR allotments, while the 2013 to 2015 period represent a historic, multi-year drought with reduced New Melones supplies. All sources of supply are summarized, to the extent available at the time of preparation of this DMP, including Woodward Reservoir releases, OID spill to SSJID main distribution canal, and District and private groundwater pumping.

SSJID diverts water stored in New Melones Reservoir to Woodward Reservoir through the Joint Main Diversion. The District manages Woodward Reservoir to best meet downstream demand. The Nick C. DeGroot Water Treatment Plant and U3 Ranch are provided water directly from Woodward Reservoir, accounting for approximately 17,000 AF annually. Figure D.1 summarizes joint main diversions into Woodward Reservoir. From 2012 to 2014 the District diverted on average 226,000 AF.

A majority of District surface water is delivered downstream of Woodward Reservoir. Woodward Reservoir releases were greatest in 2012 and 2013, averaging 189,400 AF. Releases in 2014 dropped substantially to 167,000 AF, shown in Figure D.2. Woodward Releases in 2015 are expected to be lower than 2014 releases due to the District's 36-inch water allotment.

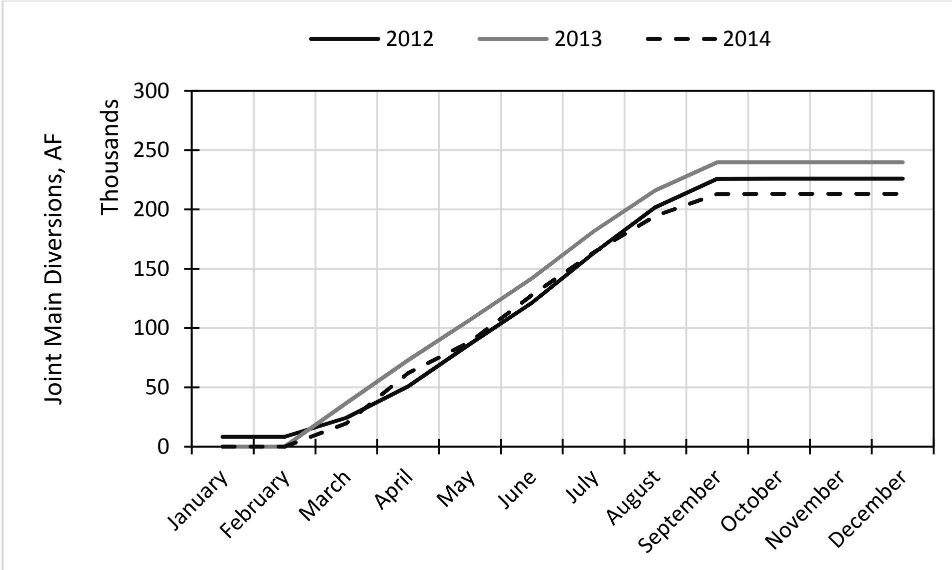

Figure D.1. Monthly cumulative Woodward Reservoir releases for 2012 through 2014.

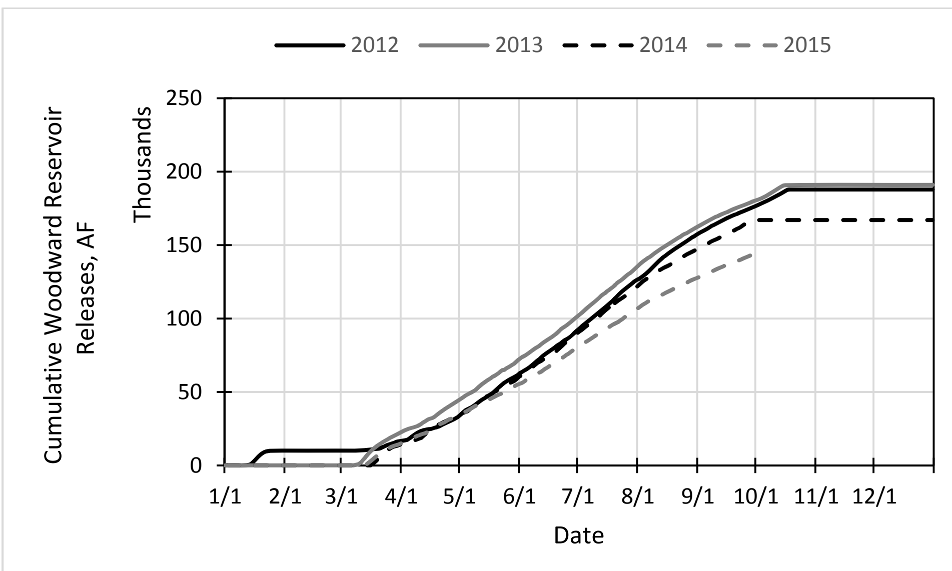

Figure D.2. Daily cumulative Woodward Reservoir releases for 2012 through October 1, 2015.

Currently, the District does not rely heavily on groundwater to supplement surface water supply. From 2012 to 2014, District pumping accounts for approximately 4 percent of on-farm deliveries (Figure D.3). SSJID is currently incorporating new wells into their delivery system to increase supplemental water supply. The 2015 district pumping is not available as these volumes are compiled, summarized and reported after the irrigation season is complete.

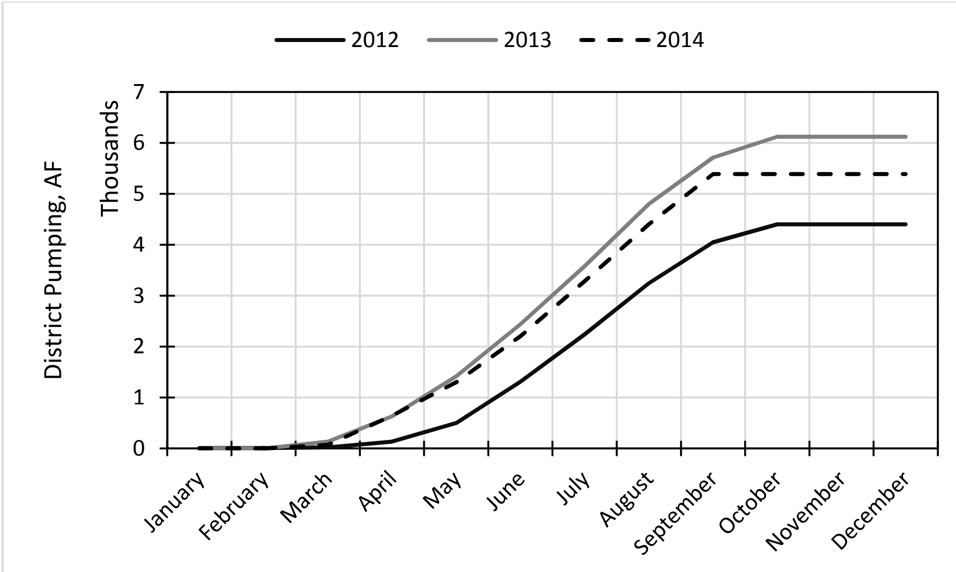

Figure D.3. Monthly cumulative District pumping for 2012 to 2014.

Between 2012 and 2014 private pumping averaged of 63,200 AF. Total annual private pumping did not change considerably between 2012 and 2014. The 2015 private pumping volume is currently unavailable, as these volumes are outputs from the District's water balance which is completed following the irrigation season. Private pumping is expected to increase in 2015 due to the District restricting growers to a 36-inch water allotment for the 2015 growing season. Private pumping is summarized in Figure D.4.

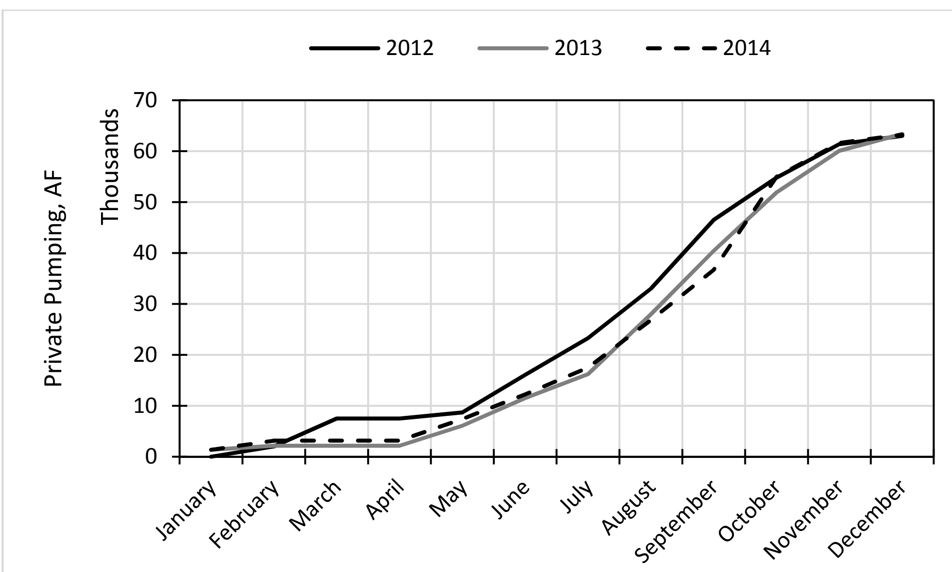

Figure D.4. Monthly cumulative private pumping for 2012 to 2014.

Other water supply available to SSJID is spills from Oakdale Irrigation District into the main supply canal. These spills are estimated as the closure for the main supply canal below Woodward Reservoir and the Main Distribution Canal accounting center in the District's water balance. 2015 OID spills are not known at this time as the District's water balance is completed after in the irrigation season is complete. On average from 2011 to 2014 OID spills approximately 7,000 AF into SSJID.

SSJID's total water supply was greatest during 2013, approximately 316,000 AF (Figure D.5.). The 2015 data to date on SSJID total water supplies is not available due to the unavailability of private pumping and other supply volumes, however the total water supplies are projected to be slightly less than those available in 2014 based on the 2015 cumulative Woodward Reservoir releases through October 1 (Figure D.2.). In addition, the District is managing Woodward Reservoir at lower water surface elevations to reduce reservoir seepage and evaporation by reducing joint main diversions.

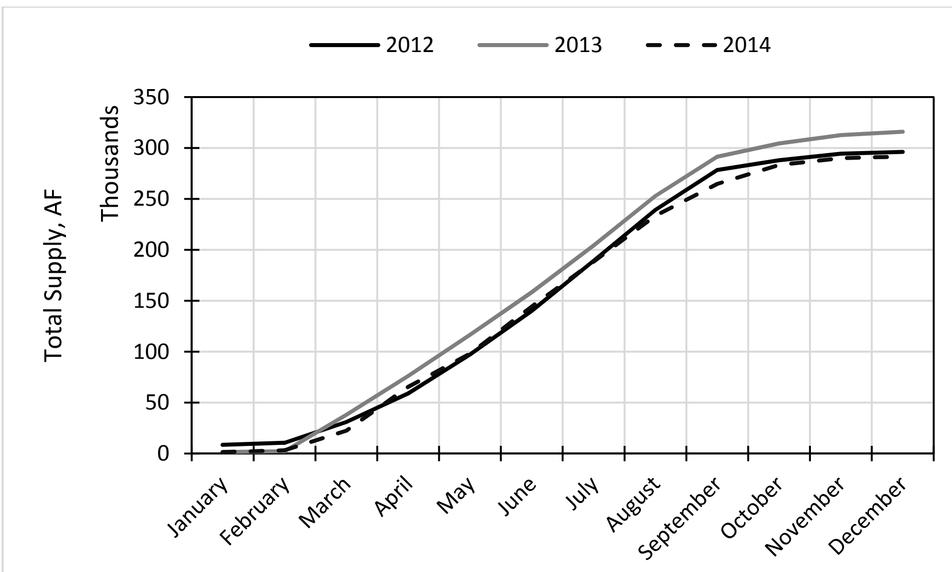

Figure D.5. Monthly cumulative total supply for 2012 to 2014.

Demand Impacts

To illustrate water demands in SSJID during drought, water demands for 2012 to 2015 are summarized, to the extent available. 2012 represents a normal supply year with full USBR allotment, while the 2013 to 2015 period represent a historic, multi-year drought with partial allotments. Demand is characterized based on monthly deliveries as quantified through the District's water balance, a measure of farm surface water demand; reference evapotranspiration (ET_o), a measure of atmospheric water demand; and crop evapotranspiration of applied water (ET_{aw}), a measure of consumptive water demand.

Cumulative delivery volumes are based on TruePoint delivery records (Figure D.5), which the district implemented the start of the 2010 irrigation season. On-farm deliveries from SSJID's water balance differ slightly from TruePoint estimates, as estimates are determined based on the 'closure' for district laterals.

Figure D.6 summarizes SSJID delivery volume from 2012 through September 27, 2015. The District's total deliveries from 2012 through 2014 have decreased over time with the district delivering 156,500 AF; 153,500 AF; and 132,200 AF; respectively. SSJID's on-farm deliveries for 2015 is projected to be approximately 110,000 AF, the lowest volume delivered since the beginning of the drought, due to increased restrictions on irrigators.

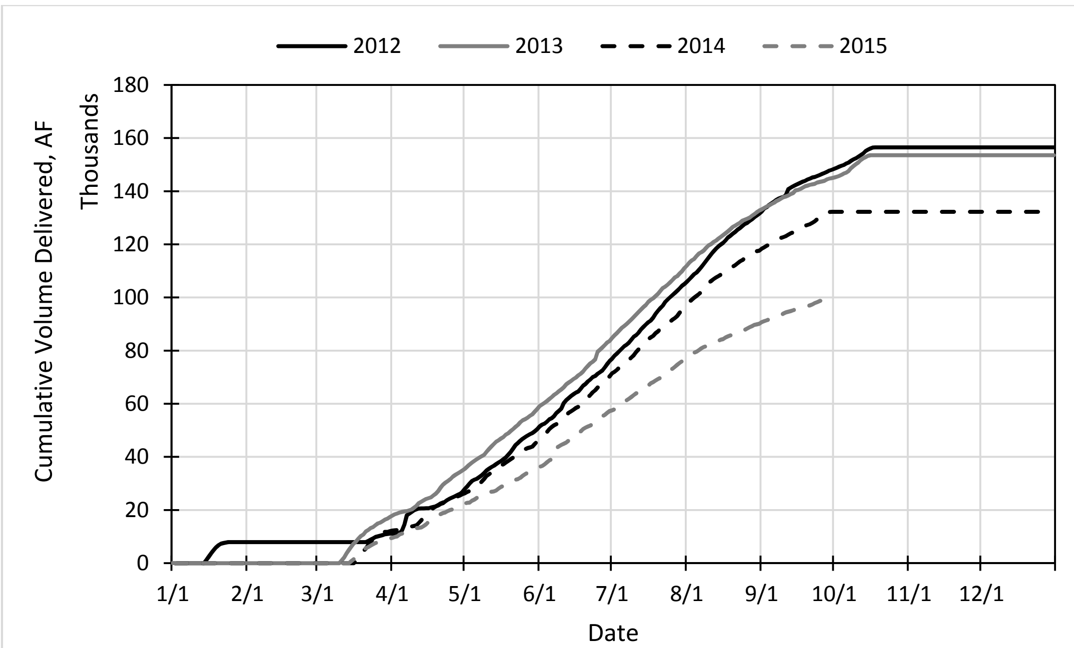

Figure D.6. Daily cumulative SSJID deliveries for 2012 through September 27, 2015 (2015 data is preliminary).

This year, 2015, cumulative ET_o is slightly lower than that last two years and on track to total about 54 inches. Daily cumulative ETo for 2011 to 2015 is summarized in Figure D.7.

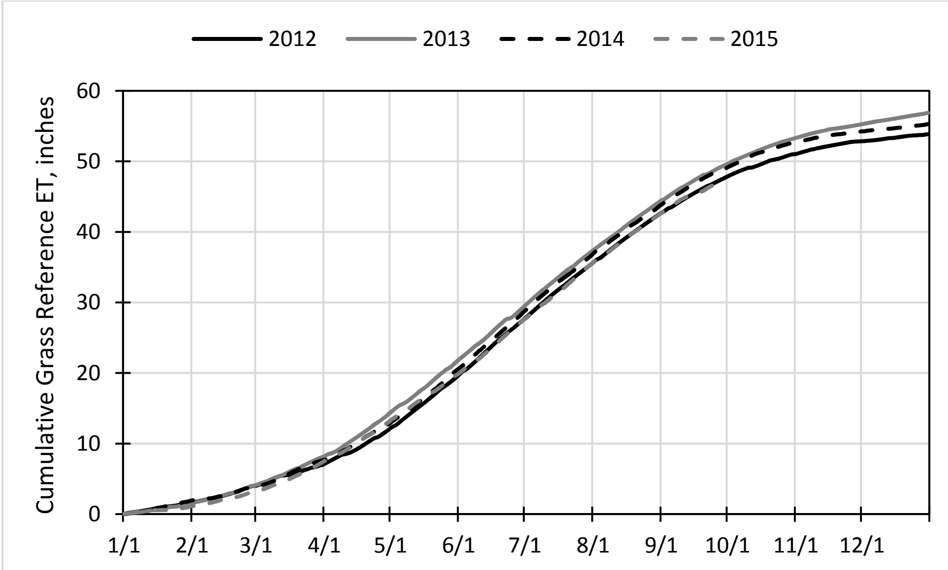

Figure D.7. Daily cumulative ET_o for 2012 to 2015.

ET of applied water follows the same trend as reference ET. As reference ET increases with warmer temperatures and increased net radiation so does ET_{aw} (Figure D.8). This is potentially due to the drought and variation in climate between years.

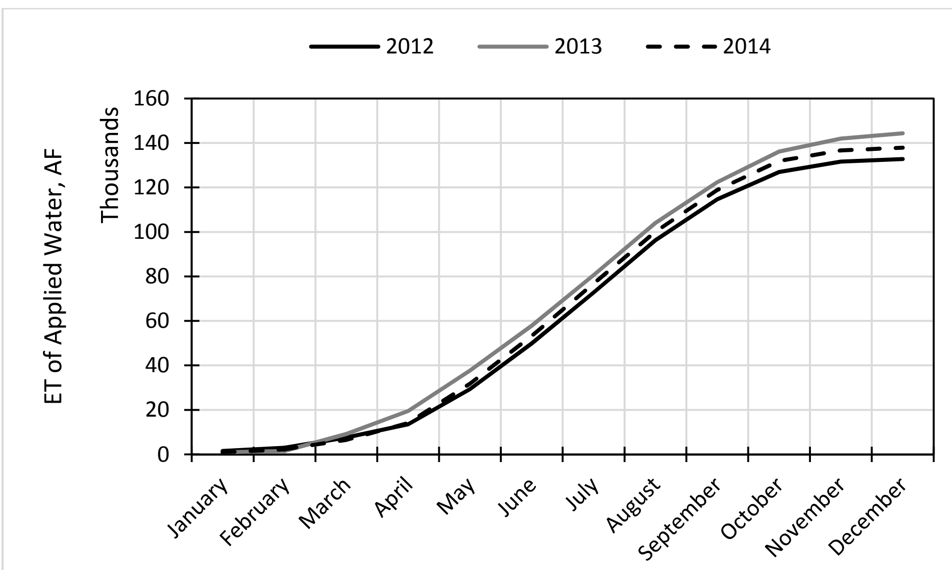

Figure D.8. Monthly cumulative crop ET_{aw} for 2012 to 2014.

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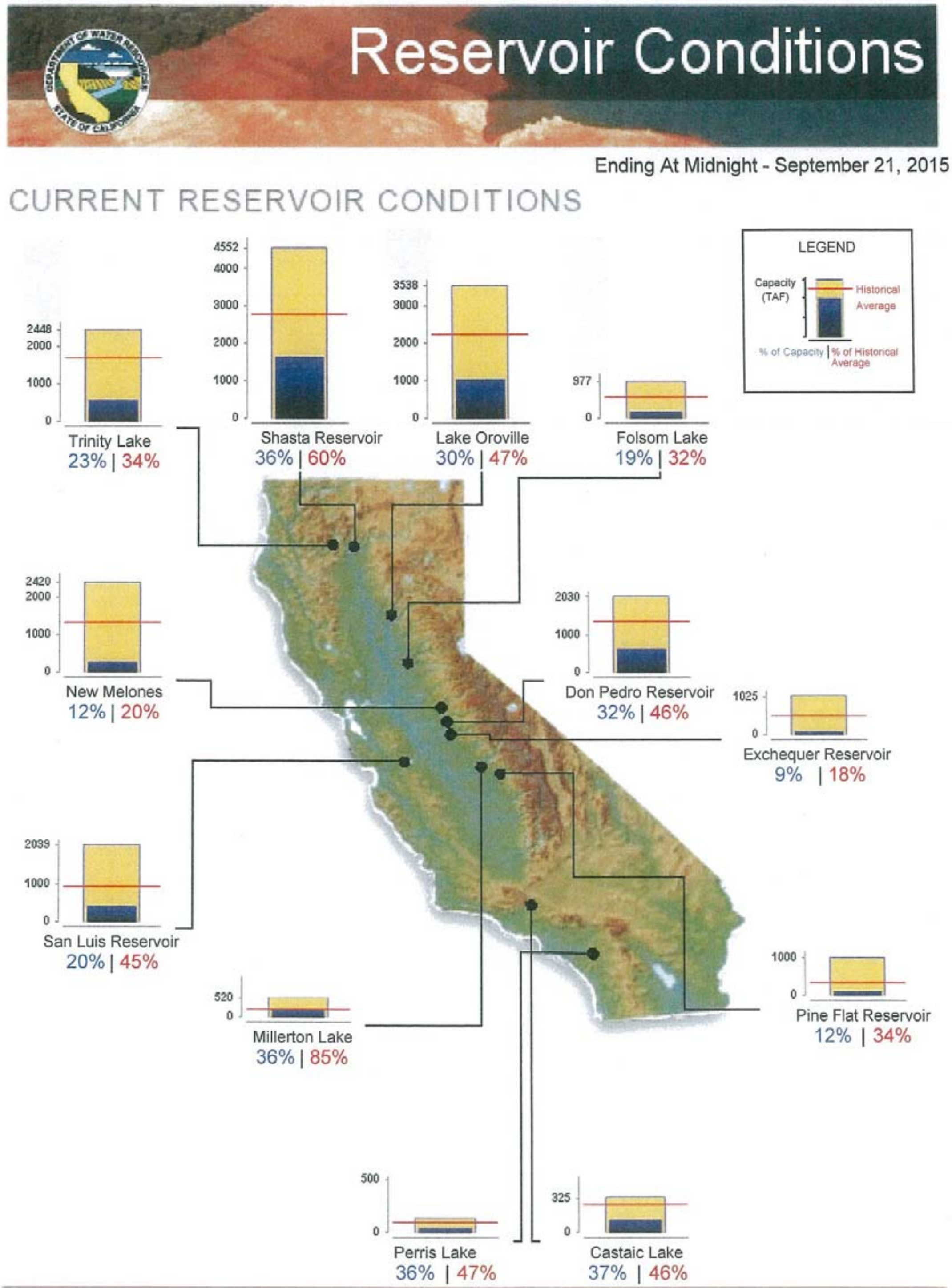
ATTACHMENT D.1. AN EXAMPLE TRI-DAM REPORT AND PROJECTED WATER BUDGET



Graph Updated 09/22/2015 07:15 AM

TRI-DAM OPERATION'S DAILY REPORT OF MIDNIGHT WATER DATA

21-Sep-15

	DONNELLS	BEARDSLEY	SAND BAR	MELONES	TULLOCH
MAX ELEV	4916.00	3397.00		1088.00	510.00
MAX STORAGE	64,325	97,802		2,419,523	66,968
SPILL CREST	4898.00	3368.00	2755.00	1088.00	481.00
STORAGE	56,893	77,838		2,419,523	37,623
ELEVATION	4,837.79	3,336.17	2,753.83	801.18	502.12
STORAGE	34,414	58,023		276,593	57,624
STORAGE CHANGE	(249)	(248)		0	67
ACRE FEET USED	274	589	497	2,001	1,716
AVERAGE DRAFT	138	297	251	1,009	865
AVERAGE SPILL	0	0			0
AVERAGE BYPASS	25	0	0		0
AVERAGE INFLOW	38	172		1,058	899
MIDNIGHT DRAFT	60	300	233		828
MIDNIGHT SPILL	0	0			0
MIDNIGHT BYPASS	25	0	0		0
PEAK INFLOW	278	510			1,631
GENERATION					
HOURS RUN	18:14	24:00	24:00		24:00
KWH	338,343	89,435	132,234		215,434
MONTHLY TOTAL	8,140,141	1,931,930	2,825,757		5,456,782

GOODWIN			A-BAY		
ELEVATION	359.81		ELEVATION		3134.91
STORAGE	523		STORAGE		352
SURCHARGE	21		AVERAGE DRAFT		55
JT MAIN AVERAGE	565		AVERAGE SPILL		0
SO MAIN AVERAGE	166		S-88 AVERAGE		23
SSJID MAIN AVERAGE	419		S-89 AVERAGE		56
OID NORTH AVERAGE	144		S-98 AVERAGE		154
GAYLORD AVERAGE	0		BLACK CREEK		0
FRYMIRE AVERAGE	9				
SEWD AVERAGE	0				

WEATHER

WEATHER	HI TEMP	LO TEMP	PRECIP	MONTH	ANNUAL
STRAWBERRY	87	50	0.00	0.12	1.35
DONNELLS	88	48	0.00	0.19	0.87
BEARDSLEY	88	52	0.00	0.11	0.50
SAND BAR	92	52	0.00	0.15	0.26
TULLOCH	100	64	0.00	0.02	0.02

CHECKED BY:SEEL

SPICER	49565
RELIEF	9462.3

SOUTH SAN JOAQUIN
IRRIGATION DISTRICT
7 Day Water Usage

SSJID 7 DAY WATER USAGE REPORT FOR THE WEEK OF Sunday, September 06, 2015

DATES	6-Sep-2015	7-Sep-2015	8-Sep-2015	9-Sep-2015	10-Sep-2015	11-Sep-2015	12-Sep-2015
MDC Maximum Flow Per Division (cfs)							
MDC-Control	239.48	236.88	264.89	265.59	300.51	290.49	280.63
Division 1	47.86	103.25	84.10	55.00	35.66	39.14	69.89
Division 2	62.43	55.84	42.26	66.24	88.57	68.31	80.75
Division 3	44.73	61.30	61.73	42.70	58.97	59.02	57.02
Division 4	40.37	39.26	10.94	31.90	39.25	39.40	37.68
Division 5	42.82	56.04	28.40	104.50	88.90	90.47	86.71
Division 6	50.80	46.44	53.94	46.18	28.36	20.09	13.16
SP-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MDC Minimum Flow Per Division (cfs)							
MDC-Control	190.12	188.42	193.84	255.78	231.38	249.69	200.19
Division 1	27.01	26.36	34.25	10.30	10.27	19.65	24.46
Division 2	39.94	12.16	14.29	22.36	35.44	20.74	18.63
Division 3	27.99	35.85	36.48	36.49	38.58	52.76	36.72
Division 4	35.73	8.79	6.24	7.80	29.73	34.73	11.26
Division 5	25.75	16.44	11.71	25.97	75.37	75.78	51.35
Division 6	12.55	0.00	15.34	0.00	0.00	0.00	0.00
SP-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MDC Flow Total Per Division (AcFt)							
MDC-Control	461.72	419.25	448.44	517.62	532.43	518.89	462.07
Division 1	62.79	121.63	134.82	40.68	47.96	64.31	66.06
Division 2	102.67	37.75	53.11	88.90	125.45	81.10	70.56
Division 3	69.39	101.62	79.64	72.87	95.36	107.58	81.85
Division 4	74.71	27.38	16.73	54.98	70.60	73.31	31.01
Division 5	75.23	76.49	46.08	161.69	162.51	161.37	138.04
Division 6	74.00	44.79	54.94	41.52	13.00	18.54	11.11
SP-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drains (OID)	26.81	20.16	-	-	2.28	7.16	-
Woodward Levels	206.82	206.87	206.91	206.96	206.95	207.01	207.17

7 DAY FLOW TOTAL (AcFt)				SEASON TO DATE (AcFt)	
MDC-Control	3360.43	98.35%	Operators	116559.20	96.24%
Drains (OID)	56.42	1.65%		4548.34	3.76%
	3416.85	100.00%	TOTAL WATER USED	121107.54	100.00%
Division 1	538.24	15.75%	J. Hasten & A. Podesto	14786.79	12.21%
Division 2	559.56	16.38%	B. Anderson & Andrew	18656.15	15.40%
Division 3	608.31	17.80%	K. Obrochta & R. Sprinkle	19490.70	16.09%
Division 4	348.71	10.21%	C. Hodge & R. Shipman	12776.88	10.55%
Division 5	821.41	24.04%	J. Lourenco & T. Hagins	21128.43	17.45%
Division 6	257.89	7.55%	J. Wirstlin & M.Donahue	17348.07	14.32%
SP-7	0.00	0.00%	-	0.00	0.00%
	282.73	8.27%	Water used to run the canal	16920.52	13.97%

Note: Water used to run canal includes Main Canal operation, evaporation, percolation, and some direct diversions from the Main Canal.

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SOUTH SAN JOAQUIN
IRRIGATION DISTRICT
7 Day Water Usage

SSJID 7 DAY WATER USAGE REPORT FOR THE WEEK OF Sunday, September 13, 2015

DATES	13-Sep-2015	14-Sep-2015	15-Sep-2015	16-Sep-2015	17-Sep-2015	18-Sep-2015	19-Sep-2015
MDC Maximum Flow Per Division (cfs)							
MDC-Control	268.43	269.85	272.35	272.35	218.05	215.86	252.03
Division 1	84.87	81.01	67.40	66.23	87.41	73.55	80.96
Division 2	68.23	59.68	46.11	41.02	36.73	35.71	55.52
Division 3	43.91	45.94	44.66	42.20	12.96	30.92	32.99
Division 4	13.84	37.89	32.27	10.74	35.06	33.30	12.79
Division 5	59.43	59.61	74.58	103.19	83.34	52.52	66.06
Division 6	5.74	28.01	29.79	39.63	44.90	36.06	13.04
SP-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MDC Minimum Flow Per Division (cfs)							
MDC-Control	162.80	164.95	190.12	179.43	168.72	168.18	175.83
Division 1	24.52	26.64	48.09	29.34	29.26	38.49	23.22
Division 2	16.92	11.09	5.65	10.88	16.87	18.82	19.96
Division 3	15.88	15.67	20.83	7.81	4.10	4.00	28.58
Division 4	9.39	9.34	9.04	7.79	9.77	9.73	9.93
Division 5	50.68	45.01	45.14	69.71	38.96	11.99	40.19
Division 6	0.00	0.00	21.06	3.06	2.42	0.60	0.00
SP-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
MDC Flow Total Per Division (AcFt)							
MDC-Control	433.06	441.26	499.78	442.70	377.97	378.34	431.14
Division 1	109.17	81.69	117.87	88.57	109.95	112.96	105.09
Division 2	54.78	63.68	51.24	42.85	49.51	50.45	70.82
Division 3	55.36	40.55	95.22	52.04	9.99	21.90	61.04
Division 4	23.86	50.68	41.16	18.87	59.17	43.98	22.99
Division 5	110.45	103.78	132.43	165.17	109.94	81.88	106.20
Division 6	0.44	29.75	49.61	36.33	48.86	30.25	11.40
SP-7	0.00	0.00	0.00	0.00	0.00	0.00	0.00
Drains (OID)	-	-	7.57	-	29.28	-	-
Woodward Levels	207.35	207.55	207.77	208.08	208.41	208.73	209.02

7 DAY FLOW TOTAL (AcFt)				SEASON TO DATE (AcFt)	
MDC-Control	3004.26	98.79%	Operators	119563.46	96.31%
Drains (OID)	36.85	1.21%		4585.19	3.69%
	3041.11	100.00%	TOTAL WATER USED	124148.65	100.00%
Division 1	725.29	23.85%	J. Hasten & A. Podesto	15512.08	12.49%
Division 2	383.33	12.60%	B. Anderson & G. Wallace	19039.48	15.34%
Division 3	336.11	11.05%	K. Obrochta & R. Sprinkle	19826.81	15.97%
Division 4	260.70	8.57%	R. Shipman & C. Hodge	13037.58	10.50%
Division 5	809.86	26.63%	J. Lourenco & T. Hagins	21938.29	17.67%
Division 6	206.64	6.79%	J. Wirstlin & D. Pauly	17554.71	14.14%
SP-7	0.00	0.00%	-	0.00	0.00%
	319.18	10.50%	Water used to run the canal	17239.70	13.89%

Note: Water used to run canal includes Main Canal operation, evaporation, percolation, and some direct diversions from the Main Canal.

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	B	C	D	E	F	G	H
3	Projected Water Budget for 2015						
4	Updated **September 21, 2015**						
5							
6							
7					**2014 Full**	**2013 Full**	
8		**Current**	**9/21/2014**		**Water Year**	**Water Year**	
9	SSJID Goodwin diversions	**184,800**	**210,659**		**215,884**	**241,374**	
10	OID drain water year-to-date per F. Avila	**4,585**					
11	OID drain water as % of diversions to-date	**2.5%**					
12	MDC losses to-date per F. Avila	**17,240**				Excludes	
13	MDC losses as % of diversions to-date	**9.3%**				40,000 a-ft to	
14	Elevation of Woodward	**209.00**				SLDMWA	
15	Accumulated inflow	**327,000**	**338,000**		**346,000**		
16							
17	**Water Budget for Different Amounts of Inflow**						
18							
19	**Description of inflow assumptions →**	**No Inflow**	**DWR 90% Probability May 8 Forecast**	**Actual YTD Inflow**	**SSJID Sept 21 Forecast**	**SSJID July 6 Forecast**	**Cons. Acct Threshold**
20							
21	**New Melones assumed inflow volume →**	**0**	**263,000**	**327,000**	**335,000**	**310,000**	**375,000**
22							
23	SSJID's 1988 contract water *(100,000 + X/3)*	100,000	188,000	209,000	212,000	203,000	225,000
24	Maximum withdrawal from conservation account	78,397	37,000	16,000	13,000	22,000	-
25	**Available to divert from Stanislaus River**	**178,397**	**225,000**	**225,000**	**225,000**	**225,000**	**225,000**
26							
27	Evaporation and seepage losses *(JSC, MSC, Woodward)*	(37,000)	(37,000)	(37,000)	(37,000)	(37,000)	(37,000)
31	Water treatment plant normal use	(19,210)	(19,210)	(19,210)	(19,210)	(19,210)	(19,210)
32	Water treatment plant 20% reduction for 7 months	2,241	2,241	2,241	2,241	2,241	2,241
33	Total adjustments between Goodwin and Woodward	(53,969)	(53,969)	(53,969)	(53,969)	(53,969)	(53,969)
34	**Available to release from Woodward into MDC**	**124,428**	**171,031**	**171,031**	**171,031**	**171,031**	**171,031**
35							
36	Normal well water supply *(Estimated by F. Avila)*	6,000	6,000	6,000	6,000	6,000	6,000
39	Expected OID tailwater *(using % at top of page)*	450	450	450	450	450	450
40	Delivery to Ripon *(Max past use: 1,245)*	(1,245)	(1,245)	(1,245)	(1,245)	(1,245)	(1,245)
41	Spills to drains *(estimated based on report from Frank)*	(18,600)	(18,600)	(18,600)	(18,600)	(18,600)	(18,600)
42	Distribution losses *(excludes drain water)*	(16,642)	(17,520)	(17,520)	(17,520)	(17,520)	(17,520)
43	Total adjustments between Woodward and the farmgate	(30,037)	(30,915)	(30,915)	(30,915)	(30,915)	(30,915)
44	**Available for irrigation at the farmgate**	**94,391**	**140,116**	**140,116**	**140,116**	**140,116**	**140,116**
45							
51	**Conservation account**						
52	Beginning balance	78,397	78,397	78,397	78,397	78,397	78,397
53	Withdrawal from conservation account				0		
54	Addition to conservation account				21,603		
55	**Ending balance** (limited to 100,000 acre-feet)				**100,000**		
56							
57	**Total diversion expected this year**						
58	Estimated daily diversions 9/22 - 9/30/2015 based on 9/21 diversion (Woodward has been filled)				334		
59	Days through 9/30/2015				9		
60	Expected diversions 9/22 - 9/30/2015				3,006		
61	Goodwin diversions to-date				184,800		
62	Expected YTD diversions through 9/30/2015				**187,806**		
63							
64	**Addition to conservation account expected this year**						
65	1988 contract diversion quantity				212,000		
66	Less: expected diversion quantity				(187,806)		
67	Available to add to the conservation account				**24,194**		

9/22/2015

ATTACHMENT D.2. SSJID EMERGENCY DROUGHT BULLETINS

- Emergency Drought Bulletin 1 – March 15, 2015
- Emergency Drought Bulletin 2 – April 6, 2015
- Emergency Drought Bulletin 3 – April 27, 2015
- Emergency Drought Bulletin 4 – May 8, 2015
- Emergency Drought Bulletin 5 – June 8, 2015
- Emergency Drought Bulletin 6 – July 8, 2015

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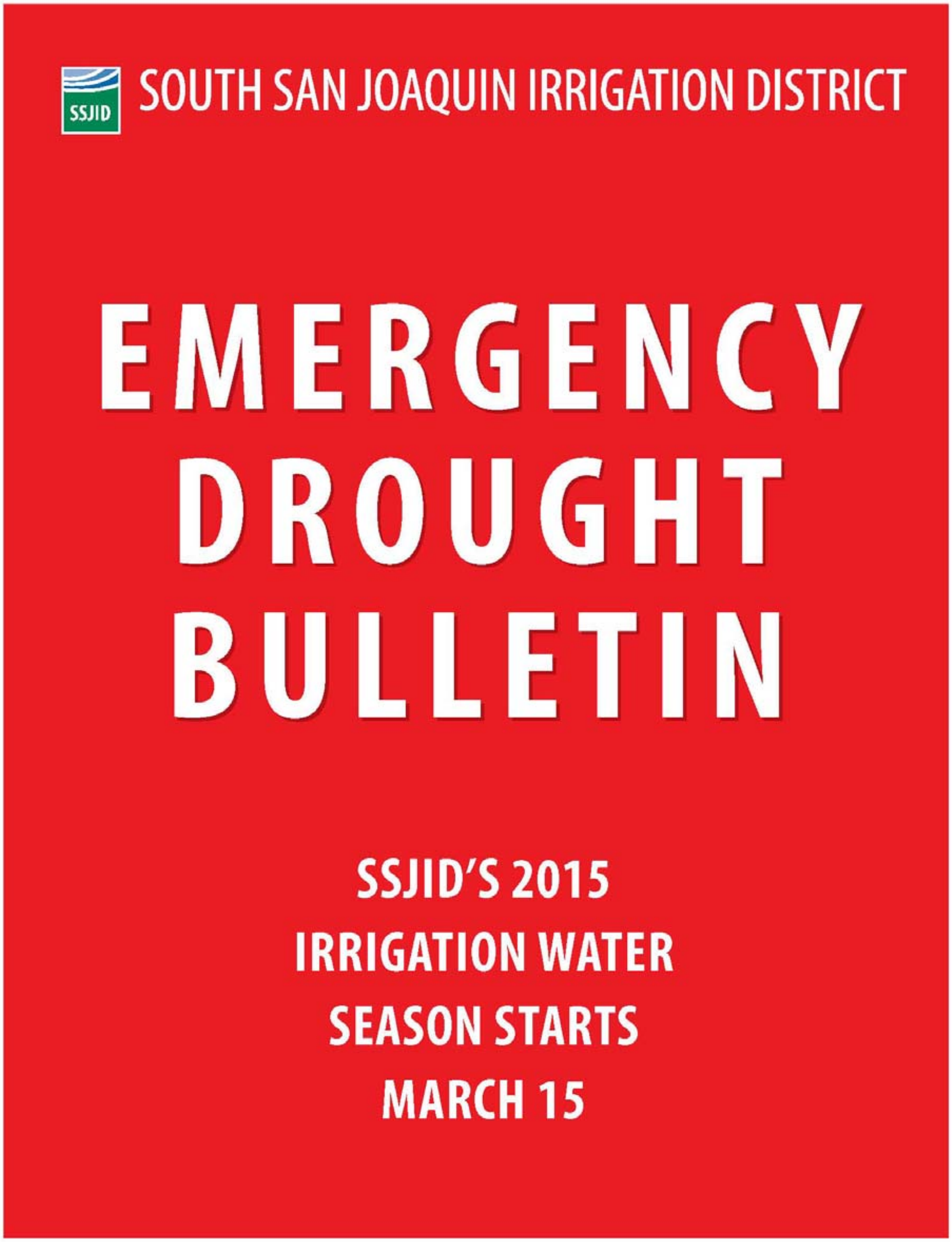
EMERGENCY DROUGHT BULLETIN 1 – MARCH 15, 2015



EMERGENCY DROUGHT BULLETIN

SSJID IN CRITICAL DROUGHT EMERGENCY

As the Stanislaus River watershed enters its fourth year of consecutive drought conditions, the picture for SSJID and our farmers is bleak. While SSJID may have enough water this year, if the pattern of drought conditions continues, there is a very real possibility our water supply will not last through the end of the 2016 irrigation season. This is a serious and harsh reality, and as such, the SSJID Board of Directors declared a water emergency at its most recent meeting. The Board has reviewed the usage of agricultural water in recent years and has found that it will be necessary to adopt a drought conservation program to reduce the quantity of water used for the purpose of conserving our water supply for the 2015 and 2016 irrigation seasons.

CONDITIONS NECESSITATING AN EMERGENCY DROUGHT DECLARATION

New Melones Reservoir is running out of water. This is the source of SSJID's water supply. The troubling pattern of long, warm dry spells between rain events in the upper watershed is continuing with the result of very little runoff into New Melones Reservoir when it does rain, as the ground and vegetation is so dry that it is soaking up all available moisture. Since October 1, precipitation in the upper watershed has been 60% of normal, and has gotten worse: January was the driest January in history, and in February no snow fell below 8,500 feet of elevation. The Department of Water Resources is expected to announce that the most recent snow survey will show that the snowpack will have declined in the last month to 17-19% of normal. Our estimates show that New Melones may decline to "dead pool" in September. The State Water Resources Control Board (SWB) has issued an advisory that Curtailment Orders for Junior Water Rights holders are possible if significant improvement in hydrology is not seen in March, given the bleak storage levels in all of the reservoirs, including New Melones. There is not enough water in New Melones to meet the Bureau of Reclamation's regulatory needs and the District's hard cap of 225,000 acre-feet this year. Any additional inflow or any conservation we can save from this year's total of 225,000 acre-feet will count toward meeting our 2016 water needs. This is why stringent conservation measures in the District will be so important during 2015. Every drop of water we save this year may be needed in 2016.

SSJID BOARD PROPOSES A 36 INCH ALLOTMENT

In order to meet the needs of both our agricultural and urban customers with a water supply of 225,000 acre-feet, including supplementation of approximately 54,000 acre-feet of water from our conservation account, the District needs to plan for the worst and hope for the best. By implementing modest conservation measures last year, the District was able to meet the demands of our irrigation and domestic customers with 217,000 acre-feet. More strict conservation measures are going to be required this year, therefore the SSJID Board is proposing to adopt a 36" limit on all parcels. By doing so, the savings will potentially be as much as 39,000 acre-feet, which would be a direct contribution to the 2016 supply. The board understands this will be a serious hardship for many. The intention is to avoid an even more serious hardship for everyone that would result from completely running out of water this year or next. The Board also has established a 10-day rotation schedule.

BOARD DECLARES START OF SEASON TO BE MARCH 15

The District expects to begin its irrigation season on March 15. Prior to the start, the Board of Directors will hold a hearing on March 10 at 9 AM at the District's Main Office followed by a decision whether to adopt a strict water allotment of 36". District studies have shown that more than half of our irrigators use less than 36". With this restriction on supply, it is incumbent upon irrigators to determine for themselves how and when to use their allotment. SSJID staff are currently identifying growers whose usage history is above 42" and will be available to work with them to determine how they can reduce their usage in order to preserve their crops and stay within the drought year allotment.

ALLOTMENT TRANSFERS

Along with the 36" limit, allotment transfers will be allowed. The general rule will be that growers can increase or decrease their water supply by transferring all or a part of the 36" allotment between land parcels, with some exceptions. Once the Board adopts the Water Allotment Policy, the District will have an application form that will be required for transfers, and the deadline for applications will be May 10. Parcels in a single transfer agreement will not need to have the same owners. Only parcels located in the District territory are eligible for the water transfer program. Transfer agreements will be for one year only and will be irrevocable. You will soon receive a notice of the hearing to be held on March 10, along with the detailed allotment policy that the Board is proposing to adopt. Transfer rules and procedures will be included. ***PLEASE REVIEW THE POLICY CAREFULLY SO THAT YOU KNOW EXACTLY HOW THE POLICY WILL AFFECT YOUR GROWING SEASON.***

WHAT YOU NEED TO KNOW REGARDING YOUR USAGE

As part of the emergency drought 36" allotment policy, water to growers will be cut off once their allotment is used. It will be your responsibility to know how much allotment you have left at any time, although the District will provide resources to assist you with this. The best resource you will have is access to SSJID's online bill payment and consumption history service, which is available by going to the SSJID website: www.ssjid.com. Directions for applying for an online account are provided in this bulletin. Once you have established an online account, your usage will be updated every day on the website; however keep in mind that the information will be three days old. Your season-to-date usage will be shown on your monthly bill, and most likely beginning in April, your bill will reflect not only acre-feet used but also inches applied. The District will also soon be mailing you a report showing how many inches of irrigation water you used in 2014 on each parcel.

You may also use this simple calculation to convert acre-feet of water used to inches:

Acre Feet divided by Acreage multiplied by 12.

For example: 60 acre-feet (amount used) divided by 15 acres (parcel size) times 12 = 48 inches of water.

DISTRICT WILL OFFER IRRIGATOR ASSISTANCE PROGRAM

The board and employees of SSJID understand that the 36" limit will be a real hardship for many farmers. So SSJID is evaluating the water usage on parcels that used more than 42" in 2014 in order to check the accuracy of the District's water use measurement methods and we are also available to recommend ways to irrigate more efficiently if possible. It is important for you to contact SSJID right away if you are concerned about the accuracy of the District's measurement of your usage. The District staff will work hard to assist you during this difficult year. If you have questions or need assistance with adhering to the 36" limit or applying for a transfer, please call the District office at (209) 249-4600.

DISTRICT WILL ISSUE FURTHER BULLETINS TO UPDATE GROWERS ON DROUGHT CONDITIONS

This is the first of a series of Emergency Drought Bulletins that will be issued throughout the irrigation season. Please be sure to look for and read each bulletin, as changes may be made to the water allotment and transfer programs if conditions change.

Please coordinate with your division manager regarding any repairs to your valves, boxes, etc. If you are aware of any damaged vents, please contact Ron Strmiska Jr., field maintenance supervisor, at (209) 993-9769 as soon as possible.

WATER SEASON 2015 JOB ASSIGNMENTS

24 HOUR EMERGENCY NUMBER 209-249-4632

DIVISION	PHONE NUMBER	DAYS	NIGHTS
1	209-652-9793	Joe Hasten	Anthony Podesto
2	209-652-9784	Bob Anderson	Andrew Mc Donald
3	209-652-9775	Keith Obrochta	Randy Sprinkle
4	209-652-7025	Collin Hodge	Rob Shipman
5	209-652-3427	Joe Lourenco	Tim Hagins
6	209-652-2409	Jason Wirstlin	Michael Donahue

REGISTER ONLINE TO PAY YOUR BILL AND VIEW YOUR CONSUMPTION HISTORY

SSJID offers online bill payment and the ability to view your water consumption history via its website: **www.ssjid.com.** This service will be particularly useful to growers this year due to the drought year water allotment policy, because it allows you to monitor your water use as recorded by SSJID. To sign up for online services, simply go online to our website, go to **District Services**, then **Billing and Customer Services.** Here you will find the **"Pay your bill online"** button. Click, and follow the directions to create your account. You will receive an email verifying that we received your request. Your account will then be linked to your log-on password. Once this process is completed, you will receive another email verifying that you're now ready to utilize the online payment system, as well as to view your account online. Registering online does not obligate you to pay your bill online. Our Finance Department can quickly complete this process in one business day after you request this service. Questions? Call Robin Giuntoli at (209) 249-4610.

www.ssjid.com

SSJID SOUTH SAN JOAQUIN IRRIGATION DISTRICT

EMERGENCY DROUGHT BULLETIN 2 – APRIL 6, 2015

SSJID
SOUTH SAN JOAQUIN IRRIGATION DISTRICT

EMERGENCY DROUGHT BULLETIN #2

April 6, 2015

Confirmation of Drought Conservation Program Provisions

The water supply picture looks increasingly grim for the coming growing season. California's governor declared a State of Emergency throughout the state due to severe drought conditions on April 1, 2015. With very little precipitation this past winter, farmers will be relying more on pumping groundwater, having to severely conserve whatever surface water they may have available to them, potentially fallowing crops, and when possible and/or necessary, transferring water allocations between their own parcels, or to other growers' farm operations.

After a public hearing at the South San Joaquin Irrigation District's Board meeting on March 10, the Board voted to adopt the drought conservation program that was described in the first Emergency Drought Bulletin SSJID mailed to you recently. The only change to the original proposal was an extension of the deadline to apply for allotment transfers from May 10 to June 15, 2015. A limit of 36" of irrigation water per parcel will be in effect because the ongoing drought threatens the District's water supply in 2015, and will most likely worsen in 2016. A 10-day rotation schedule was also confirmed.

SSJID's drought task force has already met with many of our growers to review their past year's water consumption history. All of our growers should have received their "consumption history review" in the mail. If you are concerned about how much water usage our records show for your property, you can request a review of our records. Either call SSJID at (209) 249-4675 or go online to www.ssjid.com and on the home page, under Drought Information, you will find an application for assistance with this service. Click on the link and fill out the "Application for Consumption Review," and our staff will call you within two business days to schedule an appointment to go over your water consumption history. Our staff may also be able to offer helpful suggestions for ways you may adjust your irrigation practices in order to get through this difficult season.

Use SSJID's Website for Drought Updates and Online Water Usage Data

We strongly encourage you to go to SSJID's website and sign up for an online account, where you will be able to monitor your water usage, pay your bill online (not required to view usage) and see your water usage in terms of inches applied, as well as acre-feet used. The data will be updated immediately after each irrigation, so it will be a good tool for you to keep close track of your water usage throughout the season. To sign up for online services, go to the District Services tab, then Billing and Customer Services. Here you will find the "Pay your bill online" button. Click and follow the instructions to create your account. If you have questions regarding this service, please contact Robin Giuntoli at (209) 249-4610. In addition, our website's home page, under Drought Information, will be updated if conditions change, new program options are added, and for the latest information from SSJID regarding the drought and how it will affect our growers.

Also, for measurement accuracy for those using drip, sprinkler or micro systems, we strongly recommend that you call your Division Manager/Ditchtender with the start and stop times of your water deliveries if you shut off earlier than your water order, so that you will not be billed for water you did not use.

Allotment Transfer Program

The District's Allotment Transfer Program will be essential for many growers to achieve a successful crop this year. The "Water Allotment Transfer Application" is available online as well as at our Main Office, 11011 E. Highway 120 in Manteca. The Water Allotment Transfer rules are also on our website and available at the office. There are several important things to know about the Allotment Transfer Program. The application is required before the process can begin and signatures of both parties are required. Where the land is rented, both the owner and the tenant must sign. You may transfer between your own properties and between those of other growers, as long as there is a connection to the SSJID distribution system.

In addition, with only a few exceptions, the quantity of allotment available to transfer cannot exceed the quantity of water that was used on the source parcels during the preceding season (i.e.—the amount may be less than 36"). Under no conditions can more than 36" from one parcel be transferred. For more details regarding transfers and exceptions, please refer to the official rules on the application form or call our office at (209) 249-4675.

New Program Allows for Allotment Master Accounts

On March 25, the Board of Directors approved a plan to give irrigators more flexibility in managing their 36" allotment this year. The program will allow the grouping of land parcels that are under common management into a single "allotment master account". All the parcels in an allotment master account will be treated as if they were all a single parcel for monitoring use of the 36" allotment. Individual parcels within the master account can use more or less than 36" as long as the master account group as a whole uses no more than 36". For example, if one 10-acre parcel uses 18", another 10-acre parcel in the same master account can use 54" because in combination they are using only 36".

Presently, irrigators who own more than one parcel receive just one bill listing all the parcels they own. Also, those who farm a combination of owned and leased land can have all their leased and owned parcels grouped onto a single bill if they have completed a "Landowner-Tenant Agreement" with the District. To begin with, these same parcel groups will be used for pooling allotments into a master account. This is the default grouping method for allotment master accounts.

Other parcels that are not in the default grouping can be added to an allotment master account. The only requirement is that all the parcels in a master account must be under common management. The common manager could be the owner of some parcels in the master account, a tenant on other parcels, and a "manager" on others. Adding parcels to an allotment master account does not necessarily change which parcels appear on a particular bill, unless the farmers and landowners involved desire that.

In order to add parcels under common management to a master account, we will need a "Master Account Agreement" signed by the property owner and the tenant or manager. The form for the "Master Account Agreement" can be found on the SSJID website home page under the Drought Update banner and is also available at our Main Office. ***Our office will accept faxed or emailed agreements, as long as they include an attached PDF with the required signatures. Contact Julie Vrieling at (209) 249-4675, fax (209) 249-4694.*** Allotment master accounts will reduce the number of allotment transfers that are needed, and they will be easier for both district personnel and irrigators to manage.

State Water Resources Control Board to Consider Temporary Urgency Change Petition for the Stanislaus as 2015 Goes on Record as the Worst Drought in River's Recorded History

Lake Tulloch is downstream of New Melones Reservoir. It is jointly owned and operated by Oakdale Irrigation District and SSJID as part of the Tri-Dam Project. The two districts' senior water rights usually allow the constituents they serve to have a reliable high quality source of water for irrigation and domestic uses. However, the snow survey for April 1 shows the Stanislaus River watershed at just 4% of normal, the lowest measurement ever recorded.

The two districts have been in negotiations with the federal Bureau of Reclamation (which operates New Melones Reservoir), the National Marine Fisheries Service and the State Water Resources Control Board (SWRCB), urging the approval of a Temporary Urgency Change Petition to better balance the needs of fish and farmers, domestic users, recreational uses, power generation and carryover storage during this worsening drought. Approval of the petition would provide for springtime "pulse flows" for steelhead and salmon on the Stanislaus, base flows for the fish in the river through December, and adequate supplies of water for each district, given serious conservation measures both districts are taking. The hope is that by September 30, at the end of the irrigation season, New Melones will have enough water to meet flows for spawning salmon through December 31. The plan would also help the districts to keep Lake Tulloch at normal operational levels through September. While the districts will continue to press forward with every strategy possible to help our communities get through this year, **we encourage everyone with an interest in the river to show their support by contacting the SWRCB at info@waterboards.ca.gov. and asking for approval of the petition immediately. Your action is needed!**

The Tri-Dam Project has its own website, www.tridamproject.com, and will be posting weekly updates each Friday. It is important that all interested persons check this website regularly as Tri-Dam will post updates should conditions change, and a drawdown at Lake Tulloch below scheduled operating levels becomes necessary.

Board to Update Policy to Discourage Water Theft

While SSJID already has a Policy to Discourage Unlawful Use of District Water, during this extreme drought the Board of Directors plans to update the policy to ensure that the limited water supply we have is protected for each of our growers. Information regarding the updated policy will be provided as soon as Board action is taken.

EMERGENCY DROUGHT BULLETIN 3 – APRIL 27, 2015

SSJID
SOUTH SAN JOAQUIN IRRIGATION DISTRICT

EMERGENCY DROUGHT BULLETIN #3

April 27, 2015

2015 Program for Transfers of Private Water Using District Facilities

South San Joaquin Irrigation District is now offering a program that allows use of district facilities to transfer water from private wells during the 2015 irrigation season. The program exchanges private water for district water so the private water can be used to increase the supply of any parcel in the district that is connected to the irrigation distribution system and at any time after the private water has been pumped.

The program has the following provisions and requirements. Those interested in using this program need to fill out and sign an agreement with the district. The agreement form is available at the Main Office and on the SSJID website (www.ssjid.com). The agreement is between SSJID, the well operator, and the owner, tenant, or contract manager of the receiving parcel. Questions regarding this program? Call Julie Vrieling at 209-249-4675 or email her at jvrieling@ssjid.com.

1. The owner or operator of a private well may pump well water to be used at the same location or a different location, into a district conveyance facility.
2. The quantity of water pumped will be added to the drought allotment for the receiving parcels.
3. Pumping into SSJID facilities can only occur when and where the division manager/ditchtender (DM/DT) can make use of the water, and the DM/DT must approve the pumping schedule.
4. The pump must have a meter that can be used to determine how much water is pumped.
5. After each pumping event, the DM/DT will report to the SSJID engineering department the quantity of water pumped.
6. The receiving parcels can use the additional drought allotment during regularly scheduled irrigation deliveries any time after the water private water has been pumped into district facilities, and before the end of the 2015 irrigation season.
7. SSJID will bill the ordinary volumetric rate of $3 per acre-foot for all water delivered under this program in order to avoid modifying billing software to distinguish between delivery of private well water or district water.
8. If any parcel has unused drought allotment at the end of the season it is lost and cannot be carried over to a future season.
9. An agreement to transfer private water designates the parcels which are to get the water, clarifies who is responsible for any damages resulting from this activity, gives the DM/DT permission and access to shut down the pump if necessary, and describes pump capacity.

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EMERGENCY DROUGHT BULLETIN 4 – MAY 8, 2015

Urgent Drought Bulletin—May 8, 2015

SSJID Updates its Policy for Unlawful Use of District Water

While South San Joaquin Irrigation District (SSJID) has had a long standing "Policy to Discourage Unlawful Use of District Water," during this extreme drought the Board of Directors has updated the policy to ensure that the limited water supply we have is protected for each of our growers.

The policy approved in 2014 provides for a written warning after the first violation, loss of one irrigation for the second violation and loss of irrigation for the remainder of the season thereafter.

The policy approved in 2015 also enables the District to disable or remove facilities used by the grower for the third violation of the policy in all year types. In allotment years, the policy also allows the District to disable or remove the facilities if the grower violates the policy just two times, if both occur after the grower's allotment expires. The policy has also been amended to provide that the District will provide written notice before it removes the facilities.

SSJID POLICY TO DISCOURAGE UNLAWFUL USE OF DISTRICT WATER
AMENDING THE May 20, 1919 RULES AND REGULATIONS
Governing the Distribution of Water in the South San Joaquin Irrigation District
Adopted by the Board of Directors on June 10, 2014
Amended April 13, 2015 and April 28, 2015

1. District's existing Rules and Regulations for distribution of water prohibit taking water out of turn: No. 9 – Using Water Out of Turn: any person who uses water out of his turn and without the permission of his ditchtender forfeits his right to water at the next regular irrigation and is also subject to criminal prosecution.

2. Violation of Rule No. 9 is subject to criminal prosecution: **Penal Code § 498. Theft of utility services**

(a) The following definitions govern the construction of this section:

(1) "Person" means any individual, or any partnership, firm, association, corporation, limited liability company, or other legal entity.
(2) "Utility" means any electrical, gas, or water corporation as those terms are defined in the Public Utilities Code, and electrical, gas, or water systems operated by any political subdivision.
(3) "Customer" means the person in whose name utility service is provided.
(4) "Utility service" means the provision of electricity, gas, water, or any other service provided by the utility for compensation.

(b) Any person who, with intent to obtain for himself or herself utility services without paying the full lawful charge therefor, or with intent to enable another person to do so, or with intent to deprive any utility of any part of the full lawful charge for utility services it provides, commits, authorizes, solicits, aids, or abets any of the following shall be guilty of a misdemeanor:

(1) Diverts or causes to be diverted utility services, by any means.
(2) Prevents any utility meter, or other device used in determining the charge for utility services, from accurately performing its measuring function by tampering or by any other means.
(3) Tampers with any property owned by or used by the utility to provide utility services.
(4) Makes or causes to be made any connection with or reconnection with property owned or used by the utility to provide utility services without the authorization or consent of the utility.
(5) Uses or receives the direct benefit of all or a portion of utility services with knowledge or reason to believe that the diversion, tampering, or unauthorized connection existed at the time of that use, or that the use or receipt was otherwise without the authorization or consent of the utility.

3. The violation of Rule No. 9 by a customer or any other unauthorized removal of water from the District's facilities is prohibited. As used in this Policy, a customer is a person who is charged by the District for irrigation water service on the subject land. A person who is charged a groundwater recharge fee is not considered a customer as to land which is subject to an irrigation service abandonment agreement, but is subject to Section 7.

4. Provisions applicable to customers for violations of Section 3 in all years except when a water allotment is in effect:

(a) The customer will be given a warning for the first violation. Written notice will also be provided to the parcel owner, if different than the violator, in accordance with the County Assessor's records. The warning will include a billing for the charges described in Section 6A.

(b) For the second violation in the same irrigation season, whether or not occurring on the same parcel as the first violation in a particular irrigation season:
(1) The customer will be subject to the charges described in Section 6A.
(2) The customer will forfeit the right to water for one irrigation on the parcel or parcels which are the subject of the violations, and on all parcels served by the District that are owned by the violator.

(c) For the third violation in the same irrigation season, whether or not occurring on the same parcel as the previous violations:
(1) The customer will be subject to the charges described in Section 6A.
(2) The customer will forfeit the right to District water for the rest of the irrigation season on the parcels which are the subject of the violations and on all parcels served by the District that are owned by the violator.

(d) After the first warning, violations of Section 3 may be referred for criminal prosecution.

5. Provisions applicable to customers for violations of Section 3 in years when a water allotment is in effect:

(a) This Section 5 is applicable to years when the District's Board of Directors adopts a specific allotment of the quantity of water that will be made available to customers eligible for District irrigation service and to a customer subject to an allotment pursuant to section 5E below.

(b) For the first violation in a particular irrigation season:

(1) The customer will be given a warning. Written notice will also be provided to the parcel owner, if different than the violator, in accordance with the County Assessor's records. The warning will include a billing for the charges described in Section 6A.
(2) The quantity of water reasonably determined by the District to have been used by the customer will be deducted from the customer's annual water allotment for the year of the violation.

(c) For the second violation in the same irrigation season, whether or not occurring on the same parcel as the first violation:

(1) The quantity of water reasonably determined by the District to have been used by the customer will be deducted from the customer's annual water allotment for the year of the violation.
(2) The customer will be subject to the charges described in Section 6A.
(3) The customer will forfeit the right to water for one irrigation on the parcel or parcels which are the subject of the violations, and on all parcels served by the District that are owned by the violator.
(4) If two violations are committed after the water allotment has expired, the customer is also subject to the provisions of Section 6B.

(d) For the third violation in the same irrigation season, whether or not occurring on the same parcel as the previous violations:

(1) The quantity of water reasonably determined by the District to have been used by the customer will be deducted from the customer's annual water allotment for the year of the violation.
(2) The customer will be subject to the charges described in Section 6A.
(3) The customer will forfeit the right to District water for the rest of the irrigation season on the parcels which are the subject of the violations and on all parcels served by the District that are owned by the violator.

(e) For each violation that occurs after the customer's annual water allotment for the year has been exhausted, the quantity of water reasonably determined by the District to have been used by the customer will be charged against the customer's allotment for the next irrigation season. If an allotment is not generally imposed in the next irrigation season, the customer will be again subject to an allotment in the next irrigation season, and the next season's allotment will be the same as the allotment of the season in which the violation was committed, minus the water taken in excess of the allotment during the year of the violation.

(f) After the first warning, violations of Section 3 may be referred for criminal prosecution.

6. Provisions applicable to all customer violations of Section 3:

(a) The violator is subject to a water charge at the rate of $75 per acre-foot, which is the District's cost of service in 2014, for the quantity of water reasonably determined by the District to have been used, plus the amount necessary to reimburse the District for its costs to remove irrigation facilities used in violation of this Policy, for its costs to repair District facilities damaged in violation of this Policy, and for its costs for investigation and enforcement.

(b) The District may disable or remove the facilities connected to or installed on the District's facilities that were used in violation of this Policy as follows:

(1) In all years, when a customer commits three violations in the same irrigation season, whether or not occurring on the same parcel as the previous violations or, in years when a water allotment is in effect, when a customer commits two violations after the customer's water allotment has expired in the same irrigation season, if sooner.
(2) After the irrigation season has ended, the customer must replace the facilities in accordance with the District's policies and standards then in effect at the customer's expense before the land will be eligible to receive District water service in accordance with the District's policies.
(3) Written notice will be provided to the violator before the facilities are removed. Written notice will also to be provided to the parcel owner, if different than the violator, in accordance with the County Assessor's records.

7. Provisions applicable to noncustomers for unauthorized removal of water from the District's facilities:

(a) This Section 7 is applicable to a violator who is not a customer of the District.

(b) For the first violation in a particular irrigation season:

(1) The violator will be given a written warning.
(2) The violator will be subject to the charges described in Section 6A.

(c) On a second offense, in the same irrigation season:

(1) The District may disable or remove any facilities connected to or installed on the District's facilities that were used to irrigate the subject land. Written notice will be provided to the violator before the facilities are removed. Written notice will also to be provided to the parcel owner, if different than the violator, in accordance with the County Assessor's records.
(2) The violator will be subject to the charges described in Section 6A.
(3) The violation may be referred for criminal prosecution.

8. This policy amends the District's Rules and Regulations for distribution of water originally adopted May 20, 1919.

EMERGENCY DROUGHT BULLETIN 5 – JUNE 8, 2015

SSJID
SOUTH SAN JOAQUIN
IRRIGATION DISTRICT

EMERGENCY DROUGHT BULLETIN #5

June 8, 2015

Important Changes to SSJID's Allotment Transfer Program

Deadline for Allotment Transfers Eliminated

At South San Joaquin Irrigation District's board meeting on May 20, the board decided that the previous deadline of June 15 for applications for allotment transfers is unnecessary and will be eliminated. Therefore, SSJID growers can apply for an allotment transfer anytime during the 2015 irrigation season, allowing for more time to plan mid and late season use of water.

The "Water Allotment Transfer Application" is available online (www.ssjid.com) as well as at our Main Office, 11011 E. Highway 120 in Manteca. The Water Allotment Transfer rules are also on our website and available at the office. There are several important things to know about the Allotment Transfer Program. The application is required before the process can begin and signatures of all parties are required. Where the land is rented, both the owner and the tenant must sign. You may transfer between your own properties and between those of other growers, as long as there is a connection to the SSJID distribution system.

In addition, with only a few exceptions, the quantity of allotment available to transfer cannot exceed the quantity of water that was used on the source parcels during the preceding season (i.e.—the amount may be less than 36"). Under no conditions can more than 36" from one parcel be transferred. For more details regarding transfers and exceptions, please refer to the official rules on the application form or call our office at (209) 249-4675.

Allotment Transfer Agreements Can be Rescinded Subject to Conditions and Requirements

If you have been considering applying for an allotment transfer agreement but are concerned that SSJID's board may need to reduce the allotment of 36" per parcel due to worsening drought conditions, you may now rescind a transfer agreement under the following conditions and requirements:

1. As a preceding condition, the general drought allotment has been reduced by the Board of Directors.
2. All parties to the transfer must agree to unwind it by signing a transfer rescission agreement.
3. The amount of allotment recovered from each destination parcel is the amount originally transferred to the destination parcel or if less, the amount of allotment remaining unused on the destination parcel.
4. The amount of allotment restored to the source parcels is the amount recovered from the destination parcels.
5. If there is more than one source parcel, the amount of allotment restored is distributed among the source parcels in proportion to the original transfer.
6. Once rescinded, a new allotment transfer agreement can be made.

As always, feel free to call our office at (209) 249-4675 and Julie Vrieling, our water conservation coordinator, will be happy to assists you with any of our drought provision programs and/or provide you with information regarding your 2015 irrigation season water usage.

Recap of SSJID's 2015 Drought Year Programs

The following programs have been established to assist our growers with challenging drought conditions during the 2015 irrigation season.

⇒ Approval of a program to transfer water from a private well to any location in the District, regardless of which lateral they use, or whether they are upstream or downstream from the well.

⇒ Adoption of a 36" per parcel drought allotment, which limits irrigation water deliveries in order to make our limited supply last through this season, and possibly augment next year's supply.

⇒ Establishment of a Master Account for allotments that enables growers to combine the water allotments of all the fields they farm and decide where to use the water.

⇒ Establishment of a program for transfer of allotments among parcels so farmers can increase their allotment by making a transfer agreement with another farmer.

⇒ Daily updating growers' water use history on the District's website once an online account has been established.

⇒ Provision of a consumption review service to address concerns about the accuracy of the record of the growers' consumption.

SSJID General Manager to Retire In October

When South San Joaquin Irrigation District General Manager Jeff Shields announced on April 13, 2015, that he would retire sometime before the end of the year, the SSJID Board of Directors expressed a desire to implement a succession plan that would assure a smooth transition as the District moves forward with its business.

"Jeff has been a tremendous asset to the District for the past 11 years. He will continue to have the full confidence and support of the board in his duties until such time that we develop a succession plan that will include finding his replacement," said Robert Holmes, SSJID board president.

"When my contract came up for renewal this year, I asked the board to renew it on a month to month basis, with the intent to retire before December 31, 2015," said Shields. "I am 67 years old and nearing retirement, but I want to work with the board and staff towards an orderly transition to new management. I am committed to continuing to support the efforts of SSJID as we work through this serious drought and water rights issues, and to advance the District's efforts to provide retail electric service to our community."

Shields has been with SSJID since June 2004 and has over 36 years of public agency and private sector executive management experience. He was appointed general manager in 2007, after serving as the District's utility systems director. Under his tenure with the District, SSJID built and is now successfully operating a solar farm that provides power for the Nick C. DeGroot Water Treatment Plant. The plant provides drinking water to Manteca, Lathrop and Tracy; the move to solar power has allowed the cities to keep their cost of wholesale water affordable.

South San Joaquin Irrigation District also built an award winning, state-of-the-art pressurized water delivery system in the Ripon area under Shields' direction. The "Division 9 Irrigation Enhancement Project" has received numerous state, national and international awards and recognition. Currently, Shields is overseeing a study to determine the feasibility of pressurizing all, or additional divisions, of the District. He is also managing the irrigation district through what is shaping up to be the most difficult water delivery year in SSJID's history, as California experiences its fourth year of a serious drought.

Among Shields' many notable accomplishments was guiding the District through the San Joaquin County Local Agency Formation Commission (LAFCo) process as SSJID sought approval to become the retail electric provider in its service territory. SSJID won this approval late last year, and has now completed all of the necessary LAFCo requirements. SSJID's plan will eventually bring a 15% rate discount to all current PG&E customers in Escalon, Manteca and Ripon, along with local control by an elected board of directors.

Shields' experience outside of SSJID includes 10 years as general manager of Emerald People's Utility District in Oregon, and also seven years as general manager of Trinity PUD in Northern California. He is credited with leading several agencies into the retail power business in order to reduce electricity costs for consumers and key industries. He also has experience in land use planning and environmental compliance consulting, providing expert witness services by testifying before state and federal regulatory and governing authorities, securing transmission for renewable energy projects and managing all aspects of utilities.

"I love this community and plan to stay in Ripon and continue to be actively involved in water and energy issues," said Shields. He will continue to serve on the board of The Utility Reform Network (TURN) as well as the board of the Local Energy Aggregation Network. In addition, he will continue as a board member for Give Every Child a Chance (GECAC) and as member of the Manteca Rotary Club.

SSJID Says Farewell to Customer Service Representative Luz Juarez

SSJID is preparing to say "Farewell" to Luz Juarez, our customer service representative who has been with the District for 37 years. Luz has been a key team member at SSJID, as she is the first person who greets everyone who visits our office, handles customer service for our growers and interfaces with outside organizations that seek information regarding property within the District. She is also well-known in the Manteca and Lathrop community through her work for her church and other volunteer efforts. Luz will be retiring from the District on June 30, which will be a bittersweet day for her coworkers who have grown to love and appreciate her for the kind, outgoing and helpful employee that she is. Whether it be handling calls from title companies, questions from customers or calming the occasional upset grower, Luz navigates every situation with grace and professionalism. Her knowledge of the District's history during her tenure is a treasure that will be sorely missed.

Luz is looking forward to having more time to spend with her family, to travel, and to relax, as she settles into a new routine that will no longer include her excellent attendance as an SSJID employee. We hope she will come by for an occasional visit as we look forward to hearing all about the joys of retirement from this most valued employee. Please join us in wishing Luz a wonderful retirement!

As SSJID's Finance and Administration Department anticipates several additional future employee retirements, there are two new faces that recently joined our team. Leah Codoni and Maria Gikas, both accounting technicians, will be learning each of the functions of the department and are looking forward to serving our customers in the same friendly and helpful manner as you are accustomed to. We welcome both Leah and Maria to the SSJID family.

EMERGENCY DROUGHT BULLETIN 6 – JULY 8, 2015

Emergency Drought Bulletin

July 8, 2015

SSJID is adding a new informational program for growers who need additional water, and growers who want to make water available through a transfer. This program will be facilitated through the District's website: www.ssjid.com. There will be a link under the Drought section on the home page that will list growers who are interested in accessing additional water from a list of growers who have water available (either from their allotment or from their private well water). The link will say: **Grower Water Exchange Information**. If you wish to take advantage of listing your name and contact information through this program, you will agree that your participation is completely voluntary, and that the District will simply be making the names and contact information available, but will not be involved with the actual contact between growers who want to list their names on this website page. However, depending on how the exchange is to be conducted, growers involved will have to fill out the required applications, which could be an **Allotment Transfer Application** and/or an **Agreement for Transfer of Water Through District Facilities**.

If you would like to participate in this informational program and list your name on our website, please contact Julie Vrieling at (209)249-4675 or jvrieling@ssjid.com for assistance. Please let Julie know whether you have a need for additional water OR if you have additional water available. We hope that this program will be another tool that the District can provide to help you get through this difficult Drought Emergency irrigation season.